Gross Deposit Flows

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Abstract

This paper examines aggregate deposit inflows, outflows, and the reallocation of deposits in the banking system to further our understanding of banking stability. I find that on average deposit inflows are nearly three times larger and twice more volatile than outflows. Deposit flows vary with business cycles and market conditions, across deposit types, and cross-sectionally. Moreover, there is considerable heterogeneity in flows across deposit types. I also find that the largest banks attract and retain more deposits compared to smaller banks, and deposits are reallocated from small to largest banks. Deposits are also reallocated to banks which offer higher deposit rates, have lower insolvency risk assets, and low capital levels. My findings imply that deposit inflows and the heterogeneity in depositors are important in understanding banking stability. Moreover, at the aggregate level deposits are reallocated to banks that provide more utility to depositors, suggesting some evidence of market discipline.

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1 Introduction

Instability in banking is typically associated with deposit outflows. Recent case-study evidence reveals a richer set of details associated with these outflows. The rate of outflows differs across deposit types. Deposit insurance and duration of depositor relationships slow the rate of deposit outflows (Iyer and Puri (2012), and Iyer, Puri, and Ryan (2016)). Furthermore, deposit inflows occur alongside deposit outflows (Martin et al. (2018)). Moreover, recent theoretical work also suggests the reallocation of deposit outflows from distressed banks to healthy banks (Egan et al. (2017)). Understanding stability in banking therefore requires moving beyond examining net flows (deposit outflows) at distressed banks or during crises periods. It requires an understanding of gross deposit flows - the rates of inflows and outflows, their persistence and volatility, cross-sectional variation across deposit types, time-series variation across the business cycle and market conditions, and how inflows and outflows combine to reallocate deposits in the banking system.

Moreover, we need to understand whether the magnitude of these gross deposit flows is large enough to cause instability to the banking system as a whole, and how do these deposit flows measure against proposed regulatory changes to liquidity and stable funding. This paper examines gross deposit flows to answer some of these questions and to establish facts that can further our understanding of banking stability.

I begin by examining aggregate deposit inflows and outflows to understand the magnitude, volatility, and persistence of deposit flows. Using quarterly bank level data from 1984-2017, I find the following: The average rate of deposit inflows (3.7%) is more than three times the the average rate of deposit outflows (1.1%). Deposit inflows are also more than twice as volatile as deposit outflows.[1] Moreover, I find that entries (de-novo banks) and exits (failures or mergers) do not have a significant effect on aggregate deposit inflows or outflows in the banking system, respectively. Deposit inflows and outflows are however persistent across banks and time periods. On average only 50% of the deposits that come into a bank during a quarter, stay with the bank for an additional quarter. I also find that during any given time period, including recessions, there are simultaneous inflows and outflows of deposits. Even in periods of net deposit outflows there are deposit inflows. While Martin et al. (2018) find evidence on simultaneous inflows and outflows of deposits at a failing bank, I find that simultaneous inflows and outflows of deposits exist at the aggregate industry level. These findings suggest the importance of considering deposit inflows in addition to outflows when examining the effect of deposit flows and bank stability.

Deposit inflows and outflows also vary across deposit types. The rates of inflows (3.9%) and outflows (1%) of core deposits (insured) are lower than the corresponding rates (7.3% for inflows and 5.2% for outflows) for large time-deposits (uninsured).[2] These aggregate level deposit outflows (run-off) rates are much lower than those considered in the Basel III regulations on liquidity and stable funding (Basel III, 2013). Basel III regulations assume a run-off rate of 5% (minimum of 3%) for stable funding sources, which in my case are core deposits, and a run-off rate of 10% or higher for less stable funding sources, or in my case large time-deposits. These findings suggest that the deposit run-off rates considered in the Basel regulations may be more conservative than the run-of rates observed. Core

[1] I place a caveat here that my measure of the rates and volatility of deposit flows are downward biased since my fundamental unit of analysis is the bank and thus I compute only inter-bank deposit flows and do not include intra-bank deposit flows.

[2] Core Deposits include total transaction deposits, savings deposits, and small time-deposits. Large time-deposits are defined as time deposits $\geq$ \$100,000 prior to Q1,2010 and time deposits $\geq$ \$250,000 since.

deposit inflows and outflows are also less volatile than large time-deposits. However, in dollar terms, core deposit inflows are nearly three times the inflows of large time-deposits, while outflows are of comparable magnitude. These findings indicate that despite explicit withdrawal restrictions on large time-deposits, they are more withdrawal-prone compared to core deposits, even though the rates of outflows may not be as high as considered in the Basel regulations.

Across deposit types, Martin et al. (2018) find evidence that outflows of uninsured deposits at a failing bank positively affects the outflows of insured deposits. They also find that the failing bank manages to replace some of the outflows in uninsured deposits with insured deposits. However, at the banking system level I do not find any evidence of contemporaneous relation between outflows of core and large time-deposits, though they are non-contemporaneously related. I also find that there is a contemporaneous and lagged substitution effect between core deposits and large time-deposits. While core deposit outflows are correlated with large time-deposit inflows, large time-deposit outflows are only non-contemporaneously correlated core deposit inflows. By looking at the aggregate level of deposit flows I find that such a substitution effect is not unique to failing banks. Moreover, the substitution effect of core deposit outflows and large time-deposit inflows is primarily evident in banks with low capital, high levels of NPA (Non-performing assets), and banks with low levels of loan charge-offs. So while there might be a substitution effect between core and large time-deposits at times, the directionality and magnitude of substitution various with bank distress levels. These findings have important implications in designing regulations on the sources of funding distressed banks can access, which may affect the costs borne by the regulatory agency in case of failure of the depository institution.

Deposit inflows and outflows also vary with market and economic conditions, and across deposit types. I find that the aggregate rate of deposit inflows increases during periods of high stock market returns, and the rate of deposit outflows decreases during periods of high economic activity. Across deposit types, I find that the rate of inflows of core deposits increases during periods of high stock returns, suggesting a wealth effect. On the other hand, the rate of inflows of large time-deposits increases during periods of high market volatility, suggesting that depositors view banks as "safe havens" during periods of market uncertainty. High economic activity also affects core deposits and large time-deposits differently. For core deposits, while both the rate of deposit inflows and outflows decrease, for large time-deposits only the rate of outflows decreases. Large time-deposits are also more sensitive to changes in the benchmark rate of return (the federal funds rate), compared to core deposits. While Egan et al. (2017) find that the demand for both insured and uninsured deposits are price inelastic, [3] I find that increases in the federal funds rate leads to higher inflows and lower outflows for large time-deposits. However, there is no such effect observed for core deposits. These findings further elaborate on the sensitivity of different deposit types to changes in macro economic and market conditions, and benchmark rates of return.

Thus far my focus has been on the inflows and outflows of deposits in the banking system. However, in addition to inflows and outflows there is also a reallocation of deposits amongst banks. Egan et al. (2017) give an example where the market share of uninsured deposits drops for a distressed bank while simultaneously the market share of uninsured deposits for a healthy bank increases. They suggests there might be a movement of deposits from one bank to another. I next examine the cross-sectional

[3] They calibrate a model of deposit demand using parameters for interest rates offered and probability of default to arrive at price elasticity.

variation in deposit flows, and in addition to deposit inflows and outflows, I also look at the reallocation of deposits within banks of similar size groups. The ratio of deposit inflows to outflows decreases monotonically from the largest to the smallest bank. For every $1 of outflows, the largest banks attract $9, while the smallest banks only attract roughly $2.6. On the other hand the the ratio of deposit reallocation to outflows increases monotonically from the largest to the smallest bank. For every $1 of outflow for the largest banks, $1.89 are reallocated amongst the largest banks, while for the smallest banks $1.96 are reallocated. The trends are consistent for both core deposits and large time-deposits. These findings suggest that the largest banks both attract and retain more deposits compared to the smaller banks, for every dollar of deposit outflow. Since the largest banks also have the most number of branches, these higher ratios of deposit inflows to outflows at the largest banks suggests the importance of branch networks, not only in in their ability to attract deposits, but also in reducing information asymmetry and monitoring costs (Aguirregabiria et al., 2017), and thus retaining more deposits. This monotonic trend in the ratios of deposit inflows-to-outflows and reallocation-to-outflows to cannot be captured with deposit growth rates, or deposit market share alone, and is thus valuable in understanding the funding risks faced by community banks vis-a-vis larger banks.

In addition to the reallocation of deposits within bank size groups, deposits are also reallocated across groups. I find that nearly 60% of the reallocation of core deposits is inter-group, while for large time-deposits it is only 30% , the rest being intra-group. I find that while the rates of reallocation of large time-deposits is larger than that for core deposits, large time-deposits are reallocated across banks of similar size. This suggests that the reallocation of large time-deposits is largely due to heterogeneity in bank-level dynamics within similar size groups. These figures however do not give us the direction of deposit flows. I develop on the methodology used by Meller and Metiu (2017) to measure synchronization of economic cycles across countries, to ascertain the direction of deposit flows. I find that deposits flow from smaller banks to larger banks, and this is largely evident for core deposits, post Riegle-Neal (RN) and post Gramm-Leach-Bliley (GLB), while there is no such effect for large time-deposits. One possible explanation for this effect could be the "economies of scale" enabled by RN which allowed banks to acquire other banks and operate across state boundaries and become larger, and the "economies of scope" enabled by GLB that allowed banks to engage in investment banking and insurance business in additional to commercial banking activities. Both the scale and scope effects allowed the banks to establish relationships with depositors, and hence the effect is evident more for core deposits which are more relationship based compared to large time-deposits. Combining the findings on the rates of inflows and outflows across bank size groups with the magnitude and direction of deposit outflows at smaller banks, these findings suggest that smaller banks have been losing deposits to the largest banks, and may be more vulnerable to deposit outflows and funding shortages compared to their larger counterparts.

To further understand the reallocation of deposits within the banking system, I look at deposit flows across bank characteristics. I use the basic framework of Egan et al. (2017) to interpret my results. They suggest a model where insured and uninsured depositors choose between differentiated banks based on individual utility maximizing preferences. This utility is derived from deposit rates offered, the probability of default, and the banks' ability in using these deposits effectively. And, depositors are run-prone and can move their deposits from one bank to another.

I first look at utility derived from deposit rates offered. Deposit rates offered can be viewed in two ways. One the one hand DeAngelo and Stulz (2015) suggest that banks that enjoy deposit rate advantages (lower deposit rates than competitors in the same market) should have lower leverage, or in my case lower levels of deposits.[4] Deposit rate advantages could arise for instance from lower servicing costs on loans and deposits. It could also result from distress of other banks, which raise rates during distress to attract deposits (Acharya and Mora, 2015). I consider banks having a deposit rate advantage as the percentage of branch-products in which the bank offers deposit rates lower than the median rate for that product in an MSA. Higher the percentage, greater the banks' deposit rate advantage. I find that rates of deposit inflows (outflows) are lower (higher) at banks that have a deposit rate advantage, corroborating DeAngelo and Stulz (2015). The findings are qualitatively similar for core deposits and large time-deposits. However, deposits are reallocated from banks that offer lower deposit rates to those with higher deposit rates. This finding is more in line with Egan et al. (2017) who suggest that distressed banks have lower demand for uninsured funds and hence suggestively lower rates, and with Ben-David et al. (2017) who suggest that deposit rates are associated with demand for funds and thus banks raise rates to attract funds.

