Market Power, Bank Funding, and the Transmission of the Monetary Policy to Bank Lending and Profitability *

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Abstract

This paper analyzes how bank market power affects monetary policy transmission to bank funding dynamics, lending, and profitability. First, I document variation in banks' exposure to the monetary policy via spreads on deposits, wholesale funding, and lending, and that bank market power is a strong predictor of the degree of exposure. Specifically, I show that after an increase in the policy rate, banks with higher market power adjust their deposit and loan rates relatively less, offsetting the fall in their deposit inflows through cheaper access to wholesale funding. This dampens the effect of contractionary monetary policy on their lending and profitability. That is, I present unified evidence on monetary pass-through to the U.S. commercial banks by comprehensively studying the interactions among the deposit, wholesale funding, and credit markets which is missing in the literature. Third, I show that bank market power has implications for monetary policy transmission to the real economy through its impact on bank-level lending. In particular, aggregate lending and employment decrease less in areas served by banks with higher market power following monetary contraction. Finally, I rationalize my empirical findings by building a theoretical model with monopolistic competition where market power generates imperfect pass-through of monetary policy.

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1 Introduction

Striking economic phenomenons of the recent decade in the U.S. banking industry have been the decrease in the banking competition and the growth of money market funds which are the leading players in the U.S. wholesale funding markets. In particular, the market share of the top five banks has increased significantly from less than 25% in the 1990s to over 45% in the last few years. Moreover, the total assets of money market funds nearly tripled during the same time, as shown in Figure 1. However, the current literature studied the effect of market power in isolation, focusing only on its impact on deposit and credit markets separately, and the role of market power on banks' cost of accessing wholesale funding and wholesale funding reliance is overlooked. Thus, a full understanding of how market power mediates monetary policy transmission to bank lending and profitability has been missing.

This paper examines how bank market power affects monetary policy transmission to banks' funding dynamics, lending, and profitability. First, I explore how monetary policy alters banks' funding composition between deposits and wholesale funding and whether bank market power is associated with variation in banks' exposure to monetary policy.[1] I further investigate how the change in banks' funding dynamics, in other words, change in their funding spreads and the funding composition affects monetary pass-through to bank lending spreads, interest margins, and bank profitability depending on the degree of banks' market power. In doing so, I provide novel evidence on the impact of bank market power on the transmission of monetary policy to the U.S. banking sector by jointly studying the deposit, wholesale funding, and credit markets which is critical to reaching accurate insights on the monetary policy transmission mechanism to banks' balance sheets as these markets are highly interconnected. Moreover, I show that bank market power affects the transmission of monetary policy to the macroeconomic outcomes through its impact on bank-level lending. Thus, my results have important implications for how we should think about monetary policy transmission mechanism to the real economy.

The first main contribution of this paper is documenting the dispersion in the response of banks' deposit and wholesale funding spreads to monetary policy depending on the banks' market power.[2] I show that monetary policy changes the fund-

[1] Wholesale funding refers to banks' funding sources other than retail deposits.

[2] Deposit spread is the difference between federal funds and deposit rates. Similarly, wholesale funding spread is defined as the difference between federal funds and wholesale funding rates. Widening of these spreads implies a partial pass-through of the policy rate to deposit and wholesale funding rates.

ing composition of the banks by creating a wedge in deposit and wholesale funding spreads among banks with different levels of market power. In particular, after monetary policy tightening, deposit and wholesale funding spreads increase more for banks with higher market power operating in highly concentrated local banking markets. In other words, these banks do not fully transmit the increase in interest to their depositors and access wholesale funding markets at a comparatively lower cost. As deposit spreads widen, households switch to products that offer higher yields, with deposit inflows decreasing slightly more for banks with market power as a result. At the same time, these banks considerably increase their wholesale funding dependence and compensate for the decrease in their deposit inflows through wholesale financing. Hence, I show that the funding composition of banks changes substantially in response to monetary policy and banks' market power is a good predictor of this compositional change.

My second main contribution is documenting that the change in bank funding dynamics affects monetary policy transmission to bank *lending* spreads and thus to bank lending.[3] Specifically, I show that banks with higher market power increase their loan spreads less following a monetary contraction. Two forces drive this result. First, market power enables banks to increase their deposit spreads more following a contractionary monetary policy. Second, banks with higher market power are able to access wholesale funding at a lower cost. The ability to keep deposit rates relatively low while leaning more on wholesale funding (where they get more favorable terms than other banks) enables banks with the higher market power to raise their interest on loans less as the federal funds rate rises. Thus, these banks' lending decreases significantly less compared to banks with lower market power.[4] Taken together, my results show that market power dampens the impact of monetary policy on lending by altering the funding dynamics of the banks.

