On Deposit Stability in Failing Banks

Christopher Martin,* Manju Puri,† and Alexander Ufier*

May 23, 2017

Preliminary draft. Comments welcome.

Abstract

We use a novel dataset from a US bank which failed after the financial crisis of 2007-2009 to study depositor behavior in distressed banks. Our unique data allow us to observe daily, account-level balances in all deposit accounts at the bank to examine the effect of deposit insurance (both regular and temporary measures) and other account characteristics on deposit stability, as well as the important role deposit inflows play in distressed banks. We find, when faced with bad regulatory news, uninsured depositors flee the bank. Government deposit guarantees, both regular deposit insurance and temporary deposit insurance measures (e.g., the FDIC's Transaction Account Guarantee program), reduce the outflow of deposits and meaningfully improve deposit stability. Further, we find older accounts are less prone to leave in the face of bad news, and, consistent with assumptions in Basel III, checking accounts are more stable than savings accounts. However, contrary to conventional wisdom, term deposits are more risk-sensitive than transaction accounts. Our evidence also suggests that run-off rates assumed in the Net Stable Funding Ratio may be too low, especially during periods of extreme stress. Finally, we show there was simultaneously a *run-in* at the bank during times of stress with a substantial inflow of insured deposits from new depositors. Effectively, the bank was able to offset losses of uninsured deposits with new insured deposits remarkably well as it approached failure, raising questions on the effectiveness of depositor discipline widely considered to be one of the key pillars of financial stability.

Keywords: depositor withdrawals, funding stability, depositor discipline, liquidity, LCR, NSFR, bank failure

*Federal Deposit Insurance Corporation (FDIC); chrmartin@fdic.gov, aufier@fdic.gov.
†Duke University, FDIC, and NBER; mpuri@duke.edu.

JEL Classification: G21, G28, D12, G01

1 Introduction

There were many bank failures during and after the financial crisis of 2007-2009. In this period, many systemically important institutions, as well as numerous smaller firms, faced severe liquidity stress. The stress resulted in the high-profile failure or near failure of many financial institutions and unprecedented emergency liquidity support from governments around the world. The inability of financial institutions to maintain stable funding sources was, arguably, central to the crisis. Large quantities of deposits exited from failing banks. This, in turn, prompted regulators to formulate new rules aimed at preventing a repeat of such an episode of illiquidity and funding stress.

One of the central questions for regulators during the crisis was whether to extend the scope and limit of deposit insurance in an effort to reduce deposit outflows due to depositor distress. In the US, deposit insurance for regular accounts was increased from $100,000 to $250,000. Other countries, such as the UK, took similar measures. At the same time, the US government also expanded the scale and scope of deposit insurance through other programs. The most important such program was the Transaction Account Guarantee (TAG) program, which temporarily removed the cap for deposit insurance coverage for many deposit accounts in the US during the crisis. Despite the importance attached to deposit insurance and the strong belief in its ability to enhance deposit stability — in the US and internationally — there is remarkably little evidence on the effectiveness of deposit insurance in preventing deposit outflows.

More generally, the financial crisis has motivated broad academic and policy-maker interest in the funding stability of financial institutions, especially those experiencing some form of distress. For instance, which creditors flee first? How stable are wholesale deposits? How do banks manage their liabilities during periods of stress and depositor withdrawals? If the bank experiences a large outflow of depositors due to its stressed condition, is it able to replace them? How is it able to replace them? Yet again, the empirical evidence on these important questions is scarce.

Apart from examining the effectiveness of deposit insurance and the role of depositor characteristics, it is also important to evaluate the new, post-crisis rules intended to help promote and safeguard liquidity. These rules have a first order effect on banks and their ability to make loans while maintaining capital adequacy. However, there is little empirical evidence to help validate the correct regulatory response. Among the most high-profile of such new regulations are the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR), advocated by the Basel Committee on Banking Supervision ("Basel Committee"). These require that banks maintain adequate "stability-adjusted" funding consistent with their "liquidity-adjusted" assets. Such an approach requires regulators and banks to take a stance on the stability of various funding sources. E.g., the Basel Committee expects that at least 3% of "stable" retail deposits will run-off in a month of severe liquidity stress, while at least 10% of "less stable" retail deposits do the same.

This paper provides evidence on the effectiveness of deposit insurance (both permanent and temporary measures), and the importance of other account characteristics in assessing deposit funding stability using a novel dataset for a failed bank in the US.[1] The data were collected by the FDIC from a single American bank shortly after its failure, and they allow us to measure daily, account-level balances and attributes for several years. The bank failed during the wave of bank failures following the financial crisis of 2007-2009. It had assets of roughly $2 billion around the time of the crisis and was primarily funded by deposits. Although the bank was fairly small relative to most major banks in the US, it was relatively larger in comparison with other failed banks — the average failed bank in the last decade

[1]Henceforth, unless otherwise noted, we will use the term "bank" to refer to any depository institution, whether it be a commercial bank, thrift, credit union, or the like that takes insured deposits. We use the broader term "financial institution" when needed, which includes all of the institutions under the term "bank" as well as other institutions such as non-bank finance companies, insurance companies, hedge funds and other companies commonly referred to as "shadow banks."

has been smaller than the average non-failed bank. Like many banks in the US, the bank we study appeared healthy prior to the crisis based on publicly available indicators, but deteriorated thereafter.

Using these data, we shed light on the stability of deposits and assess the deposit(or) characteristics associated with deposit stability. We provide evidence on the effectiveness of regular deposit insurance as well as the TAG program in improving depositor retention. We also document the bank's response to fleeing uninsured deposits and how the bank was able to attenuate or eliminate depositor discipline, in particular through the acquisition of certain kinds of deposits even towards the very end of its life. Additionally, we estimate run-off rates comparable to those expected by the Basel Committee for the LCR and NSFR, and comment on the appropriate run rate assumptions for deposit outflow.

Our analysis highlights a number of important points. First, term deposits at the bank we study were more risk sensitive than transaction accounts,[2] running off earlier and faster in response to stress. This is at odds with many economists' intuition, as these accounts' withdrawal restrictions should make them more stable, but likely reflects the relative sophistication of term depositors and the inherently forward-looking nature of a non-demandable deposit.

Second, we show that even in the last few months of the bank's life, when its failure appeared imminent, it was able to attract large quantities of institutional term deposits. These deposits were structured to fall just under the insurance limit; at this time the bank was offering above-market rates. The bank replaced about a third of its total deposits in this manner in the last year of life, much in the last 90 days. This is concerning for several reasons. First, it implies that depositor discipline, Basel's third pillar of financial stability,

[2]Throughout this paper, we use "term deposit" and "certificate of deposit" ("CD") as synonyms. 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.

was at best weakly operative at the bank. Second, by allowing the bank to survive longer than it otherwise would have, these institutional deposits may have allowed bank management to "gamble for resurrection" by making risky loans, increasing resolution costs for the FDIC. Third, this finding suggests that the deposit rate restrictions which the bank faced during the period, restrictions which are explicitly intended to prevent rapid deposit acquisition by undercapitalized banks, are ineffective. Finally, this also highlights a channel by which the bank was able to shift credit risk exposure (to the bank's own credit risk) from uninsured depositors to the FDIC just as it approached failure.

We conduct additional analysis taking advantage of our daily frequency data using Cox hazard models (in addition to probits and linear probability models). We find that FDIC insurance and other government guarantees, including temporary measures such TAG, significantly reduce the withdrawals of insured depositors in response to ailing bank health. Our results support the notion that deposit insurance does indeed improve funding stability. We additionally find that checking accounts are more stable than savings accounts, and depositors receiving regular deposits consistent with direct-deposited paychecks are less likely to withdraw. We also find that depositors who have been with the bank longer are less likely to exit, even when faced with bad regulatory news, suggesting that such depositors tend to be "sticky." Our regressions also support the finding from our earlier analysis that term deposits at this bank were more risk sensitive and less sticky than transaction deposits.

Finally, we use our novel data to study the LCR and NSFR rules which are currently deployed around the globe. While the LCR run-off rates assumed by US supervisory agencies appear appropriately conservative, the NSFR run-off rates may be too low, especially during periods of extreme stress. While ambiguities in the rules give rise to a range of possible rule-implied run-off rates, the bank's NSFR-comparable run-off rates exceed the rule-implied rates at some point under all approaches to resolving those ambiguities. Our findings of a run-in by new depositors raise important questions about LCR and NSFR. In particular we highlight two important areas of ambiguity: Do the rules' assumed run-off rates allow for new depositors to offset exiting depositors? And, how are operational (loosely, cash management) business accounts classified? Given that a bank can substantially reduce the stringency of the rules by classifying as many deposits as possible as operational deposits, the existence of this ambiguity can reduce the effectiveness of the rules.

While this bank did see a great deal of deposit turnover, especially close to failure, it is important to note that at no point did this bank experience a run of the type described by Diamond and Dybvig (1983) or Chari and Jagannathan (1988). Nonetheless, there was a systematic outflow of deposits from the bank prior to failure. Understanding deposit dynamics in failed banks — what kind of deposits flee as well as what new deposits come in — is important to regulators and academicians alike.

The empirical 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)). Examining bank-level data, these withdrawals can act as a form of depositor discipline on risky banks (Park and Peristiani (1998); Billett, Garfinkel, and O'Neal (1998); Martinez-Peria and Schmukler (2001); Goldberg and Hudgins (2002)). Egan, Hortaçsu, and Matvos (2017) use structural models to show that large amounts of uninsured deposits can lead to unstable banks.

A small set of papers examine the responses of individual deposits to bank distress. 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 (2016)); and Switzerland (Brown, Guin, and Morkoetter (2014)). To the best of our knowledge, ours is the first paper to use continuous, daily, account-level depositor data for a failed bank in the US, to systematically study both inflows and outflows of deposits and the underlying depositor characteristics. Our data covers a period in time when temporary deposit insurance measures such as TAG came into effect. As such, we are able to add to the literature by examining the effectiveness of both regular deposit insurance measures as well as temporary deposit insurance measures on which regulators, worldwide, have put much faith. We are also able to provide evidence on the stability of certain kinds of deposits such as term deposits, account age and kind of account held. Additionally we throw light on new, post-crisis rules such as LCR and NSFR. Last, but not least, our findings show evidence of substantial deposit inflows in times of stress, raising important questions about the effectiveness of depositor discipline.

The remainder of the paper is organized as follows: Section 2 discusses the data and the definitions of variables we construct and use in our analysis. Then, Section 3 provides a brief history of the bank, highlighting a number of our key findings and providing context for our later analysis. Section 4 presents regression results on depositor liquidations as well as results on the migration of uninsured balances in response to adverse information about the bank; Section 5 presents results on inflows of new depositors close to failure, and Section 6 presents our assessment of the LCR and NSFR rules in relation to the bank. Section 7 concludes.

2 Data

We construct our dataset from data collected by the FDIC shortly after the bank's failure. From records of the bank's deposit accounts and depositors, we construct end-of-day account balances for each deposit account. We associate accounts with their primary owner and his or her relevant characteristics. We are able to reliably construct daily deposit account balances from early 2006 until the bank's failure. Additionally, we observe all account transactions over the period, including a reasonably granular description of the nature of the transaction and the transaction amount.

We conducted several data validation exercises to ensure the quality of our data. We compared our construction of total deposit balances, balances by major account category, and balances by branch to the bank's regulatory reports. Our data compares favorably, save for a few systematic errors which appear to be due to such known phenomena as banks' sweeping of checking account balances into non-checkable accounts.[3] We also checked individual account balances, ensuring both that accounts have zero balance before account opening and after account closing, as well as that the cumulative changes in account balances over the full sample (say, from account opening to bank failure) match the sum of the transactions observed in our data. In summary, these exercises roundly support the validity of our data.

2.1 Variable Definitions

To study the characteristics of deposit(or)s associated with the stability of deposits, we measure a variety of account and depositor attributes using the failed bank's internal data. We define variables as follows:

- *Liquidation.* This dummy variable is used as the dependent variable in the regressions of Section 4. It is intended to capture a generally accepted notion of account liquidation which is consistent with recent, related studies on depositor behavior in response to bad news about the bank (for example, Iyer and Puri (2012)). Specifically, in the Cox proportional hazard model (which utilizes the time dimension of our data, in addition to the cross-section) it is equal to 1 on the day in which a deposit account balance falls below 50% of the account balance as measured at the beginning of the measurement period,[4] if the balance stays that low or lower for at least 61 days. It is 0 otherwise.

[3] Banks engage in such sweeps to lower their required reserves at the Federal Reserve, but the actions are not recorded in our data. In any event, such sweeps are irrelevant for our purposes, as the depositor is unaffected — and typically unaware — of such sweeps.

[4] By "measurement period," we are referring to the time windows over which we run regressions. We will discuss these time periods in more detail in the next subsection.

This definition of liquidation therefore captures instances where accounts with non-zero balances cash out and close as well as instances in which depositors withdraw a substantial share of their balances but maintain some funds at the bank. For cross-sectional models (linear probability and probit models), this variable is equal to 1 if, at any point in the measurement period, the account balance falls below 50% of the balance as measured at the beginning of the measurement period and stays that low or lower for at least 2 months.

- *Over FDIC Limit.* For any given account, this dummy variable is equal to 1 if there are *any* uninsured balances in the account as determined by FDIC insurance limit categories as of the start of the measurement period. It is 0 otherwise. As FDIC insurance determinations can be extremely difficult, this variable is constructed as conservatively as possible. Accounts we flag as insured definitely have no uninsured funds in them. Accounts we flag as uninsured should have uninsured funds in them, but are possibly fully insured due to complex joint account and trust rules that cannot necessarily be determined using the bank's internal data. Therefore, while all accounts marked as insured have balances that are fully insured, the pool of uninsured accounts may include some insured accounts as well. This will bias our estimates of any effects of being over the FDIC limit towards zero, so estimates in our regressions are lower bounds on the effects of being over the FDIC insurance limit. Our choice to treat all balances in an incompletely insured account as uninsured is partly based on the above-mentioned technical concerns around insurance determination, and is also supported by the findings of Section 4.3. In short, we show that in response to financial system-wide anxiety and, especially, in response to bank-specific bad news, incompletely insured depositors generally draw down their balances far below the insurance limit and often to zero. Thus, even most of the insured funds in incompletely insured accounts behave as though they are uninsured.

