Bank Regulation and Monetary Policy Transmission: Evidence from the U.S. States Liberalization *

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Abstract

This paper studies the impact of geographic banking restrictions on monetary policy transmission. Exploiting the staggered state-level deregulation of U.S. banking from the late 1970s to the early 1990s, we find that interstate deregulation sharply increased the responsiveness of bank lending to monetary shocks, nearly doubling it. The effect occurred primarily for small and illiquid banks, pointing to a strengthening of the bank lending channel of monetary transmission. We find that this is especially due to a lower propensity of small banks affiliated with complex bank holding companies to insulate borrowers from monetary contractions.

Keywords: Bank regulation; Bank lending channel; Monetary policy
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1 Introduction

Recent decades have seen the liberalization of banking systems across the globe.[1] A key component of this liberalization process has often consisted of the removal of geographic limits on banks' activity. Major examples of a deregulation of geographic banking restrictions include the liberalization that started in the United States in the late 1970s and the creation of a single banking market in the European Union following the adoption of the Second Banking Directive in 1989. While the macroeconomic implications of these regulatory changes are intensely debated, a relatively unexplored aspect is their impact on monetary policy. And yet the impact of bank regulatory reforms continues to be a top focus for monetary policymakers, who need to adjust the conduct of monetary policy to the evolving regulatory environment (Yellen (2017); BIS (2015)).

Bank lending can be a relevant channel through which monetary policy is transmitted to the broader economy.[2] A strand of literature in the "bank lending view" finds evidence that changes in bank lending contribute to the transmission of monetary shocks (see, e.g., Kashyap and Stein (1995), Kashyap and Stein (2000), and the discussion below). This channel appears to be particularly driven by the lending behavior of smaller banks (Jayaratne and Morgan (2000)) and to especially influence small firms, which often have limited access to non-bank sources of finance. Given the ample evidence that recent decades' regulatory changes have induced major transformations of the banking sector, it is natural to wonder whether such reforms impact the transmission of monetary policy through bank lending. This paper addresses this question by focusing on the geographic limitations on banks' activity. To this end, we exploit the natural experiment provided by the staggered state-level removal of geographic banking restrictions in the United States from the late 1970s to the early 1990s. During this period, states abolished restrictions on the ability of out-of-state bank holding companies to acquire and operate in-state banks (interstate banking deregulation) and on the ability of banks headquartered within a state to open additional branches (intrastate branching deregulation).

We utilize a rich data set containing information on the universe of commercial banks within the United States, as well as a plausibly exogenous measure of monetary policy shocks introduced by Romer and Romer (2004). We further complement the

[1] See, e.g., Jayaratne and Strahan (1998), Berger, Demsetz, and Strahan (1999), and Berger, Demirguc-Kunt, Levine, and Haubrich (2004).

[2] See Boivin, Kiley, and Mishkin (2010) for an overview of the channels of monetary transmission.

data with granular information on the size and complexity of bank holding companies, including a unique measure of their geographic distance from their bank subsidiaries. Our quarterly data set begins in 1977, just prior to the onset of the deregulation. The period of staggered state-level deregulation lasted until 1994, at which point 49 states and the District of Columbia had removed geographic banking restrictions. We consider the 1977-1994 period, drawing on a large sample of roughly 16,000 banks over 75 quarters for a total of over 800,000 bank-quarter observations. We also verify that the results of the analysis hold for a period extended to more recent times, up to the great financial crisis (1977-2008).

The liberalization process resulted in higher growth rates (Jayaratne and Strahan (1996)), a homogenization of state business cycles (Morgan, Rime, and Strahan (2004)) and a reduction in income inequality (Beck, Levine, and Levkov (2010)).[3] Curiously, thus far little work has been done on the relationship between geographic banking liberalization and monetary policy transmission. Hsu (2017) studies the impact of liberalization on firm-level investment reaction to monetary policy. To the best of the authors' knowledge, however, the consequences of geographic liberalization for the transmission of monetary policy through bank lending have yet to be studied.

Our first set of results show that bank lending becomes more responsive to monetary policy after a bank's home state removes interstate banking restrictions. Following the removal of interstate restrictions the response of real lending growth to a 100 basis point monetary shock nearly doubles from 2 percentage points to 4 percentage points. By contrast, the removal of intrastate branching restrictions appears to have no effect. We document with a parallel trends analysis that this finding is not driven by states with higher responsiveness to monetary policy deregulating early. We further assuage identification concerns by showing that the results continue to hold when we augment the baseline specification with state-specific time trends and interactions of monetary policy shocks with a variety of state-specific characteristics. Finally, we document that the results are also consistent across a battery of alternative specifications, including varying levels of fixed effects and explicitly controlling for the period of non-borrowed reserve targeting under the Volcker Fed.[4]

Exploiting the rich bank-level heterogeneity in our data, we next study whether the impact of interstate banking deregulation on the responsiveness of lending to monetary policy can be explained by a change in the strength of the bank lending channel

[3] See also Black and Strahan (2002) and Sun and Yannelis (2016) for other works on the effects of the liberalization.

[4] We find that the results are driven especially by contractionary monetary shocks.

of monetary policy transmission (as defined, e.g., by Kashyap and Stein (1995) and Kashyap and Stein (2000)). According to the bank lending view, a contractionary monetary policy shock raises the cost of retail deposits. If banks cannot perfectly substitute retail deposits with wholesale funding, they will contract the asset side of their balance sheets, including loans. To help isolate a bank lending channel of transmission, the literature has identified bank characteristics that influence the strength of this channel. On the liability side, for small banks it can be hard to compensate retail deposits with wholesale funding (Kashyap and Stein (1995)). On the asset side, when confronted with an increasing cost of retail deposits, illiquid banks will be especially inclined to curtail loans to avoid depleting more liquid assets (e.g., securities) below a dangerously low level (Kashyap and Stein (2000)). Based on these arguments in the literature, to identify a change in the strength of the bank lending channel we investigate the role of bank-level heterogeneity in explaining the greater sensitivity of lending to monetary policy after interstate deregulation. We find that interstate deregulation increases the lending responsiveness for small banks only. Within the category of small banks those that are relatively illiquid see the largest increase in lending responsiveness, pointing to a strengthening of the bank lending channel. Consistent with this interpretation, the loan rates on a bank's loan portfolio also become more responsive, indicating that monetary policy shocks lead to a more pronounced shift in loan supply schedules following the abolition of interstate banking restrictions.

In the second part of the paper, we consider possible mechanisms through which interstate deregulation can have strengthened the bank lending channel of monetary policy transmission. Building on previous literature, we investigate three leading mechanisms: bank market structure, loan portfolio composition, and bank organizational structure (depth and complexity). We find in our data that the deregulation affected bank market structure by increasing average bank market power and local (county-level) banking concentration. However, in our data banks with greater market power are less responsive to monetary policy and banking concentration has no impact on the link between monetary policy and bank lending.

Deregulation may also induce a structural change in the strength of the lending channel by shaping the composition of bank loan portfolios. Den Haan, Sumner, and Yamashiro (2007) document that monetary policy shocks have an asymmetric effect on commercial and industrial loans relative to real estate and consumer loans. Thus, a possible conjecture is that interstate deregulation shifted loan portfolios towards a type of lending that is relatively more sensitive to monetary policy. Yet, we find that

the deregulation has only a small impact on loan portfolio composition. Further, all three types of loans become more responsive to monetary policy after the deregulation at roughly the same magnitude.

A third leading mechanism through which interstate banking deregulation can trigger a structural change in the lending channel is by impacting bank organizational structure. The ability of bank holding companies to operate across greater geographical distance can influence banks' organizational structure in two distinct ways: by increasing organizational depth and by increasing organizational complexity. Ashcraft (2006) documents that banks affiliated with a multibank holding company are less responsive to monetary policy than stand-alone banks and puts forward the hypothesis that the deeper internal capital markets of holding companies help affiliated banks shield their loan portfolios from adverse shocks. We find this is true prior to interstate deregulation, but that banks affiliated with a holding company actually become more responsive to monetary policy post-deregulation.

After the removal of interstate banking restrictions small banks affiliated with a holding company are unique in responding to contractionary monetary policy by more strongly scaling down their loan portfolios, while retaining their holdings of securities. We conjecture that this may be driven by an increasing complexity of bank organizational structure leading banks affiliated with holding companies to engage more in transactional lending and less in relationship lending.[5] The literature has documented that banks that engage in customary relationships with borrowers tend to cushion borrowers from contractionary shocks (Beck, Degryse, De Haas, and Van Horen (2018); Petersen and Rajan (1994)). However, the reliance on relationship lending can be discouraged by the increasing organizational complexity associated with deregulation and the resulting consolidation across geographically distant markets. This increasing complexity can lead, in fact, to significant agency problems and organizational diseconomies, making it difficult to act upon the soft information which relationship lending technologies are based on (Berger, Miller, Petersen, Rajan, and Stein (2005); Deng and Elyasiani (2008)).[6] One mechanism that therefore arises as a candidate for rationalizing our findings is a change in the intensity of bank-borrower relationships and the accompanying propensity of banks to insulate their customers from negative

[5] Transactional lending relies on "hard" (codified) information, while relationship lending is based on "soft" (private, non-codified) information garnered by loan officers through personal contacts with borrowers. A complex bank holding company with several management layers can find it costly to process soft information acquired by local loan officers and prefer transactional lending to relationship lending (see, e.g., Berger, Demsetz, and Strahan (1999)).

[6] See Berger and Udell (1995), Berger and Udell (2002), and Degryse and Ongena (2005).

monetary shocks. In this view, after the deregulation and the associated increase in the organizational complexity of bank holding companies, small banks affiliated with a holding company become more prone to curtailing loans in response to an adverse monetary shock.[7]

To further investigate this mechanism, we construct various measures of complexity of bank holding companies: the distance between a bank and its holding company, the size of the holding company, and (as an inverse measure of complexity) the ratio between the size of a bank and that of its holding company. We find that the interstate deregulation raised the measures of complexity of bank holding companies. Moreover, among small affiliated banks, we find that lending responsiveness, and its increase after deregulation, are more pronounced for banks that are farther away from their parent holding company, for banks that are smaller relative to their holding company, and for banks that are affiliated with a larger holding company. Interestingly, the results of a two stage estimation approach also suggest that the increase in complexity of bank holding companies triggered by the deregulation led to a change in lending responsiveness to monetary policy both of newly affiliated banks and of banks already affiliated prior to deregulation.

Finally, we study the implications of deregulation at the aggregated state level. Following deregulation, the additional effect of a contractionary monetary shock on the aggregate lending growth of small bank holding affiliates turns out to be negative, significant, and relatively large at -8 percentage points. These banks make up 16% of total lending on average, hence there is a relevant effect on the responsiveness of total lending at the state level. We also obtain evidence that post-deregulation there is an increase in the sensitivity of state personal income to monetary policy shocks, especially in states with a higher share of small affiliated banks in state-level lending.

The remainder of the paper unfolds as follows. Section 2 details a brief history of geographic banking restrictions in the United States. In Section 3, we discuss the data and the empirical methodology. Section 4 presents the baseline results. Section 5 explores potential explanations. In Section 6, we document the effect of deregulation for aggregate lending at the state level. Section 7 concludes. The online Appendices contain additional details on the analysis as well as supplementary results.

[7] For the effect of mergers, acquisitions, and organizational structure on lending practices, see, e.g., Calomiris and Karceski (2000), Sapienza (2002), and Berger and Bouwman (2009).

2 Geographic Banking Restrictions

Until the mid-1970s most U.S. states imposed restrictions on the ability of banks to expand geographically (Jayaratne and Strahan (1998); Morgan, Rime, and Strahan (2004)). These restrictions typically included an outright ban on out-of-state banks owning in-state banks as well as strict limitations on the number of branches that an in-state bank can operate. Deregulation of these restrictions took place in the majority of states from the mid-1970s to the mid-1990s. Over this time frame, every state other than Hawaii began to allow interstate banking and 35 states removed restrictions on intrastate branching.[8]

Interstate banking was effectively banned by the Douglas amendment to the Bank Holding Company Act of 1956. The amendment stated that a bank holding company (BHC) could not acquire an out-of-state bank unless the state the bank is located in has passed a statute explicitly allowing such transactions. Maine was the first state to pass such a statute and began allowing out-of-state bank holding companies to acquire Maine banks in 1978. Deregulation particularly picked up after passage of the federal Garn-St Germain Act of 1982, which amended the Bank Holding Company Act to allow out-of-state bank holding companies to acquire failed banks or thrifts in any other state. States began entering reciprocal regional or national agreements through which bank holding companies in any state which had agreed to the arrangement could purchase banks operating in any of the other states.

Restrictions on intrastate branching were often removed in three steps. First, BHCs would be allowed to own multiple banks within one state, with each subsidiary operating as a separate institution - e.g., a depositor at one subsidiary could not access funds at a different subsidiary. Second, banks were allowed to establish additional branches through mergers and acquisitions (M&A). Finally, unrestricted branching was permitted in which banks were free to open new within-state branches as they pleased. The literature has focused on the second step, allowing branching via M&A, as the most important one. Most states had removed restrictions on in-state BHC expansion by the mid-1970s. Of the 15 states that removed such restrictions after 1975, this often occurred around the same time that M&A branching restrictions were abolished. Similarly, most states allowed unrestricted intrastate branching only a short time after allowing M&A branching.

Table A.1 in the Appendix lists the year in which each state and the District of Columbia began to permit branching via M&A and interstate banking. Dates are

[8] Fourteen states already allowed intrastate branching and one, Iowa, did not deregulate at all.

from Amel (1993) and Jayaratne and Strahan (1998). Congress passed the Riegle-Neal Interstate Banking and Branching Efficiency Act in 1994, which allowed for national interstate banking and branching, effectively ending the period of state-level deregulation. The legislation went fully into effect in 1997 but many states adopted it early, in mid-1995. Thus, the period of interest for state-level banking deregulation is from 1977 (when U.S. bank-level data relevant for our analysis becomes available) to 1994. As noted, we will verify that the effects persist to more recent times, considering also the longer sample period 1977-2008, that is, up to the great financial crisis.

3 Data and Empirical Methodology

3.1 Monetary Policy Shocks The use of conventional measures of monetary policy, such as the federal funds rate, in regression analysis is problematic. First, consider a change in the fed funds rate in response to a macroeconomic shock that affects economic conditions. The effects of the fed funds rate change are difficult to disentangle from the effects of the shock itself. Second, rate changes reflect anticipatory movements by the monetary policymaker. For example, suppose the Federal Open Market Committee (FOMC) raises the fed funds rate due to anticipated higher output growth and inflation in the coming quarters. Higher output growth is likely to be associated with an increased demand for bank loans. A regression of the change in bank lending on lagged changes in the fed funds rate may therefore show that contractionary monetary policy is associated with increased lending.

Romer and Romer (2004) seek to surmount these issues by devising a new series of monetary policy shocks. First, they construct a series of intended federal funds rate changes around FOMC meetings by combining information from the Weekly Report of the Manager of Open Market Operations and narrative accounts of each FOMC meeting. Second, using the Fed's internal Greenbook forecasts, they purge the series of variation attributable to forecasts of future macroeconomic activity through the following regression

$$\begin{aligned}\Delta ff_m = c + \beta ffb_m + \sum_{i=-1}^{2} \zeta_i \Delta \widetilde{y}_{mi} + \sum_{i=-1}^{2} \lambda_i (\Delta \widetilde{y}_{mi} - \Delta \widetilde{y}_{m-1,i}) \\ + \sum_{i=-1}^{2} \rho \widetilde{\pi}_{mi} + \sum_{i=-1}^{2} \theta (\widetilde{\pi}_{mi} - \widetilde{\pi}_{m-1,i}) + \kappa \widetilde{u}_{m0} + \epsilon_m\end{aligned} \tag{1}$$

where Δff_m is the change in the intended federal funds rate at meeting m, ffb_m is the

level of the intended funds rate prior to meeting m, $\Delta\widetilde{y}$ is the forecasted real output growth, $\widetilde{\pi}$ is the forecasted inflation, and $\widetilde{u}$ is the forecasted unemployment rate. Note that the previous period and contemporaneous forecasts of output growth and inflation are included in addition to forecasts of the next two quarters.[9] The residual of the above estimated equation, $\widehat{\epsilon}_m$, then becomes a cleaner measure of monetary policy shocks purged of endogenous and anticipatory variation. This measure will henceforth be referred to as the RR shock series.