The third contribution of this paper is to provide a unified framework to analyze the effect of bank market power on the transmission of monetary policy to banks' deposit, wholesale funding, and credit decisions which is essential to achieve a complete understanding of monetary policy transmission mechanism to bank lending due to interdependence of these markets. Prior to my work, little was known about the

[3]Lending spread is defined as the difference between the loan rate and the Treasury yield with a similar maturity.

[4]Figure 2 illustrates this mechanism in detail where Figure 2a plots the average effect of monetary policy on bank funding dynamics and lending and Figure 2b shows the impact of monetary policy on the banks with higher market power.

simultaneous effect of market power on funding and lending markets in the face of a change in the policy rate. I bridge the deposit and credit market power channels that study the impact of market power on either deposit or loan spreads separately. Additionally, I reveal the importance of the wholesale funding channel for the monetary policy transmission mechanism by documenting the heterogeneous response of banks' wholesale funding spreads to monetary policy, which has not been established previously. In particular, I show that bank market power lowers the pass-through of monetary policy into wholesale funding, deposit, and loan rates. Moreover, I find that the lending and net interest margins of banks with higher market power decrease less following a contractionary monetary policy, leading to a relative increase in the profitability of banks with higher market power.

The fourth contribution of this paper is to show that bank market power affects the monetary policy transmission mechanism to the macroeconomy. Previous literature argues that after an increase in the policy rate, deposits flow out of the banking system, and banks with deposit market power shrink their lending. This amplifies the impact of contractionary monetary policy on real economic outcomes (Drechsler, Savov, and Schnabl, 2017). However, they overlooked the effect of market power on banks' wholesale funding and lending spreads. I complete their story by comprehensively analyzing the impact of bank market power on U.S. banking markets and substantially expanding their sample. I show that lending of banks with higher market power decreases significantly less following a contractionary monetary policy as these banks substitute wholesale funding for deposit outflows, and pass-through to loan spreads are substantially lower for these banks. As a result, aggregate lending decreases less in areas served by banks with higher market power, and unemployment increases less in these regions following a contractionary monetary policy.

Lastly, I contribute to the literature by building a theoretical model of monopolistic competition both in deposit and credit markets consistent with the micro-foundations presented in Ulate (2021). I use the model to rationalize my empirical findings and explain the underlying mechanism. In the model, banks with higher market power access wholesale funding markets at a lower cost, which generates imperfect pass-through of monetary policy to their deposit, loan rates, and lending confirming my empirical findings. I cross-validate the model's predictions using data from U.S. Call Reports and show that the model performs well in matching the data.

There are a set of empirical challenges in identifying the impact of market power on the transmission of monetary policy to bank-level and macroeconomic outcomes. One significant identification challenge I face is the potential endogeneity of monetary policy. To address this concern, I use high-frequency monetary shocks from Bauer and Swanson (2022) as an instrument for the one-year Treasury rate in my analysis. These monetary policy shocks satisfy both instrument validity and exogeneity conditions as they are correlated with movements in the one-year Treasury rate yet uncorrelated with all other shocks.

Secondly, banks may have different lending opportunities, and banks' funding decisions might be responding to contemporaneous changes in bank-specific lending opportunities rather than directly to monetary policy. For example, if banks' lending opportunities reduce following the tightening of the monetary policy, banks issue fewer loans, and thus, their reliance on deposits decreases independent of banks' market power (Drechsler, Savov, and Schnabl, 2017). As a result, banks' retail rates might be affected by the change in the bank-specific loan demand rather than the banks' market power. I tackle this issue by exploiting the geographic variation in the concentration of local banking markets and show that my results go through even I compare the funding and lending spreads of the same bank located in areas with different levels of concentration. I implement this branch-level analysis using branch-level deposit and loan rate information on U.S. banks from Ratewatch. I construct my branch-level market power measure by relying on the Herfindahl index (HHI), calculated by summing up the squared asset-market shares of all depository institutions that operate branches in a given county in a given year. As decisions related to wholesale funding are made at the bank rather than the branch level, I conduct my analysis on wholesale financing at the bank level and provide a complete picture of the mechanism using bank-level data from Call Reports.

Another critical identification challenge I face is the different local lending opportunities that banks may face, irrespective of their market power. That is, monetary policy may distinctly affect local lending opportunities in different regions where banks operate. To address this issue, I use Small Business Lending data from the Federal Financial Institutions Examination Council (FFIEC), which reports a bank's lending in a given county for a particular year. To separate the effects of higher rates from the underlying macro environment, I add county-time fixed effects to my analysis which absorbs the average impact of macroeconomic variables on demand for loans. That is, I ensure that my results are not driven by the differences in local lending opportunities. I then aggregate my lending data to the county level and establish a link between bank lending and county-level real economic outcomes. The county-level analysis reveals that bank market power substantially impacts monetary policy transmission through bank balance sheets.