- *Covered by TAG/DFA.* In addition to normal FDIC deposit insurance, some deposit accounts in the US were covered by additional, temporary guarantee schemes in the years after the financial crisis. The two additional guarantee schemes were the Transaction Account Guarantee (TAG) program and guarantees mandated by the Dodd Frank Wall Street Reform and Consumer Protection Act ("Dodd Frank Act" or DFA), both administered as additional insurance coverage from the FDIC. TAG, a sub-program of the FDIC's Temporary Liquidity Guarantee Program (TLGP), placed temporary but unlimited (in dollar terms) guarantees on negotiable order of withdrawal (NOW) accounts, non-interest-bearing demand deposit accounts, and interest on lawyers' trust accounts (IOLTAs), which comprise all categories of checking accounts at this bank. The TAG guarantees were in force from October 14, 2008 until December 31, 2010. While banks were not required to participate in this additional insurance under TAG, and banks had to pay for the additional insurance, most banks (including the bank studied here) participated. The DFA guarantees similarly provided unlimited insurance for non-interest-bearing demand deposit accounts and IOLTA accounts, though not NOW accounts. The DFA guarantees were in force from December 31, 2010 until December 31, 2012. In regressions estimated on time periods prior to either program, we replace the TAG/DFA dummy with a dummy variable which is equal to 1 if the account is a checking account and over the FDIC limit as of the start of the measurement period. In those regressions, the replacement dummy variable is used to establish a baseline behavior for large checking accounts, which is the same set of accounts covered by TAG subsequent to the crisis. The use of the replacement dummy variable for large checking accounts allows us to better disentangle the effect of being a large checking account from the effect of the temporary guarantee programs (by comparing coefficients across time periods). Because the guarantee regimes change midway through the Formal Enforcement Action period (see below), we only mark accounts covered by the Dodd Frank Act guarantees with 1 for this dummy in the Formal Enforcement Action period. This variable is always 0 for term accounts, which were never covered by the programs.

- *Checking.* This dummy variable is equal to 1 if the account is a checking account and 0 otherwise. Our definition of checking accounts is comprised of non-interest checking accounts, NOW accounts, and IOLTAs. This definition excludes money market deposit accounts and other savings accounts, which we collectively refer to as savings accounts. Our definition of checking accounts is constructed to agree with the definition of transaction accounts in Federal Reserve Regulation D.

- *Direct Deposit.* This dummy variable is equal to 1 if the account is receiving a recurring direct deposit roughly every two weeks, in the form of a paycheck or a sweep from a brokerage account, for example, as of the start of the measurement period. It is 0 otherwise, and always 0 for term deposits.

- *Log(Age).* This is the natural log of the time (in years) elapsed since the primary account holder first appears in the deposit records, as of the start of the measurement period. If a depositor's original account has been closed but the individual still has other accounts with the bank, the age of the relationship is based on the age of the original account. If an individual was a secondary depositor on an account before they became a primary account holder on another account, we use the date at which the joint account was opened, as this is still an existing deposit relationship. 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 the discussion of placed deposits below for more details.

- *Prior Transactions.* This is the proportion of days in the past year, as of the start of the measurement period, in which the account holder performed at least one deposit or withdrawal involving the account under study. A value of 0 thus implies no activity and 100 implies activity every day.[5] This serves as another measure of depositors' relationship depth. This variable is always 0 for term accounts.

- *Institutional - Listed/Faxed (term deposits only).* This is the first of two dummy variables capturing institutional term deposits. We use two dummy variables to distinguish between different marketing/communication channels through which such term deposits arrive at the bank. First, we consider a deposit institutional if 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. In practice, particularly later in the bank's life, nearly all institutional term deposits are held by small depository institutions from across the US. Listed deposits are those collected through deposit rate listing services, and correspond to the Call Report item for "listing service deposits." Faxed term deposits are those which arrived at the bank via a facsimile from the depositor, an attribute we hand-identify from the bank's internal records. We group faxed deposits with listed because internal bank documentation, depositor behavior, and depositor types (namely, small depository institutions) all indicate that the faxed deposits were almost exclusively gathered from depositors who saw the rates on listing services and simply faxed their deposit request to the bank, rather than communicating directly through the listing service. We expect that institutional depositors are likely more informed about the conditions of the bank, but also face higher switching costs due to the need to acquire necessary bank services. Note that this dummy variable is defined only for term deposits. A second institutional deposit dummy is defined for term deposits, and a third for transaction accounts.

- *Institutional - Other (term deposits only).* This dummy variable is equal to 1 if the

[5] In calculating this variable, we exclude transactions which are exogenous to the depositor, such as routine, monthly interest credits.

depositor is one of the institution types listed in the bullet immediately above, but arrived by a method other than a listing service or facsimile. It is 0 otherwise. This is the second and last institutional variable defined for term deposits.

- *Institutional (transaction deposits only).* This dummy variable is equal to 1 if the account is a transaction account and the depositor is one of the institution types listed in the definition of the Institutional - Listed/Faxed variable, above. It is 0 otherwise. The bank did not collect any transaction deposits via listing services or facsimile, so we use only one institutional dummy for transaction accounts.

- *Trust.* This dummy variable is equal to 1 if the account is set up as a trust, either living or irrevocable, and 0 otherwise. Trust accounts require effort and can be expensive to establish, and they are a useful legal device mainly for depositors who are relatively wealthy or who have complex household balance sheets. As such, we expect accounts held in trust to represent more sophisticated end-depositors, who would legally be the trustees of the trust who would have authority to make decisions about the account. This definition includes payable-on-death agreements.

- *Log(Days to Maturity).* This is the natural log of the number of days until the maturity of the account as of the start of the measurement period. This value only exists for term accounts, and is always 0 for transaction accounts.

- *Placed.* This dummy variable is equal to 1 if the deposit was placed by a fiduciary or deposit broker instead of by an individual depositor. It is 0 otherwise and is always 0 for transaction accounts. Many CDs 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 each individual account may have a different true owner and the reported holder is only a fiduciary that may not make final withdrawal decisions. Note that we assume all placed deposits are insured. This assumption is supported by internal FDIC analysis of several failed banks, which found that nearly all brokered deposits at those banks were insured at time of failure. Additionally, we have reviewed the websites of a sample of the deposit placement services present at our bank, and they advertise that they structure their deposits so as to achieve full insurance coverage. Because we generally don't see the underlying depositors for placed deposits, making a more granular insurance determination is not possible.

Summary statistics, based largely on these variable definitions, are shown in Tables 1 (for new depositors) and 2 (for extant depositors). These tables will be discussed at greater length below.

2.2 Defining Time Periods of Special Relevance

As a final note before delving into the analysis, we define some nomenclature related to time periods of particular interest. In the empirical models of Sections 4 and 5, we analyze depositor behavior in four windows of time. We also use these time periods to some extent in the historical analysis of Section 3, and they are presented as grey bars in Figures 1 and 2. We identified these time periods using the bank's data and macroeconomic events in order to highlight important findings. While the precise reason for our choice of periods will become clear momentarily, in brief, the four periods are:

- *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. We chose the period because it is well before the crisis (necessary for a placebo) and is the earliest period for which the data are reliable. Data prior to the Placebo period is less reliable, as the bank did not maintain complete records that far back due to changes in the bank's deposit database systems.

- *Pre-Crisis.* The next time period we focus on is the year-long period before the financial crisis, by which we mean the year-long period ending just before September 2008. One might expect depositors to show some signs of the system-wide anxiety which was building in financial markets, and indeed they do, but there were no significant revelations of bank-specific trouble. In this period, uninsured deposits began running off, particularly uninsured term deposits. We end this period before September 2008 and intentionally exclude the crisis from the period.

- *Post-Crisis.* The Post-Crisis period begins shortly after the government's emergency actions in fall 2008. Clearly, the Post-Crisis period was a period of considerable distress across the financial system, which we will show was reflected at our bank. As in the Pre-Crisis period, though, there were not significant revelations of bank-specific trouble at this bank being studied. We exclude a few months in the fall of 2008 to avoid confounding factors which would obscure the relationships of interest. The large variety of emergency actions by the US government occurring in a short span of time, as well as markets' expectations related to these actions before their implementation, have the potential to generate unintuitive depositor behavior and make it difficult to causally identify the effects of any given program. While the fall of 2008 is certainly an interesting episode, we do not wish to contaminate our estimates of, say, the effect of deposit insurance with such confounding factors.

- *Formal Enforcement Action.* Well after the crisis but about a year before the bank failed, its primary federal regulator issued a formal enforcement action against the bank. The regulator issued a publicly announced Cease & Desist (C&D) order placing a number of restrictions on the activity of the bank. This action was intended to address the declining health of the bank and prevent its failure, though it was of course not successful in this aim. We refer to the period between the Cease & Desist order and bank failure as the Formal Enforcement Action ("Formal") period. Like the Pre-Crisis and Post-Crisis periods, this was also a period of significant distress for the bank. Unlike any of those earlier periods, though, the stress arose from the publication of bank-specific adverse information, rather than from system-wide anxiety, the latter having largely subsided since the crisis.

3 Historical Background Depositor Withdrawals and Deposit Composition

This section will provide a more detailed history of the bank, both to present several of our key findings as well as to motivate later empirical results.

Until mid-2007, this bank appeared relatively healthy. The balances in less-than-fully insured (henceforth, "uninsured") accounts, both transaction and term deposits, were steadily rising (see Figures 1 and 2). As we will discuss in Section 4, our regressions also support this assertion; most importantly, deposit insurance had comparatively little power to explain account liquidation behavior, which we interpret as a lack of concern regarding the bank's credit risk.

By mid-to-late 2007, signs of the growing financial-system-wide solvency and liquidity concerns, and their indirect impact on depositors' assessment of our bank's riskiness, are evident. Between mid-2007 and August 2008, there was net run-off in uninsured balances. Figures 1 and 2 show that the run-off was particularly rapid among 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 systematic variation in insured deposits, likely due to the presence of deposit insurance. While this period excludes the worst of the financial crisis, stress was clearly building in the financial sector, particularly in securitization and money markets (Federal Reserve Bank of St. Louis (2011)). Moreover, this period includes the high-profile failures of Bear Stearns and IndyMac in the US and the run on Northern Rock in the UK. Thus, it is not surprising that depositors, particularly more sophisticated depositors, would begin to react.

Our finding that uninsured term deposits ran off earlier than transaction deposits is, at first, surprising. It is particularly important given that economists often consider term deposits to be a more stable source of funding than many transaction accounts. Although this term deposit stability assumption appears intuitively appealing, our data suggests otherwise; and we posit a couple of reasons for the phenomenon. First, term deposit investors, particularly uninsured term deposit investors, tend to be relatively sophisticated. A greater share of term depositors than transaction depositors are corporate entities (especially depository institutions) at our bank, and these corporate entities might be expected to manage their assets more carefully. Transaction depositors are more likely to be individuals investing on their own behalf or maintaining transactional balances. Second, the decision to open or rollover a term deposit is inherently more forward-looking than decisions regarding transaction accounts. Because term deposits have a fixed maturity, term depositors are likely to consider the long-term health of the bank more carefully than depositors who can withdraw their funds penalty free, on demand.[6] Thus, it is not surprising to find that account features that make withdrawals more difficult are associated with depositors being more careful about

[6]This second rationale is partly behavioral; generally speaking, this bank's term depositors did not pay an early withdrawal fee beyond forfeiting interest earned, and sometimes paid less than that. Over our sample period, a few dozen early CD breakages resulted in penalties which exceeded earned interest by as much as 2% of the principal balance (usually 1% or less), but most of these penalties were promptly reversed by the bank and credited back to the depositor. Thus, there were effectively very low costs to early CD withdrawal. Nonetheless, term depositors appear to have behaved as though they were making the deposits for the entire CD term. The very low rate of early CD breakage supports this assertion.

renewing such accounts during times of stress. Supporting the assertion that term depositors viewed their investments as non-callable, we observe few early CD breakages.

The crisis in the fall of 2008 was a period in which severe credit and liquidity risks were realized across the financial system, and it was also a period of 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.[7] Additionally, the FDIC's TAG program became effective on October 14, 2008, temporarily providing unlimited deposit insurance for NOW accounts, non-interest-bearing demand deposit accounts, and IOLTAs, which comprise all categories of checking accounts at our bank. The change in deposit insurance is evident in Figures 1 and 2, where uninsured deposits drop precipitously and insured deposits jump between the Pre-Crisis and Post-Crisis periods denoted with grey bars. The bulk of that sudden change in balances by insurance status is mechanical, as deposit accounts between $100,000 and $250,000 suddenly became insured. A smaller portion of the change among transaction accounts also reflects the almost simultaneous application of TAG guarantees. Relatively little of the changes in transaction account balances between the Pre- and Post-Crisis periods were due to actual deposit flows. In contrast, the change in term deposit balances is driven both by the increase in the insurance limit and also by the bank's contemporaneous, rapid acquisition of third-party placed deposits, as shown in Figure 4 and discussed at greater length below.

Further supporting our assertion that term depositors at the bank were more risk sensitive, uninsured CD balances never increase substantially after October 2008. From then until the bank's failure, there were roughly 100 CD accounts which we flag as potentially uninsured. However, as noted above, our measure of insurance coverage is not perfect. In particular, while we can say definitively that accounts we consider to be fully insured are

[7] Initially, this increase was only temporary, through the end of 2010, but it was subsequently made permanent by the Dodd Frank Act.

in fact insured, there may be some accounts we flag as potentially uninsured that are also insured. Given their unresponsiveness to market-wide credit and liquidity concerns, as well as their insensitivity to bank-specific adverse information, shown in Figure 2, it is possible that many of these remaining term deposits were insured. Alternatively, survival bias may mean these remaining accounts have holders that are extremely attached to the bank. In contrast to term deposits, and reflecting their lower risk sensitivity, uninsured transaction deposits continued to accumulate, even during the remainder of the financial crisis and recession. Note that we consider TAG-covered accounts to be insured for the purposes of this discussion. Uninsured transaction deposits only began to run-off again (in the aggregate) after the formal enforcement action, shortly before the bank's failure.

