Uniform Rate Setting and the Deposit Channel*

Juliane Begenau† Erik Stafford ‡

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Abstract

Banks do not completely pass-through changes in short-term market rates to depositors. The deposit channel of monetary policy proposes that banks choose the rate of pass-through across their branches based on local deposit market concentration, which consequently affects bank deposit and loan growth. We document the widespread use of uniform deposit rate setting policies by US commercial banks and the nearly universal use of these policies by the largest banks. By definition, uniform rate setting policies ignore local market concentration and therefore the deposit channel cannot operate in these branches. We demonstrate that the early empirical evidence supporting the deposit channel requires excluding branches that are part of centralized rate setting networks, representing 85% of all commercial bank branches. Consistent with varying local demand conditions causing the empirical relationships in branch-level deposit growth predicted by the deposit channel, we find that these empirical relationships are equally reliable in the set of "rate network" branches as in the full sample of branches, despite the deposit channel being inoperable among network branches. Additionally, we show that several reliable relationships in the cross section of banks do not aggregate because of the extreme bank size distribution and the differential behavior of small and large banks.

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†Begenau: Stanford GSB and NBER and CEPR. E-mail: begenau@stanford.edu

‡Stafford: HBS. E-mail: estafford@hbs.edu

1 Introduction

Claims about the market power of bank deposits in the banking literature are numerous and far reaching. Bank deposits provide banks with access to below market funding rates.[1] In the cross section of banks and bank branches, the rate of deposit rate pass-through is found to be reliably related to local deposit market concentration (Drechsler, Savov, and Schnabl, 2017). Specifically, banks appear to adjust their deposit rates to changes in short-term market rates less completely (or more sluggishly) at branches located in more concentrated deposit markets. This cross sectional relationship forms the basis for an emerging literature that causally links economically meaningful flows of deposits and lending across branches, banks, and counties due to monetary policy,[2] further affecting relationship banking[3] and banks' interest rate risk exposure.[4] The underlying empirical relation is appealing because it appears to be both well-identified and to cumulate across banks to create a monetary policy channel. The widespread interest in building on this empirical relation motivates our inquiry into the robustness of this foundational result and therefore the inferences of the follow-on research.

We find that the deposit channel of monetary policy is neither well-identified nor does it aggregate. Central to our findings is the widespread use of uniform deposit rate setting policies among US commercial banks. Consistent with recent evidence of uniform pricing in retail (DellaVigna and Gentzkow, 2019) and around bank acquisitions (Granja and Paixao, 2021), we find that large banks are especially likely to use uniform rate setting policies. For example, in 2006, Bank of America operates 244 branches across 14 counties in Massachusetts, but sets a single deposit rate per product for all of their Massachusetts branches. In fact, Bank of America sets only 3 distinct rates for the 6 states in New England. By construction, this centralized rate setting policy does not exploit the variation in local deposit market concentration in the way assumed in recent deposit

[1] Early papers in the empirical literature examining the relation between deposit rates and market interest rates include Ausubel (1992); Berger and Hannan (1989); Diebold and Sharpe (1990); Hannan and Liang (1993); Hannan and Berger (1997); Neumark and Sharpe (1992).

[2] E.g., Drechsler, Savov, and Schnabl (2017); Wang (2018); Wang, Whited, Wu, and Xiao (Forthcoming)

[3] E.g., Granja, Leuz, and Rajan (2022)

[4] E.g., Hoffmann, Langfield, Pierobon, and Vuillemey (2019); Drechsler, Savov, and Schnabl (2021)

market power theories. From the perspective of deposit market power theories, this is especially unexpected since a large bank like Bank of America, operating across many geographic regions, is relatively well-positioned to make use of the variation in market power in its deposit rate setting choices.

The heavy reliance on uniform deposit rate setting, especially among large banks, highlights an important research design choice in the early research finding empirical support for the deposit channel. In the main analysis of the first-stage of the deposit channel reported in Drechsler, Savov, and Schnabl (2017), all "follower" branches – branches whose deposit rates are determined by a centralized rate setting policy – are excluded. This sample restriction eliminates 85% of all US commercial bank branches. We find that when follower branches are included in the branch-level within bank regressions, there is no reliable relation between deposit rate pass-through and market concentration.

Clean identification of the first-stage of the deposit channel mechanism is important because the other predicted empirical relationships about deposit and loan growth can also be caused by varying local demand conditions. We make use of the uniform rate setting behavior of commercial banks to assess the plausibility of demand factors being responsible for the observed empirical patterns. By definition, the deposit channel does not operate through branches that are part of a centralized rate setting network. Therefore, the empirical relation predicted by the deposit channel for branch deposit growth should not be reliable among these branches. However, we find that the empirical relation is equally reliable in the sample of network branches as in the full sample of branches, indicating that something other than the deposit channel is explaining the relationship.

Our first analysis characterizes the extent to which centralized rate setting is used by US commercial banks and the characteristics of the banks that utilize this policy. A bank that uses a centralized rate setting policy will have potentially several networks of branches, where all branches within the network use identical rates per deposit product. One of the branches in the network is considered the rate setting branch and the other branches in the network are its "followers." The uniform rate setting branch networks are largely based on geography, with 96% of follower branches operating within the same state as the associated rate setting branch. In the commercial bank sample covered by RateWatch, 73% of all deposits reside in "follower" branches. Large banks are the primary users of a centralized deposit rate setting policy. Among the largest 10% of US commercial banks in 2005, 96% of bank branches are followers, while 50% of branches are followers for the smallest 10% of commercial banks.

Our second analysis documents the consequences of including and excluding follower branches in the analysis of branch-level pass through rates in relation to deposit market concentration. We begin by replicating the branch-level results in DSS, calculated as they do by excluding all follower branches. This analysis reliably confirms their results. We then repeat this analysis after including the follower branches. The inclusion of follower branches in the cross sectional analysis reduces the regression coefficient on the primary variable, the interaction of the change in the Federal funds rate and county-level HHI, by nearly an order of magnitude, resulting in a coefficient that is statistically indistinguishable from zero.

Our next analysis more directly explores the sensitivity of inferences about aggregation motivated by the observation that large banks are relatively likely to use uniform rate setting policies. We consider the aggregation of the various stages of the deposit channel of monetary policy (Drechsler, Savov, and Schnabl, 2017). Drechsler, Savov, and Schnabl (2017) show that when deposit markets are more concentrated, bank-level deposit *spreads* grow faster with market rate increases, leading to slower bank-level deposit growth, which leads to slower loan growth. Drechsler, Savov, and Schnabl (2017) interpret their estimates as demonstrating that this deposit channel explains the aggregate transmission of monetary policy through bank balance sheets. We show that when the sample is restricted to the largest banks accounting for 90% of aggregate bank assets, these empirical relations are unreliable, all with the incorrect sign. In fact, among the large banks, the deposit growth relation is reliably *positive*. These results demonstrate that reliable empirical relations in the cross section of banks may be unreliable among the relatively few banks that account for virtually all of the asset and loan dollars in the banking system, which limits the aggregate effects of the deposit market power channel.

Our results have implications for other research that builds on the deposit channel evidence. For example, Granja, Leuz, and Rajan (2022) propose a causal chain, whereby deposit outflows from highly concentrated markets due to the optimal sluggishness of rate adjustment by banks in these markets causes deposits to exit relatively concentrated deposit markets and to flow into more competitive markets, which then leads to a deterioration in lending quality. This interpretation of the evidence relies on both the valid identification of the deposit channel and for such a mechanism to produce aggregate transfers of deposits across counties. Pushing against this interpretation, we find that aggregate bank-level deposit and loan growth is *higher* for banks operating in relatively concentrated markets during the period of steadily rising interest rates from 2004 to 2007.

2 Data

There are several datasets used in this analysis. We rely on RateWatch data for branch-level deposit rates. RateWatch collects weekly deposit rates advertised to new deposit accounts for a range of standardized products (e.g. $25K money market account) at the branch-level. The branch-level data includes the FDIC branch identifier and the FDIC identifier of the commercial bank owner of the branch, as well as geographic details and the history of the branch's commercial bank owner.[5] We focus on the rate quotes from the last week of a given quarter to construct a quarterly dataset. Additionally, the RateWatch dataset identifies which branches are "rate setters," and which associated branches are "followers." The follower branches offer identical rates to their associated rate setting branch. The currently available RateWatch dataset begins in 2001, somewhat later than datasets used in earlier research.[6]

We obtain detailed bank-level data from quarterly regulatory filings of commercial banks collected in multiple forms, most recently forms FFIEC 031 and FFIEC 041. The quarterly bank data

[5] RateWatch's institution details file is from the time the data was obtained and thus needs to be combined with the institution history file to ensure that branches are matched the right commercial bank owner.