The rest of this paper is organized as follows: Section 2 discusses the related literature, and Section 3 documents the relationship between the federal funds rate and aggregate deposit and wholesale funding flows, providing motivating evidence for my analysis. Section 4 describes the data and provides summary statistics. Section 5 explains the identification strategy and provides the empirical results. Section 6 presents the model. Section 7 provides robustness checks, and Section 8 concludes.

2 Literature Review

This paper contributes four strands of literature. First, it contributes to the literature on the bank lending channel of monetary policy (Bernanke, 1983; Bernanke and Blinder, 1988; Kashyap and Stein, 1994; Kashyap and Stein, 2000) which explores how bank lending responds to change in the monetary policy. In these papers, the underlying channel for the transmission of monetary policy to bank lending operates through bank reserves. On the other hand, the primary mechanism that drives the bank lending results in my paper is the variation in the response of bank funding dynamics to monetary policy based on banks' market power. Specifically, the monetary policy creates a dispersion in the wholesale funding and deposit spreads of banks with different degrees of market power, which in turn changes the funding composition of the banks and influences the monetary policy pass-through to bank loan rates and bank lending outcomes.

Second, my paper bridges the literature that examines the role of bank market power on the transmission of monetary policy to the bank deposit and lending spreads. These papers have emphasized the importance of bank competition for the monetary policy pass-through to household deposits and mortgage rates (Scharfstein and Sunderam, 2016; Drechsler, Savov, and Schnabl, 2017; Balloch and Koby, 2019; Wang et al., 2022). Yet, they examine the impact of market power either on deposit or loan spreads and overlook its effect on the cost of accessing wholesale funding and banks' funding composition. Specifically, Drechsler, Savov, and Schnabl (2017) only focus on the impact of market power on deposit spreads centering on the pre-ZLB period. On the other hand, Scharfstein and Sunderam (2016) solely investigate the role of market power on mortgage rates concentrating on the low-interest rate environment. Building on these studies, my paper explores the impact of market power on monetary policy pass-through to bank funding and lending spreads jointly. It also proposes a new channel of monetary policy transmission mechanism through wholesale funding.

Third, my paper connects to literature that studies the impact of monetary policy on wholesale funding markets. Particularly, Xiao (2020) and Choi and Choi (2021) show that monetary tightening reduces the supply of retail deposits and expands funding creation in the money markets. I contribute to this literature by studying the impact of bank market power on banks' cost of accessing wholesale funding and banks' funding composition. I document that banks with higher market power change their funding dynamics to increase their funding profits which in turn allows them to charge lower loan markups and smooth the negative effect of contractionary monetary policy on their lending. This is a new dimension that these studies have not addressed, and my results provide significant insights into the impact of bank market power for the monetary policy transmission mechanism.

Finally, my paper connects to the literature that examines the effect of monetary policy on credit costs and real economic outcomes. Gertler and Karadi (2015) document that credit costs increase after a contractionary monetary policy shock due to the rise in the risk premia leading to a contraction in output. Eggertsson et al. (2019), Ulate (2021), Brunnermeier and Koby (2018) and Heider, Saidi, and Schepens (2019) explore the impact of low and negative interest rate environments on loan spreads and bank profitability. They show that the negative rate environment leads to a decline in banks' net worth, which can deteriorate output growth. I contribute to this literature by showing that bank market power alleviates the adverse effects of monetary policy both on bank funding and credit costs. Hence, the lending of banks with higher market power decreases relatively less after an increase in the policy rate. This, in turn, mitigates the negative impact of interest rate hikes on regional macroeconomic outcomes.

3 Motivating Evidence

In this section, I use aggregate bank-level data and document that monetary policy creates a wedge between the banks' funding spreads and the policy rate, leading to a change in the funding composition of the banking sector. Moreover, I illustrate the relationship between the policy rate and the bank profitability.

Figure 3a plots the average deposit and wholesale funding rate for the U.S. commercial banks against the federal funds rate over time using Call Reports data.[5] The figure reveals that both the deposit and wholesale funding rates rise less than one-for-one with the fed funds rate, generating a spread between the banks' funding rates and the policy rate.[6] As seen from the figure, both the deposit spread ($i^{FFR} - i^{D}$) and the wholesale funding spread ($i^{FFR} - i^{WF}$) are cyclical, increasing as the federal funds rate rises. Mainly, the tightening of the monetary policy increases the demand for interest-bearing deposits and wholesale funding products with respect to the money, enabling banks to restrict the pass-through of the higher policy rate to the cost of their funding.[7]

