Decision-making delegation in banks

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November 2017

Abstract

We introduce a novel measure of decision-making delegation within banks based on whether individual branches have their deposit rates set locally. Using natural disasters as shocks to local economies, we show that this aspect of bank organizational design has real effects. Branches whose rates are set locally increase deposit rates more and experience relatively higher deposit volumes in affected counties following a disaster. Banks with more branches whose rates are set locally expand mortgage lending in affected counties relative to banks with fewer such branches. Following disasters, house prices in MSAs with more bank branches whose rates are set locally recover faster. These effects are distinct from those captured by other commonly used measures of decision-making delegation like bank size or "localness". The results are robust to instrumenting for the location of deposit rate-setting authority using bank mergers and distinct from the effect of local authority to set loan rates. Our paper highlights important spillover effects from the delegation of deposit price setting decisions in banks.

JEL codes: G20, G21
Keywords: banks, organizational structure, branch banking

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* The authors thank Matthieu Chavaz, Kristle Cortes, Elena Loutskina and seminar participants at the SFS Cavalcade North America, Barcelona GSE Summer Forum's Financial Intermediation and Risk Workshop, Midwest Finance Association Annual Meeting, St. Louis University, and Washington University in St. Louis for helpful comments.

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A large theoretical literature in economics highlights the importance of organizational design and structure for the behavior and performance of organizations.[1] The extent to which decision-making is delegated in an organization can affect the quality of its decisions and its ability to respond to a changing environment (for instance, Alonso et al. (2008)). Despite the vast theoretical literature, empirical evidence on how decision-making delegation affects organizational behavior is only now emerging, likely due to a lack of information on organizations' internal decision making processes. Banks are an especially interesting setting to study this phenomenon both because of their importance to the economy and also due to the importance of soft information for their decision-making.[2] In this paper, we study banking organizations and specifically the extent to which branches have autonomy to set deposit rates. We analyze how this aspect of bank organizational structure affects deposit and lending outcomes and local house prices.

We obtain our data from RateWatch, which conducts a weekly survey of bank branches about the interest rates they offer on deposit and loan products. Along with providing interest rate quotes, RateWatch also identifies whether a branch sets its own rate or follows rates set by another branch in its organization. We use this information to classify bank branches according to whether their rates are set locally, i.e., the county in which the branch is located, or elsewhere. Hereinafter we refer to the branches whose rates are set locally as "local rate setters". We employ natural disasters as a shock to the local economy and examine whether deposit rate decision-making delegation affects how branches (and banks) respond to natural disasters in the United States between 1999 and 2014.

Natural disasters are likely to result in property damage and also increase uncertainty about local economic conditions. Property damage can result in an immediate demand for liquidity from the local population, which can be satisfied through withdrawals of deposits or drawdowns of credit lines. A natural disaster may also increase loan

[1] We cannot possibly do justice to this very large literature in a footnote, but relevant work includes Grossman and Hart (1986), Hart and Moore (1990), Aghion and Tirole (1997), Stein (2002) among others.
[2] Recent papers that study delegation in banks include Liberti and Mian (2009), Liberti (2005), Qian et al (2015), Cerqueiro et al (2010), Skrastins and Vig (2017). While we discuss these papers in greater detail later, the one distinguishing feature of our paper is our focus on deposit rate setting.

demand for reconstruction (Cortes and Strahan (2014)). This (local) shock to liquidity is likely to increase the importance of tailoring deposit rates to the altered local conditions. If a branch's deposit rates are set locally then it can alter the rates – without affecting the rates offered by other branches of the bank – to reflect the changed conditions. Furthermore, to the extent the local branches have superior information about the severity of the disaster and the price elasticity for deposits in the local market, the altered rates can be better tailored to reflect the information. The branches whose rates are not set locally may lack both the ability (and possibly the information) to change the rates to reflect the altered local conditions. The flexibility to change rates may in turn affect a branch's ability to attract deposits.

We begin our empirical analysis by documenting that our proxy for decision-making delegation in setting deposit rates can explain some of the observed heterogeneity in deposit rates across a bank's branches. Focusing on the most frequently quoted types of accounts in RateWatch — money market accounts requiring a minimum balance of $10,000 (MM henceforth) and 12-month certificates of deposit requiring a minimum balance of $10,000 (CD henceforth) — we show that deposit rates are more dispersed across the branches of a bank when more branches have the authority to set their own rates. This highlights that when branches are allowed to set their own rates, they do not converge to a single bank-wide rate. To the extent branches set rates "optimally", an implication of our result is that, consistent with the assumption in the banking literature (Gilje at al. (2016), etc.), the deposit markets in the U.S. appear to be segmented. Furthermore, we find that the effect of decision-making delegation on deposit rate variability is present for banks of all sizes. This ensures that deposit rate delegation is a distinct aspect of bank organization and is not subsumed by bank size.

Having established the relevance of our proxy for delegation, we examine if the branches' whose deposit rates are set locally respond differentially to natural disasters. Similar to Cortes and Strahan (2015), we focus on the subset of natural disasters declared as major disasters by the Federal Emergency Management Agency (FEMA). Our empirical setting is a triple difference-in-differences specification. The treatment sample consists of branches located in a county affected by a natural disaster in a given month.[3] The control sample consists of branches in adjacent counties that were unaffected by a disaster during our event window. We focus on the seven-month window (three months before and three months after) around natural disasters. Our most restrictive specification controls for all time-invariant heterogeneity among branches using within-shock branch fixed effects and aggregate changes in supply and demand for each shock using within-shock time effects.

Following a disaster, local rate setters offer rates that are roughly three basis points higher on MM accounts and five basis points higher on CDs in the affected county. These effects are economically significant at 5-8% of the mean deposit rates offered for these products in our sample. In a dynamic specification, we find that while the response of MM rates is quick and short-lived, lasting for only three months after the month of the disaster declaration, the response of CD rates is more long-term.

A higher deposit rate, all else equal, should translate into higher deposit inflows and balances. Branch-level deposit data is only available on an annual frequency as of June 30th from the FDIC's Summary of Deposits. This precludes a high-frequency analysis of deposit levels. Given this, we focus on the two year period around the natural disaster and model the logarithm of branch-level deposit volumes. We focus on natural disasters that occur in the second quarter of a calendar year (i.e., the quarter that ends on June 30th). We do this because our previous analysis suggests that the response of deposit rates to natural disasters is immediate and short-lived (at least in the case of MM accounts). Measuring deposit amounts immediately following the disaster will also ensure that other factors do not confound our analysis. We find that after a disaster, annual deposits in affected counties are roughly four percent higher at branches whose rates are set locally as compared to branches whose rates are not set locally.

The relatively slower deposit growth in the branches in disaster counties that do not set rates locally combined with a higher loan demand (Cortes and Strahan (2014)) could result in such branches facing a liquidity shortfall. The branches can bridge this shortfall through inflows from the rest of the bank. To facilitate such inflows, the branch may have to communicate the attractiveness of investment opportunities in the local area. To the extent the

[3] We use the date of the FEMA disaster declaration which typically occurs with a lag of a couple weeks from the actual natural event to identify the event month.

natural disaster increases the uncertainty about the quality of investment opportunities and to the extent this information is soft, such communication may be imperfect (Stein (2002)). This may affect the ability of the branch to bridge the shortfall and, consequently, its lending volume. In other words, frictions in the operation of the bank's internal capital market may affect the branch's ability to bridge the liquidity gap.

To test if lending volume is affected by the degree of delegation in bank deposit rate setting, we use mortgage lending by a bank in a county as a proxy for local lending. Here again we focus on the two year period around the disaster and compare county-level annual mortgage lending by banks with a higher fraction of local rate setters to lending by banks with fewer local rate setters. Relative to the latter set of banks, we find that the former banks issue roughly nine percent more mortgages in affected countries.

In the next set of tests, we examine if the differential growth in mortgage lending translates into differential house price dynamics following natural disasters. Focusing on monthly, MSA-level changes in house prices, we differentiate between MSAs in which a majority of bank branches have their deposit rates set locally and those that do not. We find that house price declines following natural disasters are mitigated in MSAs where a majority of branches set deposit rates locally. Specifically, in the three months following a natural disaster, while house prices decline by about 0.03% on average, this decline is confined to MSAs with fewer local rate-setters. In MSAs with a larger presence of local rate setters, there is no significant decline in house prices following natural disasters. Thus, we find that the extent of delegation in deposit rate setting has real effects, in terms of mortgage lending and house price recovery following natural disasters. We show that the effects we document are distinct from those captured by other commonly used measures of decision-making delegation in banks such as bank size, "localness" etc., Our results are robust to controlling for these other measures of bank delegation.

We also conduct several additional robustness checks. While the occurrence of natural disasters is plausibly random within a region — that is, treated counties and adjacent control counties are likely randomly assigned— the extent to which deposit rates are set in a decentralized versus centralized manner is a decision variable of the bank. To control for this endogeneity in delegation, we repeat our tests after instrumenting for branch deposit rate authority using bank mergers. We find that branches that belong to banks involved in mergers are less likely to set their rates locally as compared to branches that belong to banks not involved in mergers. The exclusion restriction for our instrumental variables (IV) analysis is that bank mergers should affect branch-level deposit rate following natural disasters only through the level of delegation and not otherwise. We discuss the validity of this assumption in greater detail in Section 3.

Not only is the instrument strong in predicting branch-level delegation (the F-statistic in the first stage is over one thousand), but our results are also robust to instrumenting for branch deposit rate delegation. We find that our IV estimates are an order of magnitude larger than our OLS estimates. As compared to our OLS estimate of a three basis point increase in MM rates following natural disasters, our IV estimates indicate an average fifteen basis points increase in the MM rates. This is consistent with the endogeneity of the deposit rate delegation biasing our OLS estimates downward. This is reasonable if branches that set their rates locally are larger and have greater market power and possibly stickier deposits and hence are less likely to increase their rates in response to natural disasters.

RateWatch also provides information on how loan rates are set at the branch level which allows us to ensure that our results are due to delegation of deposit rate setting and not loan rate setting. We find that our main results are robust to controlling for whether a branch sets its loan rates locally. Specifically, following a natural disaster, deposit rates and deposit volumes are higher for branches that set deposit rates locally even after we control for autonomy in setting loan rates. Meanwhile, deposit rates and volumes are lower or no different for branches that set *loan* rates locally in the aftermath of a disaster.[4]

Our main measure of delegation is a dummy variable that identifies branches whose rates are set within a county. In alternate tests, we differentiate both across rate setters and rate followers and across rate followers that are close to and farther from their rate setter. We do this to test if distance between the rate setter and rate follower has an independent effect on the follower's response to natural disasters. Distance is often used as a measure of the cost of (or frictions in) information transmission (Petersen and Rajan (1995), Petersen and Rajan (2002), Degryse

[4] The results are analogous for mortgage lending and house prices. We do not report these results for brevity.

and Ongena (2005), Mian (2006)). If the effects we document are due to difficulties in information transmission between the rate setter and the rate follower branches, then we expect deposit rates to respond faster if the rate setter and rate follower are closer to each other. Consistent with this conjecture, we find that following natural disasters, deposit rates are lower not only among rate followers as compared to rate setters, but also when the rate setter is located farther from the rate follower. This confirms our main finding and is also suggestive of information frictions playing a role in our results.

We make a number of important contributions to the literature. We are the first to introduce a measure of delegation in deposit rate setting at bank branches and document its important effect on deposit rates, deposit volumes, lending volume and asset prices. Our evidence highlights that not delegating deposit rate setting can impose costs not only on the bank (in terms of lower deposit volume and lending volume) but also to the economy (in terms of slower price recovery). In contrast to us, the extant literature on bank organization focuses on the effect of bank size (Berger and Udell (1995), Berger et al. (1999), Strahan and Weston (1998), Berger et al. (1998), Berger et al. (2001), Berger et al. (2005), Degryse et al. (2009)), bank hierarchy (Liberti and Mian (2009); Qian et al. (2015); Skrastins and Vig (2016)) and distance (Petersen and Rajan (1995), Petersen and Rajan (2002), Degryse and Ongena (2005), Mian (2006)) on the banks' ability to lend to informationally opaque borrowers.

Our second contribution is methodological. First, our branch level measure of delegation allows us to employ a high dimensional fixed effects specification to document differential response of the branches of the same bank to natural disasters. In this regard ours is an improvement over Canales and Nanda (2012) who exploit bank-level heterogeneity to document that banks that allot less discretionary power to the branches are less responsive to the competitive lending environment.

Second, to aid identification, we follow the extant literature in banking in using localized shocks to compare the response of pre-existing organizations. Related papers include Morse (2011) who investigates the role of payday loans in mitigating shocks from natural disasters; Cortes and Strahan (2015) who compare the response of small versus large banks to natural disasters; Cortes (2014) who compares local versus non-local lenders to natural disasters and Chavaz (2016) who compares the response of local versus diversified lenders to recent U.S. hurricanes.

The rest of the paper is organized as follows. Section 1 provides the theoretical motivation, Section 2 describes the empirical methodology. Section 3 describes the data sources and provides summary statistics on the sample and verifies the relevance of our proxy for decision-making delegation. Section 4 presents the results. Section 5 concludes.

1. Theoretical Motivation

In this section, we briefly discuss the main theories that have implications for how the extent of delegation in setting deposit rates will affect branch behavior.

The theoretical literature on delegation studies a situation where an agent collects information (say about the economic environment) and compares instances when the agent has the authority to use the information to take a decision (delegation) to when she transmits the information higher up the organization's hierarchy to be used in decision-making. This literature highlights that under delegation, the decision is likely to be better tailored to the economic environment. This will happen both because of costs or frictions in communicating the information up the hierarchy (Bolton et al. (1994))[5] and also because of the effect of delegation on the incentives of the agent to collect the information. The ability to better use information in decision-making under delegation will improve the incentives of the agent to collect the information in the first place (Aghion et al. (1997) and Stein (2002)).

We study bank branch response to natural disasters. Natural disasters are likely to result in property damage which in turn can result in an immediate demand for liquidity from the local population. This demand can be satisfied through withdrawals of deposits or drawdowns of credit lines. A natural disaster may also increase loan demand for reconstruction (Cortes and Strahan (2014)). This (local) shock to liquidity is likely to increase the importance of tailoring deposit rates to the altered local conditions. To the extent the information about local deposit markets is important for deposit rate setting, one would expect a branch whose rates are set locally to be better able to align the rates to local economic conditions and consequently to attract more deposits.

[5] Relatedly, Garicano (2000) proposes a trade-off between the cost of communication and the cost of acquiring knowledge. If the costs of communication outweigh the costs of acquiring information, delegation is more attractive.