[6] From an email discussion with RateWatch, "our database team recently decided that due to inconsistencies in the amount of data we were collecting back in 1997-2000, that it would be best moving forward to only go back as far as 2001."

used for this analysis begin in 1985, but many important variables only become available in 1996. Most of our analysis that does not rely on the RateWatch data covers the period 1997 to 2020.

To calculate bank and county level deposit market concentration (Herfindahl-Hirschman index (HHI)), as well as bank and county level deposit amounts, we rely on the branch office deposit data provide by the FDIC's Summary of Deposits Survey.[7] It is useful to note that these annual deposit data are measured as of June of each year.

To calculate deposit interest expense sensitivities, also known as spread betas, we use the effective Federal funds rate (converted to a quarterly frequency based on the end of period observation) published by the Federal Reserve H.15 release. To compare to previous research we also use the Federal funds target rate.

In our analysis of stock market bank valuations, we rely on bank-level data from quarterly regulatory filings of bank holding companies (BHC) collected by the Federal Reserve in form FR Y-9C. We link each BHC to its commercial banks based on the BHC identifier (rssd9348) available in the commercial bank call reports. We use stock market data, including returns and market capitalization of publicly traded BHCs, from the Center for Research in Security Prices (CRSP). The Federal Reserve provides a table for linking the bank regulatory data with CRSP.

3 The Cross Section of Commercial Banks

Over the period 1998 to 2020, the average number of US commercial banks at year-end in our sample is 7,196. Remarkably, 90% of the aggregate assets among these banks are controlled by 818 banks, on average. The highly-skewed size distribution is important for understanding how empirical relationships discovered in the cross section of commercial banks are likely to aggregate to economy-level effects. The specific concern is that the economic behaviors, and therefore the empirical relationships, among the largest banks may be systematically different from those of smaller banks. Because the largest banks control the vast majority of assets, but represent a

[7] https://www7.fdic.gov/sod/dynaDownload.asp?barItem=6

relatively small share of the number of observations in a cross-sectional regression, the aggregate consequences and inferences may be poorly measured from standard cross-sectional analyses.

3.1 Large Banks are Different

Table 1 reports summary statistics, as of year-end 2005, for the commercial bank sample by deciles formed based on a sort of bank assets. Larger banks operate more branches. Banks below the median asset-level in 2005, operate between 1 to 2 branches, on average, while banks above the median operate 12 branches, on average. The very largest banks, in the top decile of assets, operate 46 branches, on average. Additionally, the average deposit balance per branch is increasing in bank size. The smallest banks have deposits per branch in 2005, averaging $16M, while the average deposits per branch for largest banks is nearly three times larger at $45M.

The aggregate market shares of assets, deposits, and loans is extremely skewed. The smallest 50% of banks control only 3% of each assets, deposits, and loans. In fact, the smallest 90% of banks control 11% of assets and 13% of each deposits and loans. Thus, the largest 10% of banks control nearly 90% of aggregate banking sector activity. Interestingly, within loans, these same patterns hold for business loans, which are often emphasized in the banking literature as being especially vital to local economies **CITES**.

3.2 Uniform Rate Setting Policies

A policy of uniform pricing among retail chains has been shown to be both widespread and potentially costly for firms operating across markets with varying degrees of market concentration (DellaVigna and Gentzkow, 2019). Similarly, Granja and Paixao (2021) document that when branches are acquired by banks that use uniform rate setting policies, these branches tend to be incorporated quickly into the centralized rate setting networks. On average, acquiring banks offer higher deposit rates than other local banks, such that the recently acquired branches increase their deposit rates as they are brought inline with their acquirers' policy rate. Granja and Paixao conclude that uniform deposit rate setting policies are costly for banks operating across markets with varying degrees of deposit market concentration.

It is reasonable to expect that conditional on being a large bank, reliance on uniform rate setting policies is relatively more likely. Table 1 illustrates that this indeed the case. We classify branches as being either an independent branch or part of a rate setting network. A rate setting network consists of a rate setting branch and its associated follower branches, so long as there is at least one follower branch. Otherwise, it is considered an independent branch. This notion of uniform rate setting, which requires identical offer rates across branches, is stricter than the one used by DellaVigna and Gentzkow (2019) that relies on prices being approximately equal. Table 1 reports the share of branches that are within a rate setting network by size decile. The share of network branches is monotonically increasing across size deciles. Within the decile of the smallest banks, 61% of branches are part of a rate setting network, while this share is 99% in the decile of the largest banks.

The near universal reliance on uniform rate setting among the largest banks is surprising from the perspective of recent deposit market power theories because large banks are the ones that operate across the most markets, and therefore are likely to have access to the greatest variation in deposit market power. We calculate the range of county-level deposit market HHIs within a rate setting network. We report the maximum of these ranges across the banks within each size decile (Geographic HHI range of Follower Br). For banks in the bottom five deciles, the maximum range of HHIs within networks is less than 0.1, but among the largest decile of banks the maximum HHI range is 0.31. For comparison, the average county deposit market HHI is 0.22 and the standard deviation is 0.13. Additionally, among the largest 10% of banks in 2005, 92% of their deposits that are located in high HHI counties (top third of counties sorted by HHI) reside within follower branches. Across all banks, 83% of the deposits located in high HHI counties are in follower branches. This means that the vast majority of the aggregate deposit market opportunity (in dollars) is not being actively exploited.

The widespread use of uniform rate setting, especially among the largest banks is inconsistent with the notion that, in the aggregate, the sluggishness of branch-level deposit rate adjustment is based on the local deposit market concentration. Moreover, beyond the challenge of aggregation, these summary statistics present an empirical puzzle about how a reliable relation between the sluggishness of branch-level deposit rate adjustment and deposit market concentration can be detected within a bank, given the prevalence of uniform rate setting policies across banks of all sizes. We investigate this question in detail in the next section.

4 Uniform Deposit Rate Setting and the Deposit Channel

Drechsler, Savov, and Schnabl (2017) report an important empirical result that is the basis for much follow-on research in the empirical banking literature. They find that the sluggishness (or incompleteness) with which banks adjust their deposit rates when short-term market rates change is related to the deposit market concentration in the counties where branches operate. Moreover, branch-level deposit growth is reliably slower in relatively concentrated markets when short-term market rates rise, presumably due to the relative sluggishness in branch-level deposit rate adjustment in these markets.

The primary result is that the relation between sluggishness in rate adjustment and market concentration exists at the branch-level within a bank. This result is important for two reasons. First, the within bank evidence suggests that the bank-choice mechanism is well-identified. As Drechsler, Savov, and Schnabl (2017) note, "we cannot simply compare deposits across banks because different banks may have different lending opportunities." They further argue that "if banks' lending opportunities decline as the Fed raises rates, then we would see banks make fewer loans and consequently take in fewer deposits even absent a deposits channel." The within-bank result suggests that banks optimally set deposit rates taking into account the deposit market concentration of the geographies in which their branches operate. Second, this result holds among large banks, which suggests that there is an aggregate economic effect. This finding forms the basis for a theory of a deposit channel of monetary policy and is used by other researchers as a well-identified bank deposit and lending supply shock in follow-on empirical investigations.

The previous section demonstrates the pervasive use of uniform deposit rate setting policies among US commercial banks, and for the very largest banks, the near universal use of this policy. This raises the question of how to reconcile the common bank behavior of ignoring variation in deposit market concentration in branch-level rate setting decisions with the reliable statistical relation documented in Drechsler, Savov, and Schnabl (2017).

4.1 Deposit Spreads

Central to the original Drechsler, Savov, and Schnabl (2017) empirical analysis of deposit spreads is the exclusion of all follower branches. DSS report that follower branches are excluded to avoid redundancy. There is a sort of redundancy in the follower branch rate setting choices, but in precisely the way that rejects the central premise of the deposit channel. The deposit channel relies on bank-choice, but excluding follower branches eliminates the vast majority of all rate setting choices.

It is hard to justify excluding the follower branches on either economic or statistical grounds. First, follower branches make up the majority of all branches, so they are an important component of the cross section of bank branches. Follower branches account for approximately 90% of total branch-level observations in RateWatch. Second, the follower branches clearly do not represent a random sample. The excluded follower branch observations, by definition, do not make rate setting decisions influenced by local market concentration, instead choosing to ignore local deposit market concentration. Third, the rate setting behavior of these branches overwhelmingly reflect the choices of the largest commercial banks who have the most advantaged access to variation in deposit market concentration via their control of the majority of all branches. To the extent that the largest banks choose not to make use of the variation in deposit market concentration speaks directly to the premise being investigated and the potential for any effect detected in small banks to aggregate to a mechanism relevant for the overall banking sector.