Figure 3c plots the average deposit rate by different deposit products using branch-level deposit data from Ratewatch. On average, time deposits offer higher rates than saving deposits as these products are less liquid than saving deposits.[8] Similarly, the pass-through to the wholesale funding rate is higher compared to the pass-through to the average deposit rate due to the illiquidity risk it bears.[9]

As the federal funds rate rises during monetary policy tightening cycles, the opportunity cost of holding deposits also rises. Consequently, depositors switch to relatively less liquid products that offer higher yields, such as bonds and money market products. This result can be seen by the negative relationship between the banks' core deposits and the federal funds rate presented in Figure 4a. Specifically, the core deposits of the commercial banking system shrink substantially when the federal funds rate increases.[10] In return, banks seek to compensate for the decrease in their deposits by turning to wholesale funding markets, both of which contribute to the expansion of the shares of money market mutual funds, as shown in Figure 4a. Figure 4b plots the time series of wholesale funding to deposit ratio against the federal funds rate. Importantly, there is a positive relationship between the federal funds rate and banks' wholesale funding reliance, indicating that banks substitute wholesale funding for de-

[5]I calculate the deposit rate as interest income on domestic deposits divided by domestic deposits and then annualized.

[6]Drechsler, Savov, and Schnabl (2017) also reported the spread between the federal funds rate and deposits.

[7]Xiao (2020) also reported the spread between the federal funds rate and money market products.

[8]Particularly, time deposits are locked in for a term, whereas checking and saving deposits can be withdrawn immediately, generating a liquidity premium between these products (Drechsler, Savov, and Schnabl, 2017).

[9]Wholesale funding is generally an uninsured form of borrowing, whereas retail deposits are fully insured. For instance, foreign deposits, which are a sizeable part of wholesale financing, are not guaranteed by FDIC.

[10]Banks' core retail deposits are calculated as the sum of the transaction and saving deposits.

posit outflows during periods of high-interest rates. Overall, the aggregate level analysis suggests that monetary policy changes the funding composition of the banking sector by generating a dispersion between the policy rate and bank funding rates.

Finally, Figure 3d plots the banks' net interest margins (NIM) and return on assets (ROA) against the federal funds rate and the 10-year Treasury yield. As seen from the figure, the term premium, in other words, the difference between the 10-year Treasury yield and federal funds rate, decreases when the federal funds rate increases. During the same time, NIMs and ROA also slightly decrease. As banks borrow short and lend long, an unexpected increase in the short rate increases banks' interest expense relative to their interest income, reducing their net interest margins. Taken together, the analysis suggests that the banks' profitability is significantly affected by the change in the policy rate.

4 Data and The Summary Statistics

This section describes the data and provides summary statistics relevant to my analysis.

4.1 Retail rates

I use weekly data on loan and deposit rates collected across U.S. bank branches by Ratewatch. Ratewatch provides high-quality information on weekly deposit and loan rates of various deposit and loan products at the branch level. The data spans from January 2000 to December 2019 and can be merged with other data sets using an FDIC branch identifier.[11] Using Ratewatch data for my analysis is advantageous for a couple of reasons. First, it has the most extensive product coverage among the available datasets. Specifically, it covers rates on adjustable and fixed-rate mortgages with different maturities, home equity lines of credit (HELOCs), and home equity loans with different LTVs, automobile loans, and personal loans for a specific constant loan volume. On the deposit side, it provides data on savings, time, and checking deposits with various account sizes, such as money market deposit accounts with an account size of $10,000, $25,000, $75,000, and 6-month, 12-month, 24-month certificates of deposit with an account size of $10,000, $25,000, etc.

[11] Drechsler, Savov, and Schnabl (2017) report that deposit data is available starting from 1997. However, Ratewatch provided me data beginning in 2000.

4.2 Small business lending

I collect county-level data on bank lending to small businesses from the Federal Financial Institutions Examination Council (FFIEC). The data covers small business lending by bank and county annually from 1997 to 2019.[12] In particular, it provides information about loan origination to U.S. small businesses (loans smaller than $1 million in size) at the county level by banks with assets roughly exceeding $1.25 billion.[13] I include all bank-county observations with at least $100,000 of new lending.[14] Small business lending data is particularly convenient for my analysis as small businesses have a strong dependency on local banks (Bord, Ivashina, and Taliaferro, 2015) and an illiquid form of lending. Moreover, it is well suited to investigate the impact of lending on real economic outcomes as small businesses represent more than 90% of all business establishments and around 50% of U.S. GDP. [15]

4.3 Monetary Policy Shocks

I use the Bauer and Swanson (2022) monetary policy shock series, graciously shared by the authors. These shocks are obtained by taking the first principal component of the changes in the first four quarterly Eurodollar futures contracts, ED1–ED4, around the FOMC announcements. Hence, these shocks also capture a forward guidance component, as argued in Gürkaynak, Sack, and Swanson (2005).[16] These series are summed to a quarterly or an annual frequency, and they span from 1988 to 2019.[17] I instrument the changes in the one-year Treasury rate, my policy measure, with the Bauer and Swanson (2022) shocks. I re-scale it so that its effect on the one-year nominal Treasury yield equals one. I further checked the robustness of my results using the alternative monetary policy shocks obtained by orthogonalizing the Bauer and Swanson (2022) shocks with respect to macroeconomic and financial data that pre-date the announcement.[18] There are many alternative approaches to identifying monetary policy

[12] I exclude 2008 from my analysis to ensure that the financial crises do not drive my results, small business lending dropped significantly during the financial crises, as shown in Figure 5b.