If the branch's deposit rates are not set locally, then they cannot respond quickly to local shocks to demand and supply of liquidity. This will happen both due to the information frictions highlighted above and also because such banks may not have the ability to customize deposit rates to a particular branch. This in turn would compel the branch to depend on the rest of the bank to smooth local shocks through transfer of funds. The extent to which such smoothing occurs will depend on the efficiency of the bank's internal capital market. A large theoretical literature highlights potential inefficiencies in the functioning of the internal capital market. These inefficiencies arise mainly due to potential conflict of interest between the branch and the headquarters and the inability of the branch to transmit soft information up the hierarchy (Stein (1997, 2002)). In our setting, following a natural disaster, a branch will have to communicate the continued investment opportunities in its local area for the headquarters to help bridge the liquidity shortfall. Any inefficiency in this information transmission will result in incomplete insurance from the rest of the bank. Inefficiencies can arise if this information is soft and hence cannot be credibly communicated. This in turn will result in a slower loan growth in branches whose rates are not set locally.

If a sufficient number of branches in an area do not set their rates locally and consequently experience liquidity shortfalls, then we expect aggregate credit supply to be affected in the area, and this in turn may affect local asset prices.

2 Empirical Methodology

In this section we outline our empirical methodology. We examine three dimensions of branch (and bank) response to disasters: deposit rates, deposit growth and mortgage lending. We also examine whether the differential response by branches have real effects in terms of the speed of the recovery in house prices after a disaster.

Given the constraints imposed by data availability, our empirical methodology varies with the outcome variable modeled. Our model for deposit rates involves a triple difference-in-differences specification. We focus on branches in counties that had a major disaster declaration by FEMA between 1999 and 2013 (treatment branches). The control branches include those in adjacent counties that did not experience a natural disaster during our event window -- the seven-month window centered on the disaster declaration month. We focus on "localized" disasters by imposing the requirement that *all* adjacent counties are unaffected during the event window.

Thus our first difference is between the treated and control branches, the second difference is between the pre- and post- disaster period and the third difference is across branches based on where their deposit rates are set. To implement this analysis, we estimate the following regression:

$$deposit\ rate_{i,t} = \beta_0 + \beta_1 RateSet_i + \beta_2 Treated_c + \beta_3 PostShock_t + \beta_4 RateSet_i \times Treated_c + \beta_5 Treated_c \times PostShock_t + \beta_6 RateSet_i \times PostShock_t + \beta_7 RateSet_i \times Treated_c \times PostShock_c + \Lambda \times Controls + FE + \varepsilon_{i,t} \qquad (1)$$

where the subscript *i* refers to the branch, *c* refers to the county, *t* refers to month. $RateSet_i$ takes the value of 1 if the branch's deposit rates are set within the county and 0 otherwise. Note that *RateSet* is determined before the disaster and does not vary during our event window. $Treated_c$ is a dummy variable that takes a value of 1 for branches in disaster counties and 0 for branches in adjacent control counties. $PostShock_t$ is a dummy variable that takes a value 1 in the disaster declaration month and for three months thereafter, and 0 otherwise. *Controls* are a set of bank and market characteristics that are time-invariant, and determined before the start of the event window. These include: bank size (*Log(total assets)*), funding structure (*Log(total deposits)*), a dummy for whether the bank belongs to a bank-holding company (*BHC*), the competitiveness of the bank's average deposit market (*HHI(bank average)*), the geographic spread of its branch network (*Number of counties*), and the competitiveness of the deposit market in the county in which the branch is located (*HHI(county)*).

Since deposit rates do not vary much from month to month, for the analysis reported here, we collapse the dataset into one observation for the pre-period and one for the post-period. We do this by taking average values for all the variables for a given branch-shock combination for the three month period before the disaster and for the four month period following the disaster declaration (includes the month of the disaster). This significantly reduces the number of observations and will ensure that we do not understate the standard errors. The standard errors that we report are clustered at the branch level.

We estimate two variants of the model that differ based on the fixed effects employed. The first version includes branch fixed effects and time fixed effects (for the pre- and post-shock period).[6] Note that the branch fixed effects will not subsume the bank and market characteristics because a branch can be subject to multiple shocks at different points in time and the bank characteristics vary over time for a given branch. The second version we estimate includes within-shock branch fixed effects and within-shock time fixed effects. This specification controls for all heterogeneity across branches within each shock and all aggregate demand and supply changes around the shock. Since the *Controls* do not vary for a given branch-shock combination, they will be dropped in this specification. In this specification, *RateSet*, *Treated* and *RateSet x Treated* will also be dropped as they do not vary within a branch-shock combination. Note that the latter model is more stringent as it compares the branches in the shocked county only with the branches in the adjacent unaffected county. Our coefficient of interest is β_7 which measures the extent to which deposit rates are different in the branches in the affected county when their rates are set within the county in the post-shock period as compared to branches whose rates are set outside the county.

As we mentioned before, the other dependent variables that we model— deposit levels, mortgage lending, and house prices — are reported by different entities or at different frequencies than the deposit rates. We modify our specification accordingly, while maintaining the basic triple-difference setup. These regression specifications are explained in complete detail when we present the results.

The bank is likely to delegate the decision on deposit rates to more important or larger branches. To the extent such branches also differentially respond to natural disasters, this could bias our conclusions. To control for the endogenous delegation decision, we repeat our tests after instrumenting for *RateSet* using a dummy variable that indicates whether the branch belongs to a bank that was involved in a merger in the year prior to the disaster declaration. Mergers have been used as a shock to bank size and bank organization by several papers in the banking literature (e.g., Hong and Kacperczyk (2010) and Nguyen (2016)) and we follow in this tradition. We find that branches that belong to banks involved in a merger are less likely to have their rates set within the county. Thus such branches are more likely to have *RateSet* = 0. This is reasonable given that mergers are likely to increase bank

[6] Since we collapse the data, we do not have individual monthly observations. Hence we include fixed effects to control for the month of the shock.

size and potentially the degree of centralization.

The exclusion restriction for our instrumental variables (IV) analysis is that bank mergers should affect branch-level deposit rate following natural disasters only through its effect on the level of delegation and not otherwise. We feel this is a reasonable assumption for the following reasons. A bank merger may affect branch deposit rates for a number of reasons, such as by changing the extent of diversification among deposit sources, by improving the bank's access to market borrowing etc., Notwithstanding this, we believe *RateSet* is likely to be the most obvious channel through which the bank will try to influence branch deposit rates. If the merger significantly alters the bank's cost of funds, then the bank may want to increase the degree of centralization of deposit rate determination which in turn is likely to turn *RateSet* to zero for some branches. Alternatively, if the merger does not have a significant effect on bank's cost of funds, then it is less likely to affect branch deposit rates and the extent of delegation. To this extent the mergers' influence on branch deposit rates is likely to go through *RateSet.* This will help satisfy our exclusion restriction.

3 Data and Summary Statistics

This section describes our data, examines the relevance of our proxy for deposit rate setting, and provides summary statistics of the main variables we use in our analysis.

3.1 Data

We compile data from several sources as described below.

Natural disasters: Our data on natural disasters comes from two sources. From the Federal Emergency Management Agency (FEMA), we gather data on counties included in major disaster declarations. Major disaster declarations are made by the President, at the request of a governor or tribal leader, in response to a natural event determined to have caused damage of such severity that it is beyond the capabilities of the state and local governments to respond. A FEMA disaster declaration provides access to federal assistance programs, which can be directed towards individuals or infrastructure. We obtain information on all disasters that occur during the time period 1999-2013.

We obtain information on the amount of property damage from the natural disaster from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). This dataset provides damages from disasters categorized by county-month. We match the FEMA dataset to SHELDUS based on the county where the disaster struck and the month when it was declared as a disaster by FEMA. Due to differences in the timing of disasters between FEMA and SHELDUS – while FEMA times the disasters based on the declaration month, SHELDUS may time it based on either the event month or the damage assessment month – we are only able to match 96 out of the 182 FEMA disasters in our sample to the SHELDUS data. Given this poor match, we limit the SHELDUS data to provide some summary information on the damages from the FEMA disasters. Similar to Cortes and Strahan (2015) for most of our analysis, we focus attention on FEMA disaster declarations.

Deposit rates: We obtain information on deposit rates from RateWatch for the time period 1999-2014.[7] RateWatch provides weekly branch-level data on rates offered on various types of deposit products. We collapse the data to the monthly frequency by taking the monthly average deposit rate for each product. We focus on the most frequently quoted types of accounts, money market accounts requiring a minimum balance of $10,000 (MM) and 12-month certificates of deposit requiring a minimum balance of $10,000 (CDs). This is similar to earlier research that uses the same data (Drechsler, Savov, Schnabl (2016)). Note that RateWatch's coverage is not universal. To estimate the extent of coverage in RateWatch, we compare the total bank deposits in the treated and control counties during our analysis period to the amount of deposits with the branches for which we have deposit rate data from RateWatch. We find that we have deposit rate information for branches that garner over 50% of the deposits in the treated and control counties.

RateWatch also provides us information on whether a branch sets its own deposit rates (account type-specific) or follows another branch in the organization and, if so, which one. We use this to construct a variable that measures if the deposit rates of a branch are set locally. The *RateSet* dummy takes the value of 1 if the deposit rates of a branch are set within the county and 0 otherwise. RateWatch also provides similar data for loan rates. To

[7] While we analyze disasters that occur during 1999-2013, our deposit rate data extends to 2014 to ensure we have post-disaster data for the disasters that strike late in 2013.

identify if the loan rates are set locally, we focus on mortgage loans and construct a dummy variable *LoanRateSet* that takes the value of 1 if a branch's mortgage rates are set within the county and 0 otherwise. Consistent with the construction of the deposit rate variable, we focus on the most frequently quoted type of mortgage product to construct *LoanRateSet*, which is the 15-year fixed rate mortgage for $175,000.

Deposit levels: We obtain branch-level data on deposit balances at the annual frequency (as of June 30th) from the FDIC's Summary of Deposits. We use this data to calculate one of our key dependent variables, *Log(total deposits)* at the branch level, and other independent variables like the competitiveness of different deposit markets (county-level Herfindahl-Hirschman Index (HHI)), and the geographic footprint of each bank (number of branches).

Mortgage originations: We obtain data on mortgage lending from loans reported to regulators under the Home Mortgage Disclosure Act (HMDA). The HMDA data captures the bulk of residential mortgage lending activity in the United States (Cortes and Strahan (2015)). The data contains information on the location of the property and the lender. We use this to construct mortgage originations at the bank and county level. The data is available at the annual frequency for the calendar year.[8]

House price index: We obtain data on house prices at the MSA level at the monthly frequency from the Freddie Mac House Price Index (FMHPI). The FMHPI is a repeat-sales index that measures average price changes in repeat sales or refinancing on the same properties. Properties included in the index are single-family properties whose mortgages have been purchased or securitized by Fannie Mae or Freddie Mac.

Bank structure and financial condition: We obtain data on bank financial condition and structure from the quarterly Call Report. These variables include bank size (total assets), total deposits, and whether the bank belongs to a bank-holding company.

Bank mergers: We obtain data on bank mergers from the Federal Reserve Bank of Chicago's bank merger data set.

[8] A confidential version of the data provides precise information on the date the loans were made, but the public version simply provides the year of the loan.

3.2 Relevance of our proxy for delegation in deposit rate setting

We begin our empirical analysis by documenting that when available, branches do take advantage of the autonomy to set deposit rates. To do this, we relate the fraction of a bank's branches whose rates are set locally, to the dispersion in deposit rates across the branches of a bank. We construct a bank-level variable, *Decentralization* that measures the fraction of a bank's branches whose deposit rates are set within their county. If the deposit rates are set in response to local demand and supply conditions, and if banking markets are segmented, then we expect greater variability in deposit rates in banks with a higher value of *Decentralization*. On the other hand, if the bank internal capital market perfectly smooths liquidity across the bank, then the branches should all face one marginal cost of money and hence should have (relatively) uniform deposit rates irrespective of where the rates are set. We use the standard deviation in deposit rates across a bank's branches in a given month as our measure of deposit rate heterogeneity. We calculate this separately for MMs and CDs.

In Table 1, columns (1) and (3), we report results of the regression that relates the standard deviation of MM and CD rates, respectively, to *Decentralization*. The regression includes our standard set of controls for bank characteristics (*Log(total assets*), *Log(total deposits)*, *BHC, HHI (bank average)*, and *Number of counties*), and month fixed effects. For both types of deposit rates, the coefficient on *Decentralization* is positive and significant, suggesting that there is greater variability in deposit rates across the branches of a bank with more local rate setters. Specifically, a one standard deviation increase in *Decentralization* (0.16) is associated with a 0.015 (= 0.094 * 0.16) increase in the standard deviation of MM rates across branches and a 0.016 (= 0.099 * 0.16) increase in the standard deviation of CD rates, both roughly 220% increase relative to their mean. This is consistent with the view that when branches' rates are set locally, they respond to the characteristics of the local market. An implication of our result is that local deposit markets are segmented, consistent with the assumption in most of the banking literature (Gilje at al. (2016), etc.).

In columns (2) and (4) we differentiate banks based on their size and repeat our tests. Our objective is to demonstrate that deposit rate delegation affects the variability of deposit rates both for large and small banks. We divide the banks in our sample into quintiles based on the number of branches. Banks in Quintile 1 have the fewest branches and banks in Quintile 5 have the most branches. We re-estimate the regression with dummy variables for quintiles and interactions between each quintile and the decentralization proxy. The results show that *Decentralization* increases the variability of deposit rates for banks in all the quintiles. This result indicates that not only is there variation in deposit rate delegation within banks in different quintiles but such delegation also affects the variability of deposits of those banks. These results establish the relevance of our proxy for deposit rate delegation. When more branches set deposit rates locally, there is greater variability in rates across the branches of a bank.

3.3 Summary statistics on the disaster sample

Figure 1 maps the location of disaster counties for the "localized" disasters in our sample. It is apparent from this map that the disasters are reasonably well spread across the continental United States[9] with every major region of the country represented. This ensures that our results are less likely to be influenced by local differences in economic conditions or bank market structure.

Table 2 presents additional summary statistics on the disasters in our sample. Panel A tabulates disasters by region, and reinforces the message of the map. We have a total of 182 disasters during our sample period of 1999-2013. The frequency of disasters is greater during the second half of the sample period as compared to the first half. This is mainly due to the increase in coverage in RateWatch. We have deposit rate data for more branches during the second half of the sample period as compared to the first half. To ensure this selection does not bias our conclusions, we repeat all our tests only with the data from the second half (i.e., from 2007-13) and find that our conclusions remain unchanged. While disasters occur in all four regions of the country, they are less common in the North as compared to the other regions.