To explore the empirical consequence of excluding the follower branches, we first replicate the original branch-level regressions reported by Drechsler, Savov, and Schnabl (2017). The Drechsler, Savov, and Schnabl (2017) sample period is 1997 through 2013. There is a notable limitation to replicating the result exactly. As noted earlier, the dataset that RateWatch currently offers no longer includes data from the years 1997 through 2000, which are included in the Drechsler, Savov, and Schnabl (2017) analysis. Despite our restricted sample, the original Drechsler, Savov, and Schnabl (2017) regressions are well-replicated and displayed in Panel A of Table 2. These regressions are of the form:

$$y(i,t) = b_0(i,t) + b_1 \times \text{county-HHI}(i) + b_3 \left[\Delta\text{FFR}(t) \times \text{county-HHI}(i)\right] + e(i,t). \quad (1)$$

The dependent variable is the quarterly change in branch-level savings deposit rate spreads. Savings deposits rates are the annual rates offered to new \$25K savings accounts. Deposit spreads are the difference between the Federal funds target rate and the savings deposit rate. The quarterly change in deposit spreads is regressed on a variety of fixed effects, branch-level HHI, and the interaction of branch-level HHI and the quarterly change in the Federal funds rate. Branch-level HHI is the time series average of the county-level HHI in which that branch operates. The standard errors are clustered at the bank level. The key variable of interest is the interaction term. The sensitivity of deposit *spreads* to changes in the Federal funds rate reliably increases as county-HHI increases.[8] Columns 1 and 2 include bank x quarter fixed effects, providing direct evidence that within a bank, the sluggishness of deposit rate adjustment is related to market concentration. The regressions reported in columns 3 through 6 allow for across bank variation in county-HHI. Columns 4 through 6 allow for across bank variation and also include branches from banks that operate in only one county, effectively increasing the impact of small banks.

Drechsler, Savov, and Schnabl (2017) include a set of fixed effects defined as county x quarter-is-post-2008 to control for the period after 2008, when the level of the Federal funds rate is near zero. To simplify the presentation and to make use of the extended sample available since the time of the Drechsler, Savov, and Schnabl (2017) analysis, we also report the same regressions

[8]The deposit spread increases when the difference between the Federal funds rate and the deposit rate increases, which happens when the deposit rate only partially adjusts to changes in the short-term market rate.

for the sample period 2001-2008 in Panel B of Table 2 to verify that this produces essentially the same results. Panel C of Table 2 reports these same regressions for the low interest rate sample period 2009-2020. In this extended period of near zero interest rates, the key empirical relation switches sign. The coefficient on the change in Federal funds rate interacted with county-HHI from the within bank regressions (columns 1 and 2) is negative, but indistinguishable from zero. The coefficient on this interaction term is marginally significant, but changes sign in the specifications that allow for across bank variation.

Using Drechsler, Savov, and Schnabl (2017)'s preferred specifications reported in Columns 1 and 2 of Panel B Table 2 as the baseline, we include the previously excluded follower branches and rerun the analysis. These regressions are reported in Columns 1 and 2 of Table 3. Adding the follower branches increases the number of observations in the main regressions (columns 1 and 2) from around 50K to 1.3M, highlighting the magnitude of the sample restriction in the original regressions. The interaction term coefficients in these specifications are approximately zero (0.01 and 0.02) and statistically indistinguishable from zero, despite being measured precisely.[9] Appendix Table A1 Panel A reports the results for all specifications Drechsler, Savov, and Schnabl (2017) ran, including the specifications that allow for across bank variation, with the full branch sample from RateWatch. They show that when including all branches the coefficient of interest is statistically reliable, albeit reduced by 50% to 70%, only in the specifications that allow for across-bank variations (e.g., Columns 3 through 6). Thus, the key evidence from the within bank specifications, supporting the notion that banks actively manage their deposit rate setting based on the geographic deposit market concentration of their branches, is not present in the full sample of branches.

To more directly investigate the relation between deposit rate setting and deposit market concentration among large banks, we restrict the sample to banks identified as "big." We define "big" as the largest banks each quarter whose assets cumulate to 90% of aggregate commercial bank assets that quarter. These regressions are reported in Columns 3 and 4 of Table 3. The within

[9] The standard errors for these coefficients are roughly one-third the magnitude of those in the baseline specification due to the substantially increased sample.

bank specifications produce interaction term coefficients that are near zero and statistically indistinguishable from zero. Appendix Table A1 Panel B shows that only the specification without bank-quarter and quarter fixed effects (Column 4), which permits variation across time, is reliably positive.

For branches belonging to banks that control 10% of aggregate bank assets, the preferred specification of Drechsler, Savov, and Schnabl (2017) also produces a coefficient close to zero (Columns 5 of Table 3) when follower branches are included. Only the specification that allows for across state-quarter variation results in a reliable coefficient for the relationship between deposit spreads and the interaction between market concentration and changes in the Federal Funds Rate.

Overall, these regressions suggest that the statistical reliability of the within bank, branch-level result requires the exclusion of the vast majority of branches – all of the follower branches. To the extent that there is a reliable relation, it comes from variation across bank, time or geography, and is confined to the smallest banks that control 10% of aggregate bank assets. This raises doubts about the plausibility of aggregate effects. This also raises concerns that market power motivated bank-choice may not be the driving force behind the empirical relation.

4.2 Deposit Growth

The other important empirical result in Drechsler, Savov, and Schnabl (2017), central to the deposit channel mechanism, is the relatively negative relation between branch-level deposit growth and changes in the short-term market interest rate in areas of higher deposit market concentration. Drechsler, Savov, and Schnabl (2017) emphasize again that the within bank specifications provide the most compelling evidence, as they do not rely on across bank variation that could be caused by variation in local market conditions instead of bank choices motivated by market power.

Interestingly and in contrast to the deposit spread regressions, this analysis includes all branches and main offices of deposit insured banks, including both rate setters and followers, as it uses the FDIC Summary of Deposits dataset. Arguably, it makes sense to exclude the follower branches in the deposit growth analysis. This is because the deposit channel mechanism cannot operate in follower branches whose rates have been set by another branch that may be located in a very different competitive environment. Any relation between deposit growth and the interaction of market concentration with changes in the Federal funds rate found in the follower branches must therefore be due to other factors. Drechsler, Savov, and Schnabl (2017) include follower branches in their analysis of branch-level deposit growth.

In Table 4, we explore the relation between branch-level deposit growth and the interaction of market concentration and changes in the short-term market interest rate both with and without follower branches. The structure of these regressions is the same as before, but with the change in log deposits as the dependent variable. That is, we focus on the preferred specification by Drechsler, Savov, and Schnabl (2017) that include bank-time and state-time fixed effects, as well as branch and county fixed effects. For comparison, we also include a specification that just uses bank-time, branch, and county fixed effects. The main issues investigated here are (1) the nature of the relationship among follower branches and (2) the robustness of the empirical relationship among the large banks.

We first replicate the Drechsler, Savov, and Schnabl (2017) analysis using Summary of Deposit data up to 2008.[10] The regression results in Panel A, columns 1 and 2 are at least as strong as those reported in Drechsler, Savov, and Schnabl (2017). Branches in counties with higher market concentration experience larger deposit outflows in response to a monetary policy shock in the pre-Financial Crisis era. However, Columns 3 and 4 show that this relationship is not reliable among large banks in specifications with bank-year fixed effects. In Appendix Table A2 we replicate all regression specifications run by Drechsler, Savov, and Schnabl (2017) for comparison.[11]

In the post-2008 period, the relationship between branch-level deposit growth sensitivities to

[10]Note that based on the replication code and data of Drechsler, Savov, and Schnabl (2017), their Table 3 Columns 1 and 2 regressions include a fixed effect of the county and post-Financial Crisis dummy interaction in lieu of a "quarter f.e." as indicated in their table. This motivates us to run the regressions separately for pre- and post-Financial Crisis era as shown in Panel A of Table 4.

[11]When the sample is restricted to big banks, the coefficient on the interaction term is only significant in the specifications that do not control for bank-time or time fixed effects. Hence, the statistical significant relationship is coming from across-bank variation. This indicates that the reliable relationship in the full sample of branches is driven by small banks, and as shown in Appendix Table A2, from variation across banks. The across bank variation could derive from either variation in deposit supply or from across-bank variation in deposit demand.

market interest rates and deposit market concentration is highly reliable across all specifications, but positive (Columns 5 and 6). It is not entirely clear that the deposit channel should operate in a similar way when interest rates are near zero, but the reliable positive relations are somewhat unexpected.

Panel B of Table 4 reports regressions for the sample of follower branches over the pre-2008 period. We focus on the pre-2008 period to rule out potential changes in the deposit channel mechanism due to near zero interest rates, as suggested by columns 5 and 6 of Panel A. We identify follower branches within the FDIC branch data by linking them to the RateWatch dataset. Strikingly, these regressions find a highly reliable negative relationship in all specifications. Recall that the deposit channel mechanism cannot operate within this sample, as these branches utilize a centralized rate setting policy that ignores local deposit market concentration. The reliable relation indicates that something else other than the deposit channel is driving the empirical relationship within this subset of the sample. This is important because the follower branches account for 73% of the full branch sample (e.g. the branches in the FDIC SOD dataset that can be linked to RateWatch) used in the initial empirical result and highlights that the identification strategy, even the within bank specifications, appears to breakdown.