[13] It excludes very small banks.

[14] My results are robust to using all bank-county observations in the sample.

[15] Small Business Administration January 2012. "Small Firms, Employment and Federal Policy," Congressional Budget Office, March 2012.

[16] Gürkaynak, Sack, and Swanson (2007) show that Eurodollar futures are the best predictor of future values of the federal funds rate at horizons beyond six months and are virtually as good as federal funds futures at horizons less than six months.

[17] County-level data is available only at an annual frequency whereas bank-level data is mostly available at quarterly frequency.

[18] Bauer and Swanson (2022) show that shocks obtained through both methods yield similar results on financial variables, whereas the orthogonalized shocks improve the results on macroeconomic vari-

shocks in the monetary policy literature. One of the many novel approaches is using residuals from a regression of the federal funds rate on lagged values and the Federal Reserve's information set using Greenbook forecasts as in Romer et al. (1990). Another approach is to identify the shocks in an SVAR and SVAR-IV as in Gertler and Karadi (2015), Miranda-Agrippino and Ricco (2021). However, many of these measures are not fully available for my period of study.

4.4 Federal funds rate and Treasury yields

In my analysis, I choose to use the one-year Treasury yield as the policy indicator since the average maturity of loans is higher than one year, whereas the average maturity of deposits is close to one year in the data. I instrument the one-year Treasury yield with Bauer and Swanson (2022) shocks to eliminate any concerns about the exogeneity of the policy instrument.[19] I collect the quarterly and yearly government Treasury bills and Federal fund rates from the FED H.15 series. In addition, I obtain data on U.S. commercial paper and 30-year mortgage rates from FRED.

4.5 Macroeconomic Data

The data on national level GDP, inflation and unemployment are from FRED. Similarly, data on U.S. commercial paper spread and 30-year mortgage rates also obtained from FRED. [20]

4.6 County data

County-level data on GDP is collected from the U.S. Bureau of Economic Analysis at an annual frequency; it covers January 2001 to December 2019. County-level data on unemployment and wages are obtained from the Bureau of Labor Statistics. It covers 1997 January to 2019 December at an annual frequency.

ables.

[19] High-frequency monetary policy shocks are exogenous with respect to all macroeconomic variables that are publicly known prior to the FOMC announcement itself, making them a valid instrument.

[20] Commercial paper spread refers to difference between the 3-month commercial paper and the federal funds rate.

4.7 Deposit holdings

The data on branch-level deposits is from the Federal Deposit Insurance Corporation (FDIC). The data covers the universe of U.S. bank branches annually from January 1994 to December 2019. The data set also has branch characteristics such as the parent bank, address, and geographic coordinates. I use the unique FDIC branch identifier to match it with other data sets.

4.8 Bank data

Quarterly aggregate bank-level data is obtained from the U.S. Call Reports provided by the Wharton Research data services (WRDS). I use data from January 1997 to December 2019.[21] The data contains novel information on income statements and balance sheets of all U.S. commercial banks. I match the bank-level Call Reports to the branch-level Ratewatch data using the FDIC bank identifier.

I focus on the period between 2000 to 2019 in my analysis as branch-level retail rate data is available starting from 2000. I exclude the period of financial crises from my analysis as banks' funding and lending decisions may change for other reasons unrelated to monetary policy during the extreme time of financial distress.

4.9 Summary Statistics

This section provides summary statics at the county, branch, county-bank, and bank levels.

In my empirical approach, I use the Herfindahl-Hirschman Index (HHI) as a proxy for the local banking market concentration. The HHI is calculated by summing up the squared asset shares of all banks that operate branches in a given county in a given year and then averaged over time.[22]

$$HHI_{ct} = \sum_{j \in c} \left(\frac{assets_{jct}}{\sum_{j \in c} assets_{jct}} \right)^2 \tag{1}$$

[21] I completed the missing series from data provided by Federal Financial Institutions Examination Council (FFIEC) 's website.

[22] As branch-level asset information is unavailable, I use banks' deposit-to-assets ratio from the Call Reports. I combine it with the branch-level deposit data from the Federal Deposit Insurance Corporation (FDIC) and compute the branch-level assets for each year.