This depositor behavior suggests that the time between the financial crisis and the formal enforcement action (discussed below) was one of limited stress. The acute system-wide or macroeconomic stress of the crisis had receded and the bank's health had not yet deteriorated to a critical point.

Then, around 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 C&D order.[8] The C&D order was made public immediately and appeared in the local press within a couple of business days. It was described by one banking analyst quoted by the local press as unusually harsh and indicative of very high supervisory concern about the bank. The C&D order was also very broad in the issues it identified, including insufficient capital, inadequate board oversight, deficient and incompetent management, problematic internal policies, and inaccurate financial reporting. Around the same time, reports in the local press remarked on the bank's poor health as revealed by its financial ratios, which would have been public

[8]The bank had previously been subject to a non-public memorandum of understanding (MOU) with its regulator as well as a later non-public 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 the earlier stages of decline, when failure is still relatively unlikely.

information based on regulatory reports published around the same time.[9]

Unsurprisingly, given the negative attention on the bank, transaction depositors responded strongly to the news, with an increase in aggregate run-off. Even insured transaction deposits ran off over the period, though not nearly as rapidly as uninsured deposits. As noted above, there were few uninsured term deposits left at the bank, although the few that remain still respond to the news.

Finally, three to four months before the bank failed, the banks' public regulatory filings (including amendments to previously filed and published filings) began showing the bank to be "significantly undercapitalized" and, within weeks, to be "critically undercapitalized." 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%; that is, if they are nearly insolvent in book value terms. 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.[10] Although supervisors are allowed to delay closing a bank beyond 90 days under certain circumstances, this is fairly uncommon, and contemporary press coverage of the bank supported the idea that such a delay was unlikely. Thus, depositors could expect the bank to fail very soon. As might be expected, uninsured deposit run-off accelerated substantially, as shown in the far right 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, which was highly concentrated in exotic residential mortgage products, including adjustable rate mortgages.

[9] We are unable to confirm the exact date of the regulatory report's release due to institutional transitions.
[10] See 12 U.S.C. §1831o for more detail.

4 Deposit Run-*Off*

This section presents the results of several different regression models to demonstrate new findings and also to formalize some of the key results from the previous section. We regress the account liquidation dummy on a variety of account and depositor characteristics in the context of Cox proportional hazard, linear probability (LPM), and probit models. Because the liquidation behavior of term deposits is conceptually and empirically quite different from that of transaction deposits, we run regressions separately on the two categories. For both term and transaction deposits, we run the models on four separate sample periods, one for each of the four time periods described above: Placebo, Pre-Crisis, Post-Crisis, and Formal Enforcement Action. We chose these four periods carefully, based largely on the analysis documented in the previous section, to capture periods of particular interest. Transaction accounts show a steep run-off among uninsured deposits in the Formal period. With respect to term deposits, uninsured deposits ran off largely in the Pre-Crisis period, and the large run-*in* of institutional deposits in the Formal Enforcement Action period is covered more in Section 5.

In the discussion of the results, we will generally compare the Cox model results across different time periods. The Cox results are expressed as hazard ratios, meaning that they can be sensibly compared in spite of the fact that the time periods of the regressions are of different length. The variation in sample length makes direct comparison of LPM and probit results more difficult. We also include dummies in all regressions for the physical bank branch to which a deposit account is linked in the bank's internal data. We do not, however, report the coefficient estimates for the branch controls.

4.1 Drivers of Transaction Deposit Run-Off

Focusing first on transaction deposits, Tables 3, 4, 5, and 6 present the regression estimates. The regression results for transaction deposits show that deposit insurance is effective in making deposits more stable. They also show that the TAG guarantees were effective. Further, our results provide support for intuition embodied in bank liquidity regulation, particularly with respect to checking accounts and the effect of direct depositing of paychecks. We also show that depositors with longer relationships with the bank are more sticky, particularly in the face of adverse information about the bank. In reviewing the results, we will also see further evidence of a finding from the previous section: transaction deposits were relatively less risk-sensitive than term deposits. Transaction account regressions generally don't show evidence of depositor response to system-wide financial stability concerns until after the fall of 2008, and the stress peaks only in the last year before bank failure. In contrast, the term deposit regressions will show an earlier response; as noted above, there were few uninsured term deposits remaining at the bank by late 2008.

The Placebo period (Table 3) establishes a baseline for "normal" depositor behavior when there is little financial stress. Recall that the Placebo period is in 2006.

First, we find that deposit insurance is effective in improving banks' funding stability. Accounts over the FDIC insurance limit were more likely than other accounts to liquidate, even during the Placebo period. Over the period, such accounts were liquidated at a rate about 14% faster than the baseline hazard. In contrast, the interaction of the Over FDIC Limit dummy with the Checking account dummy is not statistically different from zero. This is a useful finding because, during and after the crisis, exactly this set of accounts was covered by the temporary, unlimited FDIC insurance provided by TAG.[11] This result establishes that large checking accounts are not more or less likely to liquidate than other

[11] Strictly speaking, the sets of accounts are not identical because the deposit insurance limit also changed between the Pre-Crisis and Post-Crisis periods.

uninsured accounts in normal times. This baseline can later be compared to results for other periods to better quantify the stability-improving impact of TAG guarantees.

Next, our results support the widely held belief that checking accounts are a comparatively stable funding source. In the Placebo period, depositors liquidated checking accounts at only a little more than half the baseline hazard rate. Regulatory agencies have embedded this belief in rules, such as the LCR and NSFR, which we will discuss at greater length below. To be considered the most stable form of funding for LCR purposes, deposit accounts must be fully insured retail deposits and either be a checking account or be held by a depositor with other relationships with the bank (such as loans, other accounts, bill payment services, etc.; Basel Committee (2013)).[12]

Similarly, we find that accounts which are receiving direct deposits roughly every two weeks (indicative of direct-deposited paychecks or other regular payments) are also less likely than other accounts to liquidate. This finding also supports intuition embodied in the LCR and NSFR rules. The Basel proposal for LCR specifically notes that checking accounts should, on average, be more stable, at least partly because they are the types of accounts into which depositors might have salaries deposited (Basel Committee (2013)).

We also control for a number of other account and depositor characteristics. Because there is relatively little interesting variation across time periods in our coefficient estimates for these additional controls, we will discuss them mainly with respect to the Placebo period. Depositors with a longer relationship with the bank are generally more stable, though the coefficients are only significant in the Placebo and Formal periods.

The rate at which depositors conduct transactions has a significant, non-linear relationship with liquidation behavior. The result turns out to be fairly intuitive. Accounts on which depositors only occasionally transact are more likely to liquidate than other accounts.

[12]Recall that our definition of "checking account" is synonymous with the definition of "transaction account" in Federal Reserve Regulation D.

This reflects the fact that the depositor is generally aware of the account's existence (they occasionally transact), as opposed to forgotten accounts which never transact and liquidate relatively less often. As the frequency of transactions rises, the negative coefficient on the squared term quickly comes to dominate the positive linear term. Thus, as the depositor uses the account more (suggesting its functionality is more critical to the depositor), the account becomes less likely to liquidate than the baseline. While there are statistically significant differences in this basic result across time periods, the differences are economically small.

Finally, transaction accounts held by institutional depositors are not significantly more or less likely to liquidate than the baseline account in all periods. Trust accounts show substantial variation across periods in their relative liquidation rate.

Moving to the Pre-Crisis period in Table 4, we see that very little has changed. This is generally consistent with the historical discussion above in which transaction deposits generally did not react much to building financial system weaknesses before the crisis. The same result will not be true for term deposits. Column 4 of Table 4 shows which Cox model coefficients are statistically different from their Placebo period counterparts.[13] Only the Prior Transactions coefficients are statistically different from their Placebo period counterparts, although the sign and statistical differences from zero remain unchanged. The point estimates for the impact of deposit insurance are slightly smaller than in the Placebo period, but they are not statistically different from one another in the Cox model (again, see column (4) of Table 4).

Stress among transaction depositors becomes evident in the Post-Crisis period (Table 5), when most coefficients are statistically different from their values in the Placebo period. Surprisingly, the deposit insurance dummy is not statistically different from its earlier value, but the point estimate is much larger: such accounts liquidate at a 44% higher rate than

[13] We assess significance using a t-test assuming the two coefficients are independently distributed random variables.

other accounts at the time. Of course, this impact remains statistically different from zero, just not from the comparable estimate in an earlier period.

Additionally, these regressions suggest that TAG guarantees were equally as effective in preventing liquidation as ordinary deposit insurance during the Post-Crisis period. This is the first period in which TAG was in place, and the coefficient estimates are significantly different from earlier estimates on the interaction of the insurance and checking dummies, which are the same accounts as those covered by TAG, being statistically significantly lower and thus less likely to liquidate. In spite of the difference between the coefficients in the Placebo and Post-Crisis period, however, only the LPM coefficient estimate is statistically different from zero in the Post-Crisis period (none were statistically different from zero in prior periods). Comparing the point estimates for Over FDIC Limit and Covered by TAG/DFA in the first two rows of the table, we see that they are about the same magnitude in opposite directions (where the opposite signs arise from our definition of the dummy variables). A t-test of differences in the magnitudes of the coefficients on the two insurance coverage dummies fails to reject the null of no difference, with a p-value of 0.94, indicating they are effectively the same size. Given that TAG was new and unconventional, the program and its operational details would have been unfamiliar to depositors. Thus, it is interesting to find that depositors react to it the same as regular deposit insurance.

Relative to earlier periods, checking accounts are less stable under stress. However, they are still more stable than non-checking transaction accounts (i.e., savings accounts). Accounts receiving bi-weekly direct deposits were always previously less likely to liquidate than other accounts, and the impact is even stronger in the Post-Crisis period than the Placebo. The impact of prior transactions is statistically but not economically significantly different relative to the Placebo period.

Finally, in the Formal period, it is clear that transaction depositors responded to the bad news about their bank (Table 6). Most importantly, the impact of FDIC insurance is statistically stronger than in the Placebo period; uninsured accounts now liquidate at a rate 92% faster than other accounts in the period. The fact that deposit insurance had such a large effect on liquidation behavior supports the assertion that depositors were well aware of and very concerned by the bank's critically declining health. Of course, it also shows that deposit insurance is effective in drastically improving the stability of deposits.

The result for the Covered by DFA dummy merits additional discussion. As the TAG program ended during the Formal period, its dummy must be revised for our Formal period regressions. Following its expiry, the DFA continued its unlimited insurance coverage on checking accounts and IOLTA accounts, but not NOW accounts, through 2012.[14]

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 relationship between NOW status and liquidation at the same time that non-interest checking and IOLTA accounts may show a negative relationship. Additionally, while the Cox model includes time-varying variables, our cross-sectional LPM and probit models cannot. Given that there is confounding time variation in the TAG dummy, we revise the dummy to only capture accounts covered by the DFA guarantees.

We find that DFA guarantees statistically significantly decreased the probability of account liquidation only in some specifications in the Formal period, though the point estimates remain similar to the corresponding estimates from the Post-Crisis period and are not as large as the effect of regular deposit insurance in the Formal period. There are relatively few accounts covered by DFA guarantees which were over the regular FDIC limit, so the coefficients are estimated with less precision than in earlier periods. It is possible DFA guarantees may have been less effective, perhaps because depositors were not aware of them following the end of the more high-profile TAG guarantees, and the set of accounts covered is narrower under the DFA guarantees.

[14]NOW accounts continued to benefit from ordinary deposit insurance.

Table 6 also shows that checking accounts; accounts routinely receiving direct deposits every other week; and accounts held by depositors with longer relationships with the bank all continue to be statistically significantly stickier that other accounts in the period. Interestingly, while checking accounts remain less likely to liquidate than other accounts within the Formal period, the impact of the Checking dummy on liquidation probability is statistically smaller than the corresponding estimate in the Placebo period; checking accounts remain sticky following bank-specific bad news, but they are 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 become more sticky. There is no corresponding change for the Direct Deposit dummy.

Interestingly, transaction accounts held by trusts are statistically significantly more likely to liquidate than other accounts during the Formal period, perhaps due to depositor sophistication. In prior periods, trust accounts were either less likely to liquidate or not significantly different from other accounts.[15] We suggest that this may reflect the fact that trust depositors are likely more financially savvy than other depositors. Trusts are typically not useful legal tools for individuals with little wealth. As a result, the average trust depositor is likely more wealthy than the average individual depositor, which means they are likely also more financially savvy. If that is true, then trust depositors should be especially able to determine the solvency of the bank. In the earlier periods, there was market-wide stress that affected many depositors, but trust depositors may have correctly determined that the near-term risk to this particular bank was limited. Similarly, they may have better understood the true health of the bank after the enforcement action.

[15] Note, however, that the Cox model estimate from the Formal period, which is statistically distinguishable from zero, is not distinguishable from its Placebo period value (see column (4) of Table 6).

4.2 Drivers of Term Deposit Run-Off

Next, we consider the term deposit regressions. By way of a summary of results, the regressions support the findings from Section 3 that uninsured term deposits were more risk sensitive than uninsured transaction deposits, and they fled the bank earlier. We again find that deposit insurance is effective in improving deposit stability and we show that placed deposits exhibit a great deal of churn, liquidating often, but respond even stronger under stress. It's worth repeating our earlier finding that there are few instances in which term depositors liquidate their accounts before maturity; most liquidations occur as the term deposit rolls over.