Panel B tabulates the disasters by type of event: Fire, Flood, Hurricane, Snow, Storm, and Other. The "other" category combines several less frequently observed categories including Dam/Levee Break, Earthquake, Mud/Landslide, Multiple, and Other. Storm and Fire are by far the most frequent disasters in our sample. They both

[9] We do not have any disasters in Alaska, Hawaii, or any U.S. territories as none met our selection criteria.

constitute over 88% of the disasters. Relative to the full sample of FEMA disaster declarations, our sample of "localized" disasters includes proportionately fewer hurricanes and storms, which tend to have broad geographic impact and slightly more events in the "other" category.

Table 2 Panel C tabulates disasters by monetary damage and Table 2 Panel D presents summary statistics of damages. As mentioned before, we obtain data on monetary damage from the SHELDUS dataset. From Panel C we find that we only have information on the extent of damage for 96 out of the 182 disasters in our sample. For this subset of disasters, we find that the average (median) disaster involves \$5.2 billion (\$303 million) in damages. Note that our methodology which focuses on "localized" disasters selects relatively smaller events from among the population of FEMA events. This is evident from the fact that the average (median) FEMA disaster involves \$23 billion (\$324 million) in damages.

Table 3 presents summary statistics on the data used in the deposit rate analysis. Panel A provides an overview of the data. To construct the sample, we gather monthly branch-level observations in treated and control counties during the seven-month window centered on the disaster declaration month. As described in Section 2, for the triple difference-in-differences analysis, we collapse the dataset into one observation for the pre-period and one for the post-period.[10] This significantly reduces the number of observations and ensures that we do not understate the standard errors.

Panel B of Table 3 presents summary statistics for this sample. The average money market deposit rate in our sample is 0.32% and the average 12-month CD rate is 0.98%. The average rates are relatively low because our sample covers the period between 1999 and 2014, and the Federal Reserve's policy rate was near zero for roughly half of this period. The mean value of *Treated* is 0.20 which means that 20% of branch-month observations belong to treated counties and 80% are from control counties. This also indicates that we have about four control branches for every treated branch. The mean value of the *RateSet* variable indicates that 41.4% of observations pertain to branches whose rates are set locally.

[10] For the dynamic triple difference-in-differences analysis, which estimates a separate effect for each month in the event window, we naturally retain the full sample of monthly branch-level observations.

The mean (median) value of bank assets in our sample is \$368.9 billion (\$65.15 billion). This is very large, corresponding to the top 0.05% (0.40%) of the bank size distribution observed in Call Report data for our sample period. This partly reflects the fact that larger banks have more branches and hence are likely to be featured more often in our branch-month dataset. Taking this into account, if we limit our dataset to unique bank-month observations, we find that the average (median) bank has \$58 billion (\$396 million) in assets which corresponds to the top 0.60% (20%) of the bank size distribution. This is reflective of the fact that RateWatch is more likely to have deposit rate information for the larger banks.

The average bank in our sample overwhelmingly finances itself with deposits which can be seen from the fact that the mean value of *Log(total deposits)* is similar to the mean value of *Log(total assets)*. We find that 96% of observations correspond to branches that belong to banks that are part of a bank-holding company. By comparison, about 70% of banks observed in the Call Report during our sample period belong to a bank-holding company. We find that while the median bank operates in 117 counties, the average is higher at over 263. This highlights the presence of some very large banks. Despite this, we find that our sample includes a significant share of small and local banks. About 30% of branch-month observations belong to small banks, with assets under \$2 billion, and 18% belong to local banks, defined as those that raise more than 65% of deposits from a single county (Cortes (2014)).

Turning to the banking-markets (counties) in our sample, we find that the average Herfindahl-Hirschman index of deposit market shares is 0.194. This indicates that the average county has a moderately concentrated deposit market according to the Department of Justice's Horizontal Merger Guidelines[11]. The average county accounts for 19.2% of a bank's total deposits. We see that 39.3% of counties are important markets for the bank, which we define as a county that is in the top quartile by deposits among all counties in which a bank has branches in.

[11] Markets in which the HHI is between 1,500 and 2,500 points are generally considered moderately concentrated, and markets in which the HHI is in excess of 2,500 points are considered highly concentrated. Mergers that increase the HHI by more than 200 points in highly concentrated markets are presumed likely to enhance market power (https://www.justice.gov/atr/herfindahl-hirschman-index). The DOJ thresholds are based on an HHI calculated from market shares expressed as a percent (i.e. 10% is 10), while our HHI was calculated from market shares expressed as a fraction (i.e. 10% is 0.10), which accounts for the difference in scale.

Table 3 Panel C compares summary statistics for branches for which the deposit rates are set within the county and those for which the rates are set outside the county. Since *RateSet* does not change during the event window for a branch, we include one observation per branch-shock combination (for the event month) to do this comparison. We find that branches whose rates are set within the county are more likely to belong to smaller banks, both in terms of asset ($260 billion vs. $445 billion) and the geographic spread of the branch network (195 counties vs. 309). They are less likely to belong to banks that are part of a BHC (93% versus 97%). The parent banks of branches whose rates are set locally face similarly competitive deposit markets as compared to the parent banks of branches whose rates are not set locally (bank average HHI of 0.21 versus 0.21).

Focusing on the banking market characteristics, we find that branches whose rates are set locally tend to be located in slightly more competitive banking markets (HHI of 0.21). Branches whose rates are set locally also garner a larger share of the deposits originating in the local county (38.2% as compared to 5.8%) and the market is also more likely to be an important market for their parent bank (72.2% versus 16.1%).

Note that the significant observable differences across branches whose rates are set within their county as compared to branches whose rates are set outside the county highlights the importance of controlling for these differences. We adopt a number of methods to control for these differences (the results of some of which are available upon request).

a) In our most stringent specification, we control for within-shock branch effects and compare the pre- and post-shock deposit rates focusing on the seven month period around the shock event. While the branch fixed effects will control for all time-invariant differences across the treated and control branches, the aggregate time series variation will be controlled for using the within-shock time effects.
b) We repeat our tests after including within-time bank fixed effects. This ensures that we control for all time-varying bank characteristics.
c) We repeat our tests after confining the branches whose rates are not set locally to those that are of similar size to the branches whose rates are set locally. We do this by only including the branch with *RateSet*=0 that is in the same county as a branch with *RateSet*=1 and that is closest in terms of size

measured using the amount of deposits. This significantly reduces the observable differences across the two sets of branches.

d) Finally, our IV specification instruments for this aspect of bank organizational structure using bank mergers.

4 Results

In this section we discuss the main results of our empirical analysis.

4.1 Deposit rate

In Table 4 we estimate equation (1) with deposit rates as the dependent variable and present the results. In the first two columns the dependent variable is MM rates while in the last two columns the dependent variable is the CD rate. Specifications marked (1) include branch and time fixed effects while specifications marked (2) include within-shock branch and within-shock time fixed effects. All specifications also include a set of control variables for bank and deposit market characteristics including *Log (Total assets), Log (Total deposits), BHC, HHI (Bank average), Number of counties, and HHI(county)*. We suppress their coefficients for brevity. As mentioned before, the control variables are absorbed in specification (2).

Across all specifications, we find a positive and statistically significant coefficient on *PostShock x Treated x RateSet* indicating that branches whose rates are set locally offer higher rates following disasters. Our estimates are also economically significant. We find that while MM rates are 3.2-3.3 bps higher on average, a roughly 10% increase relative to their sample mean, the CD rates are 4.3-5.5 bps higher, a roughly 5% increase relative to their mean. Note that our estimates are also reasonably similar across specifications. This indicates that both the inclusion of explicit control variables and the fixed effects do a reasonable job of controlling for other confounding factors.

From the coefficients on the level and double interaction terms in column (1) we find that MM rates are on average the same between local- and non-local rate setters (insignificant coefficient on *RateSet*), they are lower after a natural disaster in both the treated and control counties among local rate setters (negative and significant coefficient on *PostShock x RateSet*), and are lower in the treated counties after a disaster (negative and significant coefficient on *PostShock x Treated*). We find that these results are robust to the inclusion of within-shock branch and within-shock time effects.

From column (3) we find that while CD rates are marginally lower in the treated counties, they are lower in both the treated and control counties following the disaster but are higher after a natural disaster in both the treated and control counties among branches whose rates are set locally (positive and significant coefficient on *PostShock x RateSet*). We find that these results are robust to the inclusion of within-shock branch and within-shock time effects (column (4)).

In Figure 2 and Figure 3 we explore the dynamics of the changes in deposit rates around the disaster month. We do this both to see if there is any pre-trend in the data and also to see how quickly the rates come back to normal. To do this, we revert to our branch-month dataset and replace *PostShock* with a set of seven dummy variables that represent the months relative to the disaster month and their corresponding interaction terms. The month before a disaster is the excluded category. In this specification we include within-shock branch and within-shock month effects. From Panel A of Figure 2 we find that while there is no significant difference in MM rates across branches whose rates are set locally as compared to branches whose rates are not set locally three months before the disaster, the rates are slightly lower in the former branches two months before the disaster. We find that the rates of these two branches begin to diverge starting from the disaster month. Three months after the disaster, we find that MM rates are higher in the branches whose rates are set locally by 3.1 bps. This figure clearly highlights a sharp increase in MM rates coincident with the disaster month.

In Panel B we repeat our analysis with CD rates. Here the picture is not so clean. We find that as compared to the month before the disaster, CD rates in the prior two months are lower in branches whose rates are set within the county as compared to in branches whose rates are set outside the county. This situation reverses quickly following the disaster. Three months after the disaster CD rates are 4.6 bps higher in the branches whose rates are set within the county as compared to branches whose rates are set outside the county.

From Panel C of Table 3 we find that there are systematic differences along observable dimensions across branches whose rates are set locally and branches whose rates are not set locally. These differences could drive the difference in CD rates in the pre-disaster period seen in Figure 2. To test if this is the case, in Figure 3 we repeat our dynamic analysis after matching every branch with *RateSet*=1 with a control branch with *RateSet*=0 that is closest in terms of total deposit volume. This matching will ensure that these two groups of branches are of similar size. To ensure power, we do the matching with replacement. Within this matched sample, we repeat our analysis and present the results in Figure 3. From Panel (a) we find that while there is no significant difference in the MM rates in the pre-disaster period, differences emerge from the month of the disaster and persist for the next two months. From Panel (b) we find that there is no longer a significant coefficient during the pre-disaster period. While the CD rates increase in the disaster month, unlike the MM rates, the CD rates do not jump back during the three month period following the disaster. Thus we find that once we improve the match of the control group, there no longer is a pre-trend for both MM and CD rates. In unreported analysis, we repeat the tests in Table 5 within the matched sample and obtain results similar to the ones reported in Table 5.

In Panels A and B of Table 5 we repeat our tests after controlling for a number of bank and bank market characteristics that prior literature has shown to be important for bank behavior to show that our measure of *RateSet* captures a distinct aspect of bank organization not subsumed by these other measures. The banking literature suggests that small or local banks behave differently from large banks. Small banks have a comparative advantage in lending on soft information (Stein (2002), Berger et. al. (2005)). Local banks help speed recoveries after natural disasters (Cortes (2014)). One might be concerned that our proxy for decision-making delegation simply captures these features of organizational structure. While our results in Table 1 show that there is variation in *RateSet* both for small and large banks and that it affects deposit rates for both sets of banks, to show that our results are robust, we introduce controls for small bank and local bank, and their interactions with *Treated* and *PostShock*, into the regression and examine the robustness of our results.

Another variable that has been shown to affect branch behavior is the importance of the local market to the bank. Cortes and Strahan (2014) find that banks shield their core markets from natural-disaster driven lending reallocation. To address if the *RateSet* effect is independent of this aspect of the market, we introduce a control for the importance of the market to the bank. *Important Market* takes the value of 1 if a county is in the top quartile in terms of deposit production for a bank.[12]

Table 5 Panel A presents these results for MM rates and Table 5 Panel B presents the results for CD rates after including the controls. Here again we only include two observations (pre- and post-shock) per branch-shock combination. As seen from column (1) of Panels A and B, our result is robust to controlling for bank size. The coefficient on *PostShock x Treated x RateSet* is 0.033 for MM rates (versus 0.033 in Table 4) and 0.056 for CD rates (versus 0.055 in Table 4). From column (2) of Panels A and B, we find our result is similarly robust to controlling for whether the bank is a local bank or not. When we control for the importance of the local market for deposits for the bank, we find that the coefficient on the triple interaction term involving *RateSet* is slightly larger than that in the first two columns but similar in magnitude to our baseline result. In column (4) of Table 5, Panels A and B, we add all three controls — *Small, Local, and Important Market* — and their interactions to the regression at once. The coefficient on *PostShock x Treated x RateSet* remains statistically significant and slightly larger in magnitude as compared to our baseline result.

In summary, we find that our results are robust to controlling for other aspects of bank structure and banking market importance. Our results show that the location where deposit rates are set has implications for branch deposit rate response to natural disasters. To our knowledge we are the first to highlight this aspect of bank organizational design for bank behavior. We include the controls for other aspects of bank organizational structure (*Small, Local, and Important Market),* and their interactions, in the rest of our analysis to ensure that our results are incremental.