I next look at the (dis)utility to depositors resulting from banks' probability of default. In their calibrated model Egan et al. (2017) find that a 1% increase in the risk-neutral probability of default leads to a 12% decrease in the market share of uninsured deposits for a bank, while there is no such effect on insured deposits. They attribute this to both a lowered demand for uninsured deposits and a drop in the supply. I measure a banks' insolvency risk as the ratio of non-performing assets (NPA's) to total loans, and the ratio

[4]They use the term "liquidity premium", but the essence is the same.

of Charge-Offs to NPA's. The first measure gives an estimate of a banks' probability of default (PD), while the second measure is an estimate of the banks' loss-given-default (LGD). I find that the rate of deposit inflows is roughly 43% lower, and the rate of deposit outflows is nearly 77% higher at banks with a high insolvency risk. However, the disparity in deposit inflows is more prominent in large time-deposits, while the disparity in outflows is more visible in core deposits. This is contrary to expectations that uninsured depositors would be the first to leave a distressed bank. Deposits are reallocated from banks with a high probability of default to those with a low probability of default, suggesting some market discipline. However, it is important to note that even at banks with a higher probability of default there are simultaneous inflows and outflows of deposits.

Lastly I look at the role of equity capital in deposit flows. Equity capital has been studied as both in mitigating a banks' risk of failure (Bhattacharya and Thakor (1993); Repullo (2004); and Von Thadden (2004)), or diminish a banks' ability to create liquidity by affecting the banks' incentives to monitor its borrowers (Diamond and Rajan (2000); and Diamond and Rajan (2001)). I focus on the latter since in my setup depositors derive utility from the banks' management in actively monitoring its borrowers and generating returns sufficient enough to repay the depositors. I find that the rates of deposit inflows are 34% higher at banks with high capital levels, while rates of deposit outflows are nearly 76% higher. Deposits however are reallocated from banks with high capital to banks with low capital, suggesting a reallocation towards banks that are better at producing liquidity. Again, it is worthwhile to note that even at banks with low capital levels, there are simultaneous inflows and outflows of deposits.

My findings suggest that merely focusing on deposit outflows at distressed banks may not reveal a complete picture of how deposit flows affect bank stability. I extend case-studies on individual banks to the aggregate level and show that there are simultaneous inflows and outflows of deposits across bank and deposit types, and rates of inflows and outflows vary across deposit types, and deposits flows across banks. My study provides evidence on the stability of various account types based on economic and market conditions, bank size, and the utility that depositors generate. My study has important implications for future research in the design of regulations related to banking system liquidity and stable funding.

2 Background and Related Literature

Deposit flows and banking stability have traditionally been studied under theoretical models of bank runs. Seminal work of Diamond and Dybvig (1983) suggests the mechanism through which deposit flows affect the (in)stability of banks. Works such as Postlewaite and Vives (1987), Peck and Shell (2003), Goldstein and Pauzner (2005), and Gertler and Kiyotaki (2015) have further examined bank-runs as an equilibrium response by depositors to bank health. On the other hand, Chari and Jagannathan (1988), Jacklin and Bhattacharya (1988), and Uhlig (2010) model bank-runs as purely information based response by depositors.

Empirically, Gorton (1988), Saunders and Wilson (1996), and Calomiris and Mason (1997) find that bank-runs are related to the banks' fundamentals, while Calomiris and Mason (1997) find that in addition to bank fundamentals, panic amongst depositors also plays a role. In addition to bank-runs, deposit withdrawals have also been studied as a market disciplining mechanism. Martinez Peria and Schmukler (2001) examine the banking crises in Latin America and find that depositors withdraw their deposits as means of disciplining the banks. Park and Peristiani (1998) find that in addition to deposit withdrawals, depositors also demand higher rates on deposits from distressed banks, as a disciplining mechanism.

These studies have largely considered depositors as a homogeneous group and focused on deposit outflows at failing/distressed banks. More recent case studies have found evidence that depositors are in-fact heterogeneous in nature, and respond differently to a banks' solvency risk. While some depositors leave the bank immediately at the slightest hint of insolvency, others are more patient. Depositor-bank relationships and deposit insurance plays an important role in depositors' response to perceived insolvency risk. Recent empirical evidence has also shown that even at failing banks there are simultaneous inflows and outflows of deposits, contrary to what one might expect. Moreover, recent theoretical models suggest that depositors can distinguish between healthy and distressed banks, and provide empirical evidence that deposits are reallocated from distressed to healthy banks.

To examine the heterogeneity in depositor behavior in response to perceived solvency risk, Iyer, Puri, and Ryan (2016) use deposit account-level data and examine two bank-runs on an Indian bank at different time periods. This bank was subject to a low level and a high level solvency shock over two different time periods, years apart. They find that depositors with loan relationships with the bank were less likely to run during the low solvency shock, while uninsured depositors are more likely to run. In the high solvency shock event, they find that depositors with longer relationships with the bank were less likely to run, while those with frequent past transactions were more likely to run. These findings suggest that considering depositors as a homogeneous group may not represent a complete picture in understanding the effect of deposit flows on bank stability.

In another study Martin et al. (2018) use deposit account-level data at a failing Indian bank and find that even at that failing bank there are simultaneous inflows and outflows of deposits. They find that temporary deposit guarantee measures introduced at the time of the financial crisis, and deposit insurance slows down the rate of deposit outflows. Uninsured deposits are replaced by insured deposits even when the banks' failure is public knowledge. Moreover, the inflow of deposits is large in magnitude and has a first-order impact. So, while prior literature has largely focused on deposit outflows in assessing a banks' stability, this new evidence suggests that we need to look at both inflows and outflows in understanding bank stability.

To further emphasize the heterogeneity in depositor behavior to bank insolvency risk, Egan et al. (2017) suggest a model where insured and uninsured depositors choose between differentiated banks based on their individual utility. They suggest that insured depositors are less sensitive to a banks' probability of default as they derive utility from banking services. Uninsured depositors on the other hand derive utility only from the deposit rates offered and since they would lose their deposits in case of a bank failure, are more sensitive to a banks' probability of default. They also cite an example where the market share of uninsured deposits for a distressed bank fell, while at the same time the market share of uninsured deposits increased for a healthy bank. Results from their calibrated model suggests that depositors can perceive solvency risk and move their deposits from distressed to healthy banks.

In addition to individual bank health or the health of the banking system, the aggregate demand for and supply of deposits is also affected by business cycles and market conditions (Martin et al., 2018). High levels of economic activity and market returns would lead to higher inflow of deposits into the banking system, suggesting wealth effects (Bomberger, 1993). High market volatility on the other hand would also lead to an increase in deposit inflows, since due to deposit insurance banks are viewed as "safe havens" (Acharya and Naqvi, 2012). Allen et al. (2015) suggest a model where deposits flows into banks depends on the other alternative storage technologies available to investors. They suggest if investors can generate higher returns from these other technologies there would be lower deposits available for banks and vice-versa.

Empirically, however Acharya and Mora (2015) and Helwege et al. (2017) find that banks faced funding shortfalls during the financial crisis and were only able to create liquidity due to support from the government and government-sponsored agencies. Pérignon et al. (2018) on the other hand find there were no wholesale funding dry-ups during the financial crisis. Additionally, Gatev and Strahan (2006) find that bank deposit flows increased in periods of market-wide liquidity shocks prior to the crisis.

In addition to bank insolvency risk, economic and equity market conditions, theories of bank capital suggest differences in leverage across banks based on individual bank attributes. Since leverage is the net result of changes in inflows and outflows, deposit flows should vary with individual bank attributes. DeAngelo and Stulz (2015) suggest that as a product of financial intermediation, banks produce a safe liquid claim, namely deposits, banks should be able to charge a liquidity premium for this service. This is similar in spirit to Krishnamurthy and Vissing-Jorgensen (2012) and Krishnamurthy and Vissing-Jorgensen (2013) who find a liquidity premium present in the prices of US Treasury securities. For banks however, this liquidity premium is generated in the form of deposit rate advantages. That is when a particular bank pays a lower rate of interest on its deposits compared to other banks offering similar products in the same market. DeAngelo and Stulz (2015) further suggest that higher the liquidity premium (or deposit rate advantage) higher the franchise value of the bank, and consequently lower the leverage.

In addition to the rate of return earned on their deposits, deposit flows are also affected by the demand for deposits at individual banks. Egan et al. (2017) suggest that the demand for uninsured deposits drops for a bank in financial distress, while there is no prominent effect for insured deposits. This can be expected as insured depositors derive utility from banking services, while uninsured depositors who could lose all their funds in case of a bank failure, would be more sensitive to a banks' insolvency risk. However, both insured and uninsured depositors are sensitive to a banks' probability of default albeit to varying degrees as both lose some utility with bank failure. Egan et al. (2017) further suggest that depositors are fully rational, can anticipate a banks' probability of default and more their deposits from distressed to healthier banks. So a banks' probability of default would be expected to affect the deposit inflows and outflows at that bank.

The returns a bank is able to generate for its depositors is dependent on the loan premium the bank is able to generate through its lending activities. This loan premium is a function of the banks' information production on their borrowers (Diamond, 1984) and (Campbel and Kracaw, 1980), by screening borrowers at loan origination (Stiglitz and Weiss, 1981), and monitoring the borrower over the life of the loan (Berger and Udell, 2002). Equity capital plays a critical role in this intermediation process. On the one hand equity capital can aid in generating a loan premium via the "risk absorption" hypothesis. It can mitigate the risk of bank failure (Bhattacharya and Thakor (1993); Repullo (2004); and Von Thadden (2004)). Equity can also diminish a banks' ability to generate a loan premium by affecting the banks' incentives to monitor its borrowers (Diamond and Rajan (2000); and Diamond and Rajan (2001)), or the "financial fragility crowding-out" hypothesis. Through the "risk absorption" and "financial fragility crowding out" hypothesis, equity capital can affect deposit inflows and outflows.

The "risk absorption" hypothesis considers equity capital to be a cushion against unexpected losses, and correspondingly the greater the cushion, lower the insolvency risk. Berger and Bouwman (2013) find that higher levels of equity capital help reduce a banks' insolvency risk especially during crises when the risk of insolvency is higher. They also find that higher capital levels aids a bank in increasing its market share thereby contributing to liquidity creation. Allen et al. (2015) and Mehran and Thakor (2011) provide theoretical foundations on how higher levels of equity capital help a bank expand its market share. Empirically, Calomiris and Mason (2003) find that banks with higher levels of equity capital are better able to compete for deposits and loans, that is produce liquidity. Conversely, Koehn and Santomero (1980) find that increases in regulatory capital actually increases the banks' portfolio risk and consequently increasing its insolvency risk.

On the other hand, the "financial fragility crowding-out" hypothesis considers equity to be an impediment to liquidity creation. (Diamond and Rajan, 2000) argue that higher equity capital makes the banks less fragile, thereby reducing the banks' incentives to monitor its borrower and affects its lending activity, and consequently affecting its ability to produce liquidity. Aiyar et al. (2012) study the UK market and find that regulated banks decrease lending in response to tighter capital requirements, while the effect is opposite for unregulated banks. Conversely, Jiménez et al. (2017) study the Spanish market and find that increases in capital buffers increases liquidity production by banks, and subsequently employment by firms and the banks' survival probability.

3 Data and Methodology

Data on deposits is obtained from the Reports of Condition and Income ("Call Reports") filed by banks with their respective supervisory agencies every quarter. Call Reports can be obtained from the Chicago Federal Reserve website in machine readable form.[5] I focus on Total Deposits, Core Deposits, and Large Time-Deposits. For Core Deposits I use the Uniform Bank Performance Report (UBPR) definition (Council, 2006) where Core Deposits include total transaction deposits, savings deposits, and small time deposits. Large time-deposits are defined as time deposits $\geq$ \$100,000 prior to Q1,2010 and time deposits $\geq$ \$250,000 since. My sample period for data on deposits runs from Q1,1984 - Q4,2017.