We use an updated series of RR shocks obtained from Coibion, Gorodnichenko, Kueng, and Silvia (2017). The series is initially calculated at the frequency of FOMC meetings then aggregated to a quarterly average. The updated RR shocks as well as the change in the effective fed funds rate for the period 1976Q2 - 1994Q4 are plotted in Appendix Figure A.1. The RR shock is smaller in magnitude than the change in the fed funds rate, which is unsurprising given that it is a residual of the latter. The two series typically move together and have a high positive correlation of 0.82. There is a noticeable period of outliers for both series from 1979 to 1982. During this period the Federal Reserve was targeting non-borrowed reserves (NBR) rather than the fed funds rate which resulted in large and volatile gyrations in the funds rate. Our specifications include year dummy variables or time (quarterly) fixed effects to account for this period.

3.2 Banking Variables Bank-level data are drawn from the Consolidated Reports of Condition and Income ("Call Reports") which all banks in the United States are required to file on a quarterly basis with the Federal Financial Institutions Examinations Council (FFIEC). We follow Kashyap and Stein (2000) in defining our sample as all commercial banks which are insured, have positive assets, and are located in the fifty states or Washington, D.C. Since mergers typically create discontinuities in the acquiring bank's balance sheet, a bank observation is dropped from the sample in any quarter in which a merger occurs. To prevent outliers from driving the results, a bank-quarter is dropped whenever loan growth is more than five standard deviations away from that quarter's average loan growth. Additionally, a bank-quarter is dropped if there are not four preceding quarterly observations for loan growth. This leaves slightly over 800,000 observations from 16,000 banks in the 1976Q2 - 1994Q4 period.[10] Appendix Figure A.2 shows that aggregated bank lending in our data ac-

[9] The previous period forecasts are typically observed data.

[10] As detailed below, due to the lag structure in the empirical model, our estimation sample starts in 1977Q2.

counts for a substantial share of total credit to the private sector in the United States (30-43% over the sample period).[11]

Summary statistics for bank-level variables of interest are in Table 1. The main variable of interest is real loan growth.[12] Average quarterly loan growth at a single bank is 1.13% with a standard deviation of 7.25%. Average loan growth across all banks is plotted in Appendix Figure A.3. The series is relatively stable over the sample except for the period of NBR targeting at the onset of the 1980s, which features a sharp drop.

The Call Reports do not directly include data on loan rates. However, following, e.g., Jayaratne and Strahan (1998), a proxy for the average interest rate on a bank's loan portfolio can be calculated as total interest and fee income on loans divided by the total loans of the bank. Interest and fee income on loans is reported on a year to date basis. Hence, the previous quarter's value is subtracted from the current value to obtain a quarterly measure. Interest and fee income on loans is reported biannually prior to 1983. In order to use our full sample we replace the missing first quarter observations with half of the second quarter value and the missing third quarter observations with the average of the second and fourth quarter values. The results are robust to leaving the missing values empty, however. The annualized mean of a bank's average loan rate is roughly 11.5% for the sample, with a standard deviation just over 4%. The average loan rate across all banks is shown in Appendix Figure A.4. As with real loan growth, there are large variations at the onset of the 1980s and a more stable pattern for the rest of the sample.

Loan growth for the three major loan categories are included as well in Table 1. Real estate lending saw the largest average growth over the sample at 2.16% per quarter. Commercial and industrial lending growth averaged 0.76%, while consumer lending grew an average of 0.46%.

Other bank-level variables of interest include total assets, security holdings, liquidity ratio, equity ratio, and bank holding company affiliation. Average bank assets have a mean of $173 million for the sample. We follow Kashyap and Stein (2000) in defining our securities variable. There is not a consistent variable tracking securities in the Call Reports over the entire sample. Prior to 1984 total securities are calculated as the sum of U.S. Treasury securities, U.S. government agency and corporate obligations, obligations of states and political subdivisions, all other bonds,

[11] Data on credit to the private non-financial sector are from the Federal Reserve Z.1 release, Financial Accounts of the United States.

[12] Call report loan data are in nominal terms; we adjust for inflation using the CPI.

stocks, and securities, and fed funds sold and securities purchased under agreements to resell. From 1984 to 1993 they are calculated as the sum of the book value of total investment securities, assets held in trading accounts, and fed funds sold. A consistent definition is not available for 1994. Liquidity ratio is defined as the ratio of cash and reserves to total liabilities. Affiliation with a bank holding company (on average equal to 0.53 for the sample) increases significantly over this time frame, as restrictions on bank acquisition are abolished. Finally, three measures of bank market structure are reported (see the Appendix A.1 for exact definitions): a Lerner index for banks' market power, a county-level Herfindahl-Hirschman Index (HHI), which measures local banking concentration, and a state-level HHI, which measures state banking concentration.

Table 1 also displays summary statistics split by bank size. As is conventional in the literature, small banks are defined as any bank under the 95th percentile in total assets for a given quarter.[13]

3.3 Baseline Empirical Model Throughout the empirical analysis, following the literature, we distinguish between intrastate branching deregulation and interstate banking deregulation. To study the impact of deregulation on the responsiveness of bank lending to monetary policy, we estimate a dynamic panel regression

$$\begin{aligned}\Delta log(L_{ist}) = c &+ \sum_{j=1}^{4} \alpha_j \Delta log(L_{ist-j}) + \sum_{j=0}^{4} \mu_j MP_{t-j} + \gamma_1 INTRA_{st} + \gamma_2 INTER_{st} \\ &+ \sum_{j=0}^{4} \psi_j (MP_{t-j} * INTRA_{st}) + \sum_{j=0}^{4} \varphi_j (MP_{t-j} * INTER_{st}) + \sum_{j=0}^{4} \beta_j NATL_{t-j} \\ &+ \sum_{j=0}^{4} \delta_j ST_{st-j} + \sum_{k=1}^{3} \pi_k QTR_{kt} + \sum_{k=1}^{17} \xi_k YEAR_{kt} + \eta_i + \epsilon_{ist}\end{aligned} \tag{2}$$

where the dependent variable $\Delta log(L_{ist})$ is real loan growth of bank i, located in state s, in quarter t. The independent variables include 4 lags of bank i's loan growth, the contemporaneous value and 4 lags of monetary policy shocks (MP_{t-j}), a dummy variable equaling 1 if state s permits in-state branching via M&A in quarter t ($INTRA_{st}$), a dummy variable equaling 1 if interstate banking is allowed in state s in quarter t ($INTER_{st}$), and interactions between the monetary policy shocks and the deregulation dummies. Also included are the contemporaneous values and

[13] Note that this definition allows for banks to move between size categories over time.

4 lags of national ($NATL_{t-j}$) and state (ST_{st-j}) control variables, quarter-of-a-year (QTR_{kt}) dummy variables, year ($YEAR_{kt}$) dummy variables, and a bank fixed effect (η_i). The national-level variables include the change in real GDP, the change in the personal consumption expenditures (PCE) index, and the CRSP value-weighted stock return index. The state-level variables comprise the percentage change in personal income and the change in the U.S. Federal Housing Finance Agency all-transactions house price index (see Section 4.2 for further state-level controls). Quarter-of-a-year dummies are inserted to control for seasonality in lending. Year dummies capture additional macro-level phenomena occurring during this time period, e.g., the gradual phaseout of regulation Q, the Fed regime of targeting non-borrowed reserves, and the Great Moderation. In a more comprehensive specification, we drop all national-level variables and replace year dummies with quarterly fixed effects.

The coefficients of interest are the sum of the $\psi_j's$ and sum of the $\varphi_j's$. A significant $\sum_{j=0}^{4}\psi_j$ would indicate that monetary policy has a significantly different impact on bank lending following intrastate branching deregulation. A significant $\sum_{j=0}^{4}\varphi_j$ would indicate the same for interstate banking deregulation. We have no prior expectation regarding the sign of the coefficients, as the effect of deregulation on loan sensitivity to monetary policy is theoretically ambiguous. In Sections 4.5 and 5, we will discuss and investigate in detail leading mechanisms through which deregulation can increase or reduce loan sensitivity to monetary policy.

It is important to stress that a key identifying assumption of our empirical model is that bank deregulation did not affect the response of loan demand to monetary policy shocks. This assumption allows us to interpret the interaction terms containing the deregulation dummies as evidence of a different responsiveness of loan supply to monetary policy. This appears to be a plausible assumption, as we have no reason to expect that the bank deregulation influenced the responsiveness of loan demand to monetary policy shocks.

4 Impact of Deregulation: Baseline Results

4.1 Responsiveness of Bank Lending Results for the summed coefficients of interest are presented in Panel (a) of Table 2 for the period 1977Q2 - 1994Q4 (Appendix Table A.2 reports all estimated coefficients). In Panel (d) we verify that all the results of Table 2 also hold for the extended period 1977Q2 - 2008Q4. Column (1) in Panel (a) reports the specification in equation 2 with year dummies and national-level variables while column (2) shows results for the more tightly specified variation

with time fixed effects. In column (1) the summed coefficients of the monetary policy indicator are negative and jointly significant at the 1% level.[14] A contractionary 100 basis point exogenous monetary policy shock reduces lending growth by roughly 2 percentage points over the following four quarters.[15] The summed coefficients on the interaction between intrastate branching deregulation and monetary policy are small and insignificant in both columns, indicating that intrastate deregulation has no effect on loan sensitivity to monetary policy. The summed coefficients on the interaction between interstate banking deregulation and the monetary policy indicator are negative and significant in both columns. An exogenous, contractionary monetary policy shock reduces lending growth by an additional 2.08-4.26 percentage points for a bank located in a state that has removed interstate banking restrictions.[16] The specification in column (1) indicates that, following the removal of interstate restrictions, lending growth falls by 4 percentage points in response to a 100 basis point contractionary monetary shock, almost double the pre-deregulation effect.[17] Column (2) includes the strongest controls for time-specific macro variation, and suggests that the effect of interstate deregulation is even more pronounced than that in column (1).

There is some overlap in years that both types of restrictions are deregulated for a given state. To check that inclusion of both sets of deregulation dummies is not biasing the results, in Panel (a) we also present the summed coefficients of interest for estimating equation 2 with interstate deregulation dummy and interactions only and for estimating equation 2 with intrastate deregulation dummy and interactions only. The estimates confirm that bank lending becomes more sensitive to monetary policy after interstate banking deregulation and that intrastate branching deregulation has no effect.[18] Further, we investigate whether the effects of interstate deregulation depend on whether this predates or postdates intrastate deregulation. As shown in Appendix Table A.3 we detect no significant difference.

In Table 2 Panel (d), we verify that the results continue to hold for the 1977Q2 -

[14] Column (2) reports results including time fixed effects which are perfectly collinear with national-level variables such as the monetary policy indicator.

[15] One standard deviation of the monetary policy indicator is 70 basis points, hence a contractionary one standard deviation shock reduces lending growth by 0.8-1.4 percentage points over the following four quarters.

[16] A contractionary one standard deviation shock reduces lending growth by an additional 1-3 percentage points.

[17] The increase in the response of lending growth following interstate deregulation is more than one half of the standard deviation of real lending growth.

[18] To verify that the results are not driven by the choice of monetary policy indicator, we also re-estimated the regressions using the quarterly change in the fed funds rate. The findings carry through (details available from the authors).

2008Q4 period. The estimates remain virtually unchanged.

4.2 Parallel Underlying Trends Our baseline estimation is effectively a panel specification of differences-in-differences (DID). Unlike in a usual DID we are not interested in the direct impact of the deregulation on bank lending but rather in its effect on the lending responsiveness to monetary policy. However, our framework still relies on the parallel underlying trends assumption. Specifically, the estimates from equation 2 rely on the assumption that lending responsiveness to monetary policy for states that deregulated early was not different (especially not higher) relative to states that deregulated later. To test this assumption we rerun the specification in equation 2 (including time fixed effects) but replace the deregulation dummy with event-time dummies. For each period t, these dummies are constructed as $\mathbb{1}(t - \tau_s = k)$ for $k \in \{-3, 3\}$, where τ_s represents the year of deregulation in state s. We collapse time periods more than 3 years before and after the deregulation into the "<-3" and ">3" period categories, respectively. Figure 1 presents the interaction coefficients for these dummies with the monetary policy shock measure. The vertical lines indicate 95% confidence intervals. The year before the deregulation is excluded, so the plotted coefficients are to be interpreted as relative to the year before deregulation. The figure shows that there is no evidence of pre-trends. This is reassuring and means that our results are unlikely to be driven by some state-specific unobservable characteristic that was driving both the lending responsiveness to monetary policy and the decision to deregulate.

To further assuage identification concerns, we also verify that the results continue to hold when in equation 2 we control for further time-varying characteristics at the state level, in addition to the state-specific variables used in Panel (a) of Table 2. In Appendix Table A.4, we control for a state-specific time trend. We also experiment with controlling for indicators of the structure of the banking and business sectors of the state, including the asset share of small banks in the state, an indicator of the relative health of small and large banks in the state, and the share of small firms (fewer than 20 employees) in the state.[19] We include both the level of these state-specific measures and their interaction with the monetary policy shock. In each case the result of increasing lending responsiveness to monetary policy after the interstate deregulation is found to be significant and very similar in magnitude to our baseline specification.

[19] We consider the difference between the asset-weighted average equity ratio of small banks (assets below the state median) and the asset-weighted average equity ratio of large banks.

4.3 More Robustness Analysis We carry out additional robustness tests with estimates presented in Appendix Tables A.5-A.6. A concern raised in Section 3.1 regards outliers in the monetary policy indicator (as well as real loan growth) during the Fed's period of non-borrowed reserve (NBR) targeting. To explicitly control for the NBR targeting period, we estimate two other variations of equation 2 with results in Appendix Table A.5. In particular, we include a NBR dummy variable which equals one from 1979Q4 to 1982Q3 and zero otherwise, as well as its interactions with the contemporaneous value and lags of the monetary policy indicator. The results hold up: lending growth drops by 1.71 percentage points prior to interstate deregulation and by an additional 2.33 after deregulation.

Another concern is the influence of the "Great Moderation", the decline in macroeconomic volatility observed from the mid-1980s onwards. To determine whether this played any role in the increased responsiveness of lending to monetary policy, we estimate an extension of equation 2 explicitly controlling for this period. Specifically, we insert a dummy variable equalling one from 1984 onwards and its interaction with the monetary policy indicator. Appendix Table A.6 displays the results for this expanded regression. Not surprisingly, lending is found to be less sensitive to monetary policy during the Great Moderation period, as the summed coefficients on the Great Moderation interaction term is positive and significant. Controlling for the Great Moderation, the estimates show an even more marked increase in the responsiveness of lending to monetary policy following interstate deregulation. Thus, interestingly, the interstate deregulation appears to be counteracting the influence of the Great Moderation.

4.4 Other Dimensions of Lending Responsiveness The results in Panel (a) of Table 2 indicate that lending becomes more responsive to monetary policy along the quantity dimension following interstate deregulation. Next, we examine how deregulation impacts the sensitivity of lending to monetary policy along the price dimension. Panel (b) of Table 2 presents results for estimating equation 2 with the average rate on a bank's loan portfolio as the dependent variable. Column (1) shows that, for the four quarters following a 100 basis point contractionary monetary policy shock, loan rates rise by 69 basis points. The interaction between the intrastate deregulation dummy and monetary policy is small and insignificant. The interaction between the interstate deregulation dummy and monetary policy is instead positive and significant. According to the estimates, a bank located in a state that has abolished interstate restrictions increases its average loan rate by an additional 113 basis points following

a 100 basis point monetary tightening, which is more than double the increase for a bank in a state that has not deregulated. Column (2) reports a somewhat smaller magnitude, indicating that a bank in a deregulated state increases its average loan rate by an additional 47 basis points. Regardless, this is a meaningful response as it is roughly two-thirds larger than that of a bank in a state which prohibits interstate banking.[20]

Additionally, we would like to test whether after interstate deregulation the greater lending responsiveness to monetary shocks is symmetric between contractionary and expansionary shocks. The inclusion of lagged monetary shocks in equation 2 makes it difficult to isolate the effect of each type of shock. Nonetheless, we can sum the contemporaneous and lagged monetary shocks for each observation and split the sample based on whether the summed shock is contractionary (positive) or expansionary (negative). Results are in Panel (c) of Table 2. Full sample results using one summed monetary shock rather than individual lags yield a similar differential response following interstate deregulation, although of a somewhat smaller magnitude. Splitting the sample into contractionary and expansionary shocks indicates that it is the contractionary shocks which are driving the increased sensitivity following interstate deregulation. Contractionary shocks make up about 70% of the sample and, according to the specification including time fixed effects, real loan growth sees an additional decline of 0.8 percentage points in response to such shocks after deregulation. On the other hand, the differential response to expansionary shocks is negative and statistically insignificant. While imperfect, this evidence suggests that the removal of interstate banking restrictions lead to a greater responsiveness of bank lending to contractionary monetary shocks only.