4.2 Deposit volume

A higher deposit rate, all else equal, should translate into higher deposit volumes. Since branch-level deposit data is only available at an annual frequency as of June 30th from the FDIC's Summary of Deposits, we examine how annual (June-June) deposit level is affected by natural disasters that occur in the second quarter of a calendar year. Specifically, we classify branches located in counties that experience at least one natural disaster in the second

[12] Cortes and Strahan (2014) define core markets as counties where banks have branches. We can only observe deposit rates in markets where banks have branches so we attempt to distinguish between relatively more and less important markets conditional on a branch presence.

quarter of a year as treated. Control branches are those in adjacent counties that did not experience a natural disaster during the same year and quarter.[13] The rationale for the timing is that our prior analysis shows that the deposit rate response begins immediately after the natural disaster. This indicates that one can detect a response in deposit volume close to the disaster. Measuring deposit volumes close to the disaster month will also ensure that other time-varying factors do not confound our estimates. We additionally require that neither the treated nor the control counties had a disaster earlier in the reporting period leading up the disaster declaration month, that is, in the first quarter of the declaration year or the third or fourth quarters of the prior year. Finally, we require that neither treated nor the control counties experience a natural disaster in the first two quarters of the prior calendar year. This is to ensure that the pre-shock level of deposits is not affected by a natural disaster. Within this sample, we estimate regressions of the following form:

$$\mathrm{Log}\left(total\ deposits_{i,t}\right) = \beta_0 + \beta_1 RateSet_i + \beta_2 TreatedQ2_c + \beta_3 PostShock_t + \beta_4 RateSet_i \times TreatedQ2_c + \beta_5 TreatedQ2_c \times PostShock_t + \beta_6 RateSet_i \times PostShock_t + \beta_7 RateSet_i \times TreatedQ2_c \times PostShock_t + \Lambda \times Controls + FE + \varepsilon_{i,t} \qquad (2)$$

where *i* indexes branches, and *t* indexes years. The dependent variable is the log of a branch's annual (June-June) deposit level. We include two observations per branch-shock, one before and one after the shock. *RateSet* takes the value of 1 if a branch's rates are set locally and 0 otherwise, and this variable is measured as of June 30th of the calendar year prior to the disaster month. $TreatedQ2$ is 1 for branches located in disaster counties and 0 for branches located in adjacent control counties. $PostShock$ takes a value one for the post-shock observation. *Controls* include the set of control variables that we employ in equation (1) along with controls for other features of organizational structure (*Small*, *Local*, and *Important Market*) and all of their interaction terms. Control variables are measured as of June 30th of the calendar year prior to the disaster declaration month. Fixed effects are alternately

[13] Due to the aggregation, we relax the definition of disasters. Specifically, we no longer require that all adjacent counties are unaffected by this or any other disaster in the two-year window. In our main tests, we impose no shocks in the adjacent counties on a seven-month window. If we impose the same "local" shock definition here, we lose almost all shocks. For consistency, we also repeat our tests on deposit rates, using the more relaxed definition, and find that our results remain qualitatively unchanged.

branch and year, or within-shock branch and within-shock year, with the second specification being the more stringent.[14] With the inclusion of the fixed effects, the coefficients will capture the percentage change in deposit amounts. Standard errors are robust to heteroscedasticity and clustered at the branch level.

Table 6 reports the results of estimating equation (2) in our sample. We find that the coefficient on *RateSet* $x\ TreatedQ2 \times PostShock$ is positive and significant. This indicates that branches whose rates are set locally, experience higher deposit volumes following a natural disaster as compared to branches whose rates are not set locally. Our estimates are also economically significant. We find that the deposit volumes at branches that set rates locally is 3 to 4 percentage points higher following natural disasters. From the coefficients on the double interaction terms we find that following a natural disaster, while deposit volumes are lower in branches whose rates are set locally in both the treated and control counties, they are higher among branches in the treated counties. We find that our results are robust to confining our analysis to treated and control branches that belong to banks of similar size. We also find that our results are robust to using deposit growth rate instead of *Log(total deposits)* as the outcome variable and including one observation per branch-shock.

4.3 Mortgage lending

Our results so far indicate that following natural disasters, branches whose deposit rates are set locally, increase deposit rates relative to branches whose deposit rates are not set locally and the former also experience higher levels of deposits. These results would imply that branches that do not set deposit rates locally should experience a negative liquidity shock relative to branches that do set rates locally. If there are potential frictions in the ability of the bank's internal capital market to bridge this shortfall, then such branches may experience slower loan growth. We use mortgage lending in a county as our proxy for local loan volume to test this prediction.

Our data on mortgage originations is from HMDA, which groups originations across banks and counties where the property is located. Since we do not have mortgage originations at the branch level, we aggregate our

[14] Note that while there can be more than one shock in a year, each shock occurs only at one point in time. Thus the shock fixed effects are more granular than year fixed effects and hence will subsume the latter.

branch-level proxy for where deposit rates are set to the bank-county level. To do this, we construct a dummy variable called *RateSet_County*, which takes the value of 1 if more than 50% of a bank's branches (by deposits) in a county have their rates set locally, and 0 otherwise. Data on mortgage originations is reported at the annual frequency for the calendar year. We examine how annual (calendar year) volume in mortgage lending responds to natural disasters that occur during the year.

Treated counties are those that experience at least one natural disaster during a calendar year. Control counties are adjacent counties that did not experience a disaster during the same year. Within this sample, we estimate the following regression, which is similar in spirit to our main specification (1):

$$\text{Log}\ (Mortgages_{j,c,t}) = \beta_0 + \beta_1 RateSet\_County_{j,c} + \beta_2 TreatedY_c + \beta_3 PostShock_t + \beta_4 RateSet\_County_{j,c} \times TreatedY_c + \beta_5 Treated_c \times PostShock_t + \beta_6 RateSet\_County_{j,c} \times PostShock_t + \beta_7 RateSet\_County_c \times Treated_c \times PostShock_t + \Lambda \times Controls + FE + \varepsilon_{i,t} \qquad (3)$$

where *j* indexes banks, *c* counties, and *t* years. The dependent variable is the log of mortgage lending by bank and county. Here again, we include two bank-county observations per shock, one for the year of the shock and the other for the previous year. *RateSet_County* is set as of June 30th of the calendar year prior to the year of disaster declaration. $TreatedY$ is a dummy variable that takes a value 1 for disaster counties and 0 for adjacent control counties. $PostShock$ takes a value one for the year of disaster and zero otherwise. *Controls* include the standard set of bank and market characteristics, plus *Small*, *Local*, and *Important Market* and all of their interactions. All of these controls are set as of June 30th of the year prior to the disaster declaration. Fixed effects are alternately bank-county and year, and within-shock bank-county and within-shock year. Standard errors are clustered by bank.

Table 7 reports the results of estimating equation (2) in our sample. We find that the coefficient on *PostShock* × *Treated* × *RateSet_County* is positive and significant. This indicates that following natural disasters, mortgage volume in a county is higher among banks that have a majority of their branches set their deposit rates locally. Our estimates are also economically significant. We find that the mortgage volume growth rate among banks with branches that set rates locally is 9.1 percentage points higher following natural disasters. We find that our results are robust to alternate fixed effects and surprisingly stable. From the coefficients on the level and double interaction terms we find that mortgage volumes are lower following a natural disaster in both treated and control counties (negative coefficient on *PostShock*) and is lower in the treated counties among banks that set deposit rates locally (negative coefficient on $Treated \times RateSet\_County$)

4.4 House prices

Our previous results highlight differences in mortgage lending following natural disasters based on whether or not a majority of bank branches in a county set their rates locally. In our final set of tests, we examine if these differences in lending translate into differential trends in local house prices. We employ the house price index from Freddie Mac at the monthly frequency at the MSA level to conduct our tests. Apart from conducting the analysis at the MSA level, our empirical specification is similar to the triple-difference specification we employ to study deposit rates. That is, we focus on the seven month window around the disaster month and treated MSAs are those that experience a natural disaster while control MSAs are other MSAs in the same state as the treated MSAs and that did not experience a disaster in the seven-month window around the disaster month. Our main independent variable is a dummy variable *RateSet_MSA (Agg)*, which takes the value of 1 if more than 50% of bank branches in a MSA (by deposits) have their deposit rates set within the MSA, and 0 otherwise. *PostShock* identifies the post-shock period for the treated and control MSAs and our coefficient of interest is that on the triple interaction term *RateSet_MSA (Agg)x PostShock x Treated_MSA*. Bank and market characteristics are also aggregated at the MSA level, as described in Appendix A.

Table 8 displays the results. From column (1) we find that while house prices decline by 13 percentage points in the treated and control MSAs after a natural disaster, this effect is greater in the MSAs where a majority of bank branches set their rates locally (negative coefficient on *RateSet_MSA (Agg)x PostShock).* On the other hand the house price decline is mitigated in the treated MSAs if more than 50% of bank branches in the MSA are local rate setters. The more rigorous fixed effect specification in column (2) suggests that the house price decline that follows a natural disaster is almost completely offset in affected MSAs if more than 50% of bank branches are local rate setters. The coefficient on *RateSet_MSA (Agg) x PostShock x* $Treated\_MSA$ is 0.034 which is slightly larger in magnitude but opposite in sign to that on $Treated\_MSA$ *x PostShock* (-0.033). Thus our results indicate that the branch-level deposit rate setting delegation not only affects deposit rates and volumes but also has real effects in terms of mortgage lending and house price recovery following natural disasters.

5 Robustness

5. 1 Instrumenting for deposit rate setting delegation with bank mergers

While the occurrence of natural disasters is plausibly random within a region — that is, treated counties and adjacent control counties are equally likely to be affected ex-ante — the extent to which deposit rates are set in a decentralized or centralized manner is a decision variable of the bank. To account for the possibility that branches with authority to set rates locally may be systematically different from branches without such authority, we repeat the deposit rate analysis instrumenting for *RateSet* with a dummy variable that identifies branches that belong to banks that were involved in a merger in the year prior to the disaster declaration. Bank mergers often lead to changes in organizational structure. Empirically we find that branches that belong to banks that are involved in a merger in the prior year are less likely to have their rates set within the county. This is reasonable and is consistent with bank mergers increasing bank size and the degree of centralization in deposit rate setting. The identifying assumption for the instrument is that bank mergers are exogenous to local economic conditions that would affect deposit rates. As we mentioned before, this is a reasonable assumption considering that *RateSet* may be the primary channel through which bank mergers may affect branch deposit rates.

Table 9 presents the results of estimating the IV regressions with bank deposit rates as the outcome variable. Similar to our OLS estimation, we alternately use MM rates and CD rates as the dependent variable and collapse the dataset to have one observation for the pre- period and one for the post-period. We implement the specification that includes within-shock branch and within-shock month fixed effects. Note that in this specification both *RateSet* and *RateSet x Treated* are likely to be absorbed by the fixed effects. Thus there are only two terms involving the endogenous variable: *RateSet X Post Shock* and *RateSet X Post Shock X Treated.* We instrument for these using *Merger X Post Shock* and *Merger X Post Shock X Treated* respectively. Thus we estimate two first stage regressions to avoid the "forbidden regression" problem (Wooldridge, 2002).

Panel A presents the first stage regressions. The first stage F-statistic, which tests the null hypothesis that the coefficients on all variables containing *RateSet* are jointly zero, is 1141 for both dependent variables, which exceeds the typical requirement for a strong instrument (F>10). Panel B presents the second stage regressions. After instrumenting for *RateSet,* the coefficient on the key variable of interest (*PostShock* × *Treated* × *RateSet)* is larger and significant at the 5% level or greater. For MM rates, the coefficient is 0.155, versus 0.033 for the comparable specification in Table 4, suggesting that branches that set rates locally set money market rates roughly 50% higher after a disaster, relative to their mean. For CD rates, the coefficient is 0.167, versus 0.055 for the comparable specification in Table 4. This suggests that branches that set rates locally set CD rates that are 15% higher after disaster, relative to their means. In summary, our results are robust to instrumenting for whether deposit rates are set locally using bank mergers.

5. 2 Deposit rate setting versus lending discretion

Bank branches may also vary in the degree of autonomy they enjoy in setting loan rates. One potential concern with our earlier analysis is that autonomy to set deposit rates may proxy for a branch's ability to set loan rates. To the extent that delegation improves the production of information (e.g., Stein (2002), Aghion and Tirole (1994), Bolton and Dewatripont (1997), Garicano (2000)), the canonical models of credit would argue that greater autonomy to set loan rates would improve the incentives to produce information and in turn facilitate lending (Stiglitz and Weiss (1981)). Thus, it is reasonable to expect that branches that have the ability to set their loan rates may have greater incentives to produce information and possibly lend more. To fund the credit, the branches may also pursue a more aggressive strategy to attract more deposits.

RateWatch indicates where a branch's loan rates are set. In Table 10, we repeat our tests after controlling for the location where a branch's loan rates are set. We construct a dummy variable LoanRateSet that identifies branches whose loan rates are set within the county and repeat our tests after controlling for *LoanRateSet* and its interaction terms with *PostShock* and *Treated*.

In Table 10, the dependent variables are the deposit rates. We find that the inclusion of the loan rate setter variables does not affect the coefficient on *RateSet x PostShock x Treated*, suggesting that our results are not driven by autonomy in loan decisions. The coefficient on *LoanRateSet x PostShock x Treated* is negative and significant for MM rates. That is, deposit rates are lower in the treated branches in the post shock period if the loan rates of the branches are set within the county. In unreported tests we find that controlling for the location where bank loan rates are set does not affect our reported results on deposit volume, mortgage lending volume and house price growth. Overall the results in this section show that our results are robust to controlling for where branch level loan rates are set.

5. 3 Physical Distance

So far we measure deposit rate delegation using a dummy variable that identifies if a bank deposit rates are set within the county or not. In this section, we employ a more continuous measure of deposit rate delegation, namely the distance between the branch and the rate setting branch. Prior research has employed distance to measure costs and frictions in transmitting information and has shown that such frictions affect lending decisions (Petersen and Rajan (1995), Petersen and Rajan (2002), Degryse and Ongena (2005), Mian (2006)). If the differential deposit rate response following natural disasters that we observe between local and non-local bank branches is due to frictions in information transmission, then we expect the effects to be stronger, the farther the rate setter is from the rate follower. To test this, we analyze how physical distance from the rate setting branch affects our results.

We first measure the physical distance in terms of the linear span in miles between each branch and its rate setter. This variable takes a value zero for branches that set their own rate. To distinguish between the distance effect and the rate setter vs rate follower effect, we differentiate both across rate setters and rate followers and across rate followers that are near to their rate setter and those that are farther from their rate setter. To do this, we first create a dummy variable *Follower* to identify the branches that do not set their rate locally. We further sort the branches that do not set their own rate into four quartiles based on their distance from the rate setter branch. The first quartile corresponds to follower branches that are closest to their rate setter while the fourth quartile corresponds to follower branches that are farthest from the rate setter. We then repeat our tests with deposit rates as the outcome variable and after including both a triple interaction terms involving *Distance* and a quadruple interaction term involving both *Follower* and *Distance*.

The results from Table 11 show that following natural disasters, deposit rates are lower in branches that do not set their rate locally and are also in those that are farther from their rate setting branch. This is clear from the negative and significant coefficient on the quadruple interaction term. We find that deposit rates (MM rates) are 2.4 (3.9) percentage points lower as compared to the sample mean for the furthest branches (fourth quartile) when compared to the closest ones (first quartile). Overall, these results indicate that at least some of our results may be due to frictions in transmitting information from the rate setter to the rate follower branch.

6 Conclusion

The importance of banks in allocating credit for economic growth cannot be overemphasized. This also enhances the need to understand how bank organization affects credit allocation. In this paper, we introduce a novel and a fundamental aspect of bank organizational design: the location where the interest rates for a branch's deposit products are determined and study its effect on branch and bank behavior.