In the Placebo period (Table 7), we find that deposit insurance does not cause CDs to liquidate more or less often. Particularly in light of the strong effects in later periods, we interpret this as evidence that depositors were not concerned about the bank's health in the Placebo period, consistent with our expectation. Placed CDs are statistically significantly more likely to liquidate, and they do so at a rate about three times as fast as other CDs, according to the Cox model estimates. This likely reflects the conventional belief in the banking industry that third-party-placed deposits are closer to "hot money," actively pursuing the highest returns. As a result, they are also less stable. As was true for transaction deposits, we find that the age of a depositor's relationship with the bank is negatively associated with liquidation probability.[16] Finally, Table 7 shows that the further a CD is from its maturity date, the less likely it is to liquidate. This reflects the fact that very few term deposits were withdrawn before maturity, especially in the Placebo period.

Table 8 shows comparable results for the Pre-Crisis period. The Over FDIC Limit dummy is now statistically different from zero and from its Placebo period value. Uninsured term

[16] Recall that age, here, means the length of the depositor's relationship with the bank, including relationships established via accounts other than the current CD account. A CD's remaining time to maturity is captured by a separate variable. Recall also that we treat the age of placed deposits differently, as discussed in Section 2.1.

deposits run-off at a rate about 17% faster than insured deposits. Recall that this is the period in which uninsured term deposits begin running off, likely in response to concerns relating to the health of the financial system. Relatedly, the impact of insurance in this period is also larger than the corresponding estimate for transaction deposits. The stabilizing impact of depositor relationship age is stronger relative to the Placebo period and the impact of time to maturity is attenuated; the latter likely reflects the fact that there are more early liquidations than in the Placebo period. The differences in both coefficients between the two periods are statistically significant, as indicated in column (4). Similarly, the stabilizing impact of trust accounts is attenuated relative to the Placebo period, such that they are no longer more stable than other term deposit accounts.

Table 9 demonstrates responses in the Post-Crisis period. Point estimates for the impact of FDIC insurance are substantially higher than in earlier periods, and statistically different at least relative to the Placebo period. The Cox model estimates a very large impact of insurance on term deposit liquidation: uninsured CDs liquidate at a 64% faster rate. The results also show that placed deposits, which we expect would be particularly risk-sensitive, run-off very rapidly, at 5.6 times the rate of the baseline deposit. The impact of time to maturity is especially strong in the Post-Crisis period.

Finally, Table 10 shows results for the Formal period. The impact of FDIC insurance remains large in magnitude, and the effect of age is negative and significant in some specifications. CDs further from maturity are still less likely to liquidate, and trust accounts are more likely to liquidate, as was seen with the transaction accounts in the Formal period. Particularly of note is the large response from wholesale accounts. Institutional deposits, both faxed and listed and to a lesser extent other institutional deposits, are more likely to liquidate. However, as many enter after the start of the Formal period, they do not enter into this regression for us to observe their liquidation. The placed deposits, on the other hand, run off at a rate fourteen times faster than other term deposit accounts, an incredibly high response showing the high risk sensitivity of these wholesale deposits as the bank approaches failure.

4.3 Account Liquidation and the Withdrawal of Insured Funds

Having established the increased propensity of uninsured depositors to drawn down their deposits, it remains an open question as to whether uninsured depositors concerned about the bank's health will draw down their deposits to the limit or instead draw down well below the limit. In this section, we show that when uninsured depositors withdraw funds during times of bank-specific solvency concerns, they tend to withdraw substantially more than necessary to obtain full insurance coverage. That is, they withdraw insured funds from the account in addition to uninsured funds, meaning that even insured funds can be unstable in the face of bank risk. This is an important consideration for economists concerned with financial stability and also supports our choice to code all funds in an incompletely insured account as uninsured (see Section 2.1).

Table 11 presents our results on this topic for transaction accounts.[17] Each row represents one of our four periods, and for each period we consider the set of accounts with balances $2,000 below the insurance limit or higher at the start of the period. The columns then show balances of these accounts arranged into six different bins at the end of the period. If uninsured depositors are only drawing down to the limit under stress, we should see a large number of uninsured deposits end up in the bin within $2000 of the deposit insurance limit (column (5)). If the depositors are instead halving accounts, emptying them entirely, or using some other rule of thumb to perform withdrawals, we should instead see larger numbers of accounts ending up in columns (1-4), well below the insurance limit. Particularly in the Formal period, we find evidence of the latter. The largest groupings in the formal period,

[17] 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.

relative to their previous periods, are accounts with $1 or less or those between $2000 and $2000 under half the insurance limit ($2000 to $123000, in this period), with far fewer accounts remaining above the deposit insurance limit than in any other period.

This finding is consistent with empirical findings in Davenport and McDill (2006) and Iyer et al. (2016a), and can serve to inform banking theory models (such as Davila and Goldstein (2016)) on depositor drawdown behavior during times of banking distress.

5 Deposit Run-*In*

The previous section focused on depositor run-*off*, which is traditionally the area of attention with respect to bank funding stability. In this section, we demonstrate that run-*in* is also very important to funding stability, even in a bank which was publicly known to be at high risk of failure. After providing an overview of the run-in dynamics at the bank, we use a regression framework to establish the characteristics of depositors who run in; provide time series evidence that this run-in was not solely driven by macroeconomic factors external to the bank; and provide evidence that the run-in was instead attracted by the combination of credible deposit insurance and above-market rates.

Strikingly, Figure 3 shows that the bank attracted a very large volume of new, insured term deposits in the last year or so of its life, and many of those deposits arrived in the last 90 days, after the bank became critically undercapitalized. In fact, this large inflow was sufficient to offset essentially all fleeing deposits, meaning that total deposit balances declined very little as the bank approached failure. Over the full period from formal enforcement action to failure, it attracted almost $400 million in insured term deposits from new depositors, nearly a third of its aggregate deposit base as of the formal enforcement action.

In addition to being remarkable for their volume, the inflows reflect an important shift in deposit composition near bank failure, which is another of our key findings. Figure 4 captures the shift. Shortly before the C&D order, placed term deposits, a major funding source for the bank, began running off rapidly. Of course, as shown above, both insured and uninsured transaction deposits were also running off, about $350 million over the period. As placed CDs and transaction accounts fled, the bank replaced them with institutional CDs structured to fall just under the insurance limit. Throughout this paper, we define "institutional CDs" as those CDs which were neither brokered nor placed and which were owned by financial institutions, non-financial businesses, and municipalities. However, nearly all of the new CDs attracted after the enforcement action were held by small banks, savings & loan associations, and credit unions from across the US.

The summary statistics in Table 1 provide another perspective on the change in deposit composition. The columns of the table present summary statistics for new depositors arriving at the bank in each of the four time periods on which we focus, which correspond to the grey bars in Figures 1, 2, and 4. For the purposes of these statistics, we define new depositors to be those depositors who have never appeared in the bank's deposit records before the relevant time period. The statistics all treat an account as the level of observation, rather than considering account balances. The chronological ordering of periods runs from left (early) to right (late). The share of new deposit accounts which are uninsured at time of opening declines over time from 4.0% to 0.6%. This generally reflects depositors' concern with the bank's credit risk, and the low level in the Formal period reflects the fact that most deposit inflows in the Formal period were CDs structured specifically to fall within insurance limits. Relatedly, the share of CDs in new deposits is increasing over time; in the Formal period, nearly 90% of new accounts were CDs. New depositors in the Formal period were less likely to have multiple deposit products (1.016 products in the Formal period as opposed to 1.097 deposit products in the Placebo.) This reflects the fact that these new depositors were not retail or "core" depositors, but a form of wholesale funding. Finally, 82% of new deposits in the Formal period came from institutional depositors (Listed, Faxed, and Other), up from 2.8% in the Placebo.

This change in deposit composition is important for several reasons. First, it suggests that depositor discipline was probably ineffective in restraining bank risk-taking. While some depositors enforced discipline on the bank by leaving, others offset the disciplining effect by opening new accounts. This finding is concerning especially because the Basel framework considers market (in this context, depositor) discipline of banks to be the third of three "pillars" of financial stability (see, among others, Basel Committee (2001), Martinez-Peria and Schmukler (1999), and Park and Peristiani (1998)). Our results suggest that depositor discipline may not be a reliable source of financial stability.

Second, by preventing the bank from failing for lack of funding, these new deposits extended the life of the bank. The pessimistic view is that this phenomenon would allow fundamentally insolvent banks to survive for some length of time. US experience, especially in the Savings & Loan Crisis of the 1980s, has demonstrated that prolonging the life of insolvent banking institutions can be costly; providing more time for banks to "gamble for resurrection" tends to increase the cost of resolving them when they ultimately fail (Dewatripont and Tirole (1994), FDIC (1997), and FDIC (1998)). This argument is supported by the fact that, of all US banks which received a formal enforcement action between 2000 and 2012, about 54% have since failed or been acquired by another bank.[18] These failures and mergers tend to occur relatively soon after the enforcement action, with 36% occurring within the first three years after the enforcement action and the remaining 18% occurring thereafter. Considering both that we do not observe instances of external support (such as from a parent entity) for banks subject to enforcement actions and that this bank's enforcement action was particularly harsh, it seems unlikely that the bank was independently viable as of the enforcement action.[19] Nonetheless, a more optimistic view would be that inflows of

[18] Acquisitions are slightly more common than failures among this sample of banks.
[19] The bank also tried and failed to raise capital from at least one private source during the period.

insured term deposits to troubled banks are a benign event which primarily serve to preserve banks' funding and reduce the risk of liquidity failures among fundamentally solvent banks.

Third, the large inflow of new deposits suggests that deposit rate restrictions placed on troubled banks are not sufficient to prevent rapid insured deposit acquisition. To prevent troubled banks from growing rapidly by attracting brokered deposits, US banking laws prohibit banks from continuing to accept brokered deposits unless they are either well capitalized (the highest of the five PCA capital ratio categories) or are adequately capitalized (the next lower PCA category) and have a waiver from supervisors. To prevent banks from circumventing this restriction by offering high interest rates to attract non-brokered deposits, undercapitalized institutions also may not pay deposit rates more than 75 basis points above the national average deposit rate. Again, some banks can obtain a waiver to relax this interest rate restriction. The relevant national average deposit rates are calculated and published weekly by the FDIC. See FDIC (2016) for more details on these restrictions.

The bank we study was subject to these restrictions during the period after the formal enforcement action, and yet they were able to attract deposits equal to a third of their deposit base in the last year or so before failure. Table 1 shows that the bank complied with the rate restrictions; the spread on new accounts in the Formal period was around 69 basis points.[20] 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.

Relatedly, it is interesting to note that the bank consistently, over the full period from 2006 to failure, paid rates well above national averages. Figure 5 displays the rates the

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

bank paid on newly issued 12-month CDs, a common benchmark deposit product and one for which the bank's pricing is representative of that for other deposit products.[21] Despite market interest rates generally falling throughout the later portion of the banks life, the bank was able to attract new deposits by keeping rates well above the industry median. After the formal enforcement action, with increased depositor turnover, the bank went well above the 95th percentile of rates and was thus able to attract new depositors to replace leaving ones, even while complying with the rate restrictions.

The final reason that the shift in deposit composition is important is that the shift also served to quietly transfer risk to the FDIC. Although the fleeing placed CDs and some transaction accounts were insured, about $150 million of uninsured transaction deposits also ran off. Because the bank was successful in replacing these fleeing deposits with insured institutional CDs, the share of the bank's deposits covered by insurance increased. This served to increase the FDIC's exposure to the bank's credit risk just as it was failing; that is, it shifted credit risk to the FDIC. Note that because current FDIC deposit insurance assessments are based on banks' total assets, this increased exposure would also not be priced into the deposit insurance, meaning that the cost of deposit insurance assessments does not discourage this behavior.[22] Similarly, deposit insurance assessments before April 2011 were based on banks' domestic deposits, meaning the same risk-shifting features of deposit insurance existed before 2011, as well.

[21] 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 CDs. In this way, the rate series better reflects the rate a hypothetical depositor would have faced had they approached the bank on that date. We use a moving average because there are a some days in which no new 12-month CDs are issued, and to limit the effects of outliers.

[22] Birchler (2000) makes a related point investigating banks substituting away from acquiring funding from issued uninsured bonds to insured deposits following financial difficulties.

5.1 Characteristics of New Depositors

Having shown that the bank saw substantial deposit inflows, especially late in life, Table 12 shows the results of regressions characterizing the differences between new and extant depositors, by period. The dependent variable is a dummy variable equal to 1 if the depositor is a new arrival in that period and 0 if that depositor is an existing relationship, with the right hand side being a vector of account characteristics.[23] A zero on the right hand side implies that that characteristic is relatively equally distributed between new and existing depositors, and a positive value implies that this characteristic is more common among the new depositors than the existing depositors. This approach offers advantages over raw summary statistics alone, as it compares partial effects of characteristics.

Deposits over the limit are less common among new depositors throughout all four periods we test, and by roughly the same proportion. While the proportion of extant accounts that are uninsured at the bank falls over time, so does the proportion of new depositors that are uninsured, so this number should be expected to be roughly constant. Over-the-limit transaction accounts, on the other hand, are arriving in relatively large numbers in the Placebo period. Potentially due to concerns about the economy, this trend reverses in the Pre-Crisis period, with over the limit transaction accounts being rare among new depositors compared to extant depositors. However, suggesting that TAG was effective in instilling confidence among large checking accounts, in the Post-Crisis and Formal periods, over-the-limit transaction accounts are equally prevalent among new and existing depositors. Checking deposits are always less prevalent among new depositors than existing depositors, and term deposits are always more prevalent. This is consistent with the low run-off rates of checking accounts and higher run-off rates of CDs. As checking accounts are less likely to liquidate, the extant population should have a higher proportion of checking customers

[23] As before, 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.

than the new population. Trust accounts are also notably more common in the Post-Crisis and Formal period.