As shown in Table 2 Panel (d), all the results in Panels (a)-(c) continue to hold virtually unchanged when considering the extended period 1977Q2 - 2008Q4.

4.5 Bank Lending Channel We now turn to investigate whether the effect of interstate deregulation on the responsiveness of bank lending to monetary policy can be explained by a strengthening of the bank lending channel of transmission

[20]From 1976 to 1982 interest and fee income on loans is only reported in the second and fourth quarters. For the above results we fill in the missing first and third quarter values in the way detailed in Section 3.2. As an alternative, we re-estimate equation 2 for an abbreviated sample starting in 1983. Results are in columns (3) and (4) of Panel (b) of Table 2. The summed coefficients on the monetary policy indicator in column (3) are no longer significant, but the magnitude is similar and the standard errors are not large. The summed coefficients on the interaction between the interstate deregulation dummy and monetary policy remain positive and significant in both columns (3) and (4). This confirms that replacing the missing observations in 1976-82 is not driving the results.

of monetary policy (Kashyap and Stein (1995); Kashyap and Stein (2000)). The bank lending view maintains that, following contractionary monetary policy, if retail deposits are imperfectly substitutable with wholesale funding, banks will contract the asset side of their balance sheets, including their loans. To help identify the bank lending channel, the literature has pinned down bank characteristics that affect the strength of this channel. Kashyap and Stein (1995) argue that for small banks it can be particularly hard to compensate retail deposits with wholesale funding and indeed they find that small banks are more sensitive to monetary policy than larger banks. Kashyap and Stein (2000) maintain that illiquid banks will be especially inclined to contract loans rather than securities when facing an increasing cost of retail deposits. In fact, they uncover evidence that small and relatively illiquid banks are most strongly affected by monetary policy.

Based on these arguments, to identify changes in the strength of the bank lending channel of transmission after interstate deregulation we investigate the role of bank-level heterogeneity in explaining the greater sensitivity of lending to monetary policy after the deregulation. We first estimate equation 2 separately for small and large banks. Consistent with the literature, we define a small (large) bank as any below (above) the cross-sectional 95th percentile in total assets within a given quarter. Results are presented in Panel (a) of Table 3 (Panel (d) shows robustness of all the results of Table 3 to considering the extended sample period 1977Q2 - 2008Q4). The summed coefficients reveal that both small and large banks have a roughly 2 percentage point decline in lending growth for the four quarters following a 100 basis point contractionary monetary policy shock prior to deregulation. The second row shows that interstate deregulation only affects small banks. The coefficients are very similar to the results for all banks, as the response of the lending growth of small banks to a monetary shock nearly doubles after interstate deregulation.[21] As an additional check, we estimate equation 2 with the average loan rate as the dependent variable for small and large bank samples. Appendix Table A.7 confirms that both small and large banks raise loan rates following a monetary tightening. Columns (1) and (3) suggest that following interstate deregulation the sensitivity of loan pricing to monetary policy increases for both small and large banks. Column (2) confirms this for small banks whereas column (4) shows no such evidence for large banks. These results further bolster the conclusion that interstate deregulation impacts monetary

[21] Small bank lending makes up a significant portion of overall lending in our sample (slightly less than 30% in an average year).

transmission through the lending sensitivity of small banks.

Kashyap and Stein (2000) find that the bank lending channel operates through small and relatively illiquid banks. We estimate equation 2 by liquidity ratio quartile, where the 1st quartile includes the least liquid banks in a given quarter and the 4th quartile includes the most liquid. Panel (b) of Table 3 displays results for small banks only. Prior to deregulation all liquidity quartiles respond similarly to monetary policy, declining by roughly 2 percentage points for the four quarters following a contractionary shock. According to the specification using time fixed effects, all quartiles become more sensitive to policy after interstate deregulation, but the increased responsiveness is sharply decreasing in liquidity. Consistent with the results in Panel (a), Panel (c) shows that large banks do not see a significant increase in responsiveness regardless of liquidity status. The greater responsiveness of lending to monetary policy after interstate deregulation is therefore particularly attributable to the least liquid small banks, pointing to a strengthening of the bank lending channel. This conclusion carries through when we subject the results of Table 3 to the same robustness checks performed on the results for all banks (e.g., controlling for the Volcker Fed period and for the Great Moderation).[22] Further, the conclusions remain unaltered when extending the sample period to 2008Q4, as shown in Panel (d).

Kishan and Opiela (2000) find that the effect of monetary policy on bank lending is stronger for relatively undercapitalized banks, particularly small ones. We again estimate equation 2, this time by equity ratio quartile, where the 1st quartile includes the least capitalized banks in a given quarter. Panel (a) of Appendix Table A.8 displays results for all banks. Prior to deregulation all quartiles respond similarly to policy. After interstate deregulation banks in all quartiles become more responsive to policy, with an additional decline in lending growth of 3.54-4.14 percentage points according to the specifications with time fixed effects. The increased responsiveness is slightly larger for the 1st and 2nd quartiles, but not large enough to suggest that capitalization plays a major role in the increased sensitivity of lending. In untabulated tests we also experimented with an additional measure of banks' health and efficiency, a measure of their cost efficiency. Similar to bank capitalization, the results did not reveal a major role of cost efficiency in the increased sensitivity of lending. It is worth stressing that these estimates are consistent with the findings of Kishan and Opiela (2000) on the relevance of banks' capitalization in monetary policy transmissions. In fact, our focus is specifically on the differential effect of interstate deregulation on

[22] Details on these additional robustness tests are available from the authors.

monetary transmission. In line with Kishan and Opiela (2000), we obtain evidence of a role of banks' capitalization in bank lending sensitivity to monetary policy, though this does not appear to be the key driver of the impact of deregulation on this sensitivity.

5 Mechanisms

The previous section points to a strengthening of the bank lending channel of monetary policy following the removal of interstate banking restrictions. In this section, we investigate three leading mechanisms through which interstate deregulation can have affected the lending channel: bank market structure, loan portfolio composition, and bank organizational structure. Clearly, finding evidence of any of these mechanisms does not exclude that other structural changes in bank lending behavior induced by the deregulation might also play a role in our results.

As anticipated, the analysis of the mechanisms points to a distinct role of bank organizational structure in driving the baseline results. To conserve space, we thus especially focus on this channel and present details on the tests for the other two channels (bank market structure and loan portfolio composition) in the Appendices A.1-A.2. The detected role of bank organizational structure also provides a natural interpretation for the lack of an effect of intrastate deregulation on the sensitivity of bank lending to monetary policy. This may relate to the different organizational transformations associated with interstate and intrastate deregulation, and the different types of banking institutions mostly involved in these transformations. Interstate liberation especially involved large bank holding companies (BHCs) and led to an increase in the organizational complexity of BHCs beyond state borders. Intrastate liberalization, instead, mattered particularly for smaller, less complex BHCs. It also resulted especially in the conversion of subsidiaries into branches and in mergers of branches within a state, possibly raising bank concentration within the states. The less complex nature of the institutions involved, and the more local nature of the transformations, can have resulted in less sharp increases in the complexity of banking institutions, as we will show below.

5.1 Bank Market Structure

The effects of geographic banking deregulation on bank market structure are the object of an ongoing debate. Stiroh and Strahan (2003) report that the U.S. deregulation reallocated market shares across banks in the period 1976-1994. Rhoades (2000) argues that in the United States nationwide banking concentration increased from 1980 to 1998, in part due to geographic dereg-

ulation. Berger and DeYoung (2001) detect both positive and negative links between geographic bank expansion and bank efficiency. Additionally, recent literature has examined the relationship between bank market structure and monetary policy transmission. In a study on 12 euro area countries for the period 2002–2010, Fungáčová, Solanko, and Weill (2014) document that lending is less sensitive to monetary policy when banks have greater market power, while investigating 55 developing countries for the period 2000–2007 Amidu and Wolfe (2013) obtain an opposite result. Using data on new loan origination in the United States from 1996 to 2004, Adams and Amel (2011) show that monetary policy has a weaker effect on lending when the local (MSA or county) bank market concentration is higher.

As the above, unsettled debate suggests, the effect of geographic deregulation on bank market structure is not obvious, nor is the effect of bank market structure on the sensitivity of bank lending to monetary policy. In the Appendix A.1, we test how interstate deregulation impacted bank market power and banking concentration, at the local (county) and state level. Further, we examine whether changes in bank market power and concentration can explain the increased lending sensitivity to monetary policy following interstate deregulation. The results suggest that interstate deregulation did not affect loan sensitivity through bank market structure. In our data, in fact, banking concentration has no significant impact on the sensitivity of lending to monetary policy, while increased bank market power weakens the impact of policy on lending. Since we estimate that interstate deregulation increased bank market power but strengthened the impact of policy on lending, it is unlikely that the effect of deregulation was mainly driven by changes in market power.

5.2 Loan Portfolio Composition Den Haan, Sumner, and Yamashiro (2007) document that real estate and consumer loans decrease following a monetary tightening whereas commercial and industrial loans increase. Interstate deregulation may increase certain types of lending which are more sensitive to monetary policy. Focusing on total lending may therefore mask compositional effects in banks' lending behavior. In the Appendix A.2, we find evidence that the interstate deregulation had a small impact on the composition of banks' loan portfolios. Further, each category of loans becomes more sensitive to monetary policy following deregulation, and at a similar magnitude as total lending in Table 2. Thus, it is unlikely that compositional effects are responsible for the results.

5.3 Bank Organizational Structure A third leading mechanism through

which interstate banking deregulation may have affected the lending channel of transmission of monetary policy is bank organizational structure. As bank holding companies expanded across state lines and acquired a wider network of subsidiaries, bank organizational structure may have been impacted in two ways: increasing organizational depth and increasing organizational complexity. Ashcraft (2006) finds that lending is more responsive to monetary policy for stand-alone banks than for banks affiliated with a multibank holding company (MBHC). He suggests that banks affiliated with a MBHC have access to deeper internal capital markets and this enables them to better insulate loan portfolios from policy-induced outflows of deposits.[23] If organizational depth is a major mechanism at work in our baseline results, we should then observe banks affiliated with a holding company becoming relatively less sensitive to monetary policy after interstate deregulation, or conversely that stand-alone banks should be driving the strengthening of the lending channel.

A number of studies have however underscored the consequences of organizational complexity. Greater organizational complexity can lead to an emphasis on transactional lending rather than relationship lending, as more complex organizational structures are less capable of processing and acting upon local soft information (private, non-codified information collected by loan officers through personal contacts with borrowers).[24] Moreover, prior literature highlights that bank-borrower relationships built upon soft information can be important for the availability and pricing of credit, particularly for small borrowers (Petersen and Rajan (1994); Beck, Degryse, De Haas, and Van Horen (2018)).[25] Thus, a natural conjecture is that the increased responsiveness following deregulation may be triggered by a reduced reliance on relationship lending and a resulting greater propensity of banks to cut their lending supply in response to negative monetary policy shocks. If that is the case, we would expect the greater responsiveness of lending after deregulation to be especially driven by banks affiliated with a holding company, as their stand-alone counterparts will not be directly affected by the expansion of holding companies and the associated increase in organizational complexity. In particular, increased complexity could manifest itself both through the acquisition of stand-alone banks by bank holding companies and, for banks already affiliated with bank holding companies, through the increasing

[23] See also Wieland and Yang (2017) for the role of the internal capital markets of bank holding companies in mitigating the impact of monetary policy.

[24] See, e.g., Berger, Demsetz, and Strahan (1999) and Berger, Miller, Petersen, Rajan, and Stein (2005).

[25] See also Alessandrini, Presbitero, and Zazzaro (2008), Araujo and Minetti (2011), and Minetti (2007).

complexity of the holding companies post-deregulation.

To gain an initial understanding of the role of organizational structure in our results, in Table 4 we estimate equation 2 for two subsamples: stand-alone banks and banks affiliated with a BHC.[26] If organizational depth is a dominant mechanism, we would expect the strengthening of the lending channel post-deregulation to be mostly driven by stand-alone banks, whereas we would expect it to be especially driven by affiliated banks if organizational complexity is dominant. Consistent with Ashcraft (2006), the estimates show that prior to interstate deregulation stand-alone banks respond more strongly to monetary policy than affiliated banks. After deregulation, however, affiliated banks experience a significantly larger increase in lending responsiveness compared to stand-alone banks.[27] Columns (1) and (2) in Panel (b) indicate that affiliated banks become more responsive to monetary policy after deregulation by a relatively large magnitude of 2.7-5.16 percentage points. The estimates, on the other hand, suggest that deregulation had at most a small impact on stand-alone banks. These results carry through when we restrict attention to small banks. Interestingly, Panels (b) and (c) reveal that, within the subset of affiliated banks, banks already affiliated prior to deregulation also experience a greater sensitivity to monetary policy after the deregulation. This suggests that the increasing complexity of bank holding companies post-deregulation triggered a change in the lending technologies both of newly affiliated banks and of banks already affiliated prior to deregulation.

In Appendix Table A.10 we re-estimate equation 2 across liquidity ratio quartiles for small affiliated banks. The results show that deregulation primarily leads to small and relatively illiquid affiliated banks becoming more sensitive to monetary policy. Appendix Table A.10 also looks more broadly at the response of the assets of small affiliated banks to monetary policy. Interestingly, after deregulation securities holdings of small affiliated banks appear to drop less (or grow more) in response to a contractionary shock than before deregulation.[28] This partially offsets the increased responsiveness of loan growth, moderating the decline in total asset growth for three of the four liquidity quartiles. Thus, small banks affiliated with a BHC, especially those which are relatively illiquid, respond to monetary policy after interstate deregulation by concentrating the contraction of the asset side of their balance sheets on loans

[26] Appendix Table A.9 shows robustness of the results of Table 4 for the sample period extended to 2008.

[27] The p-value for the difference between summed coefficients on Inter*MP in column 1-4 of Panel (a) relative to the corresponding column in Panels (b) or (c) is less than 0.01.

[28] With the exception of banks in the 3rd liquidity ratio quartile.

rather than security holdings.

5.4 The Response of Small Affiliated Banks The increase in the lending responsiveness of small affiliated banks following interstate deregulation points to organizational complexity as a promising explanation for the strengthening of the bank lending channel. We investigate this point in detail in Table 6.

In Panel (a) of the table, we first confirm that, following interstate deregulation, affiliation with a BHC leads to a larger responsiveness of bank lending to monetary policy. The panel shows that interstate deregulation spurred banks' affiliation with BHCs (column 1). It also confirms that, following deregulation, banks affiliated with a BHC are more responsive to monetary shocks (columns 2 and 3). Finally, in columns 4 and 5, the panel displays the results of a two-stage estimation approach, in which in the first stage we project BHC affiliation on interstate deregulation and in the second stage we insert the fitted measure of BHC affiliation interacted with the monetary policy indicator.[29] The instrumental variables approach is a way to investigate whether an increase in BHC affiliation induced by the deregulation contributes to the increased lending responsiveness post-deregulation. The second stage estimates support the hypothesis that BHC affiliation post-deregulation is a driver of the higher sensitivity of lending to monetary shocks.

To examine the role of organizational complexity more in depth, we next construct various measures of complexity of bank holding companies. For each measure, in Table 6 we perform three tests, in a fashion similar to Panel (a). We first study whether the interstate deregulation increased the measure of BHC complexity. Next, we examine whether banks' responsiveness to monetary policy is larger for banks characterized by a higher value of this measure of BHC complexity, and whether the effect of interstate deregulation on banks' responsiveness is larger for such banks. An increase in a measure of BHC complexity following interstate deregulation, in conjunction with evidence that this measure of complexity is associated with greater bank responsiveness, would suggest that the observed increase of this dimension of BHC complexity contributed to the greater bank lending responsiveness of BHC affiliated banks following deregulation. Finally, we explore the role of BHC complexity using an instrumental variables approach: in the first stage, we project the measure of BHC complexity on interstate deregulation; in the second stage, we insert the fitted

[29] As recommended by Wooldridge (2010), we estimate individual first stages for BHC affiliation and the interactions between BHC affiliation and the monetary shocks, with the full set of second stage controls included in all estimations.

value of the complexity measure interacted with the monetary policy indicator. The instrumental variables approach is a way to determine if an increase in a dimension of complexity triggered by the deregulation does drive the increased lending responsiveness post-deregulation. The idea is that BHC size, distance etc. are observable proxies for the underlying unobservable "complexity" and we aim to instrument complexity with the deregulation dummy.