Data on deposit products, deposit rates, bank branches, and the MSA of those branches is obtained from RateWatch. RateWatch provides weekly branch level deposit rates for all US commercial banks for a wide range of deposit account types. Data from RateWatch is available from January 1997 onwards. Weekly deposit rates across branches are aggregated to the branch level each quarter to arrive at average deposit rates for each bank-branch, quarter, and deposit product type.

[5] https://www.chicagofed.org/banking/financial-institution-reports/commercial-bank-data

Data on economic indicators, such as the Gross Domestic Product (GDP), Federal Funds Rate, Coincident Economic Activity Index (CEA), and the Leading Index was obtained from the Federal Reserve Economic Date (FRED) made available by the St. Louis Federal Reserve. The Coincident Economic Activity Index measures the employment and payroll activities, while the leading index predicts the aggregate 6-month growth rate for the CEA Index.

Aggregate Measures

To compute deposit flow rates, measures of persistence, and index of inter-group flows I use the methodology developed by (Davis and Haltiwanger (1992), and Davis, Haltiwanger, Schuh, et al. (1998)), and used to compute credit reallocation rates in (Herrera et al., 2011), and gross credit flow rates in (Dell'Ariccia and Garibaldi, 2005). Computation of aggregate deposit flow rates and other measures of deposit reallocation is described in the following sections.

Aggregate Flow Rates

The average deposits at a bank i between time $t-1$ and t is defined as d_{it}. For a set of n banks in the market, D_{it} is defined as the average of the total deposits of all banks. Deposit growth rate g_{it} for bank i at time t is defined as the ratio of the first difference between two time periods, divided by d_{it}. That is,

$$d_{it} = (Deposits_{i,t-1} + Deposits_{i,t})/2,\ and\ D_t = (\sum_{i=1}^{n} Deposits_{i,t-1} + \sum_{i=1}^{n} Deposits_{i,t})/2$$

$$g_{it} = (Deposits_{i,t} - Deposits_{i,t-1})/d_{it}$$

By construction, the growth measure g_{it} is bounded between $[-2, 2]$. For de-novo banks (entries) $g_{it} = 2$, while for failed/merged banks (exits)$g_{it} = -2$, for the quarter of entry or exit. In addition to being a bounded measure of growth, it incorporates a continuum of entries and exits in the banking system. This is especially important for the banking industry which has undergone substantial consolidation during the given time period. Aggregate deposit inflow rates (POS_t) are computed as the weighted average of the growth rates of banks with positive growth rates, while aggregate deposit outflow rates (NEG_t) are computed as the weighted average of the absolute values of growth rates for banks with negative growth in deposits. Specifically,

$$POS_t = \sum_{\substack{i=1 \\ g_{it}>0}}^{n} g_{it}(\frac{d_{it}}{D_t})$$

$$NEG_t = \sum_{\substack{i=1 \\ g_{it}<0}}^{n} |g_{it}|(\frac{d_{it}}{D_t})$$

Aggregate deposit reallocation rate is the sum of deposit inflow rate and deposit outflow rate ($SUM_t = POS_t + NEG_t$), and net inflow rate is the difference between deposit inflow rate and deposit outflow rate ($NET_t = POS_t - NEG_t$). Excess deposit reallocation is the difference between aggregate reallocation rate and the absolute values of net inflow rate ($EXC_t = AGG_t - |NET_t|$). EXC_t is the deposit reallocation amongst banks in excess of the minimum required to accommodate changes in deposits.

Persistence

The substantial rates (and dollar amounts) of deposit inflows and outflows each quarter raises the question whether these patterns are transitory, or are an integral part of the banking industry and intrinsic to the reallocation of deposits. To quantify the degree to which these changes are transitory or permanent I compute measures of persistence in deposit flows based on (Davis and Haltiwanger, 1992). The persistence measure for bank i at time t is computed as:

$$P_{it} = min\left[1, max\left(\frac{deposit\ growth\ rate_{t-2,t}}{deposit\ growth\ rate_{t-1,t}}, 0\right)\right]$$

A persistence measure of $P_{it} = 1$ indicates that all the new deposits that came into the bank at time t will stay with the bank for one more quarter, while a persistence measure of $P_{it} = 0$ indicates that these deposit inflows are temporary and will not last one additional quarter. The overall quarterly persistence measure for the industry is computed as the mean of quarterly persistence measures for all individual banks, or

$$P_t = \frac{1}{n}\sum_{i=1}^{n} P_{it}$$

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Inter-Group Reallocation of Deposits

Previously we have seen that there is an excess reallocation of deposits across banks. To explore whether this inter-bank reallocation of deposits is within banks in similar size groups or across banks of different sizes, I compute an index of inter-group reallocation using the methodology of (Davis and Haltiwanger, 1992). The index is computed as:

$$W_t = 1 - \frac{\sum_{j=1}^{J}(|NET_{jt}|)}{\sum_{j=1}^{J}(SUM_{jt}|)}$$

where j=1,...,J denotes the groups. If all groups have only inflows or outflows of deposits then $SUM_{jt} = |NET_{jt}|$ and the index will have a value of 0. An index value of $W_t = 0$ suggests that all deposit flows are inter-group. Conversely, if all deposit flows are only intra-group that would imply $|NET_{jt}| = 0$ and the index value would be 1. An index value of $W_t = 1$ indicates that all the deposit flows are intra-group. $0 \leq W_t \leq 1$ measures the degree of deposit flows across groups. For example $0 \leq W_t < 0.5$ would indicate that a large fraction of the deposit flows are inter-group, while $0.5 \leq W_t < 1$ would indicate that deposit flows are predominantly intra-group.

Direction of Reallocation of Deposits

The measures for inter-group reallocation of deposits gives an idea about the degree of reallocation, but does not tell us anything about the direction of reallocation. To ascertain the direction of deposit flows I construct a directionality measure that builds on the methodology developed by (Meller and Metiu, 2017) to measure synchronization of economic cycles across countries. My directionality measure is constructed using a two-step procedure. In the first step, dummy variables are created for each individual banks' deposit growth rate g_{it}, where

$$Growth\ Dummy_{it}\ (G_{it}) = \begin{cases} 1 & \text{if } g_{it} > 0 \\ 0 & \text{if } g_{it} \leq 0 \end{cases}$$

Each quarter banks are classified "Large" or "Small" based on total assets. Banks in the top 1% in total assets are classified as large, the remaining are classified as small.

In the second step, I create a N*M matrix where N is the number of large banks and M the number of small banks. Each element in the matrix is assigned a value of $+1, 0, or -1$ as follows, where the subscripts L stands large banks, and S for small banks.

$$Matrix_{ij,t} = \begin{cases} +1 & \text{if } G_{it,L} = 1 \ \& \ G_{jt,S} = 0 \\ 0 & \text{if } G_{it,L} = 1 \ \& \ G_{jt,S} = 1, \text{ or } G_{it,L} = 0 \ \& \ G_{jt,S} = 0 \\ -1 & \text{if } G_{it,L} = 0 \ \& \ G_{jt,S} = 1 \end{cases}$$

That is, each quarter deposit growth rate dummy or all large banks are compared to the deposit growth rate dummy of all small banks. If deposit growth rate at a large bank is positive while that at a small bank is negative the corresponding element matrix element is given a value of $+1$, if it is the other way round, it is given a value of -1. If growth rates at both the large and small banks are both positive or both negative, then a value of 0 is ascribed. Using this methodology, I can safely assume that each element of the matrix has a discrete uniform distribution, or $Matrix_{ij,t} \sim U[-1, 1]$.

The directionality measure for time t is computed as the average value of all elements of the $Matrix_{ij,t}$, or $\mu_t = \frac{\sum_{i=1}^{N} \sum_{j=1}^{M} Matrix_{ij,t}}{(M*N)}$. If the direction of deposit flows is truly random, then the value of the my measure is zero ($E[\mu_t] = 0$). This measure takes a value of 1 if all small banks had a negative deposit growth rate and all large banks had a positive deposit growth rate, suggesting that deposits were reallocated from the small banks to large banks. A value of -1 would mean deposits were reallocated from large banks to small banks, and a value of 0 would imply that the direction of reallocation is inconclusive.

When examining the direction of deposit flows between the largest and the smaller banks, I split my analysis on time periods prior to and after Reigle-Neal and GLB since the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (Riegle-Neal) allowed banks to operate across state boundaries and hence promoted "economies of scale" in the banking industry, while the Gramm–Leach–Bliley Act (GLBA) allowed banks and financial institutions to offer investment banking and insurance services, thereby promoting "economies of scope". It is possible that the enhanced scale and scope economies available to large banks contributed to the reallocation of deposits from small to large banks.

Deposit Rate Advantages

I compute a banks' ability to enjoy deposit rate advantage as the number of branch-products in which the bank has a deposit rate lower than the median rate in the MSA where the branch is located. Let a bank i have $n = 1, ..., N$ branches and offers $k = 1, ..., K$ products per branch, and $j = 1, ..., J$ be the MSA's in which the bank operates a branch. Then $R_{i,k,n,j}$ is the deposit rate on k^{th} product, in branch n in MSA j for bank i. And, $\bar{R}_{k,j}$ be the median MSA rate for the k^{th} product. Then the percentage of branch-products (DRA_{it}), in which a bank i enjoys a deposit rate advantage at time t is computed as:

$$DRA_{it} = \frac{\sum_{j=1}^{J} \mathbf{1}(R_{i,k,n,j} \leq \bar{R}_{k,j})}{N * K}$$

$\mathbf{1}$ is an indicator variable that takes value of 1 if the condition is met, else takes the value 0.

4 Results

Empirically, the effect of deposit flows on banking stability have largely been studied as the outflows of deposits in response to fundamental weakness at banks (Gorton (1988), Saunders and Wilson (1996), and Calomiris and Mason (1997)) or as a panic based run by depositors (Calomiris and Mason, 1997). Recent empirical evidence has suggested that in addition to deposit outflows, there are simultaneous inflows at failing/distressed banks (Martin et al., 2018). There is heterogeneity in depositor response to perceived insolvency risk of individual banks (Iyer, Puri, and Ryan, 2016). And depositors are rational and move their deposits from distressed to healthy banks (Egan et al., 2017). In this section we look at some of the properties of deposit inflows, outflows, and deposit reallocation. Then I show how examining gross deposit flows provides us with valuable information on the stability of the banking system, which cannot he garnered from studying net deposit flows alone.

Magnitude and Persistence

Table 1 shows the rates and dollar amounts of aggregate inflows, outflows, and reallocation of deposits within the banking system for the 1984 - 2017 time period. The figures are based on quarterly changes in deposits at the bank-level and all dollar amounts are in December 2017 dollars. I find that the average rate of deposit inflows (POS_D) is 3.7% (or $238 bn), and ranges from 1.2% - 10.3% (or $83bn - $932bn) each quarter over the sample period. Conversely, the rate of deposit outflows (NEG_D) averages 1.1% (or $71bn), and ranges from 0.2% - 3.7% (or $12bn - $389bn) each quarter. I find that on average, deposit inflows are nearly five times as large and five times as volatile than deposit outflows.