5 Implications for Aggregate Effects

Cross sectional regressions describe average relationships. It does not directly follow that robust cross sectional relationships will aggregate. If the nature of the relationship is different among the relatively few largest banks that control the vast majority of assets, the average relationship estimated from cross sectional regressions may be a poor proxy for a dollar-weighted relationship. Since the largest banks tend to ignore variation in market concentration in setting deposit rates, there is reason to be concerned that many inferences about aggregate effects – relying on large banks being sensitive to local market concentration in their rate setting choices – may be inappropriate.

We consider a few examples from the recent empirical banking literature to illustrate the point. Drechsler, Savov, and Schnabl (2017) develop a deposit channel of monetary policy that operates as follows. Relatively sluggish deposit rate adjustment by branches within highly concentrated markets leads to deposit outflows at the branch and bank level, which leads to lower loan growth at the branch and bank level. DSS conclude that this mechanism explains the entirety of monetary policy through bank balance sheets. Relatedly, Granja, Leuz, and Rajan (2022) focus on a county-level effect. Building on the DSS empirical results and conclusions about aggregation, GLR propose that due to the sluggish deposit rate adjustment among branches in concentrated counties, deposits leave these counties and are reinvested in more competitive counties, which leads to lower quality lending decisions by banks with greater geographic distance from their borrowers. Granja, Leuz, and Rajan (2022) emphasize the relatively unique period from 2004 to 2007, when the Federal funds rate steadily increases, within an overall recent sample where the Federal funds rate has tended to decline. The focus on a period of rising interest rates improves the statistical and economic power of the analysis since the sluggish response of bank deposit rates to market rate changes is viewed to be asymmetric – sluggish when rates are increasing and relatively quick when market rates are declining. We evaluate the robustness of the conclusions reached about the aggregate effects in these research papers.

The first stage of the causal chain in both of the considered mechanisms is that branch-level sluggishness in deposit rate adjustment is linked to deposit market concentration, as measured by HHI. As previously documented, this empirical result is not reliable in the cross section of *all* commercial bank branches within a bank. Additionally, this result is not reliable among the largest banks that control 90% of aggregate commercial bank assets. This effectively restricts the mechanism to operating across small banks. This opens the door to two concerns that appear to matter in the branch-level analyses in the previous section. First, to what extent is the across-bank empirical relationship being influenced by variation in local market conditions, or demand effects. Second, can an effect confined to small banks aggregate to an economically meaningful effect. We focus on the second of these concerns in this section.

To explore the robustness of conclusions about the deposit channel aggregating, we analyze the proposed relationships at the bank-level, focusing on value-weighted relationships. We evaluate the aggregated sensitivities of bank- and county-level deposit spreads, deposit growth, and loan growth to changes in the Federal funds rate by bank-level deposit market concentration. We initially focus on the pre-2009 period emphasized by Drechsler, Savov, and Schnabl (2017).

Table 5 displays bank-level regression results in the spirit of those reported in DSS 2017. Over the period 1998 through 2008, we estimate regressions of the form:

$$y(i,t) = b_0(i) + b_1 \times \text{HHI}(i,t) + b_3\left[\Delta\text{FFR}(t) \times \text{bank-HHI}(i,t)\right] + b_4(t) + e(i,t), \tag{2}$$

with standard errors clustered at the bank level. The coefficient of interest in these regressions is b_3. There are three dependent variables, corresponding to each of the three stages of the deposit channel mechanism. The dependent variable for the specification reported in column 1 is the quarterly change in bank deposit spreads, where the deposit rate is measured as the quarterly deposit interest expense divided by beginning balance of deposits. The dependent variable in column 2 is the change in log deposits, and the dependent variable in column 3 is the change in log loans. The predicted signs for b_3 are positive for the change in deposit spreads, and negative for both deposit and loan growth. Bank-HHI is calculated as the deposit weighted average of the county-level HHIs in which that bank's branches operate, as in Drechsler, Savov, and Schnabl (2017).

Panel A of Table 5 reports results using the full cross section of commercial banks, essentially replicating the results reported in Table 8 in Drechsler, Savov, and Schnabl (2017). These regressions find robust cross sectional patterns supporting the notion of the deposit channel. However, based on our branch-level analyses, there are a few reasons to be concerned about this interpretation of these regressions. First, the results in Panel A of Table 5 may not effectively control for variation in local demand conditions across banks and time, which is the original concern that motivated the within bank-quarter regressions that were initially viewed to be so compelling. Consistent with this concern, the branch-level regressions in Table 3 that omit bank-time and state-time fixed effects also produced a significant relationship depending on the specification and sample. Most notably, a monetary policy tightening only led to a widening of deposit spreads of small bank branches located in more concentrated areas when we allow for state-quarter variation (see Column 6 of Table 3). Second, the regressions in Panel A of Table 5 equal weight each bank, and therefore overweight the relatively more numerous small banks in the regressions. Small banks also dominate the rate-setting only sample in Table 2, as small banks are more likely to have an independent branch (see Table 1). Hence, regressions that do not control for variation in local demand conditions and overweight small banks can produce reliable estimates resembling the deposit channel in the cross-section of commercial banks.

Panel C reports regression results for the sub-sample of "big" banks, where "big" is as defined earlier – the largest banks representing 90% of aggregate commercial bank assets. Among the relatively few banks that control virtually all of the aggregate assets, there is no evidence to support the notion of a deposit channel. In the sample of large banks, all three of the interaction term coefficients are of the opposite sign to what the deposit channel predicts. A one-sided test of the predicted sign rejects all coefficients at the 10% level, rejecting the coefficient for deposit growth at the 2% level.

Table 5 also reports results for the sample period 2009 through 2020, where interest rates are low, and where the deposit channel may not operate in the same way. In the cross section of all commercial banks, only the change in deposit spread has a coefficient with the predicted sign over this period. The coefficients of both deposit and loan growth are reliably positive. In the regressions that include only the "big" banks, none of the coefficients are reliably different from zero.

The results in Table 5 suggest that a deposit channel does not aggregate, as the predicted empirical relations do not hold among large banks. Since large banks account for 90% of total commercial banks assets, deposits, and loans the predicted relationships must exist within this sample to produce a consequential aggregate effect. The fact that among large banks the deposit growth relationship is reliably positive rather than negative is particularly strong evidence against an aggregate deposit channel.

Figure 1 offers another perspective on the robustness of an aggregate deposit channel. As emphasized by Granja, Leuz, and Rajan (2022), the period from 2004 to 2007, is unique in that the Federal funds rate steadily increases during this time. Thus, the deposit channel predicts that banks operating in relatively concentrated deposit markets will experience relatively low deposit and loan growth over this period, due to their choice not to adjust deposit rates in line with other banks. Figure 1 displays the time series of log deposits (Panel A) and log loans (Panel B) for two groups of banks. Banks are classified based on their bank-HHI at the end of 2003, with those above the median considered high HHI banks and those below the median being low HHI banks. The sum, across banks within a group, of deposits and loans is calculated, representing value-weight portfolios. Panel A of Figure 1 displays the time series of log deposits for the two groups, along with the Federal funds rate, and Panel B displays log loans. For both deposits and loans, the cumulative growth is meaningfully higher for the value-weighted portfolio of highly concentrated banks. These growth patterns are precisely the opposite of the predictions of an aggregate deposit channel.

6 Discussion

The key observation is that uniform deposit rate setting policies are common at US commercial banks and nearly universal among large banks. This means that a deposit channel of monetary policy cannot operate across a large fraction of bank branches. Moreover, it cannot operate within the branches controlled by the largest banks, which limits the scope for a deposit channel aggregating to an economically meaningful mechanism of monetary policy. Our empirical results confirm this logic and identify the empirical design choice to exclude follower branches as being central to the initial evidence supporting a deposit channel. Our results show that there is no evidence of a well identified deposit channel of monetary policy in the cross section of banks and that because of the extreme bank size distribution and the differential behavior of small and large banks many empirical relations discovered in the cross section of banks do not aggregate. These results are at odds with a recent literature that link deposit market power to a wide variety of banking phenomena, relying on both the validity of the identification and the aggregation of a deposit channel of monetary policy. In this section, we explore the value of deposit market power from two additional perspectives.