I then assign to each bank branch in my data the HHI of the county in which it is located and refer to it as the HHI of the branch. For instance, I calculate the HHI of Miami as 0.11. Then I assign both Bank of America's Miami branch and Citibank's Miami branch an HHI of 0.11.[23]

Figure 6a maps the average HHI across the U.S. A lower number indicates a lower concentration level, hence a higher level of competition. There is a significant cross-sectional variation across counties, from a minimum HHI of 0.06 to a maximum of 1. Similarly, Figure 6b maps the same measure using the deposit share of the branches. Notably, both measures are highly correlated and indicate a similar dispersion in concentration among counties. On average, highly concentrated counties are smaller with a lower GDP and income. Moreover, the unemployment rate is slightly higher in these counties.

The loan spread, $(i^L - i^{UST})$, is computed quarterly as the difference between the loan rate paid on a given type of loan and the interest rate on Treasury yield with the respective maturity.[24] Appendix A provide details on the construction of bank-level variables. Table 2 Panel B to D report the change in the loan spread by various loan products using branch-level loan data. There is a substantial variation among the bank branches, indicated by high standard deviations.

The deposit spread, $(i^{FFR} - i^D)$, is computed quarterly as the difference between the fed funds rate and the rate paid on a given type of deposit.[25] Table 2 Panel A reports the change in the average deposit spread using branch-level deposit data from Ratewatch. The deposit spread varies between 0.01 to -0.03 with a standard deviation around 0.30 to 0.37, indicating a sizeable variation across branches.

Table 3 Panel A provides summary statistics at the bank level. For my bank-level analysis, I compute a bank-level measure of concentration, Bank-HHI, defined as the weighted average of Branch-HHI (HHI_c) across all branches, using branch-level assets as weights.[26] The Table indicates greater variation in the wholesale funding spread, $(i^{FFR} - i^{WF})$, computed as the difference between the fed funds rate and the average

[23] I use the asset market share of the branches as the main focus of the paper is capturing the market power on all markets. However, my results are robust to using deposit market shares as in Drechsler, Savov, and Schnabl (2017).

[24] The loan rate is calculated by dividing total interest income on loans by the volume of loans and annualized.

[25] The deposit rate is calculated by dividing total interest expense on domestic deposits by the volume of domestic deposits and annualized.

[26] $BankHHI_{jt} = \sum_{i \in j} \left(\frac{assets_{it-1}}{\sum_{i \in j} assets_{it-1}} \times HHI_{ct} \right)$ as in Equation (3).

rate paid on wholesale funding, is greater than in the deposit and loan spreads across the banks. Figure 5a plots the composition of wholesale funding for the U.S. commercial banks. Foreign Deposits, other borrowed money, brokered deposits, and repos have the highest share in banks' wholesale funding, respectively. In particular, they constitute more than 75% percent of banks' aggregate wholesale financing. Other components of wholesale funding include trading liabilities and subordinated debt, where subordinated debt comprises only a small portion of wholesale funding.

Table 3 Panel B provides summary statistics on small business lending, reported at the bank-county level at an annual frequency. Figure 5b plots the time-series of bank lending to small businesses both for the total volume and the number of loans. Notably, both series have declined substantially during the financial crises and have barely picked up to pre-crisis levels as of 2010. Table 3 Panel C provides information on annual county-level lending, GDP, unemployment, and wages. The average county-level GDP is around \$5 million, whereas average county-level wages are around \$2 million. The unemployment rate is around %6 with a standard deviation around %2.

The following section provides the empirical framework that explores the role of bank market power on the transmission of monetary policy to bank funding and lending rates, profitability, and lending. Moreover, it shows that monetary policy pass to real economic outcomes through banks' balance sheets.

5 Empirical Analysis

My theory suggests that banks that operate in highly concentrated local banking markets, namely banks with higher market power, increase their interest rates on deposits and loan rates less after a monetary contraction. Moreover, they compensate for the decrease in deposits by increasing their reliance on wholesale funding as they pay relatively less for such funds. Consequently, lending and profitability of banks with higher market power decrease less. Moreover, real economic outcomes are less adversely affected by monetary policy in regions served by banks with higher market power.

Testing my hypothesis is particularly challenging as one cannot establish a direct causal effect of monetary policy on bank retail rates due to the potential for omitted variables. One of the most prominent omitted variables is the change in bank lending opportunities. If banks' lending opportunities changes as the Fed raises rates, this may affect banks' funding and lending decisions independent of banks' market power. In particular, banks' lending may shrink due to the adverse impact of monetary policy on their bank-specific loan demand, leading to a decrease in their funding needs (Drechsler, Savov, and Schnabl, 2017). Thus, the change in lending opportunities may affect the funding and lending rates of the banks, irrespective of their market power. To obtain variation in concentration independent of bank-specific lending opportunities, I compare the deposit and lending rates across branches of the same bank located in areas with different concentration levels.[27] Comparing across branches of the same bank enables me to control the bank-specific lending opportunities and assess the effect of concentration on the responsiveness of bank retail rates to monetary policy.