In line with prior literature, we consider three proxies for BHC complexity. The first is a unique measure of geographical distance between a bank and the parent holding company. Berger, Demsetz, and Strahan (1999) succinctly offer the logic behind this measure:

> A financial institution's organizational complexity may also make it costly to provide locally-based services to small customers. For example, a multibank BHC with multiple layers of management that acquires an independent bank in another region or another country may find it costly to process relationship based information acquired through contact over time by a local loan officer in a distant market.[30]

Deng and Elyasiani (2008) discuss several reasons why greater physical distance between a parent holding company and a subsidiary may increase organizational complexity, including weakened monitoring, organizational diseconomies, and diluted bank manager incentives. The use of distance as a proxy for organizational complexity is thus a natural choice, particularly in our context of studying the effects of geographic deregulation. Our measure of bank-BHC physical distance is calculated by using bank/BHC addresses drawn from our banking data and an analogous holding company data set. Using the HERE Location Services API we then compute the distance in miles between each unique bank-BHC pair in our sample (accounting for headquarter relocations). During the early part of the sample the average distance between a bank and BHC was approximately 46 miles. In the later part of the sample, under the impulse of the deregulation process and of the geographic expansion of bank holding companies, average distance increased to over 65 miles (Table 5).

The second measure of BHC complexity is the size of a BHC, as captured by the value of its assets or the value of its capital. During the early part of the sample the average assets of a BHC were approximately 820 millions and the average capital was 49 millions. In the later part of the sample, the average assets and the average capital

[30] From Berger, Demsetz, and Strahan (1999), page 167.

were 1 billion and 67 millions, respectively (see again Table 5). Finally, as a third (inverse) measure of complexity we consider the ratio of the size (assets or capital) of the bank relative to that of its parent BHC. This measure takes into account the size gap between the bank and its BHC. In the earlier part of the sample the ratio of a bank's assets relative to the assets of its parent BHC was 0.78, while in the later part it equalled 0.72.

Table 6, Panels (b)-(f), reports the tests for the various measures of complexity (results for the extended period 1977Q2-2008Q4 are in Appendix Table A.11).[31] Column (1) of each panel shows the effects of interstate deregulation on the measure of BHC complexity. The estimates consistently suggest that interstate deregulation increased the complexity of bank holding companies. This finding aligns with the view that the U.S. deregulation process triggered an increase in the complexity of bank holding companies (for a discussion, see, e.g., Kroszner and Strahan (2014), and references therein).[32] Columns (2) and (3) of each panel investigate how (the measure of) BHC complexity affects the responsiveness of bank lending to monetary policy shocks and the impact of interstate deregulation on such responsiveness. An extension of equation 2 which allows for a differential response of banks characterized by different complexity of their parent BHC is estimated. The variables of interest in this expanded specification are therefore the double interaction between the monetary policy shock and the BHC-complexity measure, and the triple interaction between the monetary policy shock, the interstate deregulation dummy, and the BHC-complexity measure. The estimates reveal that banks affiliated with more complex BHCs tend to have a higher lending responsiveness to monetary policy and also to see a larger increase in their responsiveness after deregulation. In conjunction with the above evidence of an increase in (the measures of) complexity following interstate deregulation, these estimates corroborate the hypothesis that the greater lending responsiveness to monetary policy after deregulation is at least partly attributable to an increase in bank organizational complexity.

Finally, in columns (4) and (5) of each panel, we explore the effect of BHC complexity using a two-stage estimation approach. In the first stage we project the

[31] The results in Panels (b)-(f) are similar for small banks initially affiliated with a BHC prior to deregulation and for small banks affiliated at some point in the sample. In the panels we report the results for the former (see Appendix Table A.12 for the results obtained using the latter).

[32] We also estimated the regressions in column (1) of each panel using intrastate deregulation instead of interstate deregulation. As shown in Appendix Table A.13, we find no evidence that intrastate deregulation led to an increase in the measures of BHC complexity. As noted, this is likely to reflect the different nature of the transformations induced by the two types of deregulation.

complexity measure on interstate deregulation, and in the second stage we insert the fitted value of the complexity measure interacted with the monetary policy indicator. The estimates yield qualitatively similar insights as those in columns (2) and (3) of the panels, though the effects are estimated more precisely for the measures of complexity based on BHC size or on the size gap between the bank and its BHC. In particular, the signs of the coefficients suggest that the BHC complexity explained by interstate deregulation leads to larger bank lending responsiveness to monetary shocks.

To summarize, we find that lending becomes more responsive to monetary policy after interstate deregulation primarily for small, relatively illiquid banks affiliated with a holding company. These banks are unique in responding to monetary policy by more strongly adjusting loan portfolios, while retaining their holdings of securities. Further, the increased lending responsiveness of small affiliated banks appears to be at least partly driven by the increasing complexity of BHCs. In particular, it appears to be driven not only by banks newly affiliated after the deregulation but also by banks previously affiliated with a holding company which experienced an increasing complexity of their parent BHCs. Overall, these results are consistent with a role for bank organizational structure in the strengthening of the bank lending channel: following deregulation, banks with increasingly complex organizational structures engage in looser relationships with customers and have an increased propensity to reduce lending in response to a contractionary monetary shock.

6 Aggregate Effects

In this section, we aggregate our bank-level data to the state level to investigate the state-level effects of deregulation. Appendix Table A.15 presents results for estimating equation 2 with state-level variables.[33] When using state-level real loan growth from all banks as the dependent variable, the interaction between interstate deregulation and monetary policy is negative but insignificant. To investigate further, we aggregate state loans separately for the four different categories of banks considered in Section 5.3: small BHC affiliated banks, small stand-alone banks, large BHC affiliated banks, and large stand-alone banks. Appendix Table A.14 presents summary statistics for the share of total loans from each type of bank, while Appendix Figure A.5 plots each group's loan share over the entire sample period.

[33]The results shown are from the specification with time fixed effects. Appendix Table A.16 shows robustness for the sample extended to 2008.

We again estimate equation 2 with aggregate loan growth from each of the four bank categories as the dependent variable. Appendix Table A.15 reveals that interstate deregulation only impacts the responsiveness to monetary policy of the aggregate lending from small affiliated banks. After deregulation, following a 100 basis point contractionary shock, lending growth from all small and affiliated banks within a state declines by an additional 8 percentage points over the following four quarters.[34] This increase is more than one half of the standard deviation of the aggregate lending growth of small affiliated banks. Thus, the deregulation appears to lead to a sizable increase in the aggregate state-level response of small affiliated banks. Small affiliated banks make up on average 16% of total lending over the sample, hence a back-of-the-envelope calculation suggests that after interstate deregulation state lending growth declines by an additional $(8 \times 0.16) = 1.28$ percentage points following a contractionary monetary shock. This rough estimate is in line with the summed coefficients on the interstate-monetary policy interaction term in the first column of Appendix Table A.15 for all banks. Thus, notably, interstate deregulation results in a greater response of state-level loan growth to monetary policy in addition to the stronger response at the individual bank level. Naturally, looking at the share of total loans accounted for by small banks is likely to underestimate the dry-up of liquidity induced by a contraction of small bank lending. In fact, it has often been documented that small banks tend to specialize in granting loans to small businesses, which have inherently limited access to non-bank sources of liquidity (Kashyap and Stein (2000); Sapienza (2002); Berger and Udell (2002)).

To gain further insights into the possible state-level impact of deregulation through the increased lending responsiveness of small affiliated banks, in Appendix Table A.15 we also estimate the effects of monetary policy shocks on state personal income. The estimates suggest that interstate deregulation increased the responsiveness of state personal income to monetary shocks especially in states characterized by a larger share of small affiliated banks in state-level lending. In particular, the estimated coefficient suggests that, after interstate deregulation, following a contractionary monetary shock, state personal income declines by an additional two percentage points in a state with an above median share of small affiliated banks. This points to a material impact on state economic activity of the increased responsiveness of small affiliated banks.

[34] The estimates of the regression without time fixed effects suggest that this increase is about four times as large as the effect of monetary policy shocks pre-deregulation.

7 Conclusion

This paper examines the relationship between geographic bank regulation (restrictions on geographic bank expansion) and monetary policy transmission. From the mid-1970s to the mid-1990s the majority of U.S. states removed restrictions on out-of-state ownership of in-state banks (interstate deregulation) and on within-state branching (intrastate deregulation). By exploiting the staggered timing of state-level deregulation we find that the response of loan growth to a monetary policy shock nearly doubles following interstate deregulation. Interstate deregulation appears to strengthen the bank lending channel of transmission, as monetary policy has a greater effect on small and relatively illiquid banks after the deregulation.

To explain these results we consider three mechanisms of influence of bank deregulation on the strength of the lending channel of transmission: bank market structure, loan portfolio composition, and bank organizational structure. Though deregulation increases bank market power and local banking concentration, these changes in bank market structure are unlikely to explain the strengthening of the lending channel of monetary policy. Deregulation impacts the sensitivity to monetary policy of all major loan categories similarly, also suggesting that the greater lending responsiveness is not driven by changes in loan portfolio composition. On the other hand, we find that small banks affiliated with bank holding companies are most strongly impacted by the deregulation. After interstate deregulation such banks respond to monetary policy shocks by more strongly adjusting their loan portfolios, while buffering their holdings of securities from the shocks. The results further suggest that the increase in the complexity of bank holding companies triggered by the deregulation plays a role in the increased lending sensitivity of small affiliated banks to monetary policy. More precisely, the evidence points to a weakening of lending relationships and a resulting reduced propensity of small banks affiliated with increasingly complex holding companies to insulate customers from monetary contractions. Finally, we uncover evidence that interstate banking deregulation leads to a greater effect of monetary policy on loan growth at the state level in addition to at the individual bank level.

The analysis leaves open important questions. In the United States and other countries alike, recent years have seen calls for a reversal in the process of banking deregulation that had characterized previous decades. Our findings suggest that an important component in the impact of regulatory changes could consist of their effects on the lending channel of monetary policy. Further investigation into the effects of bank regulation on monetary policy remains an important avenue for future research.

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Table 1: Summary Statistics

	All Banks		Small Banks		Large Banks	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Real loan growth - Total (%)	1.13	(7.25)	1.15	(7.31)	0.86	(6.09)
Avg loan rate (annualized %)	11.38	(4.07)	11.37	(4.00)	11.56	(5.09)
Real loan growth - C&I (%)	0.76	(24.13)	0.78	(24.51)	0.39	(15.16)
Real loan growth - RE (%)	2.16	(15.08)	2.20	(15.30)	1.30	(10.07)
Real loan growth - Con (%)	0.46	(17.35)	0.48	(17.54)	0.08	(13.35)
C&I Share of Lending	0.21	(0.14)	0.21	(0.14)	0.30	(0.14)
RE Share of Lending	0.40	(0.19)	0.40	(0.19)	0.36	(0.17)
Con share of lending	0.24	(0.14)	0.24	(0.14)	0.24	(0.16)
Assets($)	172 mil	(2 bil)	51 mil	(58 mil)	2.5 bil	(8.7 bil)
Securities ($)	38 mil	(269 mil)	17 mil	(20 mil)	447 mil	(1.1 bil)
Liquidity Ratio	0.09	(0.23)	0.09	(0.24)	0.12	(0.08)
Equity Ratio	0.09	(0.03)	0.09	(0.03)	0.07	(0.02)
BHC Affiliation	0.53	(0.50)	0.51	(0.50)	0.83	(0.37)
Lerner Index	0.31	(0.09)	0.30	(0.09)	0.37	(0.11)
County HHI	0.33	(0.22)	0.33	(0.22)	0.33	(0.20)
State HHI	0.11	(0.11)	0.11	(0.11)	0.11	(0.11)
Number of banks	16,014		15,481		1,215	

Note: This table reports summary statistics for bank-level variables of interest. The first two columns have statistics for all banks in the sample. The third and fourth columns have statistics for small banks, defined as all banks under the 95th percentile in total assets in a given quarter. The fifth and sixth columns have statistics for large banks, defined as all banks above the 95th percentile in total assets in a given quarter. C&I refers to commercial and industrial loans, RE to real estate loans, and Con to consumer loans. For the definitions of securities, liquidity ratio and equity ratio, see Section 3.2. For the definitions of Lerner index, county HHI, and state HHI, see Section A.1.

Table 2: Banking deregulation, monetary policy and lending

Panel (a). Dependent variable: real loan growth						
	(1)	(2)	(3)	(4)	(5)	(6)
sum of coefficients	**Baseline Results**		**Interstate Only**		**Intrastate Only**	
MP	-0.0202***	-	-0.0203***	-	-0.0205***	-
	(0.0021)		(0.0022)		(0.0018)	
Inter*MP	-0.0208**	-0.0426***	-0.0209**	-0.0424***	-	-
	(0.0094)	(0.0137)	(0.0085)	(0.0127)		
Intra*MP	-0.0005	-0.0010	-	-	-0.0023	-0.0032
	(0.0030)	(0.0029)			(0.0027)	(0.0026)
observations	823,659	823,659	823,659	823,659	823,659	823,659
Panel (b). Dependent variable: average loan rate						
sum of coefficients	**1977-1994**		**1983-1994**			
MP	0.0069***	-	0.0074	-		
	(0.0008)		(0.0046)			
Inter*MP	0.0113***	0.0047**	0.0055*	0.0036**		
	(0.0020)	(0.0018)	(0.0028)	(0.0016)		
observations	822,792	822,792	495,171	495,171		
Panel (c). Dependent variable: real loan growth - by type of monetary shock						
sum of coefficients	**All Shocks**		**Contractionary Shocks**		**Expansionary Shocks**	
MP	0.0009*	-	-0.0017***	-	-0.0007	-
	(0.0004)		(0.0004)		(0.0020)	
Inter*MP	-0.0058***	-0.0086***	-0.0015	-0.0083**	-0.0125	-0.0125
	(0.0018)	(0.0030)	(0.0016)	(0.0034)	(0.0092)	(0.0092)
observations	823,659	823,659	587,071	587,071	236,588	236,588
STATE	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes	-	Yes
Panel (d). Sample extended through 2008						
sum of coefficients	**Baseline**	**Inter Only**	**Intra Only**	**Avg Rate**	**Contractionary**	**Expansionary**
Inter*MP	-0.0472***	-0.0480***	-0.0025	0.0032**	-0.0092**	-0.0119
	(0.0146)	(0.0133)	(0.0025)	(0.0015)	(0.0036)	(0.0086)
observations	1,257,186	1,257,186	1,257,186	1,255,326	824,362	432,824
STATE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2. Robust standard errors clustered at the state level are in parentheses. For details on variables and specification see Section 3.3.

Table 3: Banking deregulation, monetary policy and lending. By bank size and liquidity

Panel (a). Dependent variable: real loan growth - by bank size								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
sum of coefficients	**Small Banks**		**Large Banks**					
MP	-0.0202***	-	-0.0216***	-				
	(0.0022)		(0.0037)					
Inter*MP	-0.0212**	-0.0439***	-0.0092	-0.0081				
	(0.0093)	(0.0136)	(0.0097)	(0.0073)				
observations	787,027	787,027	36,632	36,632				
Panel (b). Small banks - by liquidity ratio quartile								
sum of coefficients	**1st**		**2nd**		**3rd**		**4th**	
MP	-0.0196***	-	-0.0207***	-	-0.0208***	-	-0.0215***	-
	(0.0027)		(0.0027)		(0.0022)		(0.0033)	
Inter*MP	-0.0340***	-0.0635***	-0.0200*	-0.0502***	-0.0121	-0.0257**	-0.0095	-0.0267*
	(0.0125)	(0.0170)	(0.0110)	(0.0162)	(0.0094)	(0.0123)	(0.0104)	(0.0150)
observations	204,559	204,559	201,126	201,126	195,307	195,307	186,035	186,035
Panel (c). Large banks - by liquidity ratio quartile								
sum of coefficients	**1st**		**2nd**		**3rd**		**4th**	
MP	-0.0106	-	-0.0212***	-	-0.0195***	-	-0.0261***	-
	(0.0198)		(0.0073)		(0.0053)		(0.0054)	
Inter*MP	-0.0308	-0.0460	-0.0169	0.0138	0.0018	0.0173	-0.0053	-0.0253
	(0.0311)	(0.0634)	(0.0234)	(0.0191)	(0.0120)	(0.0134)	(0.0157)	(0.0155)
observations	3,714	3,714	6,380	6,380	10,632	10,632	15,906	15,906
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes	-	Yes	-	Yes
Panel (d). Sample extended through 2008 - by size and liquidity ratio quartile								
sum of coefficients	**Small Banks**				**Large Banks**			
	1st	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Inter*MP	-0.0642***	-0.0538***	-0.0312**	-0.0346*	-0.0407	0.0123	0.0042	-0.0212
	(0.0174)	(0.0159)	(0.0132)	(0.0181)	(0.0616)	(0.0228)	(0.0129)	(0.0168)
observations	306,967	305,742	300,480	289,931	9,175	10,419	14,424	20,048
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Results from estimating equation 2 for different size and liquidity ratio categories are presented in Panels (a), (b), and (c). Panel (d) extends all results through 2008. Robust standard errors clustered at the state level are in parentheses. For details on variables and specification see Section 3.3.