Among wholesale categories, we observe that placed deposits are relatively less common among new depositors compared to old depositors in most periods, save the Post-Crisis period, when we saw the highest inflows of such deposits. Faxed and listing service deposits, while usually more common among new depositors than extant ones due to high turnover, are drastically more common in the Formal period compared to previous periods. A randomly selected listed or faxed deposit in the formal period has an 87% probability of being a new depositor, all else equal. Other institutional deposits are always more common amongst new depositors compared to old depositors, although due to their relatively small starting size the Pre-Crisis period sees their highest prevalence among new depositors.

5.2 Time Series Drivers of Gross Depositor Run-In

While the previous section illustrates the prevalence of certain depositor characteristics among extant and new depositors, it does not demonstrate the relative prevalence of new depositors compared to old depositors, nor attempt to control for other macroeconomic factors that could explain an overall shifting deposit base. Table 13 builds on this exercise by looking at new deposits as a proportion of total deposits. This regression includes all days of deposit data available from this bank. The left hand side of this regression is the proportion of deposits that are new as of that day, with several time and macroeconomic controls present on the right hand side of the regression.

Macroeconomic controls show results consistent with economic intuition. High stock market volatility, as represented by the log of the VIX, is positively associated with new deposit inflows, as depositors seek safer assets. Higher GDP growth and stock returns are also associated with higher deposit inflows, consistent with higher wealth. Other measures that might impact aggregate deposit flows, such as housing starts or the bank's growth profile, are not statistically significant drivers of new deposits. The time series of new depositors' share of deposits is also strongly persistent at the daily frequency, as shown by the positive and significant AR1 term.[24]

Even after controlling for macroeconomic variables, the new depositor arrival was much higher in the Formal period than other periods. Given our set of controls, this suggests that the cause of the inflows was bank-specific. The omitted time 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 in between those periods. While many of these time dummies are significant in specification (1), many of the effects of time periods are rendered insignificant by the macroeconomic control variables in specification (2). Notably still significant, there is a larger proportion of new depositors in the span between the Placebo to Pre-Crisis period, as this was also a time of deposit growth for the bank. Even larger, and consistent with the bank's observed large inflow of deposits toward the end of life, the average proportion of total deposits that are new in the Formal Enforcement Action period is large in magnitude and significance compared to all other periods. The results of the regressions support the idea that the large inflows during the Formal period were driven by the bank's increase in deposit rates relative to the industry distribution, despite depositors' knowledge of the declining health of the bank.

6 Run-Off, Run-In, and Regulatory Liquidity Ratios

As a final empirical exercise, we use our novel data to assess the realism of run-off rates assumed in the two post-crisis liquidity ratios, LCR and NSFR. This is an interesting exercise for two reasons. First, we show that the stringency of the ratios depends critically on how the ratios incorporate the massive depositor run-in documented above. The rules are unclear

[24] 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.

as to how run-in should be viewed, likely a reflection of the fact that the policy-makers who developed the ratios did not have access to data as rich as ours. While we can study gross inflows and outflows, most other data sources only allow for analysis of net flows. Going forward, policymakers should determine or clarify the rules' treatment of run-in. Second, it is of independent interest to assess the stringency of regulatory requirements, and the unique granularity of our data allows us to make a particularly rigorous assessment. In brief, we conclude that the deposit run-off rate assumptions in the LCR are likely sufficiently conservative, but that the NSFR rates may not be.

Given the nature of our data, our analysis will focus solely on *run-off rate* assumptions *for deposit products* in the two liquidity ratios.[25] Thus, we are not assessing the realism of other aspects of the rules, such as the assumptions relating both to run-off of non-deposit liabilities and to the liquidity of assets. More specifically, we compute the rule-implied aggregate deposit run-off rate for the bank and compare it to the bank's observed aggregate run-off rate. To the extent that the observed rate exceeds the rule-implied rate, we consider the rules to be insufficiently conservative. We compute the rule-implied aggregate run-off rate by categorizing all accounts into the relevant LCR/NSFR run-off categories and then taking a value-weighted average of the categories' assumed run-off rates. We acknowledge that our results should be interpreted with some caution: the single bank we study would not be subject to the rules even if it still existed; it was too small to be covered by the rules. Moreover, larger banks may experience different run-off rates due to differences in, for example, liability structure or business model.

Before turning to the results, we must highlight another significant area of ambiguity in the rules, one related to operational deposits. Operational deposits are business deposits

[25] The rules were initially proposed by the Basel Committee and are now being implemented by country-level supervisory agencies. We focus on the US supervisory agencies' final LCR rule (Federal Register (2014)), as well as their proposed NSFR rule (Federal Register (2016)). The US agencies have not yet finalized the NSFR rule. Note that the results would be little changed if we used the Basel proposals instead.

which are maintained at the bank as part of an arrangement in which the bank provides clearing, custodial, or cash management services, including accounts used for payroll. Operational deposit balances are assumed to be more stable and thus have a lower assumed run-off rate. Importantly, there are not clear guidelines on how to determine the division of accounts, meaning that banks have both the incentive and the discretion to overstate the operational share of their business deposit balances, opening the door for regulatory arbitrage. To reflect this ambiguity, we construct a range of rule-implied run-off rates; the top of the range reflects the assumption that all deposits which could be operational actually are, and the bottom of the range reflects the opposite assumptions. This construction of the range ensures that the range bounds any possible operational business deposit assignment by the bank. [26]

Turning to the results, our analysis suggests that the LCR deposit run-off rates are sufficiently conservative. The results are shown in Figure 6, where net declines in deposit balances (aggregate run-off) are represented with positive values and increases in deposit balances (aggregate run-in) are negative. At no point does the observed run-off exceed the maximum value of the LCR-consistent range, though it comes fairly close in 2008. In that period, for many allocations of business deposits between operational and non-operational categories, the bank's run-off would have exceeded the allowable rate.

In contrast, we find evidence that the NSFR run-off rates may be too low, at least if the intent of the rule was to ensure resilience in the face of severe funding stress (Figure 7). Run-off exceeds the NSFR range both in the period of system-wide anxiety around the crisis and subsequent to the publication of bank-specific adverse information in the year before failure. In the former case, the observed runoff exceeds the rule-implied range regardless of the treatment of run-in. However, allowing new depositors to offset leaving depositors causes

[26] Since the bank was not subject to the liquidity rules, both because of the time period and the bank's size, they likely did not maintain sufficient data internally to make an unambiguous classification. In any event, we do not have such data.

the rule to be breached only marginally for a short period of time. Of course, the upper end of the range assumes that all business deposits at the bank are not operational; to the extent that the bank held operational business deposits, the net run-off exceeds the range by more. In the year the before failure, the result is sensitive to the treatment of the massive depositor run-in; it occurs only if one assumes the relevant comparison is with only extant depositors. Allowing run-in by new depositors to offset exiting deposits brings observed run-off rates back below the threshold.

7 Conclusion

In this paper we use a novel, highly granular, and unique dataset to shed light on deposit inflows and outflows in failing banks, and underlying characteristics which are important in assessing deposit stability. We have a number of results that are important for both academicians and policymakers.

First, we are able to investigate whether government insurance programs, in which much faith is placed, affect deposit stability. We find that FDIC insurance is important and effective in making deposits more stable, with FDIC insured accounts much less likely to flee from the bank.

Second, we find that temporary measures to increase deposit insurance, in particular TAG and DFA-related guarantees, were also effective in increasing deposit stability during times of system-wide banking stress. The impacts of those interventions on deposit account liquidation probability are statistically and economically significant, and they are of similar magnitude to the impact of ordinary deposit insurance. Our results suggest that the programs achieved their stated goal — to increase financial stability in a time of severe stress — in spite of the fact that the programs were institutionally new and thus may have carried with them operational uncertainties in the eyes of depositors.

Third, we show that checking accounts are a more stable source of funding than savings accounts, consistent with assumptions in several Basel III proposals. This result likely reflects the non-pecuniary benefits of such accounts, as well as costs to moving such accounts between banks; checking accounts are frequently used to conveniently automate transactions, both credits and debits, and switching these automated features is costly in terms of time and effort. Hence, such accounts are relatively sticky.

Fourth, we find that term deposits are more risk-averse and run off quicker than transaction accounts. This is contrary to commonly made assumptions that term deposits are stable, which is generally assumed in Basel III and by most economists. This is likely because term depositors are more sophisticated. In particular, uninsured corporate term deposits almost completely exit on signs of trouble.

Fifth, we also find that relationship age matters for deposit stability. When the depositor has been with the bank for a long time they are less likely to flee the bank, even in the face of bad regulatory news. While this could be because of a variety of underlying factors e.g., inertia, inattention, trust, or relationships, the stickiness of such accounts in bad times suggests it is an important source of deposit stability, and suggests that developing long-term relationships can potentially help banks in bad times.

Sixth, we find that while the LCR deposit run-off rates appear appropriate, the NSFR rates may be insufficient. Of course, some caution is warranted in interpreting the results from a single small bank. Nonetheless, the present paper is rare in that it can directly assess deposit run-off in a manner similar to how banks might actually measure and experience it. The fact that we find the NSFR rates to be similar to or generally lower than rates actually experienced by our bank suggests the need for additional analysis.

Last, but not least, we document evidence that banks are able to largely undo any disciplining effect of uninsured depositors. Market discipline of banks is considered to be one of three pillars of financial stability by the Basel Committee and developed country supervisors, and economists generally believe that this is a good reason to allow banks to carry uninsured deposits. However, because the FDIC bears the credit risk of insured deposits, banks can attract insured deposits to replace uninsured depositors as they leave without paying large risk premia. This is particularly true since such troubled banks can pay interest rates sufficiently above market, apparently even while under supervisory restrictions on deposit rates. We show that the bank we study was quite effective in using this method to offset deposit run-off and perhaps to its delay failure, calling into question the efficacy of market discipline as a tool for financial stability.

References

Basel Committee on Banking Supervision (2001), "Working Paper on Pillar 3 - Market Discipline," Bank for International Settlements, September 2001.

— (2013), "Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools," Bank for International Settlements, June 2013.

— (2014), "Basel III: The Net Stable Funding Ratio," Bank for International Settlements, October 2014.

Billett, Matthew T., Jon A. Garfinkel, and Edward S. O'Neal (1998), "The Cost of Market Versus Regulatory Discipline in Banking," *Journal of Financial Economics*, Vol. 48(3), pp. 333-358.

Birchler, Urs W. (2000), "Bankruptcy Priority for Bank Deposits: A Contract Theoretic Approach," *Review of Financial Studies*, Vol. 13(3), pp. 813-840.

Brown, Martin, Benjamin Guin, and Stefan Morkoetter (2014), "Deposit Withdrawals from Distressed Commercial Banks," University of St. Gallen, School of Finance Research Paper 2013-19.

Calomiris, Charles W., and Joseph R. Mason (1997), "Contagion and Bank Failures during the Great Depression: The June 1932 Chicago Banking Panic," *American Economic Review*, Vol. 87(5), pp. 863883.

Chari, Varadarajan V., and Ravi Jagannathan (1988), "Banking panics, Information, and Rational Expectations Equilibrium," *The Journal of Finance*, Vol. 43(3), pp. 749-761.

Davenport, Andrew Mitsunori, and Kathleen Marie McDill (2006), "The Depositor Behind the Discipline: A Micro-Level Case Study of Hamilton Bank," *Journal of Financial Services Research*, Vol. 30, pp. 93-109.

Davila, Eduardo, and Itay Goldstein (2016), "Optimal Deposit Insurance," mimeo.

Dewatripont, Mathias, and Jean Tirole (1994), "The Prudential Regulation of Banks," MIT Press.

Diamond, Douglas W., and Philip H. Dybvig (1983), "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy*, Vol. 91(3), pp. 401-419.

Egan, Mark, Ali Hortaçsu, and Gregor Matvos (2017), "Deposit Competition and Financial Fragility: Evidence from the US Banking Sector," *American Economic Review*, Vol. 107(1), pp. 169-216.

Federal Deposit Insurance Corporation (1997), "History of the Eighties Lessons for the Future."

— (1998), "Managing the Crisis: The FDIC and RTC Experience, 1980-1994."

— (2016), "Frequently Asked Questions on Identifying, Accepting and Reporting Brokered Deposits," https://www.fdic.gov/news/news/financial/2016/fil16042.html, accessed on January 11, 2017.

Federal Register (2014), "Liquidity Coverage Ratio: Liquidity Risk Management Standards; Final Rule," Vol. 79(197), October 10, 2014, pp. 61440-61541.

— (2016), "Net Stable Funding Ratio: Liquidity Risk Management Standards and Disclosure Requirements; Proposed Rule," Vol. 81(105), June 1, 2016, pp. 35124-35183.

Federal Reserve Bank of St. Louis (2011), "Full Timeline of the Financial Crisis," https://www.stlouisfed.org/financial-crisis/full-timeline, accessed on March 9, 2017.

Goldberg, Lawrence G., and Sylvia C. Hudgins (2002), "Depositor Discipline and Changing Strategies for Regulating Thrift Institutions," *Journal of Financial Economics*, Vol. 63(2), pp. 263-274.

Gorton, Gary (1988), "Banking Panics and Business Cycles," *Oxford Economic Papers*, Vol. 40, pp. 751-81.

Iyer, Rajkamal, and Manju Puri (2012), "Understanding Bank Runs: The Importance of Depositor-Bank Relationships and Networks," *American Economic Review*, Vol. 102(4), pp. 1414-1445.

Iyer, Rajkamal, Thais Jensen, Niels Johannesen, and Adam Sheridan (2016a), "The Run for Safety: Financial Fragility and Deposit Insurance," mimeo.

Iyer, Rajkamal, Manju Puri, and Nicholas Ryan (2016b), "A Tale of Two Runs: Depositor Responses to Bank Solvency Risk," *Journal of Finance*, Vol. 71(6), pp. 2687-2726.

Martinez-Peria, Maria Soledad, and Sergio Schmukler (1999), "Do Depositors Punish Banks for "Bad" Behavior?: Market Discipline, Deposit Insurance, and Banking Crises," *Journal of Finance*, Vol. 56(3), pp. 1029-1051.