As banks conduct decisions related to wholesale financing at the bank level and allocate their funds internally across their branches if needed, I turn into the bank-level Call Reports data. That is, I test the mechanism that generates an imperfect monetary pass-through to banks' lending rates and dampens the impact of contractionary monetary policy on banks' lending outcomes at the bank level. This bank-level estimation strategy is especially significant to emphasize the importance of the wholesale funding channel and give a complete view of the effect of market power on the transmission of monetary policy to bank balance sheets.

To establish a causal relationship between bank lending outcomes and the real economy, I further use bank-county level small business lending data that reports small business lending by bank and county for a given year. Small business lending is a significant form of borrowing for local businesses, allowing me to show a connection between bank-level lending and regional macroeconomic outcomes. First, I examine the effect of bank market power on banks' small business lending through my bank-county estimation, which enables me to link bank-level lending outcomes to county-level lending outcomes. Then, I assess the implications of the change in county-level lending on real economic outcomes using county-level unemployment data. This county-level analysis reveals that monetary policy transmits to macroeconomic outcomes through the bank lending channel.

Sections 5.1, 5.2, 5.3 and 5.4 present these estimation strategies and report the results.

[27]This with-in bank estimation strategy comes from Drechsler, Savov, and Schnabl (2017).

5.1 Branch-level Estimation

In order to assess the impact of market power on the transmission of monetary policy to bank funding and lending spreads, I exploit the geographic variation in market power induced by the differences in the concentration of the local banking markets by using branch-level deposit and loan data from *Ratewatch*. As discussed earlier, the main challenge to identification is isolating the effect of bank market power independent of bank-specific lending opportunities. For instance, banks' lending might decrease because of the negative impact of monetary policy on their bank-specific loan demand, generating a decline in banks' need for deposits and wholesale funding. Thus, the funding and lending rates of the banks might be affected by the change in lending opportunities rather than bank market power. I tackle this issue by comparing the funding and lending spreads of the same bank located in counties with different degrees of concentration. Furthermore, I add state-time fixed effects to my analysis to ensure that these banks are subject to similar local banking market conditions, e.g., similar local loan demand. Finally, to eliminate the concerns regarding the endogeneity of the policy indicator, I instrument the change in the one-year Treasury yield with the plausibly exogenous monetary shocks of Bauer and Swanson (2022).

Equation (2) presents the baseline regression, allowing me to capture the average effect of monetary policy on bank lending and funding spreads in addition to the impact of banking market concentration.

$$\Delta y_{it} = \delta_i + \gamma_c + \lambda_s + \beta_1 \Delta R_t + \beta_2 \Delta R_t \times HHI_c + \Omega'(L) Z_t + \epsilon_{it} \tag{2}$$

Δy_{it} is either the quarterly change in the deposit spread or the change in the loan spread of branch i of bank j operating in county c from *t-1* to t. ΔR_t is the quarterly change in the one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. HHI_c is the concentration of the county where branch i of bank j is located. It is calculated by summing up the squared asset-market shares of all banks that operate in a given county in a given year and then averaged across years, as shown in Equation (1). δ_i, γ_c, and λ_s are branch, county, and state fixed effects, respectively. [28]

Branch fixed effects control for branch-specific characteristics. County fixed effects control for county-specific factors such as county-wide economic trends.[29] Similarly,

[28] The interaction term is also instrumented by the Bauer and Swanson (2022) shocks in this and all the upcoming specifications.

[29] County and branch fixed effects are highly collinear as only a really small fraction of branches

state-fixed effects control state-specific factors such as time-in-varying banking market conditions. I also add a county fixed effects interacted with a dummy variable for the zero-lower bound period to control for differences that may stem from the zero lower bound period. Z_t includes additional control variables, which include GDP growth, unemployment rate, and inflation.[30] The macroeconomic control variables were added to isolate the role of interest rates from cyclical conditions. Finally, I cluster the standard errors at the county level to control for correlation within counties. I compute the interaction terms and control variables relative to their means in this and all my upcoming specifications. The reason is that, by demeaning the variables in this way, the intercept term β_1 has the natural and desirable interpretation as the average conditional path when all controls are at their mean levels.