Table 4: Mechanisms. Bank organizational structure

Panel (a). Not Affiliated				
	(1)	(2)	(3)	(4)
sum of coefficients	**All Banks**		**Small Banks**	
MP	-0.0236***	-	-0.0236***	-
	(0.0020)		(0.0020)	
Inter*MP	-0.0057	-0.0252*	-0.0053	-0.0253*
	(0.0098)	(0.0144)	(0.0100)	(0.0144)
observations	376,569	376,569	370,452	370,452
Panel (b). Affiliated. All Banks				
sum of coefficients	**Pre or Post**		**Pre**	
MP	-0.0199***	-	-0.0204***	-
	(0.0021)		(0.0021)	
Inter*MP	-0.0265***	-0.0480***	-0.0339***	-0.0565***
	(0.0094)	(0.0135)	(0.0091)	(0.0138)
observations	653,043	653,043	518,659	518,659
Panel (c). Affiliated. Small Banks				
sum of coefficients	**Pre or Post**		**Pre**	
MP	-0.0200***	-	-0.0203***	-
	(0.0021)		(0.0022)	
Inter*MP	-0.0267***	-0.0481***	-0.0353***	-0.0594***
	(0.0093)	(0.0135)	(0.0088)	(0.0137)
observations	650,805	650,805	485,783	485,783
STATE	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes

Note: Panel (a) reports results from estimating equation 2 for unaffiliated banks. Panel (b) reports results for banks that are affiliated at any point in the sample, and banks that are initially affiliated prior to interstate deregulation. Panel (c) reports results for small banks that are affiliated at any point in the sample, and small banks that are initially affiliated prior to interstate deregulation. Robust standard errors clustered at the state level are in parentheses.

Table 5: Mechanisms. Organizational structure and complexity, small affiliated banks

	Distance between bank and BHC						
	Mean	Std Dev	1st	25th	50th	75th	99th
Full Sample	45.93	(186.88)	0	0	0	8.67	1,086.98
1976-1985	32.30	(152.95)	0	0	0	0	737.81
1986-1994	65.04	(224.64)	0	0	0.07	35.72	1,492.50
	BHC Assets						
	Mean	Std Dev	1st	25th	50th	75th	99th
Full Sample	914 mil	(3.2 bil)	0	0	37 mil	172 mil	17.1 bil
1976-1985	820 mil	(3 bil)	0	0	13 mil	102 mil	15.9 bil
1986-1994	1 bil	(3.5 bil)	0	29 mil	73 mil	245 mil	19.1 bil
	BHC Capital						
	Mean	Std Dev	1st	25th	50th	75th	99th
Full Sample	57 mil	(186 mil)	0	0	3 mil	14 mil	960 mil
1976-1985	49 mil	(162 mil)	0	0	1 mil	8 mil	851 mil
1986-1994	67 mil	(215 mil)	0	2 mil	6 mil	20 mil	1.1 bil
	Ratio of Bank Assets to BHC Assets						
	Mean	Std Dev	1st	25th	50th	75th	99th
Full Sample	0.76	(0.40)	0.003	0.42	1	1	1
1976-1985	0.78	(0.39)	0.003	1	1	1	1
1986-1994	0.72	(0.40)	0.004	0.28	1	1	1
	Ratio of Bank Capital to BHC Capital						
	Mean	Std Dev	1st	25th	50th	75th	99th
Full Sample	0.76	(0.40)	0.004	0.42	1	1	1
1976-1985	0.78	(0.39)	0.004	1	1	1	1
1986-1994	0.72	(0.40)	0.004	0.28	1	1	1

Note: This table presents summary statistics for five proxies for bank holding company (BHC) complexity. There are 9,176 small affiliated banks in the full sample, 9,034 in the 1976-1985 subsample, and 8,067 in the 1986-1994 subsample.

Table 6: Mechanisms. Organizational structure and complexity, small affiliated banks (cont.d)

	Panel (a). BHC Affiliation					Panel (b). BHC Distance					Panel (c). BHC Assets				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Complexity	Real loan growth				Complexity	Real loan growth				Complexity	Real loan growth			
Inter (sum of 4 lags)	0.0704**					12.1964***					1.1064***				
	(0.0311)					(4.4320)					(0.3654)				
Inter*MP		-0.0319**	-0.0264**				-0.0543***	-0.0408***				-0.0560***	-0.0431**		
		(0.0121)	(0.0131)				(0.0133)	(0.0117)				(0.0146)	(0.0163)		
Complexity*MP		0.0002	-				0.0003	-				-0.0041**	-		
		(0.0017)					(0.0016)					(0.0016)			
Complexity*Inter*MP		-0.0208***	-0.0301***				-0.0063	-0.0398***				0.0001	-0.0129		
		(0.0067)	(0.0109)				(0.0043)	(0.0139)				(0.0051)	(0.0169)		
MP				0.0356	-				0.1144	-				0.0302*	-
				(0.0306)					(0.2830)					(0.0179)	
$\widehat{Complexity}$***MP**				-0.1460**	1.2826				-0.0053	0.0175				-0.0091***	-0.0298**
				(0.0647)	(0.8812)				(0.0103)	(0.1968)				(0.0028)	(0.0130)
observations	616,015	616,015	616,015	616,051	616,051	484,101	484,101	484,101	484,123	484,123	484,101	484,101	484,101	484,123	484,123
	Panel (d). BHC Capital					Panel (e). Ratio of Bank Assets to BHC Assets					Panel (f). Ratio of Bank Capital to BHC Capital				
Dependent variable:	Complexity	Real loan growth				Complexity	Real loan growth				Complexity	Real loan growth			
Inter (sum of 4 lags)	0.8225**					-0.0508**					-0.0489**				
	(0.3187)					(0.0224)					(0.0234)				
Inter*MP		-0.0565***	-0.0586***				-0.0539***	-0.0618***				-0.0538***	-0.0615***		
		(0.0150)	(0.0188)				(0.0138)	(0.0210)				(0.0138)	(0.0208)		
Complexity*MP		-0.0058***	-				0.0062***	-				0.0062**	-		
		(0.0017)					(0.0023)					(0.0023)			
Complexity*Inter*MP		0.0008	0.0081				-0.0035	0.0112				-0.0037	0.0106		
		(0.0053)	(0.0165)				(0.0051)	(0.0196)				(0.0050)	(0.0194)		
MP				0.0306*	-				-0.1873***	-				-0.1877***	-
				(0.0183)					(0.0706)					(0.0705)	
$\widehat{Complexity}$***MP**				-0.0117***	-0.0364**				0.2055**	0.3613*				0.2059**	0.3644*
				(0.0036)	(0.0162)				(0.0898)	(0.1904)				(0.0897)	(0.1924)
observations	484,101	484,101	484,101	484,123	484,123	484,101	484,101	484,101	484,123	484,123	484,101	484,101	484,101	484,123	484,123
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	-	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	-	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-
Time Fixed Effects	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	-	Yes
Complexity x Time FE	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-	-

Note: Robust standard errors clustered at the state level are in parentheses. In each panel, the dependent variable in column (1) is a complexity proxy and real loan growth in columns (2)-(5). Complexity in columns (2)-(3) is a dummy variable equaling one if the complexity measure is above median. Panel (a) includes small banks affiliated at some point in the sample. Panels (b)-(f) include small banks affiliated prior to interstate deregulation. For details on variables and specifications see Section 5.4.

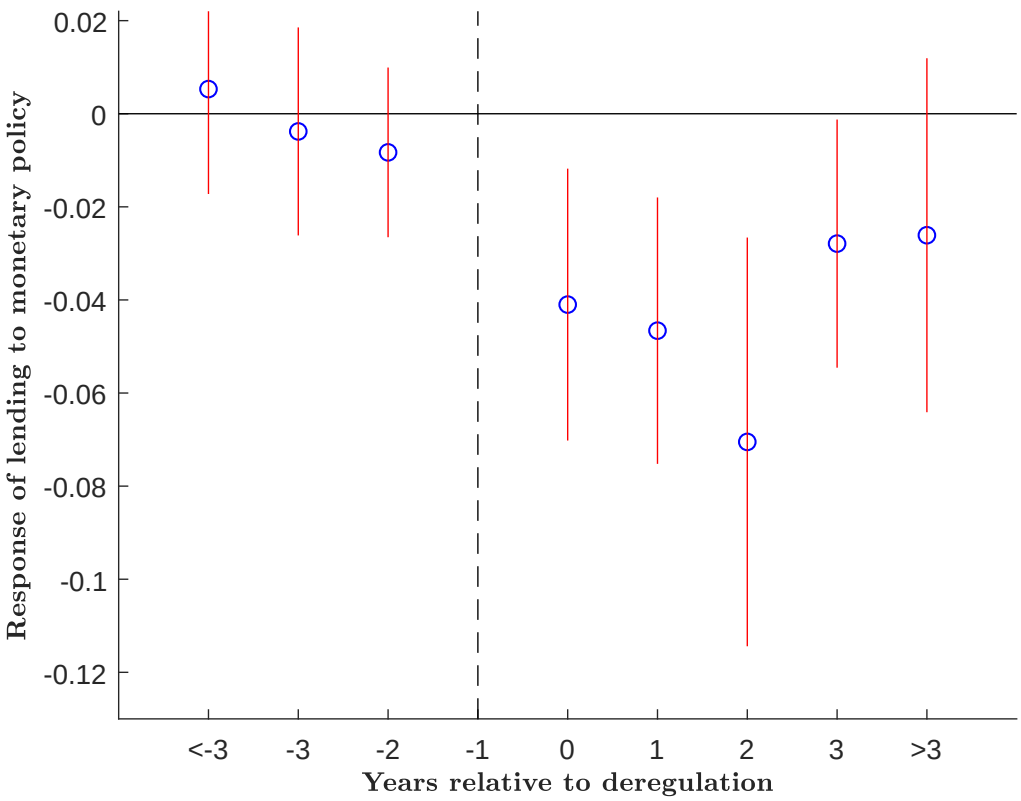

Figure 1: This figure plots the coefficients from the parallel trends event study specification, which replaces the interstate deregulation dummy with time dummies relative to the year of deregulation (see Section 4.2 for details). 95% confidence intervals based on robust standard errors clustered at the state level are represented with the vertical lines.

For Online Publication

A Appendix

A.1 Details on Bank Market Structure Tests In this Appendix A.1 we test how interstate deregulation impacted bank market power and banking concentration, at the local (county) and state level. Further, we examine whether changes in bank market power and concentration can explain the increased lending sensitivity to monetary policy following interstate deregulation. The measure of market power used is a bank-level Lerner index, computed as the difference between price of bank production and marginal cost, divided by marginal cost (see below for the computation, which follows Fungáčová, Solanko, and Weill (2014) among others). The measure of banking concentration used is the Herfindahl-Hirschman Index (HHI), calculated as the summed squares of bank market shares, $HHI = \sum_{i=1}^{N} {s_i}^2$, where s_i is the asset market share of bank i and there are N banks in the market. In a monopoly, HHI=1; in a highly diffuse market HHI is close to zero. We calculate the HHI at both the county and state levels, as bank market concentration at the local level and at the state level may be quite different.

Each of the three bank structure measures (BMS_{ist}) are then regressed on the deregulation dummies and controls, with results displayed in Table A.17, Panel (a). For example, for bank market power (the Lerner index) we estimate the following regression:

$$BMS_{ist} = c + \gamma_1 INTRA_{st} + \gamma_2 INTER_{st} + \delta ST_{st} + \beta BANK_{ist-1} + \rho_t + \eta_i + \epsilon_{ist} \tag{3}$$

where $BANK_{st-1}$ is a vector of relevant time-varying bank characteristics (inserted with a lag) and ρ_t denotes time fixed effects.[35] The estimates reveal that interstate deregulation increased bank market power (the Lerner index) and local (county-level) concentration, while we detect no significant effect on state-level concentration.

Next we examine how the bank market structure measures are related to the sensitivity of lending to monetary policy. To this end, we estimate an alternative version of equation 2, with the market structure variables interacted with the monetary policy indicator:

[35] Note that the state HHI regression and the county HHI regression are run at the state and at the county level, respectively. See Table A.17 for further details.

$$\Delta log(L_{ist}) = c + \sum_{j=1}^{4} \alpha_j \Delta log(L_{ist-j}) + \sum_{j=0}^{4} \mu_j MP_{t-j} + \gamma BMS_{ist} + \sum_{j=0}^{4} \phi_j (MP_{t-j} * BMS_{ist}) + \sum_{j=0}^{4} \beta_j NATL_{t-j} + \sum_{j=0}^{4} \delta_j ST_{st-j} + \sum_{k=1}^{3} \pi_k QTR_{kt} + \sum_{k=1}^{17} \xi_k YEAR_{kt} + \eta_i + \epsilon_{ist} \tag{4}$$

The summed coefficients on the interaction between bank market structure and monetary policy, $\sum_{j=0}^{4} \phi_j$, inform us of the differential response of lending to monetary policy depending on a bank's market power, local market concentration, and state concentration.[36] Results are in Panel (b) of Table A.17. Columns (1), (3), and (5) show results for estimating equation 4 with each bank market structure variable without the deregulation dummy and interactions. Columns (2), (4), and (6) show results for estimating equation 4 with each bank market structure variable as well as the interstate deregulation dummy and interactions. Across all columns of the panel, a contractionary monetary policy shock results in a decrease in lending growth over the following four quarters. Columns (1)-(2) suggest that banks with greater market power are less sensitive to monetary policy. According to column (1), a pure monopoly bank (Lerner = 1) decreases lending growth by 0.48% for the four quarters following a monetary tightening whereas a perfectly competitive bank (Lerner = 0) decreases lending growth by 2.91%. Columns (3)-(6) reveal that county- and state-level concentration have no effect on loan response to monetary policy. Columns (2), (4) and (6) confirm that the effect of policy on lending growth increases by roughly 2% after interstate deregulation as in the baseline results.[37]

The estimates in Panels (a) and (b) of Table A.17 suggest that interstate deregulation did not affect loan sensitivity through bank market structure. Banking concentration has no significant impact on the sensitivity of lending to monetary policy. Increased bank market power weakens the impact of policy on lending. Since interstate deregulation increased bank market power but strengthened the impact of policy on lending, it is unlikely that the effect of deregulation was mainly driven by changes in market power. Moreover, in untabulated results we also obtain that controlling for the measures of bank market structure does not alter the baseline results.

[36] The Lerner index is included with one lag to reduce simultaneity concerns.

[37] If we aggregate the county HHI and state HHI regressions to the county-level and state-level, respectively, the results are very similar with insignificant coefficients on the HHI*MP interactions.

While deregulation may not have operated through changes in bank market power or concentration it is possible that banks were differentially impacted by deregulation depending on the market structure. Table A.18 shows estimates of equation 2 for subsamples corresponding to Lerner index quartiles, with the 1st quartile having the lowest market power. In Panel (a) we tabulate results for all banks, in Panel (b) results for small banks only, and in Panel (c) results for large banks only. There is no clear trend across quartiles, as all respond more strongly after interstate deregulation, particularly the first and fourth quartiles. Again, only small banks respond more strongly after deregulation. Likewise, Appendix Table A.19 shows that interstate deregulation has a significant effect across all HHI quartiles, driven by small banks (Panel (b)). Thus, bank market structure does not appear to play a major role in the greater lending sensitivity to monetary policy after deregulation.