6.1 Does the stock market value deposit market power?

Deposit market power is viewed to be a powerful feature of bank behavior in the banking literature. The analysis in this paper, suggests that this view is overstated in at least some of its applications. To provide an additional perspective on the value of deposit market power, we explore how it is linked to stock market valuations. For the subset of publicly traded banks, those that operate branches in relatively concentrated deposit markets should expect higher valuation multiples if deposit market power is valuable to the owners of the bank. Table 6 reports panel regressions of bank valuation multiples on a variety of bank characteristics, including bank-HHI. Following standard industry conventions, we calculate Tier 1 valuation multiples, defined as market capitalization divided by tier 1 capital. All regressions include quarter fixed effects with standard errors that are clustered by quarter. We use the sample of US bank holding companies, which are the entities that closely match the set of publicly-traded banks. We calculate bank-HHI for these banks in the same way that we did for the commercial banks, by calculating the deposit weighted average of county-HHI where the bank operates branches.

The first specification includes only the bank-HHI, which has a negative coefficient that is statistically indistinguishable from zero. Specification 2 shows that bank size, measured as log assets, and return on equity (ROE), calculated as net income divided by tier 1 capital, are reliably positively associated with market valuations. Bank size and ROE are able to explain a substantial amount of the variation above that explained solely by the time fixed effects, as the adjusted-R2 increases from 0.31 to 0.43. The third specification includes size, ROE, and bank-HHI. Bank-

HHI gains marginal statistical significance, but is negatively associated with market valuation. The remaining specifications include additional control variables, but do not alter these inferences. The additional control variables include the ratio of risk weighted assets to assets and the deposit productivity measure developed in Egan, Lewellen, and Sunderam (2022).

These regressions indicate that the stock market does not value banks that operate in relatively concentrated deposit markets higher than other banks. In fact, to the extent that there is a relationship between valuation and market concentration, it is marginally negative. This is inconsistent with the standard notion that access to market power increases firm value. Thus, access to deposit market concentration is not viewed by the stock market to be as economically meaningful as it is viewed to be in the banking literature.

6.2 Deposit rates and market power

Another lens to view the economic benefits of varying access to deposit market power is to directly compare the deposit rates offered by branches in relatively concentrated and un-concentrated deposit markets. Each quarter, we calculate the deposit market HHI for each county and classify counties as either high or low concentration based on being above or below the median county-HHI. Each quarter, we also calculate the average branch-level offer rate on $25K savings accounts for branches operating in high and low concentration counties.

The top panel in Figure 2 displays the time series of average annual deposit rates for the high and low concentration groups, accounting for all of the branches in the RateWatch dataset. The two series are strikingly similar. They track each other nearly perfectly through time and each period have nearly identical values. The deposit channel of monetary policy is based on the sensitivity of these series to changes in the Federal funds rate. Given the two series are nearly identical, their sensitivities are essentially identical, as demonstrated in Section 3. Another prediction of deposit market power is that deposit rates will be lower in more concentrated counties. The figure shows that this is not the case. The time series mean difference in annual rates over the period 2001 to 2020 is 2 basis points, with the high HHI branches offering the slightly higher rate.

The bottom panel of Figure 2 displays similar portfolios constructed from the subset of branches that set deposit rates independently (i.e. not as part of a centralized rate setting network). The independent rate setting branches represent a sample similar to the one used in Drechsler, Savov, and Schnabl (2017), where all follower branches are excluded. The figure displays the differential deposit rate adjustment between branches in high and low deposit market concentration counties during the 2004 to 2007 period, emphasized by Granja, Leuz, and Rajan (2022). On average, over the period 2001 to 2020, the independent rate setting branches operating in relatively highly concentrated deposit market counties offer annual rates on savings accounts that are 8 basis points lower than those offered elsewhere. Importantly, the independent rate setting branches account for 5% of the deposits within the sample of branches covered by RateWatch. Thus, the funding benefit of deposit market power is fairly small among the small share of branches that benefit from it at all.

7 Conclusion

From the perspective of deposit channel theories, banks appear to leave economic rents on the table. There is widespread use of uniform deposit rate setting policies among US commercial banks. Large banks have a near universal use of uniform deposit rate setting policies across large geographies. As a consequence, there is little scope for an economically large deposit channel of monetary policy to exist in the cross-section of banks. The crucial first stage of the deposit channel, whereby banks choose to more sluggishly adjust their deposit rates at their branches operating in highly concentrated deposit markets, cannot operate within branch networks relying on uniform deposit rate setting policies. The earlier research finds a robust empirical relation supporting the notion of a deposit channel because it excludes all follower branches, accounting for 85% of branch observations. When all branch observations are considered, there is no within bank result.

The within bank result is important because it relatively well-identifies a bank choice to set branch-level deposit rates based on their local market power. Within bank variation skirts the empirical challenges of relying on across bank-time variation that may be due to variation in local market conditions rather than bank supply. Because the within bank result is not valid, the primary identification strategy fails. Consistent with the identification strategy failing, we find that in the second-stage of the deposit channel, where deposit growth in highly concentrated deposit markets is relatively slow due to banks' choices to more sluggishly adjust deposit rates than other branches, the predicted empirical relation is just as strong in follower branches as it is in independent branches. However, the deposit channel cannot operate within the follower branches since, by definition, their rate setting policies ignore local deposit market concentration. This indicates that the reliable empirical relation in branch-level deposit growth is largely caused by something other than the deposit channel.

The other central theme in this paper is that reliable cross sectional relationships may not aggregate because there is an extreme bank size distribution and the behavior of small and large banks is different. In US commercial banks, 10% of the banks control 90% of the assets, deposits, and loans. Large banks behave differently from small banks. Many reliable empirical relations discovered in the cross section of all banks are found to be unreliable in the subset of large banks, often with opposite signs. In these cases, the scope for average effects aggregating into economically meaningful effects is limited.

Consistent with our evidence suggesting that access to deposit market power is essentially ignored by large banks, the stock market values banks with branches operating in relatively concentrated deposit markets no higher than other banks. Thus, there is little evidence that either banks or the stock market view differential access to deposit market concentration to be a source of economic value.