Using natural disasters as a shock to the local economy, we find that the degree of decentralization in setting deposit rates has significant effects on branch and bank behavior. Following natural disasters, branches whose deposit rates are set within the county offer higher rates and experience greater deposit inflows. Consistent with imperfect insurance from the bank internal capital market, we find that mortgage lending grows at a relatively faster rate in banks with a larger fraction of local rate setting branches. Finally we document that bank organization affects house prices following natural disasters especially in areas where a majority of bank branches do not have their deposit rates set locally. We find that our results are robust to controlling for other aspects of bank organization that prior research has studied and to instrumenting for the rate setting location using bank mergers. We also find that deposit rates increase less for more distant branches, which is consistent with information frictions between the rate setting and rate following branches.

We make a number of important contributions to the literature. Our results contribute to the organization economics literature by highlighting the importance of the location where product prices are set for firm behavior. The lending response we document is consistent with imperfect insurance from the bank internal capital market. Our branch-level measure of delegation allows us to implement an empirical specification with high-dimensional fixed effects and document differential response across the branches of the same bank. Our results have important implications for both banks and their regulators. The benefits of decentralization that we document in terms of a quicker response to local shocks is something banks should take into account in determining their organizational design. Notwithstanding the benefits to decentralization we document, we find banks with both centralized and decentralized structures in our sample. This calls for future work to investigate the potential costs of decentralization in banks.

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Figure 1: Map of Disaster Counties

This figure maps the disaster counties in our sample of localized natural disasters which covers the period 1999-2013. Shaded counties experienced at least one major disaster declaration by FEMA, while all adjacent counties were unaffected in a seven-month window around the event. No natural disasters outside the continental United States met our conditions for a localized natural disasters.

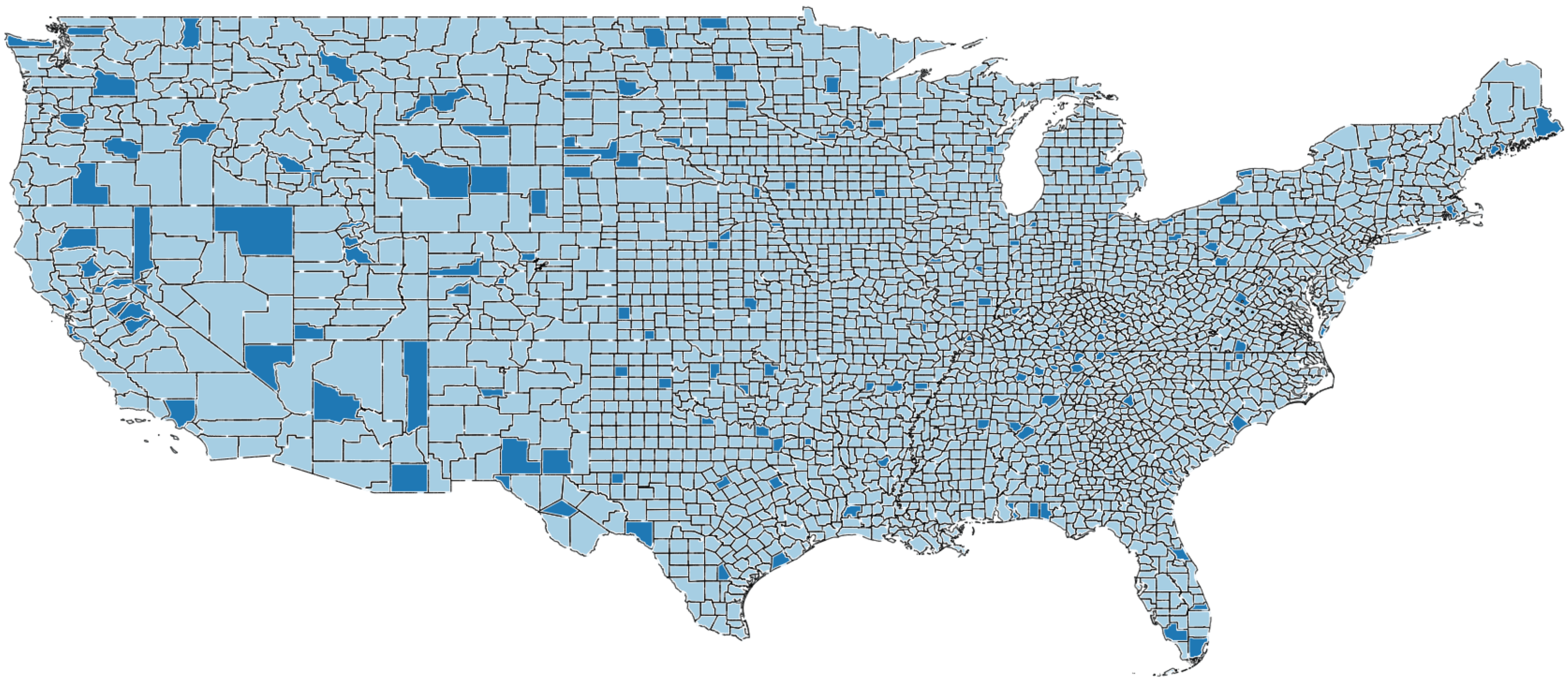
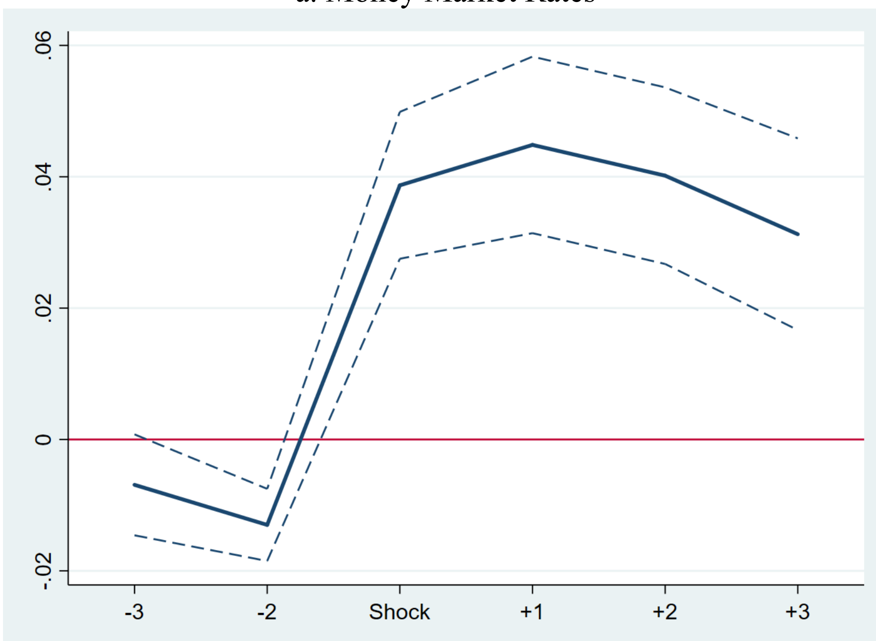


Figure 2: Dynamics of delegation and deposit rates around natural disasters

The graph plots the point estimates and 95% confidence intervals of the coefficients for the triple interaction term, $PostShock(k) \cdot Treated \cdot RateSet$, where k ranges from -3 to +3. The month before the shock declaration (-1) is the omitted category. The first graph uses the MM rate and the second graph employs the CD rate as the outcome variables

a. Money Market Rates



b. 12-month CD Rates

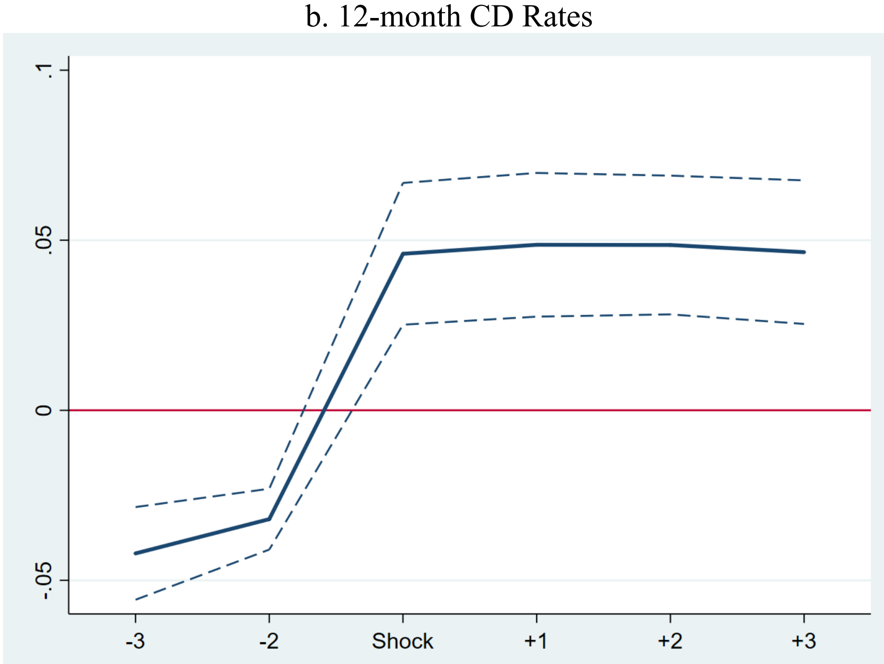
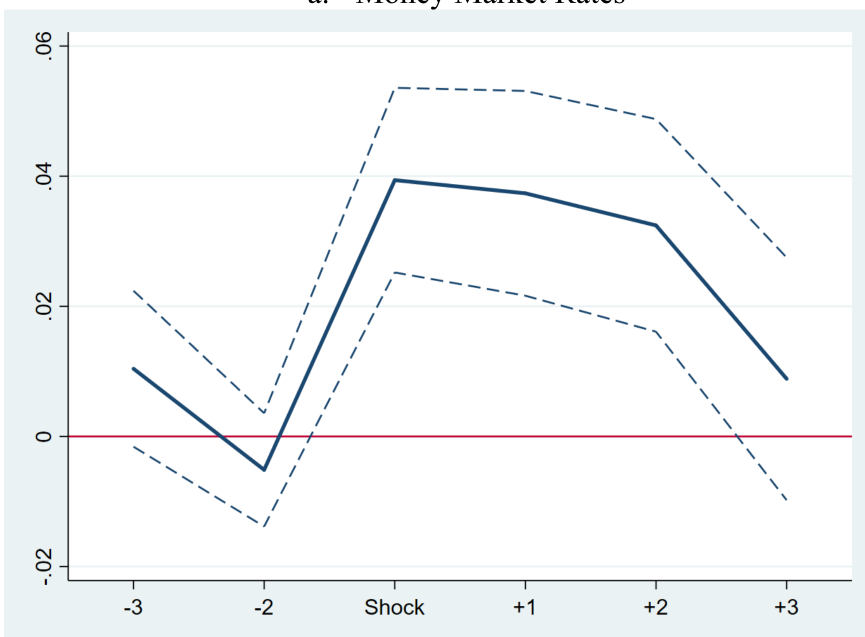


Figure 3: Dynamics of delegation and deposit rates around natural disasters (after matching branches on size)

The graph plots the point estimates and 95% confidence intervals of the coefficients for the triple interaction term, $PostShock(k)$ x $Treated$ x $RateSet$, where k ranges from -3 to +3. The month before the shock declaration (-1) is the omitted category. The first graph uses the MM rate and the second graph employs the CD rate as the outcome variables.

a. Money Market Rates



b. 12-month CD Rates

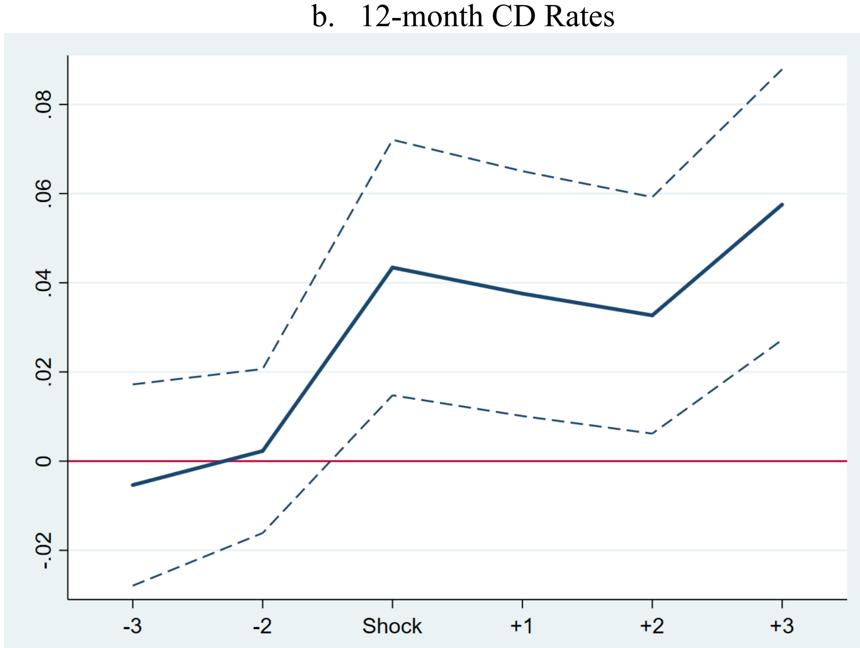


Table 1: Heterogeneity of deposit rates across branches and decentralization in deposit rate setting

This table examines the relationship between the heterogeneity in deposit rates across a bank's branches in a month and the degree to which the bank sets deposit rates in a centralized manner. The dependent variable is the standard deviation of deposit rates across the branches of a bank in a month. The key independent variable is *Decentralization,* the share of branches that set rates locally within the county in which they are located. The regression also includes a set of bank-level control variables (*Log* (*Total* assets), *Log* (*Total* deposits), *BHC*, *HHI* (*Bank average*) and *Number of counties*). The coefficients on these variables are not reported for compactness. Samples are divided to five different groups based on total numbers of branches of each bank. *Quintile*1 is the banks within bottom 20 percent and *Quintile*5 is the banks within top 20 percent in terms of total numbers of branches of the bank. All variables are defined in Internet Appendix Table A.1. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Standard Deviation of Deposit rates			
	Money Market Rates		12-month CD Rates	
	(1)	(2)	(3)	(4)
Decentralization	0.094***		0.099***	
	(8.40)		(8.85)	
Decentralization × *Quintile*1		0.030**		0.034***
		(2.45)		(2.93)
Decentralization × *Quintile*2		0.150***		0.157***
		(4.75)		(6.25)
Decentralization × Quintile3		0.111***		0.161***
		(5.88)		(5.72)
Decentralization × *Quintile*4		0.254***		0.205***
		(7.30)		(8.43)
Decentralization × *Quintile5*		0.229***		0.280***
		(7.22)		(6.29)
Observations	305781	305781	305781	305781
Adjusted R^2	0.106	0.154	0.133	0.205
Month FE	Y	Y	Y	Y

Table 2: Summary statistics on localized natural disasters

This table provides summary statistics on the localized natural disasters in our sample. A county is defined as experiencing a localized natural disaster if it had a major disaster declaration by FEMA, while all adjacent counties were unaffected in a seven-month window around the event. Panel A tabulates the locations of the disaster counties by region. Panel B tabulates the disasters by type of natural event. The Other category in this panel includes Dam/Levee Break, Earthquake, Mud/Landslide, Multiple, and Other. Panel C tabulated the disasters by monetary damages. Panel D provides summary statistics on the monetary damages.