We conclude this appendix with details on the computation of the Lerner index. The Lerner index is computed as the difference between price of bank production and marginal cost, divided by marginal cost. The average price of bank production is proxied by the ratio of total revenues to total assets. The marginal cost is calculated by estimating a translog cost function with one output and three input prices. The output price is the price of total assets and the input prices are the price of labor, price of fixed assets, and price of borrowed funds (interest on deposits). The cost function is specified as follows:

$$log(TC_{it}) = \alpha_0 + \alpha_1 log(y_{it}) + 0.5\alpha_2 (log(y_{it}))^2 + \sum_{j=1}^{3} \beta_j log(w_{j,it}) + \sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk} log(w_{j,it}) * log(w_{k,it}) + \sum_{j=1}^{3} \gamma_j log(y_{it}) * log(w_{j,it}) + \rho_t + \eta_i + \epsilon_{it} \tag{5}$$

where y is total assets and $\sum_{j=1}^{3} w_j$ are the three input prices. Time fixed effects and bank fixed effects are included. Symmetry and linear homogeneity restrictions are imposed on input prices. Total cost is the sum of the three input prices. Marginal cost can then be calculated from the estimated coefficients:

$$MC = (TC/y) * (\alpha_1 + \alpha_2 log(y) + \sum_{j=1}^{3} log(w_j)) \tag{6}$$

The resulting Lerner index, calculated as (P-MC)/MC, is a bank-level measure of market power, with a value of 0 representing a perfectly competitive bank (P=MC)

and a value of 1 representing a pure monopolist. Since expense data are available only biannually until 1983 we fill the missing first and third quarter observations with the average Lerner index of the previous and following quarters.

A.2 Details on Loan Portfolio Composition Tests Interstate deregulation may increase certain types of lending which are more sensitive to policy. Focusing on total lending may therefore mask compositional effects in banks' lending behavior. In Table A.20, Panel (a), we first check whether interstate deregulation altered the composition of banks' loan portfolios. Interstate deregulation appears to reduce the shares of commercial and industrial lending and real estate lending (relative to total loans) and to raise the share of consumer lending. The coefficients for each category share are small, however, as the share of loans going to consumer lending increases by just 0.37% after deregulation.

To further probe the role of compositional effects, equation 2 is estimated separately for each of the three loan categories with results gathered in Panel (b) of Table A.20. Interestingly, columns (1), (3), and (5) report that each loan category responds negatively to a monetary tightening.[38] While the summed coefficients on the interaction between interstate deregulation and monetary policy are not significant in the baseline specification, the alternate specification including time fixed effects reveals that each category becomes more sensitive to policy following deregulation, and at a similar magnitude as total lending in Table 2. In summary, the deregulation does not appear to have materially affected the composition of loan portfolios nor the relative sensitivity of the three loan categories to monetary policy. Thus, it is unlikely that compositional effects are responsible for the results.

A.3 Tables and Figures The following pages report appendix tables A.1-A.20 as well as appendix figures A.1-A.5.

[38]There are important differences between this study and Den Haan, Sumner, and Yamashiro (2007), as they use aggregate data in a VAR framework for a sample that extends to 2004.

Table A.1: Deregulation dates

State	Intrastate branching via M&A	Interstate banking
Alabama	1981	1987
Alaska	<1970	1982
Arizona	<1970	1986
Arkansas	1994	1989
California	<1970	1987
Colorado	1991	1988
Connecticut	1980	1983
Delaware	<1970	1988
Washington, DC	<1970	1985
Florida	1988	1985
Georgia	1983	1985
Hawaii	1986	*
Idaho	<1970	1985
Illinois	1988	1986
Indiana	1989	1986
Iowa	*	1991
Kansas	1987	1992
Kentucky	1990	1984
Louisiana	1988	1987
Maine	1975	1978
Maryland	<1970	1985
Massachusetts	1984	1983
Michigan	1987	1986
Minnesota	1993	1986
Mississippi	1986	1988
Missouri	1990	1986
Montana	1990	1993
Nebraska	1985	1990
Nevada	<1970	1985
New Hampshire	1987	1987
New Jersey	1977	1986
New Mexico	1991	1989
New York	1976	1982
North Carolina	<1970	1985
North Dakota	1987	1991
Ohio	1979	1985
Oklahoma	1988	1987
Oregon	1985	1986
Pennsylvania	1982	1986
Rhode Island	<1970	1984
South Carolina	<1970	1986
South Dakota	<1970	1988
Tennessee	1985	1985
Texas	1988	1987
Utah	1981	1984
Vermont	1970	1988
Virginia	1978	1985
Washington	1985	1987
West Virginia	1987	1988
Wisconsin	1990	1987
Wyoming	1988	1987

Note: Column 1 lists the year that each state allowed branch banking through mergers and acquisitions. Column 2 lists the year each state entered into an interstate banking agreement with other states. * indicates that a state had not deregulated before 1994. Dates from Amel (1993) and Jayaratne and Strahan (1998).

Table A.2: Baseline specification. All coefficient estimates

Dependent variable: Real Loan Growth (1976Q2 - 1994Q4)							
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
Loan Growth (t-1)	0.100***	CRSP(t-4)	0.0491**	INTRA*MP	-0.0009	1983 Dummy	0.0098***
	(0.0126)		(0.0186)		(0.0008)		(0.0027)
Loan Growth (t-2)	0.0157	PI	0.0010***	INTRA*MP(t-1)	-0.0004	1984 Dummy	0.0065***
	(0.0105)		(0.0003)		(0.0007)		(0.0022)
Loan Growth (t-3)	0.0395***	PI(t-1)	0.0015***	INTRA*MP(t-2)	0.0007	1985 Dummy	-0.0129***
	(0.00487)		(0.0004)		(0.0008)		(0.0019)
Loan Growth (t-4)	0.1663***	PI(t-2)	0.0019***	INTRA*MP(t-3)	0.0004	1986 Dummy	-0.0073***
	(0.0114)		(0.0003)		(0.0008)		(0.0014)
GDP	-4.85e-07	PI(t-3)	0.0004*	INTRA*MP(t-4)	-0.0003	1987 Dummy	-0.0089***
	(6.31e-06)		(0.0002)		(0.0009)		(0.0022)
GDP(t-1)	-1.64e-06	PI(t-4)	0.0007***	INTER*MP	-0.0088***	1988 Dummy	0.0022
	(8.31e-06)		(0.0002)		(0.0026)		(0.0026)
GDP(t-2)	-4.23e-05***	HPI	0.0005***	INTER*MP(t-1)	0.0011	1989 Dummy	-0.0011
	(6.47e-06)		(8.85e-05)		(0.0026)		(0.0025)
GDP(t-3)	3.73e-05***	HPI(t-1)	0.0006***	INTER*MP(t-2)	0.0005	1990 Dummy	-0.0074***
	(5.19e-06)		(0.0001)		(0.0024)		(0.0024)
GDP(t-4)	1.29e-05*	HPI(t-2)	0.0007***	INTER*MP(t-3)	-0.0065***	1991 Dummy	-0.0017
	(6.66e-06)		(8.75e-05)		(0.0021)		(0.0030)
PCE	-0.0039*	HPI(t-3)	0.0006***	INTER*MP(t-4)	-0.0071***	1992 Dummy	-0.0076**
	(0.0021)		(9.15e-05)		(0.0020)		(0.0031)
PCE(t-1)	-0.0004	HPI(t-4)	0.0003***	Q2 Dummy	0.0208***	1993 Dummy	-0.0007
	(0.00229)		(6.50e-05)		(0.0018)		(0.0039)
PCE(t-2)	0.0114***	MP	0.0022***	Q3 Dummy	0.0083***	1994 Dummy	0.0147***
	(0.0026)		(0.0007)		(0.0015)		(0.0050)
PCE(t-3)	-0.0229***	MP(t-1)	-0.0087***	Q4 Dummy	0.0040***	Constant	-0.0047
	(0.0030)		(0.0006)		(0.0014)		(0.00510)
PCE(t-4)	-0.0029	MP(t-2)	-0.0086***	1978 Dummy	-0.0120***		
	(0.0027)		(0.0006)		(0.0011)	Observations	823,659
CRSP	0.0156	MP(t-3)	-0.0029***	1979 Dummy	-0.0283***	Number of banks	15,990
	(0.0115)		(0.0005)		(0.0024)	R-squared	0.124
CRSP(t-1)	0.0553***	MP(t-4)	-0.0024***	1980 Dummy	-0.0296***		
	(0.0156)		(0.0004)		(0.0027)		
CRSP(t-2)	0.0552***	INTRA	-0.0003	1981 Dummy	0.0101**		
	(0.0143)		(0.0019)		(0.0042)		
CRSP(t-3)	0.1017***	INTER	0.0017	1982 Dummy	0.0077***		
	(0.0144)		(0.0016)		(0.0019)		

Note: This table reports full results from estimating equation 2 with the baseline specification. Robust standard errors clustered at the state level are in parentheses. GDP is the change in real GDP, PCE is the change in the personal consumption expenditures index, CRSP is the CRSP value-weighted stock return index, PI is the percentage change in state personal income, HPI is the change in the state all-transactions house price index, and Q2, Q3, and Q4 are quarter-of-a-year dummies.

Table A.3: Robustness. Relative timing of deregulation

sum of coefficients	
Inter*MP	-0.0363**
	(0.0167)
Inter*MP*Inter_First_Dummy	-0.0081
	(0.0237)
observations	823,620
STATE	Yes
Bank Fixed Effects	Yes
Time Fixed Effects	Yes

Note: This table reports full results from estimating equation 2 with an additional Inter_First_Dummy which equals 1 for banks located in a state that deregulated interstate banking prior to deregulating intrastate branching. The dummy, its interaction with the monetary shocks, its interaction with the Interstate dummy, and its triple interaction with both variables are added to the regression. Robust standard errors clustered at the state level are in parentheses.

Table A.4: Further robustness tests

sum of coefficients	**(1)**	**(2)**	**(3)**	**(4)**
Inter*MP	-0.0414***	-0.0410***	-0.0449***	-0.0390***
	(0.0132)	(0.0125)	(0.0131)	(0.0123)
Small Bank Share*MP	-	0.0088	-	-
		(0.0250)		
Small Bank Health*MP	-	-	-0.0008	-
			(0.0909)	
Small Business Share*MP	-	-	-	-0.0945
				(0.0688)
observations	823,659	823,659	823,659	822,746
State Specific Time Trend	Yes	No	No	No
Bank Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2 with additional state level controls. Column (1) includes state specific time trends, column (2) includes the share of small bank assets within a state, column (3) includes the health of small banks within a state, and column (4) includes the share of small businesses within a state. The latter three variables are included in levels and interacted with the monetary policy indicator. Robust standard errors clustered at the state level are in parentheses.

Table A.5: Robustness. NBR targeting

sum of coefficients	**(1)**	**(2)**
MP	-0.0171***	0.0239***
	(0.0022)	(0.0079)
Intra*MP	-0.0006	-0.0009
	(0.0030)	(0.0029)
Inter*MP	-0.0233**	-0.0340***
	(0.0093)	(0.0104)
NBR	-0.0048***	-0.0125***
	(0.0015)	(0.0018)
NBR*MP	-	-0.0406***
		(0.0074)
observations	823,659	823,659
STATE	Yes	Yes
NATIONAL	Yes	Yes
Bank Fixed Effects	Yes	Yes
Year Dummies	Yes	Yes

Note: This table reports results from estimating equation 2 with controls for the period of non-borrowed reserve (NBR) targeting from 1979 to 1982. Column (1) includes a dummy variable equalling 1 for quarters during the NBR regime and equalling 0 otherwise. Column (2) includes the NBR dummy and an interaction between the dummy and the monetary policy indicator. Robust standard errors clustered at the state level are in parentheses.

Table A.6: Robustness. Great Moderation

sum of coefficients	**(1)**	**(2)**
MP	-0.0206***	-0.0200***
	(0.0019)	(0.0021)
GM*MP	0.0258***	0.0593***
	(0.0077)	(0.0170)
Inter*MP	-	-0.0427***
		(0.0131)
observations	823,659	823,659
STATE	Yes	Yes
NATIONAL	Yes	Yes
Bank Fixed Effects	Yes	Yes
Year Dummies	Yes	Yes

Note: This table reports results from estimating equation 2 with controls for the "Great Moderation" from 1984 onwards. Column (1) includes a dummy variable equalling 1 for quarters during the Great Moderation and equalling 0 otherwise, and an interaction between the GM dummy and the monetary policy indicator. Column (2) includes the interaction between the interstate deregulation dummy and the monetary policy indicator. Robust standard errors clustered at the state level are in parentheses.

Table A.7: Responsiveness of loan rate, by bank size

Dependent variable: Avg loan rate				
	Small		Large	
sum of coefficients	**(1)**	**(2)**	**(3)**	**(4)**
MP	0.0067***	-	0.0110***	-
	(0.0009)		(0.0014)	
Inter*MP	0.0111***	0.0042**	0.0129***	0.0011
	(0.0020)	(0.0019)	(0.0029)	(0.0020)
observations	786,207	786,207	36,585	36,585
STATE	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes

Note: This table reports results from estimating equation 2 with average loan rate as the dependent variable. Columns (1) and (2) report results for small banks only (those under the 95th percentile in total assets). Columns (3) and (4) report reports for large banks only (those above the 95th percentile in total assets). Robust standard errors clustered at the state level are in parentheses.

Table A.8: Banking deregulation, monetary policy and lending. By bank capitalization

All banks - by equity ratio quartile								
Panel (a)	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MP	-0.0206***	-	-0.0190***	-	-0.0211***	-	-0.0200***	-
	(0.0025)		(0.0021)		(0.0029)		(0.0035)	
Inter*MP	-0.0219*	-0.0427**	-0.0235**	-0.0414***	-0.0134	-0.0354***	-0.0096	-0.0369**
	(0.0113)	(0.0177)	(0.0104)	(0.0146)	(0.0099)	(0.0118)	(0.0109)	(0.0140)
observations	204,740	204,740	208,100	208,100	209,731	209,731	201,088	201,088
Small banks - by equity ratio quartile								
Panel (b):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0201***	-	-0.0189***	-	-0.0213***	-	-0.0200***	-
	(0.0027)		(0.0021)		(0.0029)		(0.0035)	
Inter*MP	-0.0211*	-0.0480**	-0.0250**	-0.0427***	-0.0142	-0.0359***	-0.0111	-0.0381**
	(0.0120)	(0.0194)	(0.0101)	(0.0142)	(0.0099)	(0.0117)	(0.0104)	(0.0137)
observations	181,399	181,399	200,779	200,779	206,024	206,024	198,825	198,825
Large banks - by equity ratio quartile								
Panel (c):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0251***	-	-0.0251**	-	-0.0149	-	-0.0242	-
	(0.0038)		(0.0095)		(0.0135)		(0.0376)	
Inter*MP	-0.0182*	-0.0034	0.0120	0.0004	-0.0021	-0.0067	0.0603	-0.0166
	(0.0094)	(0.0102)	(0.0243)	(0.0333)	(0.0250)	(0.0576)	(0.0511)	(0.0359)
observations	23,341	23,341	7,321	7,321	3,707	3,707	2,263	2,263
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes	-	Yes	-	Yes

Note: Panel (a) reports results from separately estimating equation 2 for all banks that fall into the 1st, 2nd, 3rd, and 4th quartiles of equity ratio within a given quarter. Panel (b) reports results for small banks only and panel (c) reports results for large banks only. Equity ratio is measured as total equity divided by total assets. Robust standard errors clustered at the state level are in parentheses.

Table A.9: Bank organizational structure. Sample through 2008

	Not Affiliated		Affiliated. All Banks		Affiliated. Small Banks	
	All Banks	**Small Banks**	**Pre or Post**	**Pre**	**Pre or Post**	**Pre**
Inter*MP	-0.0292**	-0.0294**	-0.0526***	-0.0603***	-0.0526***	-0.0627***
	(0.0145)	(0.0145)	(0.0145)	(0.0150)	(0.0145)	(0.0149)
observations	469,231	461,969	1,106,710	724,580	1,098,503	680,441
STATE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: The first two columns report results from estimating equation 2 for unaffiliated banks. The third and fourth columns report results for all banks that are affiliated at any point in the sample, and banks that are initially affiliated prior to interstate deregulation. The fifth and sixth columns report results for small banks that are affiliated at any point in the sample, and small banks that are initially affiliated prior to interstate deregulation. Robust standard errors clustered at the state level are in parentheses.