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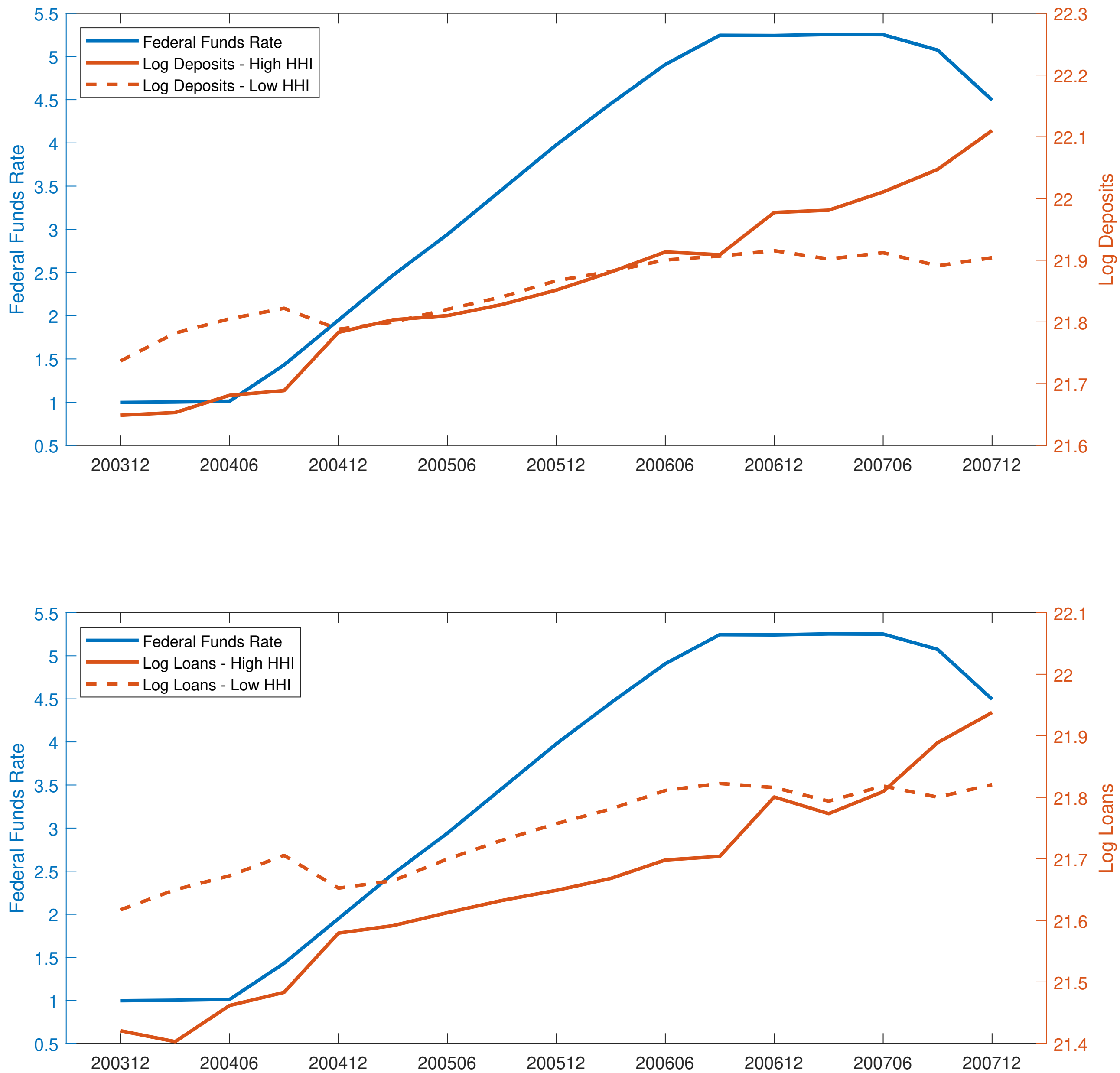
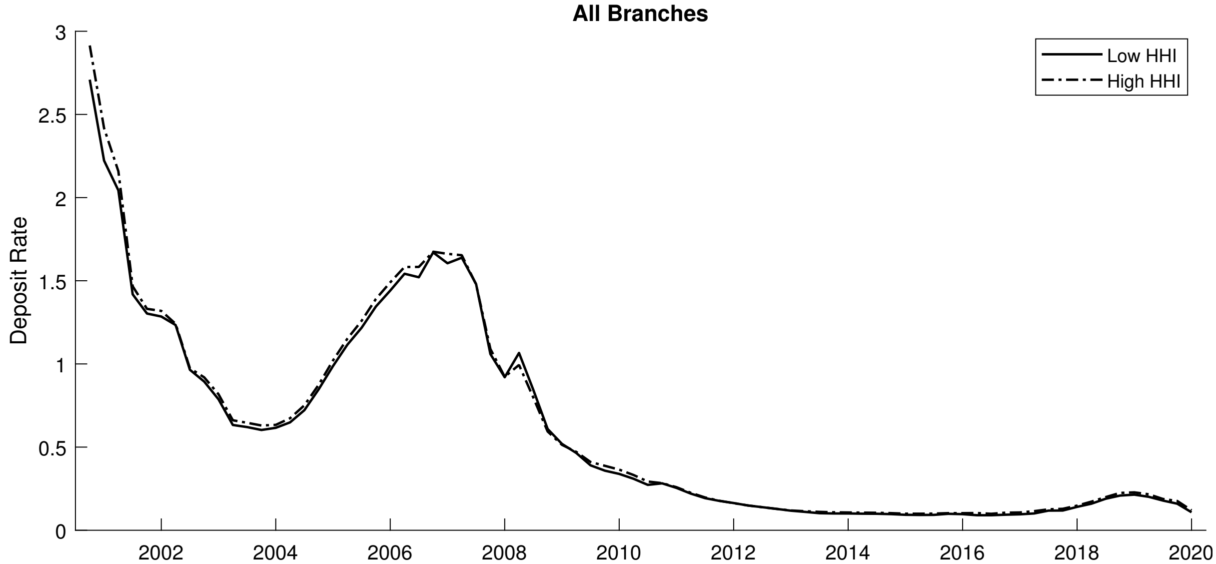
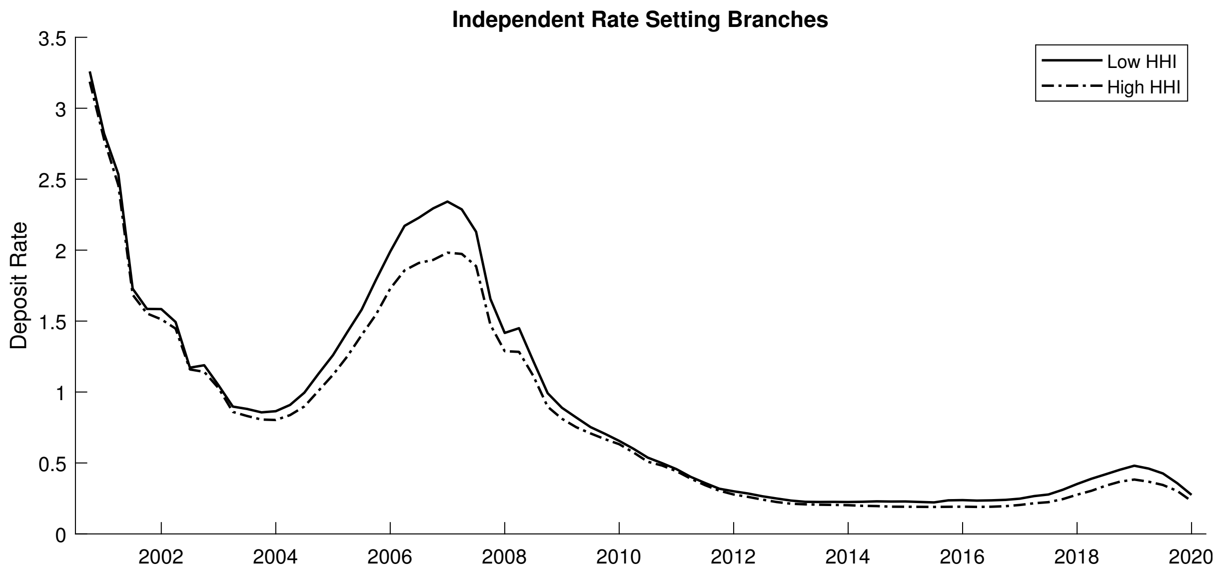
Figure 1: Deposit Growth



Notes: Notes: This figure displays log deposits and log loans for US commercial banks. Banks are assigned to one of two groups based on their bank-HHI being above or below the median bank-HHI that quarter. Bank-HHI is calculated as the deposit weighted average of the county-level HHIs in which that bank's branches operate, as in Drechsler, Savov, and Schnabl (2017). The top panel plots the time series of log deposits and the Federal funds rate. The bottom panel plots the time series of log loans and the Federal funds rate.

Figure 2: Savings Deposit Rates





Notes: This figure displays the average money market account offer rates of bank branches in the RateWatch sample for account sizes of $25K. Bank branches are assigned to one of two groups based on operating in a county with deposit market HHI above or below the median county-HHI that quarter. The top panel plots the average using all branches. The bottom panel plots the average savings rate calculated over independent branches. Independent branches are rate setting branches without follower branches.

Table 1: **Summary Statistics by Bank Decile**

	Bank Deciles									
	1	2	3	4	5	6	7	8	9	10
Number of Banks	599	599	599	599	599	599	599	599	599	599
Number of Banks using Networks	330	355	373	393	423	445	469	507	553	573
Number of Branches	702	797	918	1043	1150	1337	1582	1995	3038	28010
Number of Rate Setting Branches	341	403	431	448	440	448	431	432	450	1054
Number of Network Branches	428	545	685	815	949	1151	1419	1858	2926	27745
Number of Independent Branches	274	252	233	228	201	186	163	137	112	265
Network Branches to Total Ratio	0.61	0.68	0.75	0.78	0.83	0.86	0.90	0.93	0.96	0.99
Number of high HHI Follower Branches	176	198	231	277	323	437	463	618	948	7617
Followers in high HHI to Total Branch Ratio	0.25	0.25	0.25	0.27	0.28	0.33	0.29	0.31	0.31	0.27
Agg. Asset Share	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.89
Agg. Deposit Share	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.87
Agg. Loan Share	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.87
Agg. Business Loan Share	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.90
Deposits per Branch ($ M)	16.0	22.9	26.2	29.6	31.9	30.8	35.4	35.9	37.1	45.1
Deposits per Branch in High HHI Counties ($ M)	15.0	22.3	25.2	27.8	29.2	26.4	32.3	30.8	30.9	43.8
Deposits per Branch in Low HHI Counties ($ M)	15.8	21.3	26.3	31.5	33.0	29.9	36.0	40.3	37.5	44.6
Sum of Deposits in High HHI Counties ($ B)	5	9	12	14	16	19	22	26	36	341
Sum of Follower Branch Deposits in High HHI Cts ($ B)	2	4	5	7	9	11	15	18	30	314
Geographic HHI range of Follower Br.	0.08	0.08	0.08	0.09	0.09	0.11	0.11	0.16	0.18	0.31
Geographic Rate range of Follower Br.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: This table presents summary statistics based on RateWatch and FDIC Summary of Deposits data in 2005 Q4. Bank deciles are based on asset size ranking. A network is defined as a rate setting branch that has one or more follower branches. An independent branch is a rate-setting branch that has no follower branches. HHI is the county level Herfindahl index based on counties' deposit market concentration in 2005. Low HHI denotes the bottom third of the HHI distribution and high HHI the top third.