Panel A: By Regions					
	Mid-West	North	South	West	Total
1999	0	0	0	1	1
2000	0	0	2	1	3
2001	0	0	2	2	4
2002	1	0	1	1	3
2003	3	0	2	5	10
2004	1	0	2	9	12
2005	1	0	0	0	1
2006	2	0	6	3	11
2007	8	1	8	6	23
2008	3	1	5	5	14
2009	3	0	17	7	27
2010	3	1	4	7	15
2011	5	2	10	5	22
2012	2	0	11	4	17
2013	9	7	1	2	19
Total	41	12	71	58	182

Panel B: By Types								
	Fire	Flood	Hurricane	Snow	Storm	Tornado	Other	Total
1999	1	0	0	0	0	0	0	1
2000	0	0	0	0	2	0	1	3
2001	4	0	0	0	0	0	0	4
2002	3	0	0	0	0	0	0	3
2003	5	0	0	0	3	0	2	10
2004	5	0	1	1	3	0	2	12
2005	0	0	0	0	1	0	0	1
2006	4	0	0	0	7	0	0	11
2007	10	0	0	0	12	0	1	23
2008	4	0	0	0	10	0	0	14
2009	13	0	0	0	13	0	1	27
2010	4	2	1	0	8	0	0	15
2011	8	2	1	0	11	0	0	22
2012	5	0	0	0	11	0	1	17
2013	1	3	1	0	12	2	0	19
Total	67	7	4	1	93	2	8	182

Table 2 – Continued

Panel C: By Monetary Damages (Million USD)								
	>10,000	>2,000	>1,000	>500	>100	<100	Unknown	Total
1999	0	0	0	0	0	0	1	1
2000	1	0	0	0	0	2	0	3
2001	0	0	0	0	0	1	3	4
2002	0	0	0	0	0	0	3	3
2003	1	2	0	0	0	1	6	10
2004	0	1	0	0	0	0	11	12
2005	0	0	0	0	0	0	1	1
2006	2	2	0	0	2	2	3	11
2007	0	0	1	1	2	5	14	23
2008	0	1	0	0	3	5	5	14
2009	1	3	3	0	4	5	11	27
2010	2	1	1	1	2	4	4	15
2011	1	1	0	3	3	2	12	22
2012	1	1	1	3	3	2	6	17
2013	2	2	1	2	5	1	6	19
Total	11	14	7	10	24	30	86	182

Panel D: Summary Statistics for Monetary Damages						
	N	Mean	S.D.	25th	Median	75th
Monetary Damages (Million USD)	96	5214.076	15812.575	59.987	303.088	2121.767

Table 3: Summary statistics for the deposit rate data

This table reports summary statistics for the disaster sample used to analyze deposit rates. Panel A presents a reconciliation of observations for different versions of the dataset employed in our analyses. The starting dataset is constructed by gathering branch-month observations on branches located in treated and control counties in a seven-month window centered on the disaster declaration month. This sample is used in the dynamic difference-in-differences analysis. Panel B reports summary statistics on the collapsed panel that is used in the static difference-in-differences analysis. Panel C examines differences between branches that set rates locally and those that do not. The branch-shock panel is used in Panel C to avoid overstating *t*-statistics due to repeated sampling of the same data (control variables are fixed for each branch and shock at the beginning of the shock event window).

Panel A: Reconciliation of Observations

Dataset	Observations	N	Used in:
Full panel	Monthly, with seven months per branch and shock	103117	Fig. 2, Fig. 3 (matched subsample)
Collapsed panel	One pre- and post- observation per branch and shock	29462	T3-PB, T4, T5, T9, T11
Branch-shock panel	One observation per branch and shock	14731	T3-PC

Panel B: Summary Statistics

	N	Mean	S.D.	25th	Median	75th
Money market rate, %	29462	0.323	0.405	0.055	0.183	0.400
12-month CD rate, %	29462	0.976	1.060	0.200	0.551	1.467
Treated (dummy)	29462	0.200	0.400	0.000	0.000	0.000
RateSet (dummy)	29462	0.414	0.493	0.000	0.000	1.000
Bank characteristics:						
Total assets, $ billions	29462	368.799	550.347	1.054	65.147	503.327
Log(total assets)	29462	17.047	3.412	13.868	17.992	20.037
Log(total deposits)	29462	16.752	3.329	13.618	17.686	19.664
BHC (dummy)	29462	0.956	0.204	1.000	1.000	1.000
Number of counties	29462	262.730	284.136	6.000	117.000	534.000
Small (dummy)	29462	0.298	0.457	0.000	0.000	1.000
Local (dummy)	29462	0.184	0.388	0.000	0.000	0.000
HHI, bank average	29462	0.211	0.071	0.180	0.208	0.220

continued on next page

Table 3, Panel B, continued from last page

	N	Mean	S.D.	25th	Median	75th
Market characteristics:						
HHI, county	29462	0.194	0.111	0.131	0.161	0.228
County share of bank deposits	29462	0.192	0.311	0.004	0.031	0.199
Important Market (dummy)	29462	0.393	0.488	0.000	0.000	1.000

Panel C: Univariate Comparison

	RateSet=1				RateSet=0				Difference	
	N	Mean	Median	SD	N	Mean	Median	SD	Diff	(*t*-stat)
Bank characteristics:										
Total assets, \$ billions	6104	260.675	8.789	485.375	8627	445.302	118.165	580.016	-184.628***	(-20.34)
Log(total assets)	6104	16.131	15.989	3.401	8627	17.695	18.588	3.269	-1.563***	(-28.12)
Log(total deposits)	6104	15.859	15.737	3.316	8627	17.384	18.258	3.191	-1.525***	(-28.11)
BHC (dummy)	6104	0.931	1.000	0.253	8627	0.974	1.000	0.158	-0.043***	(-12.64)
Number of counties	6104	195.993	31.000	252.913	8627	309.949	211.000	295.347	-113.956***	(-24.46)
Small (dummy)	6104	0.430	0.000	0.495	8627	0.204	0.000	0.403	0.226***	(30.42)
Local (dummy)	6104	0.333	0.000	0.471	8627	0.079	0.000	0.270	0.254***	(41.31)
HHI, bank average	6104	0.211	0.206	0.082	8627	0.211	0.209	0.061	-0.000	(-0.23)
Market characteristics:										
HHI, county	6104	0.207	0.174	0.111	8627	0.184	0.150	0.109	0.023***	(12.38)
County share of bank deposits	6104	0.382	0.186	0.393	8627	0.058	0.009	0.112	0.324***	(72.47)
Important Market (dummy)	6104	0.722	1.000	0.448	8627	0.161	0.000	0.367	0.561***	(83.28)

Table 4: Delegation and deposit rates around natural disasters

This table examines the effect of deposit rate setting delegation on deposit rates observed around a natural disaster. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration ,0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. The regression also includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* a*ssets*), *Log* (*Total* d*eposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*). The coefficients on these variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Deposit Rate			
	Money Market Rates		12-month CD Rates	
	(1)	(2)	(1)	(2)
Treated	0.039		-0.039**	
	(1.39)		(-2.03)	
RateSet	-0.170		0.199*	
	(-1.52)		(1.78)	
PostShock	-0.003		-0.020***	
	(-0.38)		(-2.80)	
Treated × *RateSet*	0.005		0.069**	
	(0.12)		(2.01)	
PostShock × *RateSet*	-0.012***	-0.009***	0.009**	-0.001
	(-4.29)	(-3.65)	(2.23)	(-0.20)
PostShock × *Treated*	-0.017***	-0.015***	-0.002	-0.015***
	(-4.75)	(-4.12)	(-0.34)	(-2.96)
PostShock × *Treated* × *RateSet*	0.032***	0.033***	0.043***	0.055***
	(5.50)	(5.87)	(4.89)	(5.98)
Observations	29462	29462	29462	29462
Adjusted R^2	0.862	0.944	0.977	0.984
Branch FE	Y	N	Y	N
Time FE	Y	N	Y	N
Branch-Shock FE	N	Y	N	Y
Time-Shock FE	N	Y	N	Y

Table 5: Delegation versus other organizational structure characteristics

This table examines whether the effect of deposit rate setting delegation on deposit rates around a natural disaster is distinct from the effect of other features of organizational structure. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration, 0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. *Z* refers to other organizational structure characteristics (*Small, Local,* or *Important Market*). For each specification the variable(s) included in *Z* are listed under the column numbers. The regression also includes a set of control variables for bank and deposit market characteristics (*Log* (*Total assets*), *Log* (*Total deposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*). The coefficients on these variables are not reported for compactness. All variables are defined in Table A.1 of the Internet Appendix. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

Panel A	*Money Market Rates*			
	(1)	(2)	(3)	(4)
Z=	*Small*	*Local*	*Important Market*	*Everything*
$PostShock \times RateSet$	-0.008***	-0.009***	-0.016***	-0.015***
	(-3.19)	(-3.38)	(-5.04)	(-4.70)
$PostShock \times Treated$	-0.013***	-0.014***	-0.010***	-0.010**
	(-3.40)	(-3.84)	(-2.59)	(-2.33)
$PostShock \times Treated \times RateSet$	0.033***	0.035***	0.046***	0.045***
	(5.75)	(5.79)	(6.75)	(6.42)
$PostShock \times Z$	-0.004	-0.000	0.011***	
	(-1.35)	(-0.14)	(4.00)	
$PostShock \times Treated \times Z$	-0.008	-0.010	-0.025***	
	(-1.44)	(-1.56)	(-4.07)	
Observations	29462	29462	29462	29462
Adjusted R^2	0.944	0.944	0.944	0.944
Branch-Shock FE	Y	Y	Y	Y
Time-Shock FE	Y	Y	Y	Y

Panel B	$12 - month\ CD\ Rates$			
	(1)	(2)	(3)	(4)
Z=	*Small*	*Local*	*Important Market*	*Everything*
$PostShock \times RateSet$	-0.001	-0.003	-0.009**	-0.009**
	(-0.15)	(-0.70)	(-2.08)	(-2.14)
$PostShock \times Treated$	-0.013**	-0.014***	-0.009	-0.008
	(-2.46)	(-2.83)	(-1.63)	(-1.39)
$PostShock \times Treated \times RateSet$	0.056***	0.058***	0.073***	0.072***
	(6.06)	(6.35)	(6.75)	(6.66)
$PostShock \times Z$	-0.001	0.007	0.014***	
	(-0.18)	(1.34)	(3.34)	
$PostShock \times Treated \times Z$	-0.008	-0.006	-0.034***	
	(-0.73)	(-0.45)	(-3.28)	
Observations	29462	29462	29462	29462
Adjusted R^2	0.984	0.984	0.984	0.984
Branch-Shock FE	Y	Y	Y	Y
Time-Shock FE	Y	Y	Y	Y

Table 6: Delegation and deposit volume around natural disasters

This table examines the effect of deposit rate setting delegation on deposit volume around a natural disaster. The dataset consists of two observations per branch on deposit volume prior to or following a natural disaster for branches in treated and control counties that had disaster declarations in the second quarter of a year, 1999-2013. *Log*(Total d*eposits)* is the natural log of deposits balance as of June 30th of the calendar year. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration in the second quarter of a year, 0 for adjacent unaffected counties. Treated and control counties were required to have no disaster declarations from the first quarter of the year prior to the disaster through the first quarter of the year of the disaster. *PostShock* takes the value of 1 in the year (July to June) of the disaster declaration in the second quarter of a year. The regression includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* a*ssets*), *Log* (*Total* d*eposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*), other organizational structure characteristics (*Small, Local, Important Market)*, and interactions between the organizational structure variables and treatment. The coefficients on the bank, deposit market, and organizational structure variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Log(Total deposits)	
	(1)	(2)
Treated	-0.004	
	(-0.38)	
RateSet	-0.009	
	(-0.08)	
PostShock	0.004	
	(0.86)	
Treated × *RateSet*	0.001	
	(0.04)	
PostShock × *RateSet*	-0.021**	-0.025***
	(-2.55)	(-2.78)
PostShock × *Treated*	0.022***	0.021***
	(3.70)	(3.43)
PostShock × *Treated* × *RateSet*	0.038***	0.040***
	(2.88)	(2.71)
Observations	72908	72908
Adjusted R^2	0.964	0.961
Branch FE	Y	N
Year FE	Y	N
Branch-Shock FE	N	Y
Year-Shock FE	N	Y

Table 7: Delegation and mortgage lending around natural disasters

This table examines the effect of deposit rate setting delegation on mortgage lending around a natural disaster. The dataset consists of two observations on mortgage lending of the year prior to or following a natural disaster for banks in treated and control counties that had disaster declarations, 2000-2013. *Log (Mortgages)* is the natural log of mortgage originations of the calendar year. *RateSet_County* takes the value of 1 for a bank and county if more than 50% of the bank's branches (by deposits) in the county set rates locally, 0 otherwise. *Treated* takes the value of 1 for bank-counties that had a disaster declaration in a year, 0 for adjacent unaffected counties. Treated and control counties were also required to have no disaster declarations in the prior year. *PostShock* takes the value of 1 in the year of the disaster declaration. The regression includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* a*ssets*), *Log* (*Total* d*eposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*), other organizational structure characteristics (*Small, Local, Important Market)*, and interactions between the organizational structure variables and treatment. The coefficients on the bank, deposit market, and organizational structure variables are not reported for compactness. Standard errors are clustered at the bank-county level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parenthesis.