Park, Sangkyun, and Stavros Peristiani (1998), "Market Discipline by Thrift Depositors," *Journal of Money, Credit, and Banking*, Vol. 30(3), pp. 347-364.

Saunders, Anthony, and Berry Wilson (1996), "Contagious Bank Runs: Evidence from the 1929-1933 Period," *Journal of Financial Intermediation*, Vol. 5(4), pp. 409-423.

Table 1: Summary Statistics for New Depositors, by Period

	Placebo	Pre-Crisis	Post-Crisis	Formal
Number of New Accounts	2858	1872	813	2199
New Depositors Per Day	13.355	5.128	4.492	6.525
Over FDIC Limit at Start of Account	0.040	0.024	0.010	0.006
Starting Balance	28111	33482	66207	168262
CD	0.446	0.498	0.406	0.869
Savings	0.504	0.386	0.424	0.070
Checking	0.049	0.116	0.170	0.061
Checking & Over FDIC Limit	0.009	0.006	0.005	0.000
↪ *(TAG/DFA-covered accounts)*				
Starting Interest Rate	4.698	3.468	1.552	1.191
Starting Interest Spread to Market	2.883	1.919	0.877	0.693
Types of Account At Bank	1.097	1.076	1.084	1.016
Institutional - Listed	0.000	0.002	0.004	0.574
Institutional - Faxed	0.000	0.005	0.028	0.178
Institutional - Other	0.028	0.222	0.225	0.066
Placed	0.001	0.029	0.181	0.009
Trust	0.037	0.031	0.082	0.037

This table shows summary statistics across all new depositors opening accounts in each of the four event periods. Depositors who already had an account at the bank at the beginning of each period are excluded. All statistics are calculated within the relevant event period and exclude all other days. "Types of Account at Bank" takes an integer value of 1 to 3 for each depositor, counting the number of deposit products they will have over their lifetime among CD, savings, and checking accounts.

Table 2: Summary Statistics for Extant Depositors, by Period

	Placebo	Pre-Crisis	Post-Crisis	Formal	Failure
Number of Accounts	42257	46332	38927	31114	25847
Over FDIC Limit at Start of Period	.064	0.084	0.011	0.022	0.016
Starting Balance	27865	27466	32057	44886	48642
CD	0.196	0.256	0.226	0.127	0.194
Savings	0.728	0.676	0.694	0.762	0.674
Checking	0.077	0.068	0.080	0.111	0.132
Checking & Over FDIC Limit	0.006	0.007	0.004	0.004	0.004
↪ *(TAG/DFA-covered accounts)*					
Direct Deposit	0.027	0.029	0.023	0.034	0.031
Starting Interest Rate	4.095	4.372	2.484	0.936	0.880
Starting Interest Spread to Market	2.979	3.090	1.763	0.740	0.665
Types of Account At Bank	1.341	1.348	1.340	1.317	1.330
Institutional - Listed	0.000	0.000	0.000	0.002	0.062
Institutional - Faxed	0.000	0.000	0.001	0.001	0.021
Institutional - Other	0.014	0.016	0.028	0.050	0.068
Placed	0.013	0.016	0.047	0.039	0.008
Trust	0.015	0.017	0.017	0.023	0.028
Age of Relationship in Years	2.241	3.103	4.25	5.810	6.120
Years Since Start of Previous Period	-	1.25	1.25	1.78	0.92

This table shows summary statistics across all extant depositors that had accounts at the start of the four event periods. All statistics are calculated within the relevant event period and exclude all other days. “Types of Account at Bank” takes an integer value of 1 to 3 for each depositor, counting the number of deposit products they will have over their lifetime among CD, savings, and checking accounts.

Table 3: Who Withdraws? Placebo Period; Transaction Deposits

	Cox P.H. (1)	*LPM* (2)	*Probit* (3)
Over FDIC Limit	1.140**	0.0300**	0.0306**
	(2.27)	(2.21)	(2.16)
Checking & Over FDIC Limit	1.164	0.0210	0.0317
↪*Later, Covered by TAG/DFA*	(1.07)	(0.64)	(0.91)
Checking	0.526***	−0.137***	−0.123***
	(−11.01)	(−11.99)	(−13.71)
Direct Deposit	0.648***	−0.104***	−0.0928***
	(−5.87)	(−6.45)	(−7.19)
Log(Age)	0.989	−0.00757***	−0.00565**
	(−1.00)	(−2.73)	(−2.09)
Prior Transactions	1.071***	0.0145***	0.0148***
	(23.40)	(22.71)	(22.55)
Prior Transactions^2	0.999***	−0.000186***	−0.000196***
	(−16.86)	(−19.28)	(−18.42)
Institutional	0.874	−0.0203	−0.0248
	(−1.17)	(−0.81)	(−1.02)
Trust	0.966	−0.00207	−0.00429
	(−0.25)	(−0.07)	(−0.14)
Branch Controls	Yes	Yes	Yes
N	6125877	33973	33973
Log Likelihood	−91348.3	−19977.1	−19220.4
Model P-Value	< 0.001	< 0.001	< 0.001
No. of Liquidations	8920	8920	8920

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation during the placebo period, well before the financial crisis. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 4: Who Withdraws? Pre-Crisis Period; Transaction Deposits

	Cox P.H. (1)	*LPM* (2)	*Probit* (3)	*Difference vs. Placebo* (4)
Over FDIC Limit	1.067	0.0283**	0.0282**	
	(1.53)	(2.18)	(2.14)	
Checking & Over FDIC Limit	1.152	0.0332	0.0416	
↪*Later, Covered by TAG/DFA*	(1.36)	(1.07)	(1.30)	
Checking	0.591***	−0.152***	−0.145***	
	(−10.43)	(−11.46)	(−12.45)	
Direct Deposit	0.647***	−0.120***	−0.116***	
	(−7.14)	(−7.04)	(−7.62)	
Log(Age)	0.986	−0.00399	−0.00328	
	(−1.05)	(−0.94)	(−0.77)	
Prior Transactions	1.053***	0.0126***	0.0134***	†††
	(18.95)	(16.67)	(16.87)	
Prior Transactions^2	0.999***	−0.000169***	−0.000189***	††
	(−15.30)	(−15.36)	(−15.08)	
Institutional	1.076	0.0234	0.0229	
	(0.88)	(0.98)	(0.92)	
Trust	1.014	0.0262	0.0273	
	(0.13)	(0.86)	(0.87)	
Branch Controls	Yes	Yes	Yes	
N	9897521	34476	34476	
Log Likelihood	−132171.2	−23717.7	−22606.0	
Model P-Value	< 0.001	< 0.001	< 0.001	
No. of Liquidations	12960	12960	12960	

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation during the pre-crisis period. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. Column (4) indicates whether the hazard rate for the Cox model (in column (1)) is statistically different from the corresponding estimate in the Placebo period. Differences significant at the 99% level are represented by †††, 95% by ††, and 10% by †.

Table 5: Who Withdraws? Post-Crisis Period; Transaction Deposits

	Cox P.H. (1)	*LPM* (2)	*Probit* (3)	*Difference vs. Placebo* (4)
Over FDIC Limit	1.444**	0.0770**	0.0710**	
	(2.41)	(2.37)	(1.99)	
Covered by TAG/DFA	0.708	−0.0791*	−0.0549	†
↪*Formerly,*	(−1.45)	(−1.69)	(−1.53)	
Checking & Over FDIC Limit				
Checking	0.697***	−0.0612***	−0.0550***	†††
	(−5.40)	(−5.49)	(−5.80)	
Direct Deposit	0.502***	−0.112***	−0.0977***	††
	(−6.61)	(−7.09)	(−9.02)	
Log(Age)	0.990	−0.000270	0.000609	
	(−0.42)	(−0.07)	(0.15)	
Prior Transactions	1.052***	0.00818***	0.00837***	†††
	(13.14)	(12.61)	(12.65)	
Prior Transactions^2	0.999***	−0.000108***	−0.000117***	†††
	(−10.81)	(−11.59)	(−11.25)	
Institutional	1.069	0.0122	0.00997	
	(0.71)	(0.70)	(0.57)	
Trust	0.739**	−0.0489**	−0.0485**	
	(−2.07)	(−2.13)	(−2.40)	
Branch Controls	Yes	Yes	Yes	
N	4835656	30112	30112	
Log Likelihood	−59487.6	−14680.5	−14703.3	
Model P-Value	< 0.001	< 0.001	< 0.001	
No. of Liquidations	5841	5841	5841	

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation during the post-crisis period. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. Column (4) indicates whether the hazard rate for the Cox model (in column (1)) is statistically different from the corresponding estimate in the Placebo period. Differences significant at the 99% level are represented by †††, 95% by ††, and 10% by †.

Table 6: Who Withdraws? Formal Enforcement Action; Transaction Deposits

	Cox P.H. (1)	*LPM* (2)	*Probit* (3)	*Difference vs. Placebo* (4)
Over FDIC Limit	1.919***	0.230***	0.224***	†††
	(10.00)	(10.76)	(9.10)	
Covered by DFA	0.844	−0.0792*	−0.0577	
↪*Formerly, Covered by TAG/DFA*	(−1.11)	(−1.67)	(−1.44)	
Checking	0.805***	−0.0625***	−0.0597***	†††
	(−4.38)	(−5.15)	(−5.37)	
Direct Deposit	0.735***	−0.0548***	−0.0579***	
	(−3.87)	(−3.14)	(−3.61)	
Log(Age)	0.936***	−0.0147***	−0.0139**	††
	(−3.11)	(−2.63)	(−2.53)	
Prior Transactions	1.013***	0.00448***	0.00467***	†††
	(3.95)	(5.77)	(5.85)	
Prior Transactions^2	1.000***	−0.0000698***	−0.0000752***	†††
	(−4.77)	(−6.48)	(−6.47)	
Institutional	0.997	−0.00184	−0.00250	
	(−0.04)	(−0.11)	(−0.16)	
Trust	1.169**	0.0577***	0.0533**	
	(2.11)	(2.68)	(2.37)	
Branch Controls	Yes	Yes	Yes	
N	7032455	27145	27145	
Log Likelihood	−74902.1	−16439.4	−15786.8	
Model P-Value	< 0.001	< 0.001	< 0.001	
No. of Liquidations	7547	7547	7547	

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation in response to the formal enforcement action. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. Column (4) indicates whether the hazard rate for the Cox model (in column (1)) is statistically different from the corresponding estimate in the Placebo period. Differences significant at the 99% level are represented by †††, 95% by ††, and 10% by †.

Table 7: Who Withdraws? Placebo Period; Term Deposits

	Cox P.H.	*LPM*	*Probit*
	(1)	(2)	(3)
Over FDIC Limit	1.023	0.00349	0.00524
	(0.35)	(0.23)	(0.33)
Log(Age)	0.975	−0.00802*	−0.00879*
	(−1.35)	(−1.86)	(−1.90)
Log(Days to Maturity)	0.641***	−0.130***	−0.136***
	(−25.98)	(−24.22)	(−23.05)
Placed	2.935***	0.203***	0.221***
	(14.10)	(9.27)	(8.48)
Institutional - Listed/Faxed	–	–	–
↪*Omitted - too few obs.*	–	–	–
Institutional - Other	1.681***	0.0634	0.0666
	(2.65)	(1.30)	(1.16)
Trust	0.735**	−0.0708***	−0.0801***
	(−2.49)	(−2.78)	(−3.15)
Branch Controls	Yes	Yes	Yes
N	1180628	6567	6566
Log Likelihood	−15734.6	−4012.7	−3822.4
Model P-Value	< 0.001	< 0.001	< 0.001
No. of Liquidations	1867	1867	1867

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation during the placebo period, well before the financial crisis. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 8: Who Withdraws? Pre-Crisis Period; Term Deposits

	Cox P.H.	*LPM*	*Probit*	*Difference vs. Placebo*
	(1)	(2)	(3)	(4)
Over FDIC Limit	1.173***	0.0487***	0.0495***	†
	(4.73)	(4.21)	(4.31)	
Log(Age)	0.938***	−0.0385***	−0.0398***	†
	(−6.12)	(−10.29)	(−10.27)	
Log(Days to Maturity)	0.783***	−0.0599***	−0.0631***	†††
	(−27.62)	(−18.35)	(−18.01)	
Placed	3.042***	0.179***	0.200***	
	(19.74)	(7.90)	(11.33)	
Institutional - Listed/Faxed	0.308	−0.400*	−0.413**	
	(−1.18)	(−1.94)	(−2.00)	
Institutional - Other	1.730***	0.0829	0.0873*	
	(3.77)	(1.60)	(1.82)	
Trust	1.011	0.000833	0.00320	††
	(0.17)	(0.04)	(0.14)	
Branch Controls	Yes	Yes	Yes	
N	2487654	10438	10436	
Log Likelihood	−50099.8	−6700.0	−6374.4	
Model P-Value	< 0.001	< 0.001	< 0.001	
No. of Liquidations	5749	5749	5749	

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation during the pre-crisis period. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. Column (4) indicates whether the hazard rate for the Cox model (in column (1)) is statistically different from the corresponding estimate in the Placebo period. Differences significant at the 99% level are represented by †††, 95% by ††, and 10% by †.