Table A.10: Bank organizational structure (asset response)

Effect of Inter*MP on Asset Side of Balance Sheet				
	Small pre-affiliated - by liquidity ratio quartile			
Quartile:	**1st**	**2nd**	**3rd**	**4th**
Loan Growth	-0.0759***	-0.0729***	-0.0379***	-0.0400**
	(0.0166)	(0.0167)	(0.0146)	(0.0167)
Securities Growth	0.0674**	0.0815**	-0.0394	0.0661
	(0.0371)	(0.0374)	(0.0526)	(0.0473)
Asset Growth	-0.0123	-0.0157	-0.0283***	0.0036
	(0.0099)	(0.0106)	(0.0133)	(0.0186)
STATE	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2 by bank liquidity ratio quartile, with the 1st quartile being the least liquid and the 4th quartile being the most liquid. The results are for small banks affiliated with a bank holding company prior to interstate deregulation. The dependent variable is real loan growth in the first row, securities growth in the second row, and total asset growth in the third row. Robust standard errors clustered at the state level are in parentheses.

Table A.11: Robustness. Bank organizational structure and complexity. Sample through 2008

	Panel (a). BHC Affiliation					Panel (b). BHC Distance					Panel (c). BHC Assets				
Dependent variable:	Complexity	Real loan growth				Complexity	Real loan growth				Complexity	Real loan growth			
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Inter (sum of 4 lags)	0.0078					-4.2307					0.9013***				
	(0.0189)					(13.5373)					(0.2559)				
Inter*MP		-0.0531***	-0.0357**				-0.0602***	-0.0448***				-0.0582***	-0.0523***		
		(0.0130)	(0.0135)				(0.0138)	(0.0128)				(0.0138)	(0.0154)		
Complexity*MP		-0.0007	-				-0.0008	-				-0.0051***	-		
		(0.0015)					(0.0013)					(0.0017)			
Complexity*Inter*MP		0.0009	-0.0267**				-0.0016	-0.0392***				-0.0025	-0.0082		
		(0.0035)	(0.0120)				(0.0021)	(0.0141)				(0.0021)	(0.0177)		
MP				-0.0252***	-				-0.0282***	-				-0.0216***	-
				(0.0061)					(0.0063)					(0.0051)	
$\widehat{Complexity}$***MP**				-0.0053	0.7610**				-0.0001	-0.0084				-0.0007	-0.0324**
				(0.0097)	(0.3339)				(0.0001)	(0.2353)				(0.0006)	(0.0141)
observations	1,051,463	1,051,463	1,051,463	1,051,521	1,051,521	678,179	678,179	678,179	678,204	678,204	678,179	678,179	678,179	678,204	678,204

	Panel (d). BHC Capital					Panel (e). Ratio of Bank Assets to BHC Assets					Panel (f). Ratio of Bank Capital to BHC Capital				
Dependent variable:	Complexity	Real loan growth				Complexity	Real loan growth				Complexity	Real loan growth			
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Inter (sum of 4 lags)	0.6509***					-0.0481**					-0.0465**				
	(0.2269)					(0.0182)					(0.0191)				
Inter*MP		-0.0601***	-0.0579***				-0.0584***	-0.0664***				-0.0584***	-0.0661***		
		(0.0139)	(0.0163)				(0.0145)	(0.0220)				(0.0145)	(0.0219)		
Complexity*MP		-0.0063***	-				0.0065***	-				0.0066***	-		
		(0.0018)					(0.0023)					(0.0022)			
Complexity*Inter*MP		0.0004	0.0007				-0.0028	0.0119				-0.0029	0.0113		
		(0.0020)	(0.0147)				(0.0031)	(0.0206)				(0.0031)	(0.0204)		
MP				-0.0215***	-				0.2106	-				0.2074	-
				(0.0051)					(0.3379)					(0.3305)	
$\widehat{Complexity}$***MP**				-0.0008	-0.0396**				-0.2859	0.4086*				-0.2818	0.4119*
				(0.0008)	(0.0176)				(0.4215)	(0.2163)				(0.4122)	(0.2186)
observations	678,179	678,179	678,179	678,204	678,204	678,179	678,179	678,179	678,204	678,204	678,179	678,179	678,179	678,204	678,204
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	-	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	-	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-
Time Fixed Effects	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	-	Yes
Complexity x Time FE	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-	-

Note: Robust standard errors clustered at the state level are in parentheses. In each panel, the dependent variable in column (1) is a complexity proxy and real loan growth in columns (2)-(5). Complexity in columns (2)-(3) is a dummy variable equaling one if the complexity measure is above median. Panel (a) includes small banks affiliated at some point in the sample. Panels (b)-(f) include small banks affiliated prior to interstate deregulation. For details on variables and specifications see Section 5.4.

Table A.12: Robustness. Bank organizational structure and complexity. Further tests

	Panel (a). BHC Affiliation					Panel (b). BHC Distance					Panel (c). BHC Assets				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Complexity	Real loan growth				Complexity	Real loan growth				Complexity	Real loan growth			
Inter (sum of 4 lags)	0.0704**					10.3059***					0.9656**				
	(0.0311)					(3.7537)					(0.4035)				
Inter*MP		-0.0319**	-0.0264**				-0.0469***	-0.0361***				-0.0424***	-0.0349**		
		(0.0121)	(0.0131)				(0.0125)	(0.0114)				(0.0132)	(0.0129)		
Complexity*MP		0.0002	-				0.0006	-				-0.0032**	-		
		(0.0017)					(0.0015)					(0.0015)			
Complexity*Inter*MP		-0.0208***	-0.0301***				-0.0052	-0.0438***				-0.0088*	-0.0213*		
		(0.0067)	(0.0109)				(0.0035)	(0.0131)				(0.0049)	(0.0113)		
MP				0.0356	-				0.5204	-				-0.0161	-
				(0.0306)					(5.9558)					(0.0747)	
$\widehat{Complexity}$***MP**				-0.1460**	1.2826				-0.0256	0.0038				-0.0022	-0.0186
				(0.0647)	(0.8812)				(0.2772)	(0.0048)				(0.0142)	(0.1079)
observations	616,015	616,015	616,015	616,051	616,051	616,015	616,015	616,015	616,051	616,051	616,015	616,015	616,015	616,051	616,051
	Panel (d). BHC Capital					Panel (e). Ratio of Bank Assets to BHC Assets					Panel (f). Ratio of Bank Capital to BHC Capital				
Dependent variable:	Complexity	Real loan growth				Complexity	Real loan growth				Complexity	Real loan growth			
Inter (sum of 4 lags)	0.7309**					-0.0411*					-0.0387*				
	(0.3456)					(0.0206)					(0.0219)				
Inter*MP		-0.0441***	-0.0425**				-0.0477***	-0.0621***				-0.0476***	-0.0618***		
		(0.0138)	(0.0142)				(0.0131)	(0.0204)				(0.0131)	(0.0203)		
Complexity*MP		-0.0042***	-				0.0052**	-				0.0052**	-		
		(0.0015)					(0.0022)					(0.0022)			
Complexity*Inter*MP		-0.0073	-0.0104				0.0001	0.0206				-0.0001	0.0202		
		(0.0057)	(0.0092)				(0.0045)	(0.0155)				(0.0044)	(0.0153)		
MP				-0.0236	-				-0.4061	-				-0.4089	-
				(0.1260)					(0.3957)					(0.4013)	
$\widehat{Complexity}$***MP**				-0.0010	-0.0054				0.4608	1.3343				0.4641	1.3675
				(0.0306)	(0.1494)				(0.4807)	(2.5745)				(0.4873)	(2.7045)
observations	616,015	616,015	616,015	616,051	616,051	616,015	616,015	616,015	616,051	616,051	616,015	616,015	616,015	616,051	616,051
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	-	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	-	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-
Time Fixed Effects	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	-	Yes
Complexity x Time FE	-	-	Yes	-	-	-	-	Yes	-	-	-	-	Yes	-	-

Note: Robust standard errors clustered at the state level are in parentheses. In each panel, the dependent variable in column (1) is a complexity proxy and real loan growth in columns (2)-(5). Complexity in columns (2)-(3) is a dummy variable equaling one if the complexity measure is above median. The sample includes small banks affiliated at some point from 1977-1994. For details on variables and specifications see Section 5.4.

Table A.13: Effect of intrastate deregulation on BHC complexity

	BHC Affiliation	BHC Distance	BHC Assets	BHC Capital	Ratio of Bank-BHC Assets	Ratio of Bank-BHC Capital
Intra (sum of 4 lags)	0.0229	13.7259	0.3074	0.1742	-0.0190	-0.0173
	(0.0336)	(11.7273)	(0.4459)	(0.3713)	(0.0219)	(0.0227)
observations	485,758	485,758	485,758	485,758	485,758	485,758
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the effect of intrastate deregulation on BHC affiliation and five proxies for BHC complexity. Four lags of the intrastate deregulation dummmy are included and the coefficients are summed together. Robust standard errors clustered at the state level are in parentheses.

Table A.14: Share of loans, by holding affiliation status

Share of Total Loans (National)			
	Whole Sample	1976-1985	1986-1994
Small Affiliated	0.16	0.13	0.18
Small Stand Alone	0.12	0.16	0.08
Large Affiliated	0.61	0.60	0.62
Large Stand Alone	0.11	0.11	0.12

Note: This table reports the share of total loans at the national level for four categories of banks: small banks (below the 95th percentile in assets) affiliated with a bank holding company (BHC), small stand alone banks, large banks (above the 95th percentile in assets) affiliated with a BHC, and large stand alone banks. Column 1 presents average share for the entire sample (1976-1994), column 2 presents average share for the early part of the sample (1976-1985), and column 3 presents average share for the later part of the sample (1986-1994).

Table A.15: Aggregate Effects

Panel (a). Dependent variable: state-level real loan growth					
	All Banks	**Small Affiliated**	**Small Stand Alone**	**Large Affiliated**	**Large Stand Alone**
	(1)	(2)	(3)	(4)	(5)
Intra*MP	0.0047	-0.0162	0.0241	0.0386	-0.0613
	(0.0090)	(0.0259)	(0.0266)	(0.0300)	(0.0617)
Inter*MP	-0.0189	-0.0801*	0.1372	-0.0174	0.1383
	(0.0399)	(0.0424)	(0.1092)	(0.0536)	(0.1206)
observations	3,621	3,539	3,621	3,367	1,639
Panel (b). Dependent variable: state-level personal income growth					
	Small Bank Share		Small Affiliated Bank Share		
	Below Median	**Above Median**	**Below Median**	**Above Median**	
	(1)	(2)	(3)	(4)	
Inter*MP	-0.0313	-2.0795**	-0.5086	-2.2637***	
	(0.6300)	(0.9583)	(0.9614)	(0.8066)	
observations	1,847	1,825	1,765	1,907	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2 with data aggregated at the state level. The dependent variables for each respective column in Panel (a) are real loan growth for all loans within a state, real loan growth for all small BHC affiliated banks within a state, real loan growth for all small stand alone banks within a state, real loan growth for all large BHC affiliated banks within a state, and real loan growth for all large stand alone banks within a state. The dependent variable in Panel (b) is state personal income growth. Robust standard errors clustered at the state level are in parentheses.

Table A.16: Aggregate Effects. Sample through 2008

Panel (a). Dependent variable: state-level real loan growth					
	All Banks	**Small Affiliated**	**Small Stand Alone**	**Large Affiliated**	**Large Stand Alone**
	(1)	(2)	(3)	(4)	(5)
Intra*MP	0.0017	-0.0113	0.0225	0.0304	-0.0578
	(0.0138)	(0.0262)	(0.0296)	(0.0305)	(0.0719)
Inter*MP	-0.0048	-0.0766*	0.1383	-0.0259	0.1106
	(0.0498)	(0.0408)	(0.1104)	(0.0503)	(0.1298)
observations	6,477	6,395	6,477	6,048	2,677
Panel (b). Dependent variable: state-level personal income growth					
	Small Bank Share		Small Affiliated Bank Share		
	Below Median	**Above Median**	**Below Median**	**Above Median**	
	(1)	(2)	(3)	(4)	
Inter*MP	-0.1877	-2.2206**	-0.8466	-3.3998***	
	(0.6194)	(1.0529)	(0.5047)	(0.8066)	
observations	3,275	3,253	3,191	3,337	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes

Note: This table reports results from estimating equation 2 with data aggregated at the state level. The dependent variables for each respective column in Panel (a) are real loan growth for all loans within a state, real loan growth for all small BHC affiliated banks within a state, real loan growth for all small stand alone banks within a state, real loan growth for all large BHC affiliated banks within a state, and real loan growth for all large stand alone banks within a state. The dependent variable in Panel (b) is state personal income growth. Robust standard errors clustered at the state level are in parentheses.

Table A.17: Mechanisms. Bank market structure

Panel (a)	Effect of deregulation on market structure		
Dependent Variable:	**Lerner Index**	**County HHI**	**State HHI**
Inter	0.0065*	0.0128**	-0.0193
	(0.0037)	(0.0056)	(0.0104)
observations	878,625	205,817	3,825
Bank Fixed Effects	Yes	-	-
County Fixed Effects	-	Yes	-
State Fixed Effects	-	-	Yes
Time Fixed Effects	Yes	Yes	Yes

Panel (b)	Dependent variable: real loan growth					
sum of coefficients	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
MP	-0.0291***	-0.0287***	-0.0204***	-0.0200***	-0.0197***	-0.0193***
	(0.0034)	(0.0034)	(0.0020)	(0.0024)	(0.0023)	(0.0025)
LI*MP	0.0243***	0.0253***	-	-	-	-
	(0.0084)	(0.0081)				
County_HHI*MP	-	-	-0.0019	-0.0012	-	-
			(0.0031)	(0.0031)		
State_HHI*MP	-	-	-	-	-0.0272	-0.0245
					(0.0200)	(0.0203)
Inter*MP	-	-0.0206**	-	-0.0205**	-	-0.0199**
		(0.0085)		(0.0085)		(0.0085)
observations	819,992	819,992	823,659	823,659	823,659	823,659
STATE	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Note: Panel (a) reports the effect of deregulation on the three bank market structure variables: Lerner index (proxy for market power), county-level HHI (concentration), and state-level HHI (concentration). In panel (a), bank-level regressions include a vector of lagged bank characteristics (size, liquidity, and equity). Panel (b) reports results from estimating equation 4 with the three bank market structure variables. Odd columns include the interaction between the bank market structure and monetary policy only. Even columns include the interaction between interstate deregulation and monetary policy as well. Robust standard errors clustered at the state level are in parentheses.

Table A.18: Mechanisms. Bank market structure (cont.d)

All banks - by lerner index quartile								
Panel (a):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0184***	-	-0.0202***	-	-0.0214***	-	-0.0211***	-
	(0.0025)		(0.0025)		(0.0027)		(0.0032)	
Inter*MP	-0.0235*	-0.0537***	-0.0197**	-0.0355***	-0.0066	-0.0271**	-0.0160	-0.0405**
	(0.0129)	(0.0171)	(0.0075)	(0.0119)	(0.0080)	(0.0105)	(0.0122)	(0.0171)
observations	202,018	202,018	207,650	207,650	207,048	207,048	206,943	206,943
Small banks - by lerner index quartile								
Panel (b):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0182***	-	-0.0199***	-	-0.0211***	-	-0.0216***	-
	(0.0025)		(0.0025)		(0.0028)		(0.0033)	
Inter*MP	-0.0246*	-0.0567***	-0.0200***	-0.0363***	-0.0065	-0.0286***	-0.0180	-0.0434**
	(0.0129)	(0.0165)	(0.0075)	(0.0118)	(0.0082)	(0.0105)	(0.0125)	(0.0180)
observations	199,197	199,197	202,937	202,937	199,059	199,059	185,834	185,834
Large banks - by lerner index quartile								
Panel (c):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0300**	-	-0.0304***	-	-0.0306***	-	-0.0177***	-
	(0.0142)		(0.0093)		(0.0059)		(0.0064)	
Inter*MP	-0.0238	0.0538	-0.0206	0.0063	-0.0056	-0.0043	-0.0076	-0.0148
	(0.0667)	(0.0687)	(0.0221)	(0.0204)	(0.0129)	(0.0140)	(0.0118)	(0.0114)
observations	2,821	2,821	4,713	4,713	7,989	7,989	21,109	21,109
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes	-	Yes	-	Yes

Note: This table reports results for estimating equation 2 across Lerner index quartiles, where the 1st quartile has the lowest market power and the 4th has the highest market power. Panel (a) reports results for all banks, panel (b) reports results for small banks (below the 95th percentile in assets), and panel (c) reports results for large banks (above the 95th percentile in assets). Robust standard errors clustered at the state level are in parentheses.