	Log(Mortgages)	
	(1)	(2)
Treated	-0.006	
	(-0.28)	
RateSet_County	0.238	
	(1.27)	
PostShock	-0.079***	
	(-5.66)	
Treated × *RateSet_County*	-0.130***	
	(-2.80)	
PostShock × *RateSet_County*	-0.017	-0.018
	(-0.62)	(-0.66)
PostShock × *Treated*	-0.006	-0.017
	(-0.38)	(-1.05)
PostShock × *Treated* × *RateSet_County*	0.091**	0.091**
	(2.54)	(2.40)
Observations	35822	35822
Adjusted R^2	0.933	0.935
Bank-County FE	Y	N
Year FE	Y	N
Bank-County-Shock FE	N	Y
Year-Shock FE	N	Y

Table 8: Delegation and house prices around natural disasters

This table examines the effect of deposit rate setting delegation on house prices around a natural disaster. MSA-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. Δ*HPI* is the percentage change in an MSA-level house price index. *RateSet_MSA (Agg)* takes the value of 1 if more than 50% of branches in the MSA (by deposits) set their own deposit rates locally (within the MSA), 0 otherwise. *Treated* takes the value of 1 if the MSA had a disaster declaration, 0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. The regression includes a set of control variables for deposit market characteristics (*HHI(MSA))* and organizational structure characteristics (*Small, Local, Important Market)* — all of which are aggregated to the MSA level — and interactions between the organizational structure variables and treatment. The coefficients on the deposit market and organizational structure variables are not reported for compactness. Standard errors are clustered at the MSA level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Δ*HPI* (%)	
	(1)	(2)
Treated_MSA	-0.070	
	(-0.99)	
RateSet_MSA (Agg)	0.068	
	(1.14)	
PostShock	-0.125***	
	(-2.87)	
RateSet_MSA (Agg) × *Treated_MSA*	0.059	
	(0.94)	
RateSet_MSA (Agg) × *PostShock*	-0.082**	-0.020*
	(-2.22)	(-1.84)
Treated_MSA × *PostShock*	-0.030	-0.033*
	(-0.48)	(-1.91)
RateSet_MSA (Agg) × *PostShock* × *Treated_MSA*	0.047	0.034**
	(0.82)	(1.97)
Observations	9832	9832
Adjusted R^2	0.619	0.983
MSA FE	Y	N
Time FE	Y	N
MSA-Shock FE	N	Y
Time-Shock FE	N	Y

Table 9: Delegation and deposit rates around natural disasters: Instrumental variables

This table examines the effect of deposit rate setting delegation on deposit rates observed around a natural disaster, instrumenting for delegation using bank mergers. Panel A reports the first stage regression, Panel B reports the second stage. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration, 0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. *Merger* takes the value of 1 if the bank was involved in a merger in the year prior to the disaster declaration, 0 otherwise. Control variables are the same as in Table 4 but coefficients on these variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

Panel A: First Stage				
	Money Market Rates		*12-month CD Rates*	
	PostShock × RateSet	*PostShock × Treated × RateSet*	*PostShock × RateSet*	*PostShock × Treated × RateSet*
PostShock × Merger	0.317***	0.000	0.317***	0.000
	(46.53)	(0.00)	(46.53)	(0.00)
PostShock × Treated × Merger	- 0.497***	-0.180***	- 0.497***	-0.180***
	(-26.08)	(-10.06)	(-26.08)	(-10.06)
Observations	29462	29462	29462	29462
F-Statistics	1141.79	-	1141.79	-
Sanderson-Windmeijer Chi-Square	2165.78	2283.92	2165.78	2283.92
Sanderson-Windmeijer F-Statistics	2165.46	2283.58	2165.46	2283.58
Branch-Shock FE	Y	Y	Y	Y
Time-Shock FE	Y	Y	Y	Y

Panel B: Second Stage	*Deposit Rate*	
	Money Market Rates	*12-month CD Rates*
$PostShock \times Treated$	-0.048***	0.021
	(-3.83)	(0.60)
$PostSho\widehat{ck \times} RateSet$	-0.123***	-0.315***
	(-14.00)	(-15.38)
$PostShock \times \widehat{Treated} \times RateSet$	0.155***	0.167**
	(5.41)	(2.31)
Observations	29462	29462
Adjusted R^2	-1.109	-1.267
Branch-Shock FE	Y	Y
Time-Shock FE	Y	Y

Table 10: Delegation of deposit rate setting versus loan rate setting

This table examines separately the effects of deposit rate setting delegation versus loan rate setting delegation on deposit rate around natural disasters. We introduce a dummy into our baseline specifications that measures the extent to which mortgage loan rates are set locally. *LoanRateSet* takes the value of 1 if a branch sets mortgage loan rates locally (within the county), 0 otherwise. Control variables are the same as in Tables 4. Coefficients on control variables are omitted for compactness. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Deposit Rate			
	Money Market Rates		*12-month CD Rates*	
	(1)	(2)	(1)	(2)
PostShock × *Treated*	-0.017***	-0.014***	-0.007	-0.012**
	(-4.05)	(-3.31)	(-1.38)	(-2.26)
RateSet × *PostShock*	-0.008**	-0.010***	0.007*	0.000
	(-2.35)	(-2.79)	(1.80)	(0.11)
RateSet × *PostShock* × *Treated*	0.046***	0.050***	0.047***	0.053***
	(5.36)	(5.22)	(3.35)	(3.32)
LoanRateSet × *PostShock*	-0.010***	0.002	-0.024***	-0.025***
	(-2.83)	(0.56)	(-4.80)	(-5.10)
LoanRateSet × *PostShock* × *Treated*	-0.020**	-0.027***	0.002	0.001
	(-2.45)	(-3.21)	(0.13)	(0.10)
Observations	21700	21700	21700	21700
Adjusted R^2	0.878	0.945	0.980	0.984
Branch FE	Y	N	Y	N
Time FE	Y	N	Y	N
Branch-Shock FE	N	Y	N	Y
Time-Shock FE	N	Y	N	Y

Table 11: Delegation versus other organizational structure characteristics (Distance)

This table examines the effect of distance between a branch and its deposit rate setter on deposit rates observed around a natural disaster. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *Distance* is a quartile value from 1 to 4 for the distance between the branch and its rate setter in miles (1 being the bottom quartile). For rate setter, *Distance* is set to be zero. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration, 0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. *Follower* identifies branches that follow deposit interest rates set by another branch in other counties. The regression also includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* assets), *Log* (*Total* deposits), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*). The coefficients on these variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Deposit Rate	
	Money Market Rates	12-month CD Rates
	(1)	(2)
Treated × *PostShock*	0.017**	0.021*
	(2.41)	(1.70)
Follower × *PostShock*	-0.009*	0.006
	(-1.76)	(0.86)
Treated × *Follower* × *PostShock*	-0.013	-0.031*
	(-1.27)	(-1.90)
Distance × *PostShock*	-0.002	-0.004**
	(-1.49)	(-2.22)
Treated × *Distance* × *PostShock*	0.001	0.011**
	(0.30)	(2.18)
Follower × *Distance* × *PostShock*	0.008***	-0.001
	(3.80)	(-0.36)
PostShock × *Treated* × *Follower* × *Distance*	-0.008*	-0.013*
	(-1.82)	(-1.92)
Observations	29462	29462
Adjusted R^2	0.944	0.984
Branch-Shock FE	Y	Y
Time-Shock FE	Y	Y

Appendix A: Variable definitions

Variable	Definition	Level
Standard deviation of deposit rates	Standard deviation of deposit interest rates across the branches of a bank in a particular month	Bank
Decentralization	Fraction of a bank's branches that not set their own deposit rate	Bank
RateSet	Dummy variable that equals 1 if a branch sets its own deposit rates or follows the rate set by another branch in the same county. Account-type specific.	Branch
RateSet_County	Dummy variable that equals 1 if more than 50% of a bank's branches (by deposits) in the county set their own deposit rates or follow rates set by other branches within the county. Set as of June 30th of the year prior to a disaster.	Bank-County
RateSet_MSA (Agg)	Dummy variable that equals 1 if more than 50% of branches in the MSA (by deposits) set their own deposit rates or follow rates set by other branches within the same MSA. Set three months before a disaster month.	MSA
Treated	Dummy variable that equals 1 for bank branches in counties that experience a natural disaster.	Branch
TreatedQ2	Dummy variable that equals 1 for counties that experienced a natural disaster during the second quarter of a year and no disaster during its previous five quarters.	County
TreatedY	Dummy variable that equals 1 for counties that experienced a natural disaster during the year and no disaster during the previous year.	County
Treated_MSA	Dummy variable that equals 1 for MSAs that experienced a natural disaster.	MSA
PostShock	Dummy variable that equals 1 for the bank branches or bank-counties in the treatment and control counties or MSAs for the post-disaster period.	Branch, Bank-County, MSA
Market controls		
HHI (County)	Herfindahl-Hirschman Index for a county level deposit market as of June 30th	County
HHI (MSA)	Herfindahl-Hirschman Index for an MSA level deposit market as of June 30th	MSA
Bank level controls		
Number of Counties	Number of counties in which a bank has a branch	Bank
Log (Total Assets)	The logarithm of a bank's total assets	Bank
Log (Total Deposits)	The logarithm of a bank's total deposits	Bank
HHI (Bank Average)	Deposit-weighted average of HHIs in counties in which a bank has a branch.	Bank

Variable	Definition	Level
BHC	A dummy that equals 1 if a bank is part of a bank-holding company	Bank
Small	Dummy variable that equals 1 if a bank has less than 2 billion in assets.	Bank
SmallMSA	Share of deposits in an MSA held by small banks	MSA
Local	Dummy variable that equals 1 if a bank obtains more than 65% of its deposits from a single county.	Bank
LocalMSA	Share of deposits in an MSA held by local banks	MSA
Important Market	Dummy variable that equals 1 if a county is in the top quartile of deposits among the counties in which a bank has branches.	Bank-County
Important MarketMSA	Share of deposits in an MSA held by banks for which the MSA is an important MSA, defined as the MSA being in the top quartile of MSAs in which a bank has branches in terms of the bank's deposit balance	MSA

Internet Appendix for Decision-making delegation in banks

Table A.1: Additional summary statistics

Panel A: Effect on heterogeneity of deposit rate across branches (bank × month)						
	N	Mean	S.D.	25th	Median	75th
Standard Deviation of MM rates	305781	0.007	0.057	0.000	0.000	0.000
Standard Deviation of CD rates	305781	0.007	0.048	0.000	0.000	0.000
Decentralization (dummy)	305781	0.252	0.158	0.125	0.250	0.333
Total Asset, $ billions	305781	3.327	48.867	0.120	0.230	0.485
Log (Total Assets)	305781	12.529	1.286	11.697	12.346	13.091
Total Deposit, $ billions	305781	2.310	32.497	0.101	0.193	0.395
Log (Total Deposits)	305781	12.339	1.256	11.523	12.169	12.887
BHC (dummy)	305781	0.886	0.318	1.000	1.000	1.000
Number of Counties	305781	5.873	29.536	1.000	2.000	4.000
HHI, bank average	305781	0.223	0.114	0.146	0.199	0.271

Panel B: Effect on annual deposit balance growth (branch × year)						
	N	Mean	S.D.	25th	Median	75th
Log(Total deposits)	72908	10.461	1.057	9.869	10.504	11.106
Treated (dummy)	72908	0.304	0.460	0.000	0.000	1.000
RateSet (dummy)	72908	0.460	0.498	0.000	0.000	1.000
Small (dummy)	72908	0.424	0.494	0.000	0.000	1.000
Local (dummy)	72908	0.266	0.442	0.000	0.000	1.000
ImportantMarket (dummy)	72908	0.428	0.495	0.000	0.000	1.000
HHI, county	72908	0.206	0.114	0.129	0.174	0.248

Table A.1 – Continued

Panel C: Effect on annual mortgage lending growth (bank × county × year)						
	N	Mean	S.D.	25th	Median	75th
Log(Mortgages)	35822	8.931	1.807	7.766	8.912	10.074
Treated (dummy)	35822	0.302	0.459	0.000	0.000	1.000
RateSetAbvMedCounty (dummy)	35822	0.353	0.478	0.000	0.000	1.000
Small (dummy)	35822	0.499	0.500	0.000	0.000	1.000
Local (dummy)	35822	0.273	0.446	0.000	0.000	1.000
ImportantMarket (dummy)	35822	0.286	0.452	0.000	0.000	1.000
HHI, county	35822	0.212	0.123	0.131	0.181	0.251

Panel D: Effect on monthly HPI growth (MSA × time)						
	N	Mean	S.D.	25th	Median	75th
ΔHPI (%)	9832	0.167	0.798	-0.270	0.215	0.654
TreatedMSA (dummy)	9832	0.157	0.363	0.000	0.000	0.000
RateSetAbvMedMSA (dummy)	9832	0.427	0.495	0.000	0.000	1.000
SmallMSA	9832	0.328	0.202	0.166	0.290	0.454
LocalMSA	9832	0.208	0.174	0.074	0.162	0.294
ImportantMarketMSA	9832	0.513	0.271	0.318	0.496	0.726
HHI, MSA	9832	0.169	0.076	0.127	0.153	0.188

Table A.2: Regression results with data from 2007-2013

This table examines the effect of deposit rate setting delegation on deposit rate (Panel A), deposit volume (Panel B), mortgage lending (Panel C) and house prices (Panel D) around a natural disaster only with the data from 2007-2013. Except for the differences of the sample periods, all other specifications of Panels A, B, C, and D are the same as in Tables 4, 6, 7, and 8, respectively. Coefficients on control variables are omitted for compactness. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

Panel A: Effect on Deposit Rate	*Deposit Rate*			
	Money Market Rates		12-month CD Rates	
	(1)	(2)	(1)	(2)
Treated	0.032		-0.038*	
	(1.07)		(-1.96)	
RateSet	-0.305**		0.245*	
	(-2.19)		(1.88)	
PostShock	0.009		-0.030***	
	(1.23)		(-4.27)	
Treated × *RateSet*	0.003		0.108***	
	(0.06)		(2.99)	
PostShock × *RateSet*	-0.014***	-0.010***	0.008**	-0.004
	(-4.94)	(-3.93)	(1.98)	(-0.89)
PostShock × *Treated*	-0.017***	-0.017***	-0.003	-0.012**
	(-4.18)	(-4.15)	(-0.54)	(-2.24)
PostShock × *Treated* × *RateSet*	0.033***	0.035***	0.044***	0.054***
	(5.28)	(5.74)	(4.77)	(5.56)
Observations	27242	27242	27242	27242
Adjusted R^2	0.858	0.936	0.975	0.981
Branch FE	Y	N	Y	N
Time FE	Y	N	Y	N
Branch-Shock FE	N	Y	N	Y
Time-Shock FE	N	Y	N	Y

Table A.2 – Continued

Panel B: Effect on Deposit Balance	*Ln(Deposit)*	
	(1)	(2)
Treated	-0.024**	
	(-2.34)	
PostShock	0.002	
	(0.36)	
Treated × *RateSet*	-0.021	
	(-0.99)	
PostShock × *RateSet*	-0.017**	-0.023**
	(-2.00)	(-2.35)
PostShock × *Treated*	0.031***	0.027***
	(4.71)	(4.12)
PostShock × *Treated* × *RateSet*	0.035**	0.039**
	(2.46)	(2.50)
Observations	66002	66002
Adjusted R^2	0.966	0.959
Branch FE	Y	N
Year FE	Y	N
Branch-Shock FE	N	Y
Year-Shock FE	N	Y