Table 2: **Market Power and the Sensitivity of Deposit Spreads**
Rate Setting Branches

Panel A: 2001-2013

	Dependent Variable: Δ Savings Rate Spread					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.08	0.05	0.07	0.12	0.10	0.10
	(2.12)	(1.59)	(3.39)	(6.07)	(5.14)	(5.35)
Bank-Qrt FE	Yes	Yes	No	No	No	No
State-Qrt FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
County X ZLB FE	Yes	Yes	No	Yes	No	No
Qrt FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.77	0.77	0.72	0.73	0.73	0.74
Adjusted R^2	0.77	0.77	0.72	0.73	0.73	0.74
N	96,696	96,754	208,359	376,749	376,787	378,022

Panel B: 2001-2008

	Dependent Variable: Δ Savings Rate Spread					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.07	0.05	0.07	0.12	0.10	0.10
	(1.94)	(1.46)	(3.12)	(6.02)	(5.10)	(5.40)
Bank-Qrt FE	Yes	Yes	No	No	No	No
State-Qrt FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Qrt FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.77	0.77	0.74	0.75	0.75	0.75
Adjusted R^2	0.77	0.77	0.74	0.75	0.75	0.75
N	53,675	53,697	106,958	215,304	215,311	215,838

Table 2: **Market Power and the Sensitivity of Deposit Spreads**
Rate Setting Branches

Panel C: 2009-2020

	Dependent Variable: Δ Savings Rate Spread					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	-0.17	-0.17	-0.06	-0.07	-0.05	-0.06
	(-1.02)	(-1.26)	(-1.35)	(-2.05)	(-1.84)	(-2.12)
Bank-Qrt FE	Yes	Yes	No	No	No	No
State-Qrt FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Qrt FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.93	0.93	0.88	0.87	0.87	0.87
Adjusted R^2	0.65	0.66	0.72	0.71	0.71	0.71
N	44,807	45,237	133,285	211,417	211,457	212,812

Notes: This table reports OLS estimates from regressions described in equation 1. The dependent variables are the quarterly change in the annualized percentage deposit spreads. The coefficient of interest is the interaction of branch HHI and the quarterly change in the annualized Federal funds rate target. Deposit spreads are measured as the difference between the Federal funds rate and the branch deposit offer rate on $25K savings deposit accounts. HHI is the Herfindahl index that measures deposit market concentration in a county and is averaged over 1994-2013. The regressions include bank-quarter-, state-quarter-, branch-, county-, quarter, and county and post-2008 period fixed effect as indicated in the table. A "Rate-Setter" branch is defined as a branch that actively sets rates for itself and possibly for "follower" branches. Standard errors are clustered at the county level and t-statistics are reported below point estimates. The data is sourced from RateWatch and the FDIC covering 2001Q1 to 2013Q4 (Panel A), 2001Q1 to 2008Q4 (Panel B), and 2009Q1-2020Q4 (Panel C)

Table 3: **Deposit Spread Regressions Including All Branches**

	Dependent Variable: Δ Savings Rate Spread					
	All Banks		Big Banks		Small Banks	
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.01	0.02	0.01	0.00	0.01	0.04
	(1.24)	(1.30)	(1.62)	(0.24)	(0.65)	(2.38)
Bank-Qrt FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Qrt FE	Yes	No	Yes	No	Yes	No
Branch FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 FE only	0.90	0.88	0.90	0.88	0.92	0.89
Adjusted R^2	0.90	0.88	0.90	0.88	0.92	0.89
N	1,334,540	1,334,585	848,702	848,733	472,867	472,945

Notes: This table reports OLS estimates from regressions described in equation 1. The dependent variables are the quarterly change in the annualized percentage deposit spreads. The coefficient of interest is the interaction of branch HHI and the quarterly change in the annualized Federal funds rate target. Deposit spreads are measured as the difference between the Federal funds rate and the branch deposit offer rate on $25K savings deposit accounts. The sample observations are at the branch-quarter level for banks that are active in at least two counties, covering the period 2001Q1-2008Q4. HHI denotes deposit market concentration in a county and is averaged over the period 2001-2008. Columns 1 and 2 include all branches, Columns 3 and 4 are restricted to the branches of big banks, and Columns 5 and 6 are restricted to the branches of small banks. A bank is defined as big if its assets are in the top 90th percentile of the asset distribution in a given quarter. Small banks are those with total assets in the bottom 10th percentile of the asset size distribution. The regressions include bank-quarter-, state-quarter-, branch-, and county fixed effects. Standard errors are clustered at the county level and t-statistics are reported below point estimates. The data is sourced from RateWatch and the FDIC covering 2001Q1 to 2008Q4.

Table 4: **Bank Deposit Market Power and Deposit Outflows**

Panel A: Branch Data Sample

	Dependent Variable: Δ Log Branch Deposits					
	All 1994-2008		Big 1994-2008		All 2009-2020	
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR	-1.32	-1.29	-0.66	-0.86	2.39	3.16
	(-3.15)	(-2.92)	(-1.42)	(-1.67)	(4.57)	(6.15)
Bank Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State Year FE	Yes	No	Yes	No	Yes	No
Branch FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 FE only	0.20	0.20	0.20	0.19	0.17	0.16
Adjusted R^2	0.20	0.20	0.20	0.19	0.17	0.17
N	837,363	837,368	484,027	484,044	934,415	934,429

Panel B: RateWatch Matched Sample 1994-2008

	Dependent Variable: Δ Log Branch Deposits	
	All Branches	Follower Branches
	(1)	(2)
HHI x chg FFR	-1.76	-1.72
	(-4.03)	(-3.84)
Bank Year FE	Yes	Yes
State Year FE	Yes	Yes
Branch FE	Yes	Yes
County FE	Yes	Yes
R^2 FE only	0.22	0.23
Adjusted R^2	0.22	0.23
N	451,732	427,700

Notes: This table reports OLS estimates from regressions described in equation 1. The dependent variable is the change in log deposits at the branch level. The variable of interest is the interaction of the change in the Federal funds rate with branch HHI. The regressions include bank-quarter-, state-quarter-, branch-, county-, and quarter fixed effect as indicated in the table. Standard errors are clustered at the county level and t-statistics are reported below point estimates. The data is sourced from the Summary of Deposits (SOD) data (Panel A Columns 1 through 4), and 2008 to 2020 (Panel A Columns 5 and 6). The big bank designation is determined based on the commercial bank call report data matched to the FDIC Summary of Deposits (SOD) sample. Panel B is the sample of the SOD data that is matched to the RateWatch data sample.

Table 5: **Deposit Channel Aggregation**

Panel A: 1998-2008 All Banks

	Δ Spread (1)	Δ Log Deposits (2)	Δ Log Loans (3)
HHI x Chg. FFR	0.074	-2.047	-0.873
	(8.23)	(-10.51)	(-4.24)
Bank FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2 FE only	0.54	0.17	0.22
Adjusted R^2	0.54	0.17	0.22
N	358,220	358,220	357,260

Panel B: 2009-2020 All Banks

	Δ Spread (1)	Δ Log Deposits (2)	Δ Log Loans (3)
HHI x Chg. FFR	0.104	1.452	3.646
	(8.49)	(3.54)	(7.44)
Bank FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2 FE only	0.72	0.11	0.15
Adjusted R^2	0.72	0.11	0.15
N	291,060	291,060	290,259

Panel C: 1998-2008 Big Banks

	Δ Spread (1)	Δ Log Deposits (2)	Δ Log Loans (3)
HHI x Chg. FFR	-0.059	1.745	0.971
	(-1.33)	(2.15)	(1.45)
Bank FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2 FE only	0.29	0.07	0.09
Adjusted R^2	0.29	0.07	0.09
N	51,766	51,766	51,654

Panel D: 2009-2020 Big Banks

	Δ Spread (1)	Δ Log Deposits (2)	Δ Log Loans (3)
HHI x Chg. FFR	0.029	0.061	4.379
	(0.48)	(0.02)	(1.52)
Bank FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2 FE only	0.50	0.08	0.14
Adjusted R^2	0.50	0.08	0.14
N	23,255	23,255	23,159

Notes: This table reports OLS estimates from regressions (as described in equation 2) of the change in the deposit spread (Column 1), deposit growth (Column 2), and loan growth (Column 3). The variable of interest is the interaction of bank HHI and the change in the Federal funds rate. The data is at the bank-quarter level and from commercial bank call report filings (FFIEC 031 and FFIEC 041 forms) and the Summary of Deposits data from the FDIC. Standard errors are clustered at the bank level and t-statistics are reported below point estimates.