Table 9: Who Withdraws? Post-Crisis Period; Term Deposits

	Cox P.H.	*LPM*	*Probit*	*Difference vs. Placebo*
	(1)	(2)	(3)	(4)
Over FDIC Limit	1.641**	0.0691*	0.0882*	††
	(2.51)	(1.86)	(1.68)	
Log(Age)	0.950**	−0.00148	−0.00145	
	(−2.29)	(−0.38)	(−0.28)	
Log(Days to Maturity)	0.470***	−0.194***	−0.209***	†††
	(−55.79)	(−52.97)	(−42.52)	
Placed	5.592***	0.284***	0.345***	†††
	(25.20)	(21.63)	(17.66)	
Institutional - Listed/Faxed	0.886	−0.0328	−0.128	
	(−0.17)	(−0.40)	(−1.22)	
Institutional - Other	0.741	−0.00493	−0.0443	†††
	(−1.36)	(−0.15)	(−1.02)	
Trust	1.047	−0.00842	−0.0146	†
	(0.29)	(−0.36)	(−0.47)	
Branch Controls	Yes	Yes	Yes	
N	1263007	8328	8328	
Log Likelihood	−18393.4	−3803.9	−3738.6	
Model P-Value	< 0.001	< 0.001	< 0.001	
No. of Liquidations	2251	2251	2251	

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation during the post-crisis period. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. Column (4) indicates whether the hazard rate for the Cox model (in column (1)) is statistically different from the corresponding estimate in the Placebo period. Differences significant at the 99% level are represented by †††, 95% by ††, and 10% by †.

Table 10: Who Withdraws? Formal Enforcement Action; Term Deposits

	Cox P.H. (1)	*LPM* (2)	*Probit* (3)	*Difference vs. Placebo* (4)
Over FDIC Limit	1.666***	0.0983**	0.109*	††
	(2.61)	(2.02)	(1.89)	
Log(Age)	1.034	-0.0120	−0.0176*	†
	(1.19)	(−1.61)	(−1.66)	
Log(Days to Maturity)	0.592***	−0.0601***	−0.0799***	†††
	(−27.36)	(−10.82)	(−10.53)	
Placed	14.29***	0.597***	0.616***	†††
	(29.46)	(26.50)	(36.33)	
Institutional - Listed/Faxed	1.858***	0.0927**	0.0968*	
	(3.38)	(1.99)	(1.71)	
Institutional - Other	1.396**	−0.0313	−0.0438	
	(2.18)	(−0.95)	(−0.98)	
Trust	1.401**	0.00166	0.00398	†††
	(2.23)	(0.05)	(0.09)	
Branch Controls	Yes	Yes	Yes	
N	855693	3511	3508	
Log Likelihood	−11783.6	−1803.7	−1729.4	
Model P-Value	< 0.001	< 0.001	< 0.001	
No. of Liquidations	1629	1629	1629	

This table shows estimates from Cox proportional hazard, linear probability, and probit models for the probability of account liquidation in response to the formal enforcement action. Liquidation is defined as withdrawing 50% or more of the account balance and remaining below that level for 60 days or more. Cox estimates are expressed as hazard ratios, LPM estimates are OLS coefficient estimates, and Probit estimates are marginal effects. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. Column (4) indicates whether the hazard rate for the Cox model (in column (1)) is statistically different from the corresponding estimate in the Placebo period. Differences significant at the 99% level are represented by †††, 95% by ††, and 10% by †.

Table 11: 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	5.8%	8.2%	11.4%	10.3%	11.7%	52.6%
Pre-Crisis	9.0%	8.1%	9.9%	15.5%	16.2%	41.3%

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	2.1%	6.0%	14.5%	12.0%	1.7%	63.7%
Formal	21.7%	6.4%	21.9%	14.4%	7.8%	27.6%

For all transaction accounts which were $2,000 shy of the deposit insurance limit or higher at the beginning of each period, this table shows their distribution into various account-size bins at the end of the period.

Table 12: New Depositor Characteristics

	Placebo	*Pre-Crisis*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Over FDIC Limit	−0.0798***	−0.0538***	−0.0785***	−0.0509***
	(-16.00)	(-16.58)	(-9.64)	(-8.85)
Covered by TAG/DFA	0.0707***	−0.0398***	0.00123	-0.0150
↪*Or,*	(4.33)	(-3.67)	(0.09)	(-1.10)
Checking & Over FDIC Limit				
Checking	−0.0315***	−0.0137***	−0.0191***	-0.00348
	(-6.83)	(-3.69)	(-6.78)	(-1.26)
Term Deposit	0.106***	0.0475***	0.00447**	0.0718***
	(36.24)	(23.55)	(2.49)	(27.26)
Placed	−0.148***	0.0000419	0.0614***	−0.0746***
	(-14.38)	(0.01)	(17.95)	(-16.39)
Institutional - Listed/Faxed	-0.153	0.631***	0.517***	0.869***
	(-1.44)	(15.53)	(27.00)	(215.92)
Institutional - Other	0.0281***	0.309***	0.0818***	0.0336***
	(2.63)	(50.53)	(17.93)	(8.52)
Trust	0.0106	-0.00139	0.0249***	0.0389***
	(1.19)	(-0.22)	(4.68)	(7.43)
Branch Controls	Yes	Yes	Yes	Yes
N	45115	48204	39740	33313
Log Likelihood	980.0	13890.7	23623.9	20255.6
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

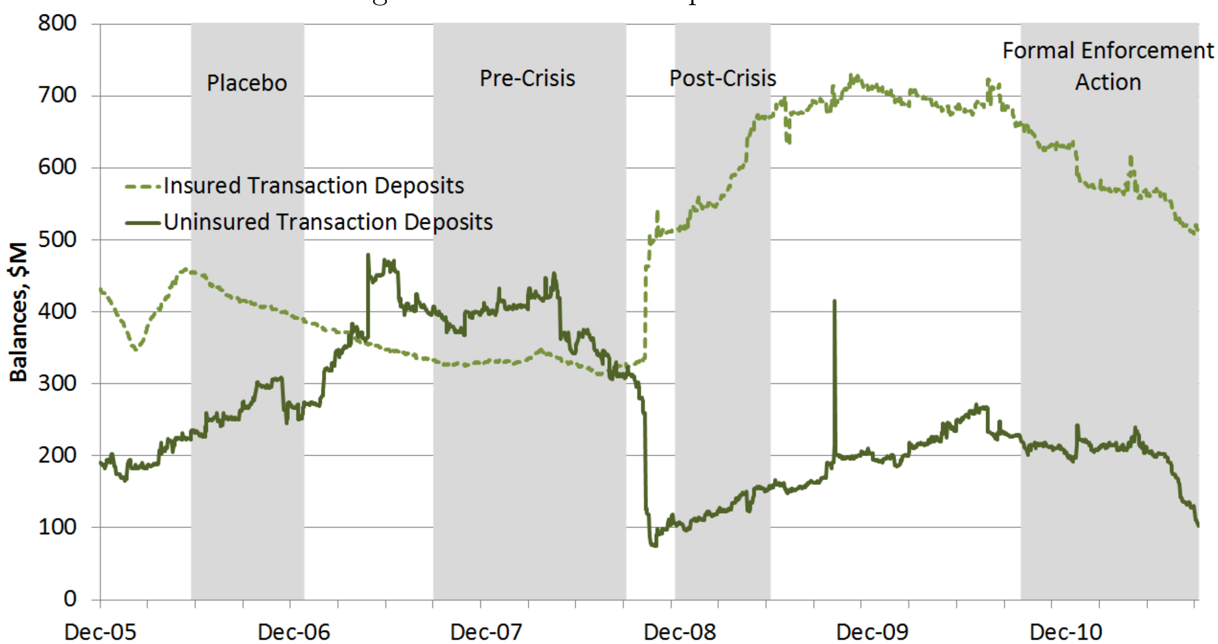
This table presents estimates from daily frequency, account-level regressions of a dummy variable, which equals one for newly arrived depositors' accounts and zero otherwise, on account characteristics. The results show what deposit(or) attributes were associated with new deposit(or)s. All models are estimated with OLS. T-statistics are in parentheses. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 13: What Explains the Share of Depositors that Are New?

	(1)	(2)	(3)
Time Period Dummies:			
Pre-Placebo	0.000509***	0.000139	0.000142
	(2.68)	(1.50)	(1.58)
Placebo to Pre-Crisis	0.000179*	0.000141**	0.000150**
	(1.77)	(2.03)	(2.19)
Pre-Crisis	−0.000159***	0.0000226	0.0000323
	(-2.94)	(0.16)	(0.24)
Crisis	0.000000299	0.000200	0.000191
	(0.00)	(0.86)	(0.86)
Post-Crisis	-0.0000613	0.000214	0.000215
	(-0.96)	(0.80)	(0.84)
Post-Crisis to Formal	−0.000134**	0.000114	0.000106
	(-2.37)	(0.48)	(0.47)
Formal	0.000535***	0.000570**	0.000578**
	(2.58)	(2.16)	(2.27)
Macro Controls:			
Log(VIX)		0.000225***	0.000224***
		(2.71)	(2.74)
GDP Growth		0.0000246***	0.0000266***
		(2.60)	(2.67)
Housing Starts		0.000000325	0.000000314
		(1.46)	(1.47)
Daily S&P500 Return		0.00240*	0.00221*
		(1.78)	(1.68)
Daily Deposit Growth			0.0146
			(1.64)
AR(1)		0.448***	0.436***
		(13.63)	(12.88)
Constant	0.000295***	−0.000993**	−0.000980**
	(5.94)	(-2.21)	(-2.25)
N	2079	2078	2078
Model P-Value	< 0.001	< 0.001	< 0.001

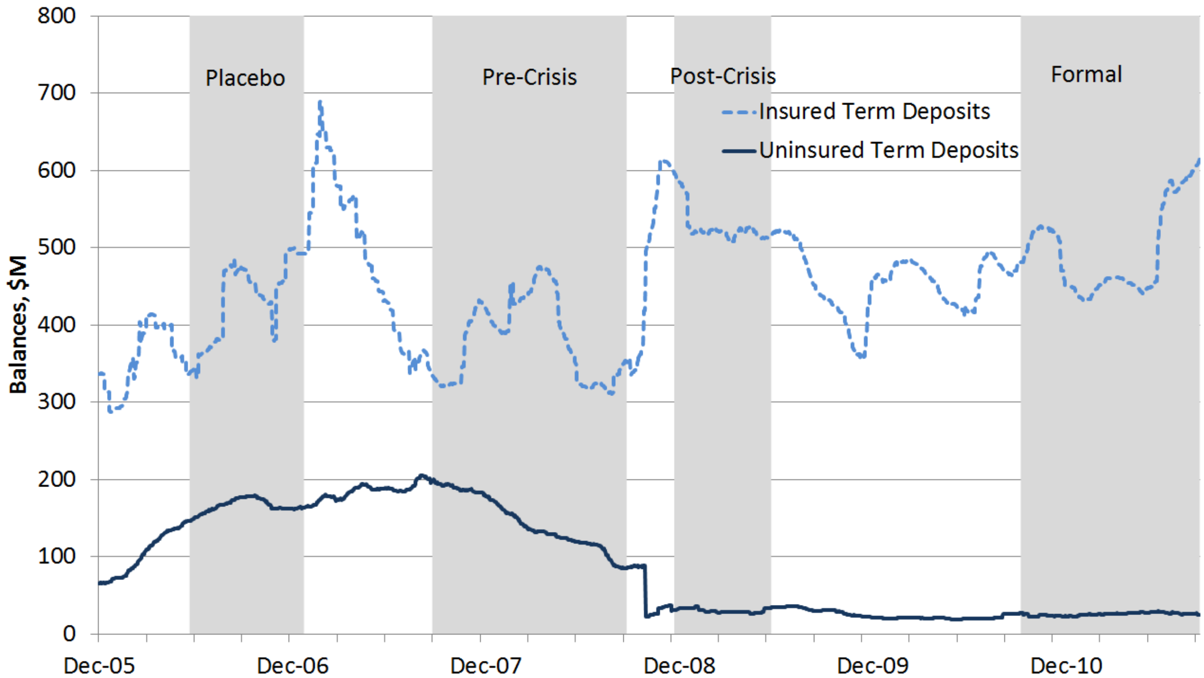
This table presents estimates of the daily-frequency association between the share of depositors at the bank who are new (as of that day) and various controls. All models are OLS, with Newey-West standard errors. Standard error lag length is set to 9. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Figure 1: Transaction Deposit Balances



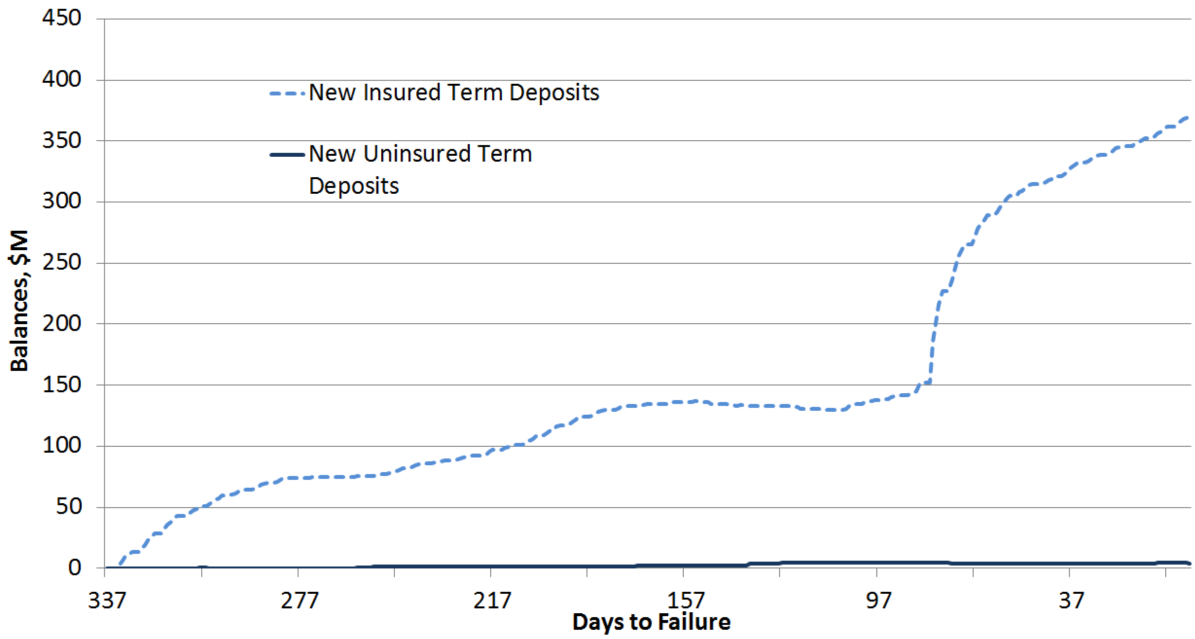
This figure shows total balances in transaction deposit accounts. The dotted light green line shows those deposits which were fully insured, while the solid dark green line shows total balances in less-than-fully-insured accounts. Grey bars denote the time periods analyzed in the regressions of Section 4, and overlaid text identifies the name of each period. Note that the dramatic, brief spike in uninsured 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