I find a similar trend across deposit types, though the magnitude varies considerably. Core deposits have an average inflow rate of 3.9% and an outflows rate of 1%, but on average deposit inflows are nearly six times as large as deposit outflows. Large time-deposits have an average inflow rate of 7.3% and an outflows rate of 5.2%, an on average deposits inflows are only twice as large as deposit inflows. In dollar terms however, inflows of core deposits are much higher ($216bn) compared to inflows of large time-deposits ($123bn), each quarter, while outflows of core deposits ($55bn) are comparable in magnitude to outflows of large time-deposits ($50bn), attesting to the "sticky" nature of core deposits. These aggregate level deposit outflows (run-off) rates are much lower than those considered in the Basel III regulations on liquidity and stable funding (Basel III, 2013). Basel III regulations assume a run-off rate of 5% (minimum of 3%) for stable funding sources, which in my case are core deposits, and a run-off rate of 10% or higher for less stable funding sources, or in my case large time-deposits. These findings suggest that the deposit run-off rates considered in the Basel regulations may be more conservative than the run-of rates observed.

These findings suggest that not only should deposit inflows be considered in evaluating the stability of the banking system, considering heterogeneity in deposit types is also important. I would also like to mention here that while the banking industry has consolidated over time (see Figure **??** in the Appendix), I find that the entry and exit of banks into and from the system, by itself has little impact on deposit inflows and outflows, respectively. The effect of bank entries and exits on the magnitude of deposit flows is shown in Table 1 and further elaborated in Figure 2.

Figure 1 further elaborates on the simultaneous inflows and outflows of deposits. We see that every quarter there are both deposit inflows and outflows, irrespective of whether the net inflows are positive or negative. Specifically, in periods of negative net deposit flows i.e. when the blue bars are below the 0 level line, there are deposit inflows, and in periods of net positive deposit flows, there are deposit outflows. Additionally, we see that during the most recent financial crisis (2007 - 2009) only large time-deposits experienced net outflows, while during the previous crisis (2000 - 2001) core deposits experienced net outflows. There are also simultaneous inflows and outflows even in periods of net deposit outflows. Martin et al. (2018) document a similar behavior using account-level data, and find that even at individual distressed banks there are simultaneous deposit inflows and outflows.

To assess whether these deposit flows are due to temporary shocks to individual banks, or are structural to the banking industry, I compute measures of persistence in deposit flows. We find that deposit inflows and outflows are highly persistent. Figure 3 shows the plots of average persistence measure across time periods, and Table 2 shows the average persistence measure across deposit types.

We find that on average the persistence measure for the entire sample period is 0.61 (range 0.53 - 0.68) for total deposits, 0.57 (range 0.30 - 0.69) for core deposits, and 0.51 (range 0.42 - 0.60) for large time-deposits. This indicates that roughly only 50% - 60% of new deposits stay with the bank for an additional quarter, while the remaining deposits either leave the banking system or are redistributed amongst the banks. This further suggests that both deposit inflows and outflows are innate to the each bank and hence both should be considered in designing regulations on liquidity and stable funding.

In addition to deposit inflows and outflows into the banking system, there is also a reallocation amongst banks. This reallocation (EXC_D) of deposits within the banking system which averages around 2.1% (or \$136bn), and ranges from 0.5% - 5.4% (or \$24bn - \$487bn) each quarter. The reallocation rate for core deposits is around 2%, while the reallocation rate for large time-deposits is much higher at around 9.1%. However, the average ratio of reallocation to outflows is around 1.8-1.9 across deposit types. This ratio suggests that for every \$1 that leaves the banking system, \$1.9 is reallocated amongst banks. Reallocation suggests that depositors are rational, and while some depositors may withdraw their depositors from the banking system completely, nearly twice choose to move their deposits to other banks which provide them with a greater utility.

Contemporaneous and Cross-Correlations

Martin et al. (2018) find that when uninsured depositors leave a failing bank they also with their insured deposits that the banks. They also find that at the failing bank they study outflow of uninsured deposits was accompanied with an inflow of insured deposits, albeit from different depositors via internet listing services. To further examine whether such patterns are unique only to failing banks or a common occurrence in the banking system, I examine contemporaneous and cross-correlations between deposit inflow and outflows, across deposit types. I first examine the correlations in deposit inflows and outflows at the aggregate level.

Table 3 shows the correlations between deposit inflows and outflows for core deposits and large time-deposits. From the table we see that outflows of core deposits are associated with lower inflows of core deposits ($\rho(POS_{Core}, NEG_{Core}) = -0.24^{**}$), or an inflow of core deposits leads to a lower outflow of core deposits.Outflows of core deposits are also associated with inflows of large time-deposits $((\rho(NEG_{Core}, POS_{LTD}) = 0.23^{**})$, suggesting some degree of substitution in funding sources. I however do not find any evidence that outflows of large time-deposits are associated with inflows of core deposits $((\rho(NEG_{LTD}, POS_{Core}) = 0.11)$. We also see that inflows of core and large time-deposits are also also positively correlated with each other $((\rho(POS_{Core}, POS_{LTD}) = 0.26^{**})$, but outflows are not significantly correlated $((\rho(NEG_{Core}, NEG_{LTD}) = 0.14)$. This suggests that while there is a run-in of different types of depositors simultaneously, the run-offs don't happen simultaneously, which is essential in understanding depositor run-offs and bank stability.

I then examine the correlations between deposit inflows and outflows by various levels of insolvency risk, across deposit types. I use levels of equity capital, Non-Performing Assets (NPA's) and Charge-Offs (CO's) to identify insolvency risk.

Table 4 shows that while inflows of core and large time-deposits are positively correlated across risk categories, simultaneous outflows are indifferent to capital levels, but are more likely in banks with high Charge-Offs. We also see that the substitution effect between core deposits and large time deposits is most evident in banks with low capital, high levels of NPA's, and low Charge-Offs. These findings suggest that the substitution effect between core deposits and large time-deposits is largely prominent at banks facing greater insolvency risk, similar to the findings by Martin et al. (2018).

I also examine non-contemporaneous or cross-correlations between deposit inflows and outflows, across deposit types. From Figure 4 we see that core deposit inflows are positively correlated with large time-deposit inflows, both contemporaneously and with future inflows.

Deposit outflows for core deposits and large time-deposits are also correlated with each other but non-contemporaneously, suggesting that both core deposits and large time-deposits don't necessarily the leave the banking system at the same time. The cross-correlations between inflows/outflows of core and large time-deposits suggest the presence of a substitution effect between core deposits and large time-deposits, albeit non-contemporaneously. Outflows of large time-deposits are followed by inflows of core deposits after a period of 5 quarters. Inflows of large time-deposits affect the outflows of core deposits both with a lead and a lag.

Economic and Market Conditions

I next examine the effect of macroeconomic and market conditions on deposit flows. Table 5 shows the effect of economic and market conditions on deposit flows. I find that the aggregate rate of deposit inflows increases during periods of high stock market returns, and the rate of deposit outflows decreases during periods of high economic activity. Across deposit types, I find that the increase in the inflow of deposits is primarily due increases in core deposits inflows. These findings suggest the presence of a wealth effect, where high economic activity is accompanied by increased lending by banks, and thus an increase in the demand for funds. Martin et al. (2018) find a similar result in their study.

On the other hand, the rate of inflows of large time-deposits increases during periods of high market volatility, suggesting that depositors view banks as "safe havens" during periods of market uncertainty. These findings are consistent with (Acharya and Naqvi, 2012) and (Gatev and Strahan, 2006),and could potentially be attributed to the liquidity and safety of bank deposits during economic contractions. So while investors can choose bank deposits as means to earn higher returns vis-a-vis other storage technologies (Allen et al., 2015), bank deposits may be viewed as a safe storage mechanism rather than investments, especially during periods of economic uncertainty.

High economic activity also affects core deposits and large time-deposits differently. For core deposits, while both the rate of deposit inflows and outflows decrease, for large time-deposits only the rate of outflows decreases. Large time-deposits are also more sensitive to changes in the benchmark rate of return (the federal funds rate), compared to core deposits. While Egan et al. (2017) suggest that all deposits are price inelastic, I find that increases in the federal funds rate leads to higher inflows and lower inflows for large time-deposits, while there is no such effect observed for core deposits. These findings further elaborate on the sensitivity of different deposit types to changes in macro economic and market conditions, which should be taken into consideration when evaluation deposit flows and bank stability.

Cross-Sectional Variation

We have seen that the magnitude and volatility of aggregate deposit inflows and outflows differs substantially. Deposit flows is a persistent feature for all banks, and flows vary with economic and market conditions. I now explore the variation in deposit flows, the magnitude of inter-group deposit flows, and the direction of deposit flows across bank size groups.

Table 6 shows the rates of deposit inflows, outflows, and the reallocation of deposits across bank size groups. Banks as classified into size groups each quarter based on total assets and deposit flow measures are computed as percentage of total group deposits.[6] We see that the very largest banks (total assets in the top 1 percentile) have higher rates of deposit inflows (4.2%) compared to inflow rates of 3.0% - 3.9% in the other groups. The largest banks also have a comparable-to-lower rate of deposit outflows (1.2%) compared to the 1.1%-2.6% rate of outflows for other groups. The these findings are similar for both core and large time-deposits.

The ratio of deposit inflows to outflows decreases monotonically from the largest to the smallest bank. For every $1 of outflows, the largest banks attract $9, while the smallest banks only attract roughly $2.6. On the other hand the the ratio of deposit reallocation to outflows increases monotonically from the largest to the smallest bank. Similarly for every $1 in outflow of core deposits and large time-deposits, the largest bank attract $11.8 and $1.9 respectively. On the other hand, for every $1 in outflow of core and large time deposits, the smallest bank attract only $2.5 and $1.6, respectively. For every $1 of outflow for the largest banks, $1.89 are reallocated amongst the largest banks, while for the smallest banks $1.96 are reallocated. Similarly, for core and large time-deposits, for every $1 of outflow at the largest banks, $1.9 and $1.7 are reallocated amongst banks of similar size, while $1.9 are reallocated amongst the smallest banks.

These findings suggest that the largest banks both attract and retain more deposits compared to the smaller banks, for every dollar of deposit outflow. Since the largest banks also have the most number of branches, these higher ratios of deposit inflows to outflows at the largest banks suggests the importance of branch networks, not only in in their ability to attract deposits, but also in reducing information asymmetry and monitoring

[6]My findings are similar if instead of computing rates as percentage of total group deposits I use aggregate deposits in the banking system.

costs (Aguirregabiria et al., 2017), and thus retaining more deposits. This monotonic trend in the ratios of deposit inflows-to-outflows and reallocation-to-outflows to cannot be captured with deposit growth rates, or deposit market share alone, and is thus valuable in understanding the funding risks faced by community banks vis-a-vis larger banks.

Deposits are not only reallocated amongst banks in similar size groups, but also across groups. I find that nearly 60% of the reallocation of core deposits is inter-group, while for large time-deposits it is only 30% , the rest being intra-group. We saw that while the rates of reallocation of large time-deposits is higher than that for core deposits (9.1% vs. 2%, refer Table 1), large time-deposits are largely reallocated across banks of similar size. This suggests that the reallocation of large time-deposits is largely due to heterogeneity in bank-level dynamics within similar size groups, and not so much as differences in banking practices between the largest and smaller banks.

These reallocation figures however do not give us the direction of deposit flows. I develop on the methodology used by Meller and Metiu (2017) to measure synchronization of economic cycles across countries, to ascertain the direction of deposit flows.