Table 6: Market Power and Market Valuation

	Dependent Variable: Market-to-Tier 1 Equity Ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
HHI		-0.158		-0.410	-0.375	-0.362
		(-0.61)		(-1.87)	(-1.66)	(-1.60)
Size			0.173	0.174		-0.072
			(9.00)	(9.14)		(-0.97)
ROE			1.005	1.012	0.937	0.935
			(4.97)	(5.00)	(4.95)	(4.96)
Deposit Productivity					0.336	0.448
					(12.43)	(3.88)
RWA/A						-0.227
						(-0.92)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.31	0.31	0.43	0.43	0.47	0.47
N	28,921	28,921	28,705	28,705	23,388	23,388

Notes: This table reports OLS estimates from bank stock market valuation regressions. The dependent variable is the ratio of market capitalization (market value of equity) divided by Tier 1 capital. Bank-HHI is calculated as the deposit weighted average of the county-level HHIs in which that bank's branches operate, as in Drechsler, Savov, and Schnabl (2017). Size is the log of assets. ROE is the trailing four quarters of net income divided by beginning of period Tier 1 capital. Deposit Productivity is calculated as in Egan, Lewellen, and Sunderam (2022). RWA/A is the ratio of risk-weighted assets to assets. Standard errors are clustered at the bank level and t-statistics are reported below point estimates. The data is from FR-Y-9C filings, CRSP, and the Summary of Deposits.

Appendix A More Results

In TableA2 we explore the relation between branch-level deposit growth and changes in the short-term market interest rate both with and without follower branches. The structure of these regressions is the same as before, but with the change in log deposits as the dependent variable. The main issues investigated here are (1) the nature of the relationship among follower branches and (2) the robustness of the empirical relationship among the large banks.

We first replicate the DSS findings (Panel A of Table A2). Branches in counties with higher market concentration experience larger deposit outflows in response to a monetary policy shock in the pre Financial Crisis era. The regression results in Panel A are at least as strong as those reported in DSS 2017. However, Panel B shows that this relationship does not hold among large banks once we control for time fixed effects (columns 3, 5 and 6) or bank x time fixed effects (col 1-2). Hence, the reliable relationship is coming from across-bank variation. The across bank variation could dominated by either variation in deposit supply or from across-bank variation in deposit demand.

In the post-2008 period, from 2009 through 2020, the relationship between branch-level deposit growth sensitivities to market interest rates and deposit market concentration is highly reliable across all specifications, but positive (Panel C). It is not entirely clear that the deposit channel should operate in a similar way when interest rates are low, but the reliable positive relations are somewhat unexpected.

Panel D of Table A2 reports regressions for the sample of follower branches over the pre-2008 period. We identify follower branches within the FDIC data by linking to the RateWatch dataset. Strikingly, these regressions find a highly reliable negative relationship in all specifications. Recall that the deposit channel mechanism cannot operate within this sample, as these branches utilize a centralized rate setting policy that ignores local deposit market concentration. The reliable relation indicates that something else other than the deposit channel is driving the empirical relationship within this subset of the sample. This is important because 90% of deposits reside in the follower branches in this sample of FDIC SOD branches that can be linked to RateWatch. This highlights that the identification strategy, even the within bank specifications, appears to breakdown.

Table A1: **Robustness of Market Power and Deposit Rate Sensitivity Regressions**

Panel A: All Branches 2001-2008

	Dependent Variable: Δ Savings Rate Spread					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.01	0.02	0.03	0.06	0.03	0.04
	(1.17)	(1.27)	(1.97)	(5.98)	(2.70)	(3.12)
Bank-Qrt FE	Yes	Yes	No	No	No	No
State-Qrt FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Qrt FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.90	0.88	0.69	0.72	0.70	0.71
Adjusted R^2	0.90	0.88	0.69	0.72	0.70	0.71
N	1,336,790	1,336,827	1,340,951	1,570,901	1,570,938	1,573,541

Panel B: All Branches of Big Banks 2001-2008

	Dependent Variable: Δ Savings Rate Spread					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.01	0.01	0.00	0.04	0.00	0.00
	(1.65)	(0.26)	(0.14)	(2.49)	(0.01)	(0.09)
Bank-Qrt FE	Yes	Yes	No	No	No	No
State-Qrt FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Qrt FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.90	0.88	0.69	0.72	0.68	0.69
Adjusted R^2	0.90	0.88	0.69	0.72	0.68	0.69
N	832,033	832,059	834,056	848,920	848,942	850,287

Table A1: **Robustness of Market Power and Deposit Rate Sensitivity Regressions**

Panel C: All Branches of Small Banks 2001-2008

	Dependent Variable: Δ Savings Rate Spread					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.00	0.04	0.06	0.07	0.07	0.07
	(0.10)	(2.25)	(3.30)	(5.65)	(4.05)	(4.58)
Bank-Qrt FE	Yes	Yes	No	No	No	No
State-Qrt FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Qrt FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.91	0.89	0.71	0.74	0.72	0.73
Adjusted R^2	0.91	0.89	0.71	0.74	0.72	0.73
N	492,134	492,209	506,862	716,119	716,171	723,226

Bank- vs Branch-HHI

	Dependent Variable: Δ Savings Rate Spread					
	Target FFR			Effective FFR		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR target	0.04		0.06			
	(3.48)		(3.51)			
HHI bank x chg FFR target		-0.01	-0.04			
		(-0.33)	(-1.06)			
HHI x chg FFR				0.04		0.05
				(3.03)		(2.78)
HHI bank x chg FFR					0.01	-0.02
					(0.27)	(-0.39)
State-Qrt FE	Yes	Yes	Yes	Yes	Yes	Yes
Branch FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 FE only	0.71	0.71	0.71	0.65	0.65	0.65
Adjusted R^2	0.71	0.70	0.70	0.65	0.64	0.64
N	1336017	1265575	1265551	1336017	1265575	1265551

Table A1: **Robustness of Market Power and Deposit Rate Sensitivity Regressions**

Notes: This table reports OLS estimates from regressing the quarterly change in the annualized percentage rate of 25K savings deposit accounts on the interaction of branch HHI and the quarterly change in the annualized federal funds rate target. The sample includes all branches of the full sample (Panel A), all branches of big banks (Panel B), and all branches of small banks (Panel C). The regressions include bank-quarter-, state-quarter-, branch-, county-, and quarter fixed effect as indicated in the table. Standard errors are clustered at the county level. t-statistics are reported below point estimates. The data is sourced from RateWatch and the FDIC covering 2001Q1 to 2008Q4.

Table A2: **Bank Deposit Market Power and Deposit Outflows**

Panel A: Pre-2009

	Dependent Variable: Δ Log Branch Deposits					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR	-1.33	-1.21	-0.76	-3.06	-2.21	-0.89
	(-3.06)	(-2.48)	(-2.45)	(-8.95)	(-5.74)	(-3.20)
Bank Year FE	Yes	Yes	No	No	No	No
State Year FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.20	0.19	0.01	0.15	0.14	0.01
Adjusted R^2	0.20	0.19	0.01	0.15	0.14	0.01
N	754,560	754,566	782,541	913,053	913,059	939,745

Panel B: 1994-2008 Big Banks

	Dependent Variable: Δ Log Branch Deposits					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR	-0.63	-0.69	0.08	-1.04	-0.29	0.18
	(-1.27)	(-1.23)	(0.18)	(-2.44)	(-0.55)	(0.41)
Bank Year FE	Yes	Yes	No	No	No	No
State Year FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.20	0.19	0.01	0.16	0.15	0.01
Adjusted R^2	0.20	0.19	0.01	0.16	0.15	0.01
N	483,933	483,950	502,342	498,003	498,020	516,534

Table A2: **Bank Deposit Market Power and Deposit Outflows**

Panel C: 2009-2020

	Dependent Variable: Δ Log Branch Deposits					
	At least 2 Counties			All		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI x chg FFR	2.22	2.89	2.53	2.66	2.97	2.74
	(4.08)	(5.47)	(5.28)	(5.91)	(6.06)	(5.91)
Bank Year FE	Yes	Yes	No	No	No	No
State Year FE	Yes	No	No	Yes	No	No
Branch FE	Yes	Yes	No	Yes	Yes	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	No	Yes	Yes
R^2 FE only	0.16	0.16	0.02	0.12	0.12	0.02
Adjusted R^2	0.16	0.16	0.02	0.12	0.12	0.02
N	924,050	924,066	939,263	996,166	996,182	1,011,080

Panel D: RateWatch Match 1994-2008

	Dependent Variable: Δ Log Branch Deposits	
	All Branches	Follower Branches
	(1)	(2)
HHI x chg FFR	-1.76	-1.72
	(-4.03)	(-3.84)
Bank Year FE	Yes	Yes
State Year FE	Yes	Yes
Branch FE	Yes	Yes
County FE	Yes	Yes
R^2 FE only	0.22	0.23
Adjusted R^2	0.22	0.23
N	451,732	427,700

Notes: This table reports OLS estimates from regressing the change in log deposits at the branch level on the interaction of the change in the Federal Funds Rate with branch HHI. The regressions include bank-quarter-, state-quarter-, branch-, county-, and quarter fixed effect as indicated in the table. Standard errors are clustered at the county level. t-statistics are reported below point estimates. The data is sourced from RateWatch and the FDIC covering 2001Q1 to2008Q4 (Panel A and B), and 2001Q1 to 2008Q4 (Panel B).