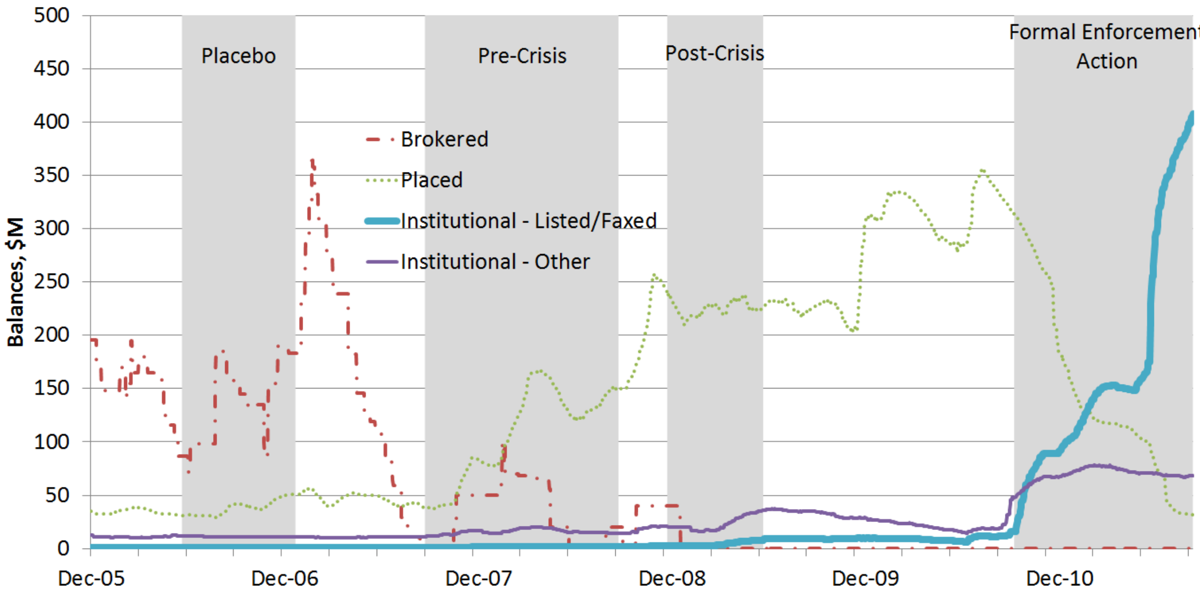
This figure shows total balances in term deposit accounts. The dotted light blue line shows those deposits which were fully insured, while the solid dark blue line shows total balances in less-than-fully-insured accounts. Grey bars denote the time periods analyzed in the regressions of Section 4, and overlaid text identifies the name of each period.

Figure 3: Term Deposit Balances From New Depositors



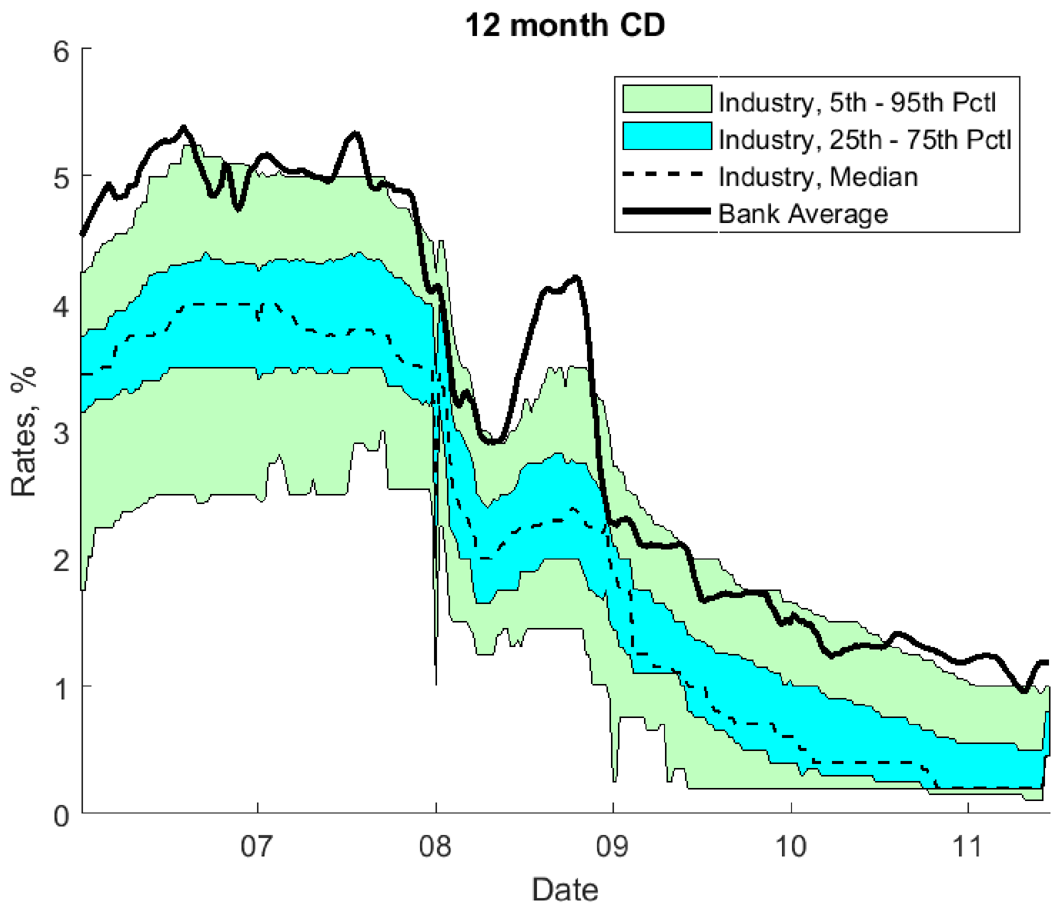
This figure shows balances in term deposit accounts from depositors who opened their first deposit account with the bank after the formal enforcement action — new depositors. The dotted light blue line shows those deposits which were fully insured, while the solid dark blue line shows total balances in less-than-fully-insured accounts.

Figure 4: Term Deposit Balances in Brokered, Placed, and Institutional Accounts



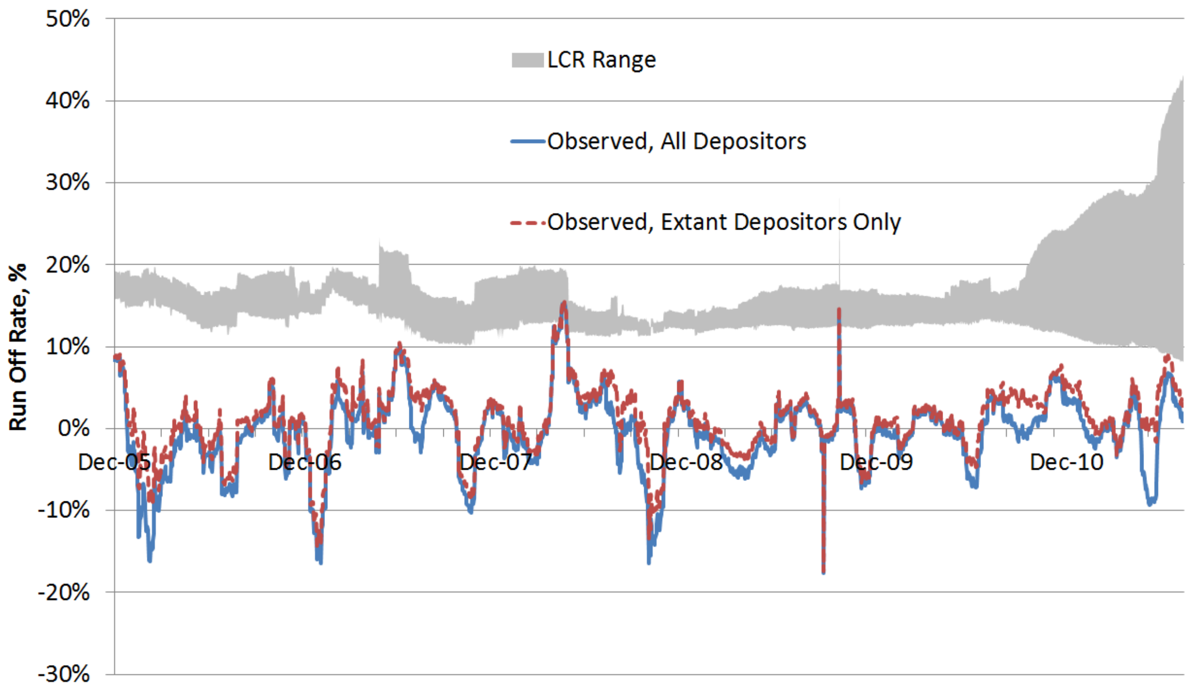
This figure shows term deposit account balances in brokered accounts (dash-dotted red), placed accounts (dotted green), and institutional deposits obtained via rate listing services and faxes (bold blue), and other institutional deposits (solid, thin purple) accounts. Placed deposits are non-brokered deposits placed by a financial institution on behalf of a third party. 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. The third party is generally not identified to the bank accepting the deposit. Institutional deposits are all non-brokered, non-placed deposits owned by banks, savings & loan associations, credit unions, other business/corporate entities, and municipalities. Grey bars denote the time periods analyzed in the regressions of Section 4, and overlaid text identifies the name of each period.

Figure 5: Deposit Rates Relative to the Market Distribution



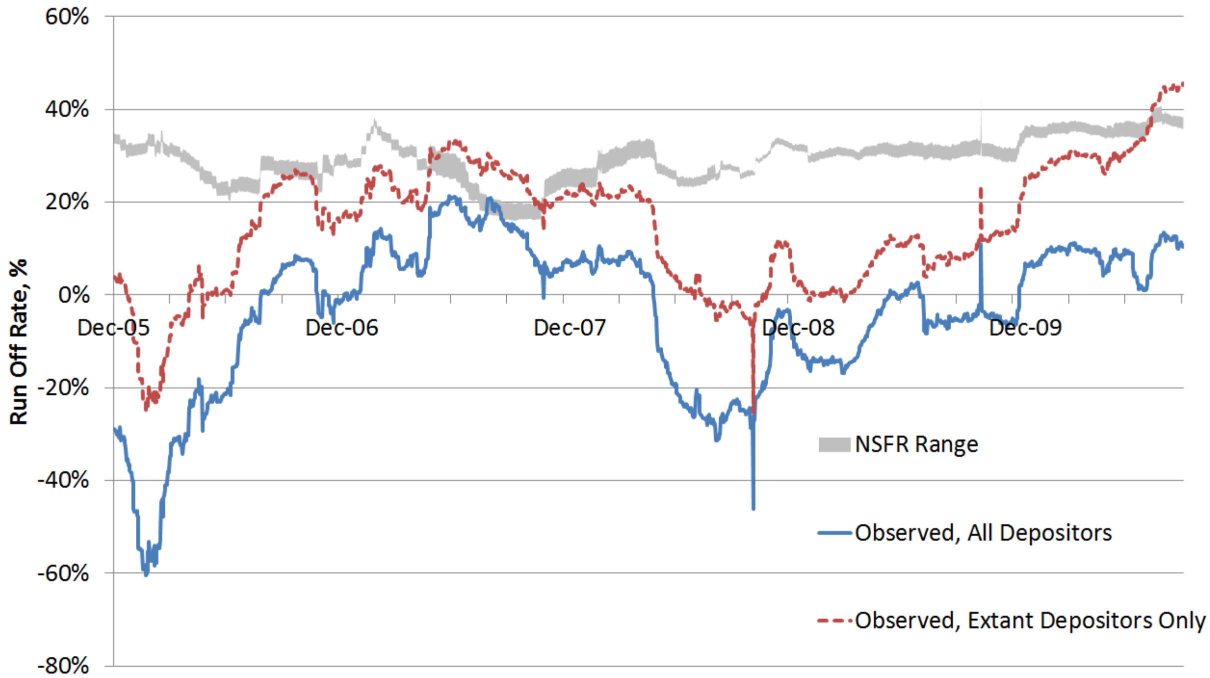
This figure shows the centered, 30-day moving average of all rates offered on newly issued 12-month term deposits with balances below $100,000 ("Bank Average;" solid black line) relative to the distribution of banking industry rates (from RateWatch) for the same product. The industry median is in dotted black, the teal area shows the industry interquartile range, and the green area shows the coverage of the 5th to 95th industry percentiles. The bank average series is intended as 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 6: LCR Comparison



This figure shows the range of run-off rates consistent with LCR (grey interval), where the range arises from uncertainty as to the share of business deposits which are considered operational. The extremes of the interval correspond to the parameterizations wherein either all or no business deposits are operational. The solid blue and dotted red lines show observed 30-day run-off considering all depositors and only depositors who were at the bank as of the calculation date. All run-off rates are calculated in a forward-looking manner. That is, at any given date, the plotted values correspond to run-off observed over the following 30 days.

Figure 7: NSFR Comparison



This figure shows the range of run-off rates consistent with NSFR (grey interval), where the range arises from uncertainty as to the share of business deposits which are considered operational. The extremes of the interval correspond to the parameterizations wherein either all or no business deposits are operational. The solid blue and dotted red lines show observed one-year run-off considering all depositors and only depositors who were at the bank as of the calculation date. All run-off rates are calculated in a forward-looking manner. That is, at any given date, the plotted values correspond to run-off observed over the following year.