Bank Specific Attributes Affecting Deposit Flows

In the preceding section(s), I established that there are simultaneous inflow and outflow of deposits, these flows are large in magnitude, they vary with economic and market conditions, and across bank size groups. We found that these inflows, outflows, and reallocation of deposits is a persistent feature of the banking system. This section explores other attributes that could potentially explain deposit flows. I examine the ways in which depositors derive utility from bank deposits, and how each of these factors affects deposit flows. I consider three main factors, as mentioned in Egan et al. (2017), namely deposit rates offered, insolvency risk, and ability to effectively utilize deposits. Each of these are discussed in the sections below.

Deposit Rate Advantages

To interpret my results I use the framework of DeAngelo and Stulz (2015), who suggest that banks that enjoy deposit rate advantages over their peers should have lower leverage and consequently lower (higher) rates of deposit inflows (outflows). Deposit rate advantage is computed as the percentage of branch-products in which a given bank offers deposit rates lower than the median MSA rate for that product. Table 9 shows the rates of deposit inflows, outflows, and reallocation in the highest and the lowest decile groups ranked on deposit rate advantages. I find that deposit inflows for the banks in the highest group are nearly 25% compared to to banks in the lowest decile group. Similarly core deposit inflows are nearly 23% lower, and large time-deposit inflows are 15% lower. Deposit outflows at banks in the highest decile are nearly 38% than banks in the lowest decile. Similarly outflows are 20% and 56% higher for core and large time-deposits respectively. We also see that rates of reallocation are higher for the banks in the highest decile, and this is consistent across deposit types.

As another measure, I scale the deposit rate advantage measure computed earlier with the banks' net interest margin. This enables us to examine whether the high (low) deposit rate advantage eventually results in higher (lower) interest margins. However, here we see that while deposit inflows are lower at banks in the highest decile, outflows and rates of reallocation are also lower compared to banks in the lowest decile, and this is consistent across deposit types.

I further compute the directionality measure for deposit flows based on deposit rate advantages. If indeed depositors are rational and return seeking, ceteris paribus one should expect to see deposits flow from banks offering lower deposit rates (higher deposit rate advantage) to banks with higher deposit rates (lower deposit rate advantages). Table 10 shows the direction of deposit flows. As one would expect the directionality index is negative, indicating that deposits move from banks in the higher group to banks in the lower group. The directionality index is -0.0783^{***} for total deposits, -0.0493^{***} for core deposits, and -0.1269^{***} for large time deposits. When considering the scaled version of deposit rate advantage, the results are only significant for large time-deposits, which have a directionality index of -0.0155^{*}.

My findings are consistent with the model of DeAngelo and Stulz (2015) and show that depositors are rational and return seeking, and thus deposits are reallocated to banks which provide depositors with a higher utility via higher deposit rates.

Insolvency Risk

Utility derived by depositors from bank also depends from the banks' insolvency risk. While uninsured depositors would be most at risk since they would lose their deposits in case of a bank failure, even insured depositors would face some loss in utility from the extinguishment of depositor-bank relationship. Saunders and Wilson (1996) find that informed depositors can ex-ante identify failing and non-failing banks and withdraw their deposits in anticipation of a bank failure. Egan et al. (2017) echo a similar sentiment that depositors are fully rational and move their deposits from distressed banks to healthy banks.

I examine whether aggregate deposit flows are affected by banks' *"unconditional"* insolvency risk. I measure the *"unconditional"* insolvency risk as the ratio of Non-Performing Assets (NPA's) / Total Loans.[7] Heitz and Narayanamoorthy (2018) suggest that NPA's are a good proxy for a timely measure of a banks' probability of default. Moreover, a high level of NPA's as percentage of total loans indicates that the bank may sooner or later face the risk of insolvency.

Table 9 show the rates of deposit inflows, outflows, and reallocation for groups in the highest and lowest deciles of their NPA ratio. I find that deposit inflows at banks in the highest decile are nearly 43% lower and outflows are nearly 77% compared to banks in the lowest decile. Trend are similar for core deposits, where inflows are 40% lower and outflows are 69% higher, and for large time-deposits where inflows are 47% lower and outflows are 40% higher. Deposit reallocation rates are 48%, 42%, and 3% higher for banks in the highest decile, for total, core, and large time-deposits respectively.

I also examine the direction of deposit flows. If depositors can perceive insolvency risk at banks, one should expect to see negative values for directionality index. From Table 10 we see that on average deposits are reallocated from banks in the highest decile to banks in the lowest decile of NPA ratio. Directionality index is -0.1923^{***} for total deposits, -0.1573^{***} for core deposits, and -0.1351^{***} for large time-deposits.

My findings demonstrate that depositors are informative and hence the lower (higher) rates of inflows (outflows) at banks in the highest decile on NPA's. We also see that

[7] I stress on the word *"unconditional"* since the actual insolvency risk is more likely to be determined by the level of NPA's, conditional on the amount of loan loss reserves and equity capital.

depositors move their deposits from banks that have higher insolvency risk to banks with lower insolvency risk, suggest some evidence of market discipline.

Equity Capital

I next examine the effect of the level of equity capital on deposit flow rates. In addition to deposit rates and insolvency risk, depositors also derive utility from how well the bank is able to use these deposits to generate returns sufficient enough to repay the depositors (Egan et al., 2017). Equity capital can either aid in this process by reducing insolvency risk, which is the "risk absorption" hypothesis or it could hinder this process by reducing banks' incentives to screen and monitor its borrowers, which is the "financial fragility crowding-out" hypotheses.[8]

Table 9 shows the rates of deposit inflows, outflows, and reallocation for banks in the highest and lowest deciles ranked according to level of equity capital. I find that on average deposit inflows are nearly 35% higher at banks in the highest decile, and this percentage varies from 38% for core deposits to 27% for large time-deposits. I also see that deposit outflows are nearly 92% higher and deposit reallocation is nearly 78% higher for banks in the highest decile. The findings lend support to the "risk absorption" hypothesis that equity capital reduces banks' insolvency risk and consequently banks with higher equity capital have higher rates of deposit inflows and reallocation. However, the high rates of deposit outflows also suggest that high equity levels hinder a banks' screening and monitoring ability, consistent with the "financial fragility crowding out" hypothesis.

[8] The terms "risk absorption" hypothesis and "financial fragility crowding-out" hypothesis have been borrowed from (Berger and Bouwman, 2009).

Table 10 shows the directionality index for deposit reallocation. We see that on average, deposits are reallocated from banks in the highest decile to banks in the lowest decile. Directionality index is -0.0680^{***} for total deposits, -0.0755^{***} for core deposits, and -0.0325^{***} for large time-deposits. The directionality measure lends support to the "financial fragility crowding-out" hypothesis, suggesting that lower capital levels aid banks' screening and monitoring roles, and hence deposits are reallocated from banks with higher levels of equity capital to those with lower levels.

My findings are consistent with both the "risk absorption" and the "financial fragility crowding-out" hypotheses. One possible explanation for these contradictory results is that both leverage and equity capital ratios have regulatory upper and lower bounds, respectively. Another aspect could be that minimum required regulatory capital is computed on an assets' risk weight, which may or may not have the same effect on deposit flows, than if it were based on the assets liquidity creation weight. Furthermore, while theoretically a bank could obtain deposits as desired, regulatory interventions could prevent the bank from obtaining certain kinds of deposits.[9]

4.1 Conclusion

This paper examines the flow of deposits in the banking system by computing measures of deposit inflows, outflows, and the reallocation of deposits. I find that deposit inflows are larger in magnitude and volatile than deposit outflows. At any given time period there are simultaneous inflows and outflows of deposits, even in time periods of new deposit outflows. Across deposit types, the magnitude of inflows for core deposits is larger than

[9]For example, a bank that is below the "Well Capitalized" status cannot obtain or renew brokered deposits without the regulators approval.

large time-deposits, but both have similar magnitudes of deposit outflows. Moreover, the inflows and outflows of core and large time-deposits are affected differently by business and economic conditions. The findings suggest that better understand banking system stability, one needs to consider both deposit inflows and outflows and the heterogeneity in flows across deposit types.

I also find that there is substantial reallocation of deposits across banks. I find that large banks are able to attract and retain more deposits compared to their smaller counterparts. In addition to attracting and retaining more deposits, large banks have been attracting deposits away from smaller banks, and this effect is more evident after Riegle-Neal and Gramm Leach Bliley Acts. The findings suggest that deposit funding stability could be an issue of grater concern for smaller banks compared to the large banks.

Lastly, I examine the flow of deposits based on the utility depositors generate from the banks. I find that deposits largely flow to banks that provide better utility to depositors, in terms of deposit rates offered, solvency risk of the bank, and banking efficiency. These findings attest to the market disciplining role of depositors.

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Figures and Tables

Table 1. Gross Deposit Inflows, Outflows, and Reallocation

Measure	N	Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max
		Total Deposits				**Core Deposits**				**Large Time-Deposits**			
Inflows (POS_D)	135	0.037	0.017	0.012	0.103	0.039	0.026	0.011	0.245	0.073	0.029	0.019	0.158
Outflows (NEG_D)	135	0.011	0.007	0.002	0.037	0.010	0.007	0.002	0.033	0.052	0.020	0.018	0.115
Reallocation (EXC_D)	135	0.021	0.011	0.005	0.054	0.020	0.011	0.004	0.050	0.091	0.028	0.035	0.160
Entry	135	0.002	0.005	0.000	0.062	0.002	0.005	0.000	0.060	0.002	0.007	0.000	0.078
Exit	135	0.001	0.007	0.000	0.083	0.00003	0.0001	0.000	0.001	0.002	0.020	0.000	0.237
Inflows / Outflows	135	4.820	4.457	0.509	36.026	6.230	8.772	0.537	87.010	1.653	1.064	0.234	5.707
Reallocation / Outflows	135	1.972	0.132	1.017	2.000	1.979	0.118	1.073	2.000	1.808	0.364	0.467	2.000
						In 2017 Dollars ($ Billions)							
Inflows (POS_D)	135	237.74	124.96	83.84	932.80	216.42	123.72	50.11	836.41	70.63	34.36	17.82	215.96
Outflows (NEG_D)	135	71.00	46.14	12.00	389.25	55.10	31.45	7.56	157.89	50.39	24.36	18.57	207.44
Reallocation (EXC_D)	135	136.62	75.31	24.00	487.71	108.00	60.25	15.13	315.77	85.57	27.80	35.64	182.99

Table 1 shows the rates and dollar amounts of deposit inflows (POS_D), outflows (NEG_D), aggregate flows (SUM_D), net flows (NET_D), and excess reallocation (EXC_D) in the banking system for the 1984 - 2017 sample period. The central fact captured by the table is that the rate of deposit inflows (3.7%) is larger than the rate of deposit outflows (1.1%). However, deposit inflows are more volatile than deposit outflows. The rate of inflows and outflows for core deposits (3.9%, and 1%) is smaller than the corresponding rates for large time-deposits (7.3%, and 5.2%), although the inflows and outflows of large time-deposits are more volatile. I also see that in addition to the simultaneous inflows and outflows, there is an excess reallocation of deposits in the banking system. Excess reallocation is the change in total deposits, in excess of the net deposit flows. Excess reallocation ranges from 0.5% - 5.4% ($24bn - $487bn) for the sample period. Additionally, we see that entries (de-novo banks) and exits (failure of merger) have little effect on aggregate deposit flow rates.