Table A.19: Mechanisms. Bank market structure, by county HHI quartile

All banks - by HHI quartile								
Panel (a):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0202***	-	-0.0178***	-	-0.0194***	-	-0.0232***	-
	(0.0030)		(0.0033)		(0.0022)		(0.0026)	
Inter*MP	-0.0154	-0.0264*	-0.0205***	-0.0411**	-0.0207**	-0.0448***	-0.0210*	-0.0406**
	(0.0145)	(0.0148)	(0.0068)	(0.0122)	(0.0101)	(0.0150)	(0.0107)	(0.0159)
observations	204,761	204,761	206,920	206,920	206,337	206,337	205,641	205,641
Small banks - by HHI quartile								
Panel (b):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0196***	-	-0.0178***	-	-0.0191***	-	-0.0238***	-
	(0.0030)		(0.0035)		(0.0023)		(0.0026)	
Inter*MP	-0.0162	-0.0307*	-0.0176***	-0.0373***	-0.0207**	-0.0457***	-0.0224**	-0.0430***
	(0.0147)	(0.0156)	(0.0065)	(0.0121)	(0.0103)	(0.0150)	(0.0108)	(0.0159)
observations	196,482	196,482	197,437	197,437	196,086	196,086	197,022	197,022
Large banks - by HHI quartile								
Panel (c):	**1st**		**2nd**		**3rd**		**4th**	
sum of coefficients	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
MP	-0.0228***	-	-0.0258***	-	-0.0262***	-	-0.0099	-
	(0.0080)		(0.0064)		(0.0052)		(0.0094)	
Inter*MP	-0.0099	-0.0038	-0.0312	-0.0233	-0.0226	-0.0157	-0.0126	-0.0165
	(0.0378)	(0.0365)	(0.0200)	(0.0236)	(0.0142)	(0.0132)	(0.0158)	(0.0135)
observations	8,279	8,279	9,483	9,483	10,251	10,251	8,619	8,619
STATE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes	-	Yes	-	Yes

Note: This table reports results for estimating equation 2 across county-level HHI quartile, where the 1st quartile has the lowest market concentration and the 4th has the highest market concentration. Panel (a) reports results for all banks, panel (b) reports results for small banks (below the 95th percentile in assets), and panel (c) reports results for large banks (above the 95th percentile in assets). Robust standard errors clustered at the state level are in parentheses.

Table A.20: Mechanisms. Bank loan portfolio composition

Effect of deregulation on category share of total loans			
Panel (a)	**C&I Share**	**RE Share**	**Con Share**
Inter	-0.0064***	-0.0174***	0.0037*
	(00013)	(0.0023)	(0.0022)
observations	857,525	857,525	857,525
BANK	Yes	Yes	Yes
STATE	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes

Dependent variable: real loan growth, by loan category						
Panel (b)	**C&I Loans**		**Real Estate Loans**		**Consumer Loans**	
sum of coefficients	(1)	(2)	(3)	(4)	(5)	(6)
MP	-0.0225***	-	-0.0158***	-	-0.0379***	-
	(0.0043)		(0.0031)		(0.0029)	
Inter*MP	-0.0230	-0.0434**	-0.0104	-0.0401**	0.0046	-0.0365***
	(0.0189)	(0.0194)	(0.0088)	(0.0162)	(0.0104)	(0.0128)
observations	737,753	737,753	795,076	795,076	778,630	778,630
STATE	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL	Yes	-	Yes	-	Yes	-
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	-	Yes	-	Yes	-
Time Fixed Effects	-	Yes	-	Yes	-	Yes

Note: Panel (a) reports the effect of deregulation on the share of total loans for each of the three major loan categories: commercial and industrial loans, real estate loans, and consumer loans. Panel (b) reports results from estimating equation 2 for the three loan categories. Robust standard errors clustered at the state level are in parentheses.

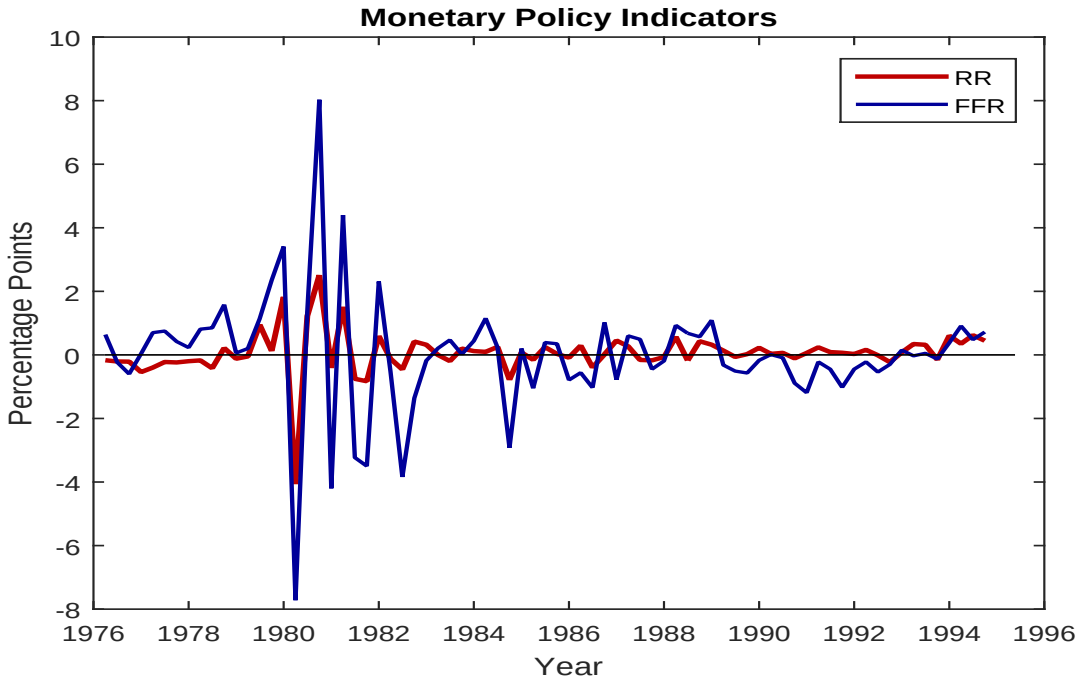

Figure A.1: This figure plots the RR shock series in red and the quarterly change in the fed funds rate in blue in 1976-1994.

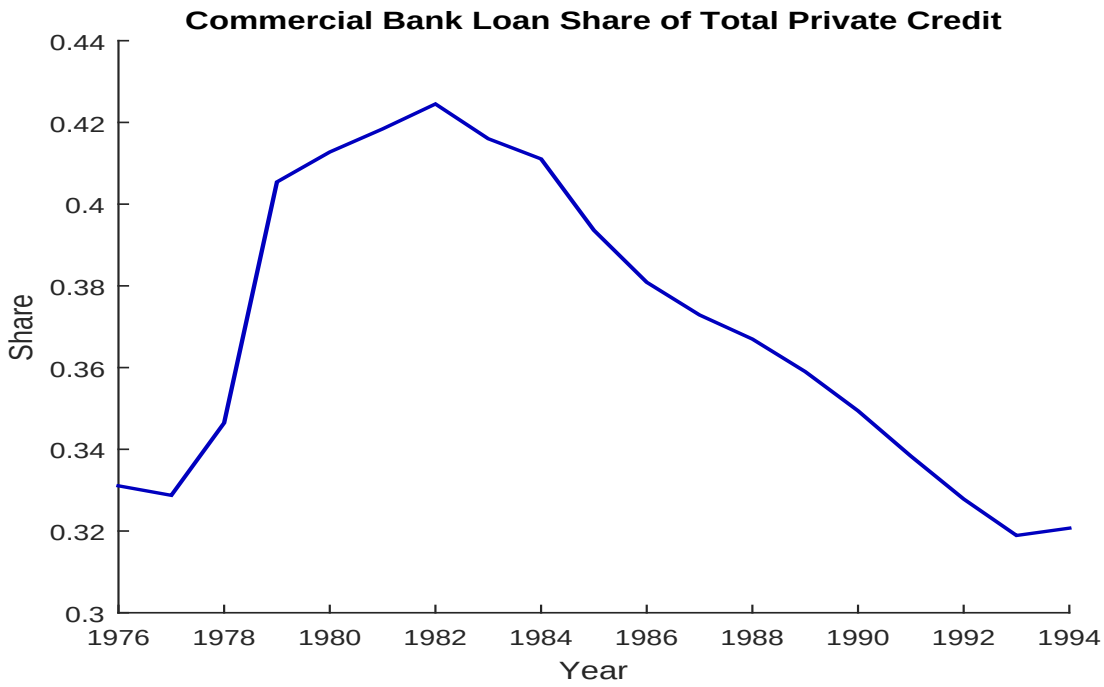

Figure A.2: This figure plots aggregate bank lending in our sample as a share of total private non-financial credit in the U.S. in 1976-1994. Data on private non-financial credit is from the Federal Reserve Z.1-Financial Accounts release.

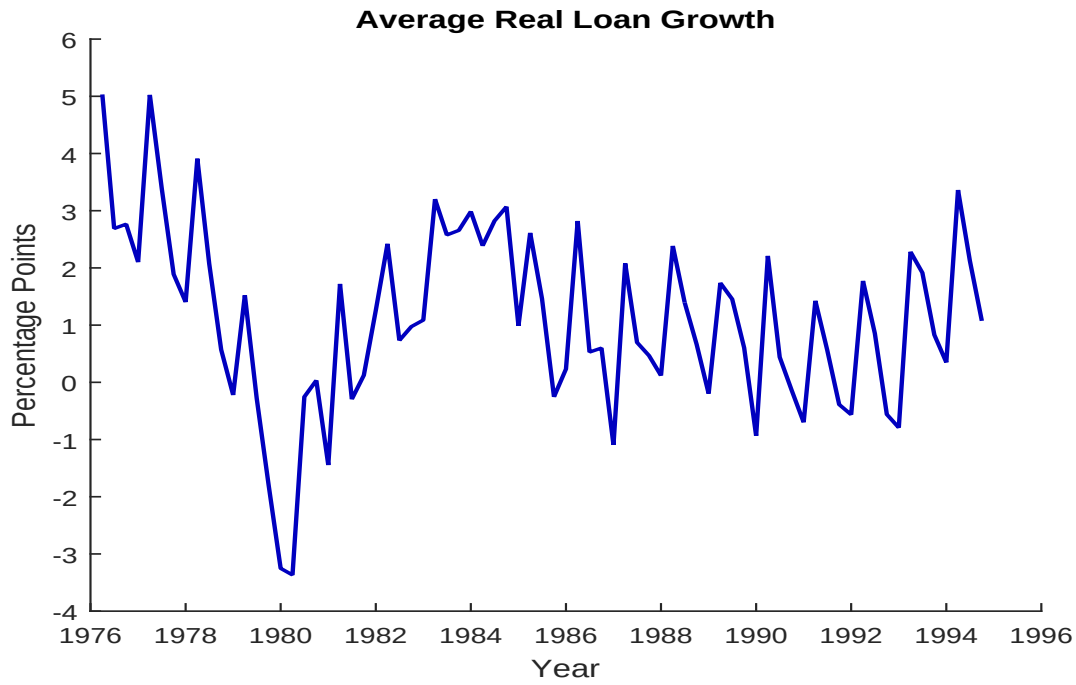

Figure A.3: This figure plots average real loan growth in 1976-1994.

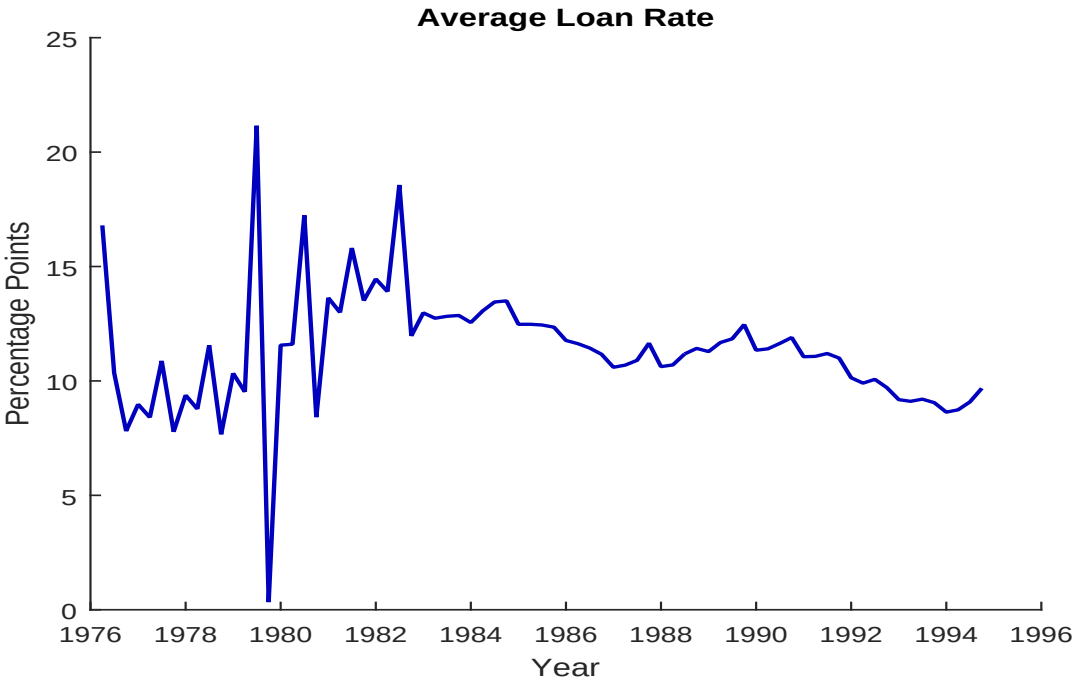

Figure A.4: This figure plots the average ratio of interest and fee income on loans to total loans (average loan rate) for 1976-1994.

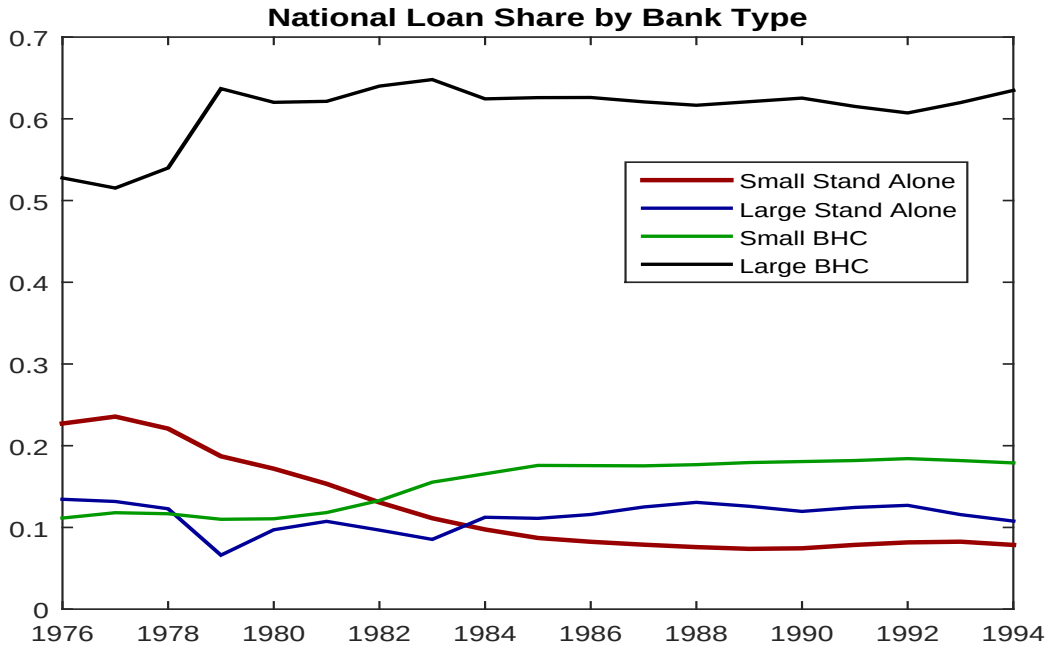

Figure A.5: This figure plots the share of national lending for four types of banks in 1976-1994: small stand alone banks (unaffiliated with a BHC), small banks affiliated with a BHC, large stand alone banks, and large banks affiliated with a BHC.