Table A.2 – Continued

Panel C: Effect on Mortgage Lending	*Ln(Mortgage)*	
	(1)	(2)
Treated	0.001	
	(0.06)	
RateSet_County	0.222*	
	(1.73)	
PostShock	-0.036**	
	(-2.30)	
Treated × *RateSet_County*	-0.057	
	(-1.08)	
PostShock × *RateSet_County*	-0.009	-0.006
	(-0.34)	(-0.23)
PostShock × *Treated*	-0.019	-0.024
	(-1.14)	(-1.35)
PostShock × *Treated* × *RateSet_County*	0.093**	0.082**
	(2.46)	(2.04)
Observations	29832	29832
Adjusted R^2	0.943	0.936
Bank-County FE	Y	N
Year FE	Y	N
Bank-County-Shock FE	N	Y
Year-Shock FE	N	Y

Table A.2 – Continued

Panel D: Effect on House Price Index	ΔHPI (%)	
	(1)	(2)
Treated_MSA	-0.137	
	(-1.47)	
RateSet_MSA (Agg)	-0.061	
	(-0.72)	
PostShock	-0.112**	
	(-2.05)	
RateSet_MSA (Agg) × *Treated_MSA*	0.001	
	(0.01)	
RateSet_MSA (Agg) × *PostShock*	-0.092**	-0.034**
	(-2.02)	(-2.31)
Treated_MSA × *PostShock*	-0.012	-0.043
	(-0.12)	(-1.59)
RateSet_MSA (Agg) × *PostShock* × *Treated_MSA*	0.148*	0.040
	(1.74)	(1.52)
Observations	5714	5714
Adjusted R^2	0.686	0.981
MSA FE	Y	N
Time FE	Y	N
MSA-Shock FE	N	Y
Time-Shock FE	N	Y

Table A.3: Delegation and deposit rates around natural disasters (matching)

This table examines the effect of deposit rate setting delegation on deposit rates observed around a natural disaster. Every branch with *RateSet*=1 is matched with a control branch with *RateSet*=0 that is closest in terms of total deposit volume. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration, 0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. The regression includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* a*ssets*), *Log* (*Total* d*eposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county))*), other organizational structure characteristics (*Small, Local, Important Market)*, and interactions between the organizational structure variables and treatment. The coefficients on the bank, deposit market, and organizational structure variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Deposit Rate	
	Money Market Rates	12-month CD Rates
	(1)	(2)
PostShock × *Treated*	0.014	0.023*
	(1.50)	(1.82)
PostShock × *RateSet*	-0.006	0.007
	(-1.29)	(1.12)
PostShock × *Treated* × *RateSet*	0.028***	0.044***
	(3.03)	(3.13)
Observations	24276	24276
Adjusted R^2	0.965	0.987
Branch-Shock FE	Y	Y
Time-Shock FE	Y	Y

Table A.4: Delegation and deposit rates around natural disasters (within-time bank FE)

This table examines the effect of deposit rate setting delegation on deposit rates observed around a natural disaster. This regression adds within-time and bank fixed effects. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration ,0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. The regression also includes a set of control variables for bank and deposit market characteristics (Log ($Total$ assets), Log ($Total$ deposits), BHC, HHI ($Bank\ average$), $Number\ of\ counties$, and $HHI(county)$). The coefficients on these variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Deposit Rate	
	Money Market Rates	12-month CD Rates
	(1)	(2)
Treated	0.039	-0.039**
	(1.39)	(-2.03)
RateSet	-0.170	0.199*
	(-1.52)	(1.78)
PostShock	-0.003	-0.020***
	(-0.38)	(-2.80)
Treated × *RateSet*	0.005	0.069**
	(0.12)	(2.01)
PostShock × *RateSet*	-0.012***	0.009**
	(-4.29)	(2.23)
PostShock × *Treated*	-0.017***	-0.002
	(-4.75)	(-0.34)
PostShock × *Treated* × *RateSet*	0.032***	0.043***
	(5.50)	(4.89)
Observations	29462	29462
Adjusted R^2	0.862	0.977
Time-Bank FE	Y	Y

Table A.5: Delegation and deposit rates around natural disasters (dynamics)

This table examines the dynamics of the effect of deposit rate setting delegation on deposit rates observed around a natural disaster. Observations are branch-month for bank branches located in treated and control counties in a seven-month window centered on the disaster month. *PostShock (k),* where *k* ranges from -3 to +3, are a set of seven dummy variables that represent the months relative to the disaster month. The month before the shock declaration (-1) is the omitted category. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration, 0 for adjacent unaffected counties. Panel A reports the results without matching. Panel B reports the results after matching every branch with *RateSet*=1 with a control branch with *RateSet*=0 that is closest in terms of total deposit volume. The regression includes a set of control variables for bank and deposit market characteristics (*Log* (*Total assets*), *Log* (*Total deposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*), other organizational structure characteristics (*Small, Local, Important Market)*, and interactions between the organizational structure variables and treatment. The coefficients on the bank, deposit market, and organizational structure variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

Panel A: No Matching	*Deposit Rate*	
	Money Market Rates	12-month CD Rates
	(1)	(2)
PostShock (-3) × Treated × RateSet	-0.007*	-0.042***
	(-1.76)	(-6.06)
PostShock (-2) × Treated × RateSet	-0.013***	-0.032***
	(-4.64)	(-7.01)
PostShock (0) × Treated × RateSet	0.039***	0.046***
	(6.78)	(4.33)
PostShock (+1) × Treated × RateSet	0.045***	0.049***
	(6.54)	(4.52)
PostShock (+2) × Treated × RateSet	0.040***	0.049***
	(5.86)	(4.67)
PostShock (+3) × Treated × RateSet	0.031***	0.046***
	(4.20)	(4.32)
Observations	103117	103117
Adjusted R^2	0.945	0.986
Branch-Shock FE	Y	Y
Month-Shock FE	Y	Y

Table A.5 – Continued

Panel B: Matching	*Deposit Rate*	
	Money Market Rates	12-month CD Rates
	(1)	(2)
PostShock (-3) × Treated × RateSet	0.010*	-0.005
	(1.70)	(-0.47)
PostShock (-2) × Treated × RateSet	-0.005	0.002
	(-1.15)	(0.23)
PostShock (0) × Treated × RateSet	0.039***	0.043***
	(5.44)	(2.97)
PostShock (+1) × Treated × RateSet	0.037***	0.038***
	(4.66)	(2.68)
PostShock (+2) × Treated × RateSet	0.032***	0.033**
	(3.89)	(2.42)
PostShock (+3) × Treated × RateSet	0.009	0.058***
	(0.94)	(3.72)
Observations	84966	84966
Adjusted R^2	0.953	0.986
Branch-Shock FE	Y	Y
Month-Shock FE	Y	Y

Table A.6: Delegation and deposit rates around natural disasters (non-local disasters)

This table examines the effect of deposit rate setting delegation on deposit rates observed around a natural disaster. This regression relaxes definition of local disasters: it is not required that all adjacent counties are unaffected by this or any other disaster in the seven months window. Branch-month panel with a seven-month window centered on the disaster month is collapsed into one observation for the pre-period and one for the post-period. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration ,0 for adjacent unaffected counties. *PostShock* takes the value of 1 in the post-period. The regression includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* a*ssets*), *Log* (*Total* d*eposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*), other organizational structure characteristics (*Small, Local, Important Market)*, and interactions between the organizational structure variables and treatment. The coefficients on these variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Deposit Rate	
	Money Market Rates	12-month CD Rates
	(1)	(2)
PostShock × *RateSet*	-0.010***	-0.009***
	(-6.25)	(-4.21)
PostShock × *Treated*	-0.012***	-0.005**
	(-5.86)	(-2.16)
PostShock × *Treated* × *RateSet*	0.021***	0.007*
	(8.08)	(1.92)
Observations	197610	197610
Adjusted R^2	0.959	0.989
Branch-Shock FE	Y	Y
Time-Shock FE	Y	Y

Table A.7: Delegation and deposit volume around natural disasters (matching)

This table examines the effect of deposit rate setting delegation on deposit volume around a natural disaster after matching every branch with *RateSet*=1 with a control branch with *RateSet*=0 that is closest in terms of bank and branch size. The dataset consists of two observations per branch on deposit volume prior to or following a natural disaster for branches in treated and control counties that had disaster declarations in the second quarter of a year, 2000-2013. *Ln*(*Deposit)* is the natural log of deposits balance as of June 30th of the calendar year. *RateSet* takes the value of 1 for branches that set rates locally (within the county), 0 otherwise. *Treated* takes the value of 1 for branches located in a county that had a disaster declaration in the second quarter of a year, 0 for adjacent unaffected counties. Treated and control counties were required to have no disaster declarations from the first quarter of the year prior to the disaster through the first quarter of the year of the disaster. *PostShock* takes the value of 1 in the year (July to June) of the disaster declaration in the second quarter of a year. The regression includes a set of control variables for bank and deposit market characteristics (*Log* (*Total* a*ssets*), *Log* (*Total* d*eposits*), *BHC*, *HHI* (*Bank average*), *Number of counties*, and *HHI(county)*), other organizational structure characteristics (*Small, Local, Important Market)*, and interactions between the organizational structure variables and treatment. The coefficients on the bank, deposit market, and organizational structure variables are not reported for compactness. Standard errors are clustered at the branch level. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

	Ln(Deposit)	
	(1)	(2)
Treated	-0.040	
	(-1.31)	
PostShock	-0.020***	
	(-2.62)	
Treated × *RateSet*	0.022	
	(0.63)	
PostShock × *RateSet*	0.006	0.007
	(0.56)	(0.71)
PostShock × *Treated*	0.031**	0.041***
	(2.24)	(2.91)
PostShock × *Treated* × *RateSet*	0.031*	0.032*
	(1.68)	(1.80)
Observations	65096	65096
Adjusted R^2	0.974	0.974
Branch FE	Y	N
Year FE	Y	N
Branch-Shock FE	N	Y
Year-Shock FE	N	Y

Table A.8: Delegation of deposit rate setting versus loan rate setting

This table examines separately the effects of deposit rate setting delegation versus loan rate setting delegation on deposits, mortgage lending, and house prices around natural disasters. We introduce a dummy into each of our baseline specifications that measures the extent to which mortgage loan rates are set locally. Panel A reports the deposit volume regressions that focus on disaster declarations in the second quarter of calendar years. *LoanRateSet* takes the value of 1 if a branch sets mortgage loan rates locally within the county, 0 otherwise. Panel B reports the mortgage lending regressions. *LoanRateSet_County* takes the value of 1 if more than 50% of a bank's branches in a county (by deposits) set rates locally within the county. Panel C reports the house price regressions. *LoanRateSet_MSA (Agg)* takes the value of 1 if more than 50% of branches in the MSA (by deposits) set rates locally within the MSA, 0 otherwise. Control variables in the regressions in Panels A, B, and C are the same as in Tables 6, 7, and 8, respectively. Coefficients on control variables are omitted for compactness. Statistical significance at the 10%, 5% and 1% levels is denoted by *, ** and ***, respectively. *t*-statistics are in parentheses.

Panel A: Effect on Deposit Balance	*Ln(Deposit)*	
	(1)	(2)
Treated	-0.001	
	(-0.11)	
PostShock	0.006	
	(0.87)	
Treated × *RateSet*	0.026	
	(0.93)	
PostShock × *RateSet*	-0.024*	-0.030*
	(-1.67)	(-1.79)
PostShock × *Treated*	0.015**	0.015**
	(2.25)	(2.05)
PostShock × *Treated* × *RateSet*	0.043**	0.056***
	(2.20)	(2.67)
LoanRateSet × *Treated*	-0.059	
	(-1.64)	
LoanRateSet × *PostShock*	0.019	0.012
	(1.46)	(0.82)
LoanRateSet × *PostShock* × *Treated*	-0.023	-0.033
	(-1.19)	(-1.62)
Observations	44014	44014
Adjusted R^2	0.970	0.967
Branch FE	Y	N
Year FE	Y	N
Branch-Shock FE	N	Y
Year-Shock FE	N	Y

Table A.8 – Continued

Panel B: Effect on Mortgage Lending	*Ln(Mortgage)*	
	(1)	(2)
Treated	-0.003	
	(-0.16)	
RateSet_County	0.277	
	(1.46)	
PostShock	-0.061***	
	(-4.11)	
Treated × *RateSet_County*	-0.135***	
	(-2.77)	
PostShock × *RateSet_County*	-0.010	-0.011
	(-0.36)	(-0.40)
PostShock × *Treated*	-0.008	-0.016
	(-0.46)	(-0.88)
PostShock × *Treated* × *RateSet_County*	0.088**	0.094**
	(2.43)	(2.43)
LoanRateSet_County	-0.208***	
	(-5.58)	
Treated × *LoanRateSet_County*	0.003	
	(0.09)	
PostShock × *LoanRateSet_County*	-0.024	-0.025
	(-1.13)	(-1.18)
PostShock × *Treated* × *LoanRateSet_County*	0.009	-0.006
	(0.30)	(-0.20)
Observations	35822	35822
Adjusted R^2	0.933	0.935
Bank-County FE	Y	N
Year FE	Y	N
Bank-County-Shock FE	N	Y
Year-Shock FE	N	Y

Table A.8 – Continued

Panel C: Effect on House Price Index	ΔHPI (%)	
	(1)	(2)
Treated_MSA	-0.103	
	(-1.15)	
RateSet_MSA (Agg)	-0.011	
	(-0.15)	
PostShock	-0.192***	
	(-4.21)	
RateSet_MSA (Agg) × *Treated_MSA*	0.066	
	(0.83)	
RateSet_MSA (Agg) × *PostShock*	-0.046	-0.030**
	(-1.00)	(-2.28)
Treated_MSA × *PostShock*	-0.045	-0.038*
	(-0.61)	(-1.86)
RateSet_MSA (Agg) × *PostShock* × *Treated_MSA*	0.018	0.044**
	(0.25)	(2.15)
LoanRateSet_MSA (Agg)	0.126*	
	(1.88)	
LoanRateSet_MSA (Agg) × *Treated_MSA*	-0.099	
	(-1.25)	
LoanRateSet_MSA (Agg) × *PostShock*	-0.057	0.012
	(-1.25)	(0.89)
LoanRateSet_MSA (Agg) × *PostShock* × *Treated_MSA*	0.116	-0.019
	(1.61)	(-0.95)
Observations	8420	8420
Adjusted R^2	0.640	0.983
MSA FE	Y	N
Time FE	Y	N
MSA-Shock FE	N	Y
Time-Shock FE	N	Y