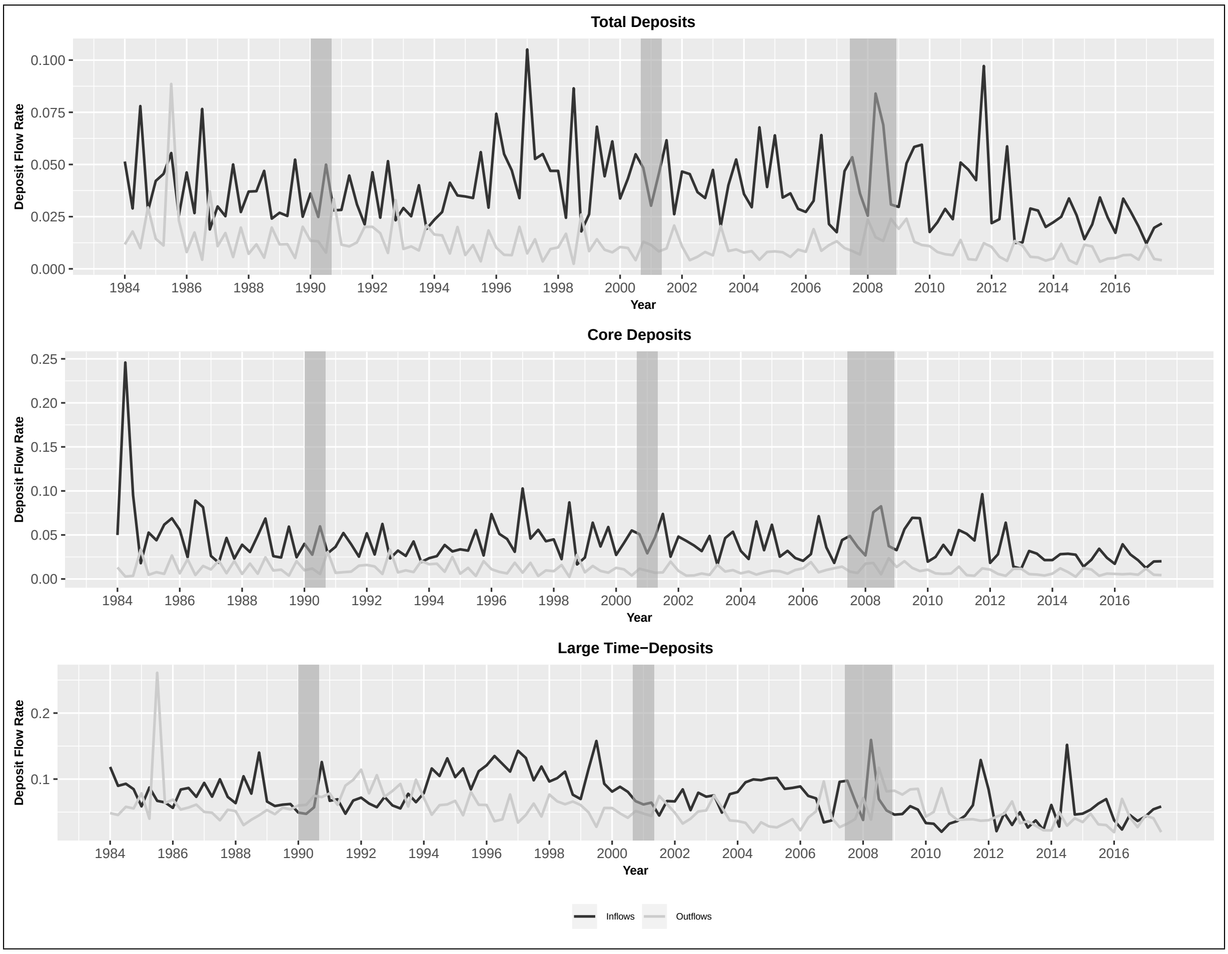

Figure 1. Simultaneous Inflows and Outflows of Deposits

Figure 1 shows the rates of simultaneous inflows, outflows, and net inflows for total, core, and large time-deposits. We see that in all quarters during the sample there are simultaneous deposit inflows and outflows in the banking system. It can also be seen that during the most recent financial crisis, only large time-deposits had periods of net outflows, while there was a net inflow of core and total deposits during the same time period. However, there was a large outflow of core deposits liquidity during the 2000 - 2001 financial crisis.

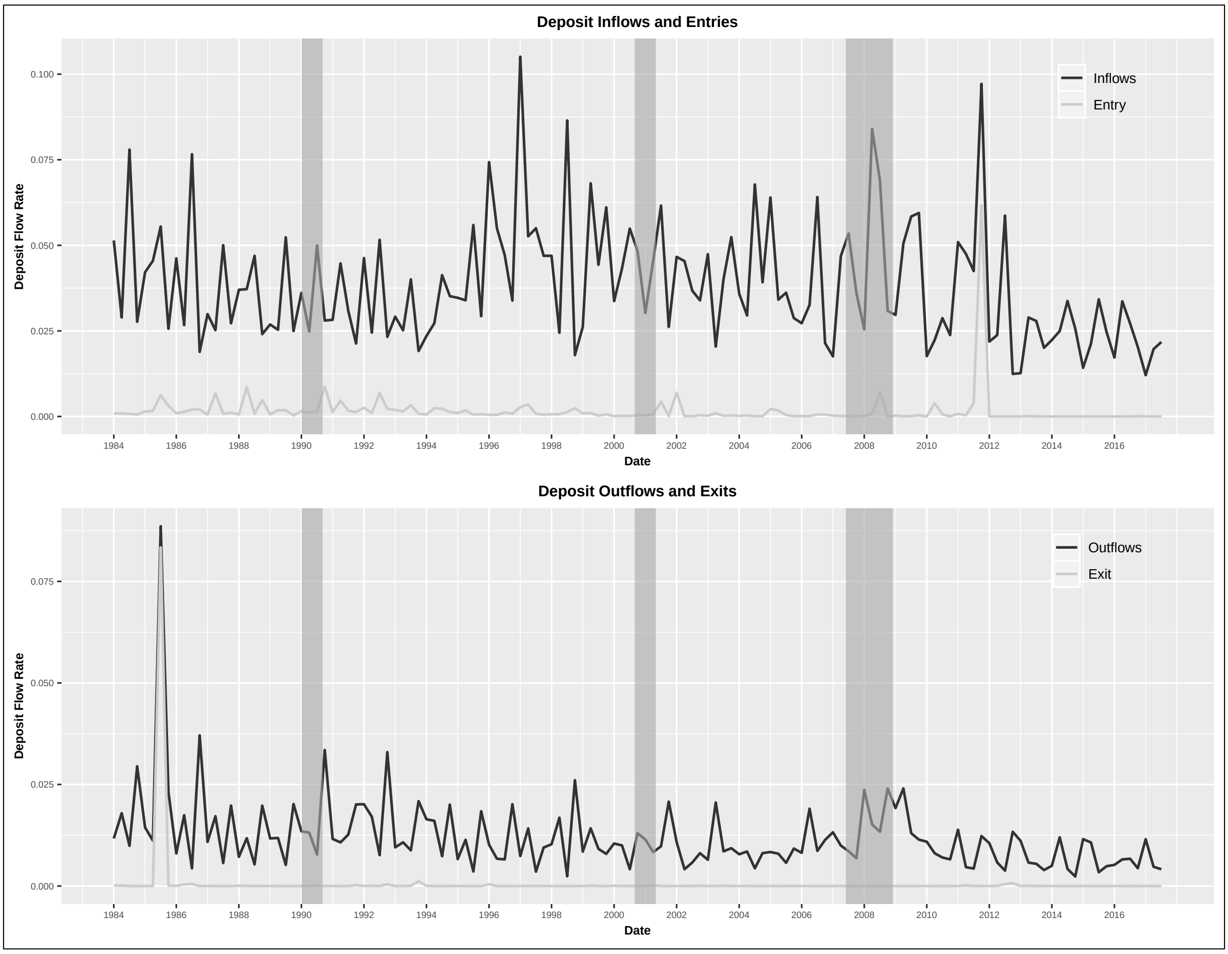

Figure 2. Inflows, Outflows, Entry and Exit

Figure 2 shows the aggregate rates of deposit inflows and outflows, and the rates of inflows and outflows as a result of entries (de-novo banks) and exits (failures or mergers). I find that while there has been substantial consolidation in the industry (see Figure **??** as a result of mergers and bank failures, entries and exits by themselves have little effect on the rates of deposit inflows and outflows. The spike in deposit inflows as a result of entries in 2010-2011, was primarily due to thrifts' change of charter to commercial banks. The spike in outflows seen in 1985-1986 was a result of many bank failures during the Savings & Loan crisis during that time period.

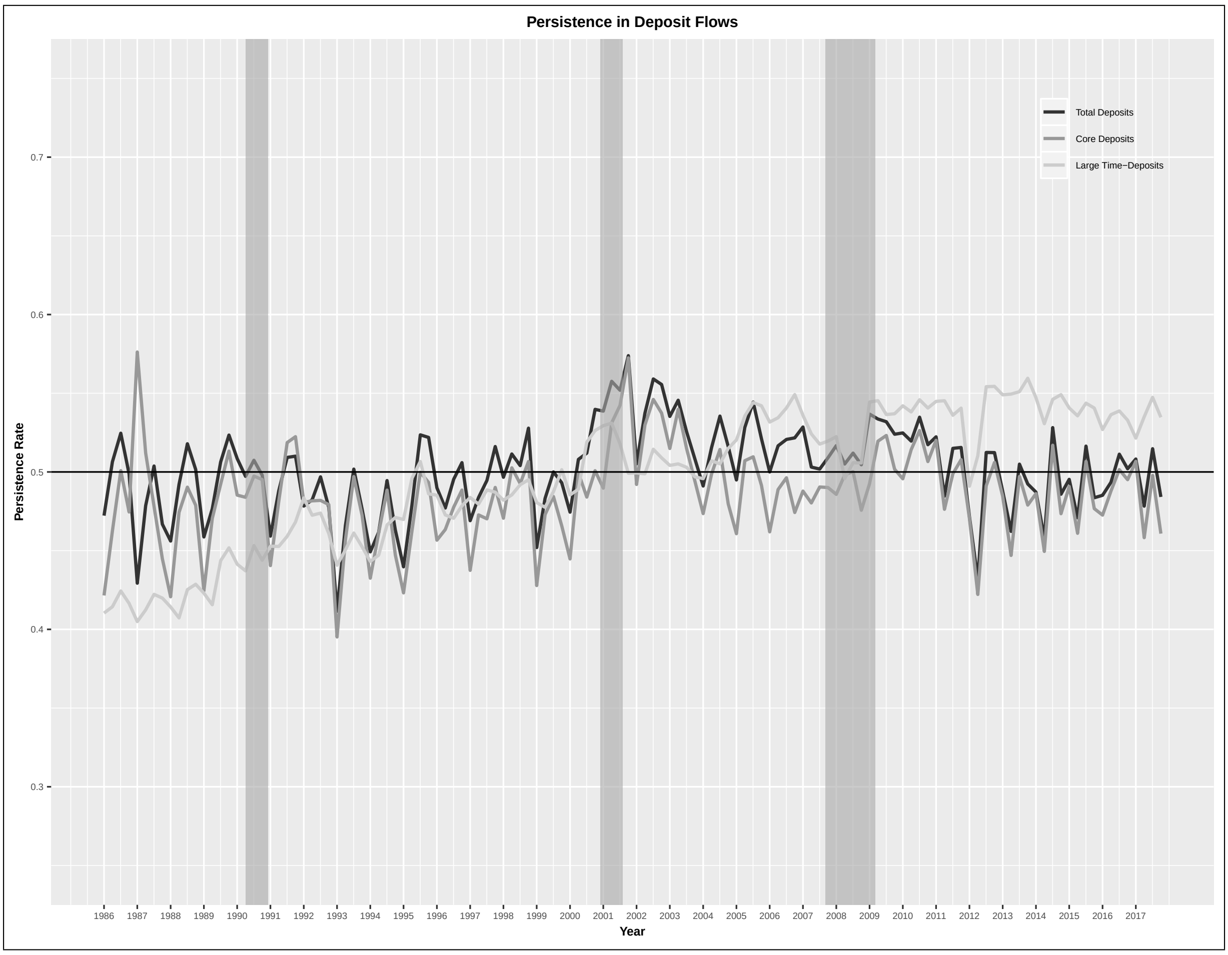

Figure 3. Persistence in Deposit Flows

Figure 3 shows the persistence in deposit flows at banks across time periods. Vertical gray bars are NBER recession periods and the horizontal line is the 50% persistence level. A persistence level of 1 indicates that all deposits that came into a bank remain for one more quarter, while a persistence level of 0 indicates that none of the deposits that came into a bank remained for another quarter. I see that for most part of the sample period the persistence measure is above 0.5, indicating that on average only 50% of the deposits that come into a bank stay for another quarter.

Table 2. Persistence Measures - Summary Statistics

	Total Deposits	Core Deposits	Large Time-Deposits
Mean	0.501	0.486	0.497
St. Dev.	0.028	0.029	0.042
Min	0.412	0.395	0.405
Max	0.574	0.576	0.560

Table 2 shows that roughly only 50% of deposits that enter a bank remain at the bank for one more quarter, while the rest either leave the banking system or are reallocated amongst other banks. This further indicates that there is substantial reallocation of deposits in the banking system.

Table 3. Correlations - Core Deposits and Large Time-Deposits

	POS_{CORE}	NEG_{CORE}	POS_{LTD}	NEG_{LTD}
POS_{CORE}	1			
NEG_{CORE}	-0.24**	1		
POS_{LTD}	0.26**	0.23**	1	
NEG_{LTD}	0.11	0.14	-0.16	1

Table 3 shows the correlations between deposit inflows and outflows for core deposits and large time-deposits. From the table we see that outflows of core deposits are associated with lower inflows of core deposits. However, the outflows of core deposits are also associated with inflows of large time-deposits, suggesting a substitution effect in funding sources. We also see that inflows of core and large time-deposits are also also positively correlated with each other, but outflows are not significantly correlated. This suggests that while there is a run-in of different types of depositors simultaneously, the run-offs don't happen simultaneously.

Table 4. Correlations - By Insolvency Risk

	$\rho_{(POS_{CORE},POS_{LTD})}$	$\rho_{(POS_{CORE},NEG_{LTD})}$	$\rho_{(NEG_{CORE},POS_{LTD})}$	$\rho_{(NEG_{CORE},NEG_{LTD})}$
High Capital	0.89***	−0.07	−0.09	0.22***
Low Capital	0.23***	−0.07	0.19**	0.19**
High NPA	0.59***	0.21**	−0.15*	0.01
Low NPA	0.42***	−0.01	0.04	−0.03
High CO	0.33***	0.04	0.01	0.14*
Low CO	0.33***	0.14*	0.14	0.03

Table 4 shows the correlations between deposit inflows and outflows for core deposits and large time-deposits, by various levels of insolvency risk. NPA is Non-Performing Assets / Total Loans, and CO is Charge-Offs/Non-Performing Assets. We see that while inflows of core and large time-deposits are positively correlated across risk categories, simultaneous outflows are indifferent to capital levels, but are most likely in banks with high Charge-Offs. We also see that the substitution effect between core deposits and large time deposits is most evident in banks with low capital, high levels of NPA's, and low Charge-Offs.

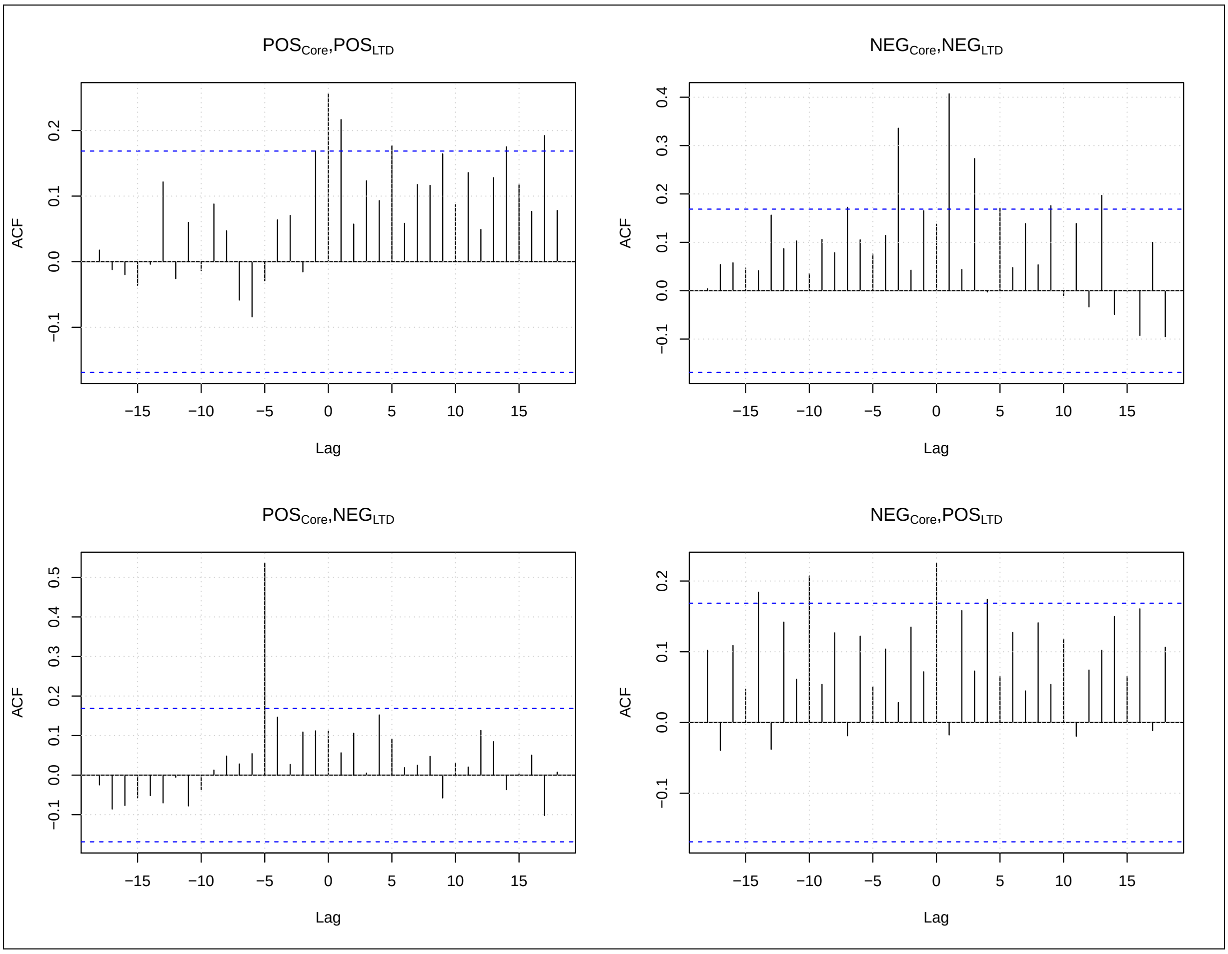

Figure 4. Cross-Correlation - Core Deposits and Large Time-Deposits

Figure 4 shows the cross correlation plots between deposit inflows/outflows for core deposits and large time-deposits. We see that core deposit inflows are positively correlated with large time-deposit inflows, both contemporaneously and with future inflows. Deposit outflows for core deposits and large time-deposits are also correlated with each other but non-contemporaneously, suggesting that both core deposits and large time-deposits don't necessarily the leave the banking system at the same time.

The cross-correlations between inflows/outflows of core and large time-deposits suggest the presence of a substitution effect between core deposits and large time-deposits, albeit non-contemporaneously. Outflows of large time-deposits are followed by inflows of core deposits after a period of 5 quarters. Inflows of large time-deposits affect the outflows of core deposits both with a lead and lag.

Table 5. Deposit Flows - Macro Variables

	Total Deposits		**Core Deposits**		**Large Time-Deposits**	
	POS_D	NEG_D	POS_D	NEG_D	POS_D	NEG_D
GDP Growth Rate	−0.0003	0.001*	−0.0005	0.0004	0.001	0.0005
	(0.001)	(0.0003)	(0.001)	(0.0003)	(0.002)	(0.001)
Fed Funds Rate	0.0004	−0.0005	−0.001	−0.0001	0.006***	−0.003***
	(0.001)	(0.0003)	(0.001)	(0.0003)	(0.002)	(0.001)
CEA Index	−0.0002	−0.0002***	−0.0003**	−0.0001**	−0.0001	−0.001***
	(0.0002)	(0.00005)	(0.0002)	(0.00005)	(0.0002)	(0.0001)
Lead Index	−0.005	−0.003***	−0.006**	−0.002*	0.001	−0.007**
	(0.003)	(0.001)	(0.003)	(0.001)	(0.005)	(0.003)
VIX Change	0.011	0.002	0.008	0.004	0.032***	−0.010
	(0.008)	(0.002)	(0.008)	(0.002)	(0.012)	(0.007)
S&P 500 Returns	0.062*	−0.003	0.075**	−0.001	0.056	0.006
	(0.035)	(0.011)	(0.036)	(0.011)	(0.054)	(0.034)
Constant	0.058***	0.031***	0.076***	0.022***	0.065**	0.171***
	(0.016)	(0.005)	(0.017)	(0.005)	(0.025)	(0.016)
Observations	111	111	111	111	111	111
Adjusted R^2	0.042	0.207	0.071	0.113	0.280	0.389

*p<0.1; **p<0.05; ***p<0.01

Table 5 shows the effect of macro-economic and market conditions on deposit inflows and outflows, across deposit types. I find that the aggregate rate of deposit inflows increases during periods of high stock market returns, and the rate of deposit outflows decreases during periods of high economic activity. Across deposit types, I find that the rate of inflows of core deposits increases during periods of high stock returns, suggesting a wealth effect. On the other hand, the rate of inflows of large time-deposits increases during periods of high market volatility, suggesting that depositors view banks as "safe havens" during periods of market uncertainty.

High economic activity also affects core deposits and large time-deposits differently. For core deposits, while both the rate of deposit inflows and outflows decrease, for large time-deposits only the rate of outflows decreases. Large time-deposits are also more sensitive to changes in the benchmark rate of return (the federal funds rate), compared to core deposits. Increases in the federal funds rate leads to higher inflows and lower inflows for large time-deposits, while there is no such effect observed for core deposits. These findings further elaborate on the sensitivity of different deposit types to changes in macro economic and market conditions, and benchmark rates of return.

Table 6. Deposit Flows - By Bank Size

Measure	N	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
		Total Deposits		**Core Deposits**		**Large Time-Deposits**	
		Largest Banks (Top 1 Percentile, Mean Size=$83.1bn, Median Size=$28.5bn)					
Inflows (POS_D)	135	0.042	0.029	0.046	0.037	0.076	0.042
Outflows (NEG_D)	135	0.012	0.012	0.012	0.018	0.057	0.031
Reallocation (EXC_D)	135	0.021	0.016	0.018	0.015	0.085	0.033
Inflows / Outflows	135	9.093	15.201	11.842	19.647	1.930	1.857
Reallocation / Outflows	135	1.892	0.311	1.902	0.323	1.686	0.510
		Large Banks (1^{st}% - 10^{th}%'tile, Mean Size=$2.71bn, Median Size=$1.47bn)					
Inflows (POS_D)	135	0.039	0.016	0.044	0.028	0.076	0.032
Outflows (NEG_D)	135	0.026	0.022	0.014	0.016	0.054	0.037
Reallocation (EXC_D)	135	0.025	0.014	0.023	0.012	0.095	0.038
Inflows / Outflows	135	4.460	4.826	5.987	12.577	1.739	1.146
Reallocation / Outflows	135	1.979	0.132	1.972	0.183	1.897	0.272
		Average Sized Banks (10^{th}% - 25^{th}%'tile, Mean Size=$430mn, Median Size=$394mn)					
Inflows (POS_D)	135	0.032	0.011	0.035	0.021	0.064	0.024
Outflows (NEG_D)	135	0.011	0.004	0.015	0.025	0.043	0.020
Reallocation (EXC_D)	135	0.021	0.008	0.022	0.008	0.077	0.020
Inflows / Outflows	135	3.507	2.253	4.244	10.609	1.745	0.970
Reallocation / Outflows	135	1.989	0.068	1.976	0.181	1.889	0.261
		Median Banks (25^{th}% - 50^{th}%'tile, Mean Size=$181mn, Median Size=$166mn)					
Inflows (POS_D)	135	0.030	0.010	0.033	0.019	0.063	0.023
Outflows (NEG_D)	135	0.011	0.004	0.016	0.030	0.043	0.022
Reallocation (EXC_D)	135	0.022	0.006	0.024	0.008	0.078	0.030
Inflows / Outflows	135	3.083	1.919	3.461	7.989	1.666	0.863
Reallocation / Outflows	135	1.976	0.118	1.950	0.229	1.890	0.261
		Small Banks (< 50^{th}%'tile, Mean Size=$61mn, Median Size=$55mn)					
Inflows (POS_D)	135	0.033	0.012	0.035	0.019	0.072	0.028
Outflows (NEG_D)	135	0.014	0.004	0.019	0.030	0.050	0.022
Reallocation (EXC_D)	135	0.028	0.007	0.030	0.008	0.095	0.038
Inflows / Outflows	135	2.646	1.759	2.587	2.841	1.589	0.755
Reallocation / Outflows	135	1.969	0.138	1.920	0.247	1.924	0.187

Table 6 shows the deposit flow measures for total, core, and large time-deposits across banks of different size groups. I see that the largest banks have higher rates of gross and net deposit inflows compared to other groups, while the other groups have higher rates of excess deposit reallocation, and this effect is consistent across deposit types. We also see that there is substantial excess reallocation of deposits across bank size groups. So while as a group the largest banks may be producing the most liquidity, there is considerable variation in the deposit flow rates. even within banks in the same group.

Table 7. Deposit Flows Across Bank Size-Groups

	N	Mean	St. Dev.	Min	Max
	Largest Banks $\longleftrightarrow$ Large Banks				
Total Deposits	135	0.446	0.244	0.037	0.915
Core Deposits	135	0.407	0.253	0.019	0.931
Large Time-Deposits	135	0.695	0.186	0.272	0.990
	Largest Banks $\longleftrightarrow$ Average Banks				
Total Deposits	135	0.441	0.263	0.049	0.954
Core Deposits	135	0.406	0.275	0.021	0.974
Large Time-Deposits	135	0.674	0.211	0.161	0.992
	Largest Banks $\longleftrightarrow$ Median Banks				
Total Deposits	135	0.443	0.271	0.043	0.971
Core Deposits	135	0.410	0.283	0.022	0.979
Large Time-Deposits	135	0.673	0.215	0.150	0.987
	Largest Banks $\longleftrightarrow$ Small Banks				
Total Deposits	135	0.447	0.275	0.040	0.974
Core Deposits	135	0.413	0.286	0.030	0.973
Large Time-Deposits	135	0.674	0.220	0.134	0.989

Table 7 shows the index of inter-group deposit flows between the very largest banks and banks of other sizes. The index is constructed using the methodology of (Davis and Haltiwanger, 1992). An index value of 0 indicates that all flows are inter-group, whereas an index value of 1 indicates that all flows are intra-group. Index value greater than 0.5 indicates that flows are largely intra-group, while those below 0.5 indicate that flows are largely inter-group. We can see that for the sample period, on an average, around 55-60% of the flow of total and core deposits are inter-group, and the remaining 40-45% are intra-group. However, for large time-deposits, we see that around 67-70% of all deposit flows are intra-group, and only 30-33% are inter-group.

In Table 6 we saw that there is considerable variation in deposit flow rates, even within banks in the same size groups, here we see that this heterogeneity in the liquidity production promotes the flow of deposits across banks in different size groups. While we can see that deposits flows across banks of different size groups, the index does not tell us on the direction of deposit flows.

Table 8. Reallocation Of Deposits - Very Largest Banks Vs. All Other Banks

	Mean			*Trend*		
	Total Deposits	**Core Deposits**	**Large Time-Deposits**	**Total Deposits**	**Core Deposits**	**Large Time-Deposits**
Full Sample	-0.0208	-0.0080	-0.0645	0.002^{***}	0.002^{***}	-0.0002
(Q2,1984 - Q4,2017)	(0.9508)	(0.7406)	(1.0000)	(0.0003)	(0.0003)	(0.0002)
Pre Reigle-Neal	-0.1082	-0.0995	-0.0708	-0.006^{***}	-0.002	-0.007^{***}
(Q2,1984 - Q3,1994)	(1.0000)	(1.0000)	(0.9999)	(0.002)	(0.002)	(0.001)
Post Reigle-Neal	0.0163	0.0308^{**}	-0.0618	0.003^{***}	0.003^{***}	-0.00005
(Q3,1994 - Q4,2017)	(0.1208)	(0.0142)	(1.0000)	(0.0004)	(0.0004)	(0.001)
Post Gramm–Leach–Bliley	0.062^{***}	0.0800^{***}	-0.0756	0.002^{***}	0.002^{***}	0.001^{**}
(Q1,2000 - Q4,2017)	(< 0.0001)	(< 0.0001)	(1.0000)	(0.001)	(0.001)	(0.0003)

While Table 7 showed us that here is considerable reallocation of deposits across banks of different sizes, it did not tell us anything on the direction of these deposit flows. To overcome this limitation I construct a directionality measure to ascertain the direction of deposit reallocation between the largest banks and the other banks. Table 8 shows the mean and the trend in direction of deposit reallocation across time periods. The direction is computed as flows between small banks and the very largest banks. A net positive value indicates that deposits are reallocated from smallest banks to the largest banks, while a net negative value indicates otherwise.

We see that post Reigle-Neal (Q3,1994), there is a net reallocation of total and core deposits from smaller to the largest banks and this effect becomes even stronger post Gramm–Leach–Bliley, 1999 (GLB). We also see that the overall trend is is positive post Riegle-Neal for all deposit types. One possible explanation for this effect could be the "economies of scale" enabled by Riegle-Neal which allowed banks to acquire other banks and operate across state boundaries and become largeer, and the "economies of scope" enabled by GLB that allowed banks to engage in investment banking and insurance business in additional to commercial banking activities.

Table 9. Deposit Flow Measures: Bank Attributes

	Total Deposits			Core Deposits			Large Time-Deposits		
	POS_D	NEG_D	EXC_D	POS_D	NEG_D	EXC_D	POS_D	NEG_D	EXC_D
				Deposit Rate Advantage					
High	0.047	0.011	0.021	0.047	0.012	0.023	0.075	0.039	0.061
Low	0.062	0.008	0.016	0.061	0.010	0.019	0.088	0.025	0.046
High / Low	0.75	1.38	1.31	0.77	1.20	1.21	0.85	1.56	1.33
				Deposit Rate Advantage/ Interest Margin					
High	0.051	0.009	0.015	0.051	0.010	0.016	0.079	0.037	0.053
Low	0.054	0.011	0.018	0.055	0.010	0.017	0.086	0.043	0.055
High / Low	0.94	0.81	0.83	0.93	1.00	0.94	0.92	0.86	0.96
				NPA					
High	0.035	0.023	0.034	0.040	0.022	0.034	0.055	0.060	0.073
Low	0.061	0.013	0.023	0.066	0.013	0.024	0.103	0.146	0.071
High / Low	0.57	1.77	1.48	0.60	1.69	1.42	0.53	0.41	1.03
				Capital Ratio					
High	0.062	0.025	0.041	0.068	0.024	0.039	0.094	0.062	0.089
Low	0.046	0.013	0.023	0.049	0.013	0.024	0.074	0.047	0.070
High / Low	1.35	1.92	1.78	1.38	1.85	1.63	1.27	1.32	1.27

Table 9 shows the rates of deposit inflows, outflows, and excess reallocation based on bank attributes, across deposit types. High group represents banks in the top decile and Low group is for banks in the bottom decile for that measure. Deposit Rate Advantage is computed as the percentage of branch-products where a bank offers deposit rates lower than the median rate for a particular product in a given MSA. NPA is the ratio of Non-Performing Assets / Total Loans, and Equity Capital Ratio is Total Equity Capital / Total Assets.

We see that rates of deposit inflows is nearly 15% - 25% lower for banks that have a high deposit rate advantage, while deposit outflows are nearly 20% - 56% higher. However, when the deposit rate advantage is scaled by interest margin, we see that while rates of inflow are lower for banks in the highest decile, the rates of outflows are also lower. We also see that the rates of inflows are nearly 40% - 47% lower at banks with high NPA, while deposit outflows are 69% - 77% higher. For large time-deposits however, the rate of outflows is lower for banks in the highest decile of NPA's. Across capital levels, we see that both inflows, outflows, and the rates of excess reallocation are higher for banks in the highest decile.

Table 10. Direction of Deposit Reallocation

Total Deposits	Core Deposits	Large Time-Deposits
	Deposit Rate Advantage	
-0.0783^{***}	-0.0493^{***}	-0.1269^{***}
(< 0.0001)	(< 0.0001)	(< 0.0001)
	Deposit Rate Advantage / Interest Margin	
-0.0042	-0.0012	-0.0155^{*}
(0.6278)	(0.8903)	(0.0149)
	NPA	
-0.1923^{***}	-0.1573^{***}	-0.1351^{***}
(< 0.0001)	(< 0.0001)	(< 0.0001)
	Capital Ratio	
-0.0680^{***}	-0.0755^{***}	-0.0325^{***}
(< 0.0001)	(< 0.0001)	(< 0.0001)

Table 10 shows the direction of deposit reallocation across banks for a variety of measures. Net positive values indicate that on average, over the sample period, deposits are reallocated from banks in the Low group to banks in the High group, negative values indicate otherwise.

We see that in addition to lower rates of deposit inflows and higher rates of deposit outflows at banks which have a high deposit rate advantage, deposits are reallocated from the high group to the low group. Similarly, we see that deposits are reallocated from banks with high levels of NPA to those with lower levels. For capital levels, while we saw banks in the high group had higher levels of deposit inflow and outflow rates, on average deposits are reallocated from the high group to the low group. These results are consistent across deposit types.

These findings suggest that on average, depositors move from banks that provide them low utility to banks which give the depositors higher utility.