I further add bank-time fixed effects, which absorb all time-varying differences between banks and allow me to compare the branches of the same bank located in areas with different concentration levels following Drechsler, Savov, and Schnabl (2017). That is, I control for changes in bank-specific lending opportunities that the change in the monetary policy might cause. I also add state-time fixed effects to control state-level changes in local deposit and lending markets. Finally, I run several specifications with different combinations of fixed effects to gauge their impact and check the robustness of my results.[31]

Table 4 shows that, on average, banks increase their deposit spreads, $(i^{FFR} - i^{D})$ after an increase in the policy rate, and deposit spreads widen more for branches in more concentrated areas. That is, the pass-through of monetary policy to deposit rates decreases with bank concentration. Column (1) focuses on all bank branches in my sample and examines the spread dispersion across the branches of the different banks, whereas columns (2) to (5) focus on the banks that operate in at least two counties to make sure that the county-specific community banks do not drive my results. In particular, Columns (3), (4), and (5) add state-time fixed effects, bank-time fixed effects, and both state-time and bank-time fixed effects, respectively.

Table 4 Panel A reports the results for 12 months of certificates of deposits, a common type of small-time deposit. Column (1) documents that deposit spreads increase around 34 bps after a 100 bps raise in the one-year Treasury yield. That is, the av-

change counties.

[30] Results are robust, adding the change in the commercial paper spread and 30-year mortgage spread.

[31] Adding time fixed effects absorbs the β_1 as the change in the interest rate is the same for all branches at a particular point in time. On the other hand, it allows me to control for underlying observable and unobservable systematic differences between observed time units.

erage deposit rate on 12-months CDs increases by 66 bps after a 100 bps increase in the policy rate. The interaction term on the change in the policy rate and the concentration index indicates that deposit spreads increase 13 bps more for branches that operate in more concentrated counties. In other words, deposit rates increases around 3.9 bps (13*0.30=3.9) less in bank branches that serve in counties with a 0.30 higher Herfindahl-Hirschman Index. Where 0.30 refers approximately the 75th percentile of the HHI distribution. Column (5) of Table 4 shows that deposit spreads of bank branches located in counties with higher concentrations increase more compared to branches located in areas with lower concentrations, even comparing the branches of the same bank located in the same state. Specifically, the deposit rate increase is around 3 bps (10*0.30=3) less for the bank branch that operates in a county with a 0.30 higher HHI than the county where the other branch is located.

Table 4 Panel B reports the results for $25K Money Market accounts, a common saving deposit type. It shows that spreads increase around 85 bps after a 100 bps increase in the one-year Treasury yield, which is 25 bps higher for branches located in concentrated counties.[32] In other words, the average deposit rate on $25K Money Market accounts increases only 15 bps after a 100 bps increase in the one-year Treasury yield. Moreover, it increases around 7.5 bps (25*0.30=7.5) less for bank branches that operate in counties with a 0.30 higher HHI. Column (5) of Table 4 shows that deposit spreads of bank branches located in counties with higher concentrations increase more compared to branches located in areas with lower concentrations, even comparing the branches of the same bank located in the same state. As seen from the results, the interest rate pass-through is much lower for savings deposits than time deposits, which can be explained by the relative liquidity of saving deposits over time deposits.[33]

Tables 5 to 6 present the results for various loan products. The results indicate that loan spreads, $(i^L - i^{UST})$ increase after monetary policy tightening.[34] However, monetary policy pass-through to loan spreads is lower in more concentrated areas. One explanation for this result is that branches located in more concentrated areas reduce their loan markups to mitigate the effects of the fall in loan demand without losing profits, as they can increase their deposit spreads from the funding side. Specifically,

[32] The magnitude of the rise in the deposit spread is slightly higher than the one reported in Drechsler, Savov, and Schnabl (2017) due to the instrumental variable approach used in my paper. Usage of the Bauer and Swanson (2022) shock slightly amplifies the response of the deposit spread.

[33] Time deposits are locked in for a term, whereas checking and saving deposits can be withdrawn immediately.

[34] Results are robust using the loan rates instead of spreads.

Table 5 Panel A Column (1) show that personal loan spreads increase around 18 bps after a 100 bps increase in the one-year Treasury yield.[35] Yet, this increase is around 29 bps less for banks in areas with higher market concentration. That is, loan rates increase around 8.7 bps (29*0.30=8.7) less in bank branches that serve in counties with a 0.30 higher Herfindahl-Hirschman Index. Columns (2) to (5) report the results for the banks that operate at least in two counties for different fixed effect specifications, and the results are robust. Table 5 Panel B reports the results on 72-month automobile loans. The spread on automobile loans increases by 25 bps on average, but it rises 19 bps less for banks in more concentrated areas. If a bank branch is located in a county with a 0.30 higher Herfindahl-Hirschman Index, the rate on automobile loans increases by 5.7 bps (19*0.30=5.7) less on average.[36] Column (5) shows the result remains significant even when we compare the branches of the same bank operating in the same state yet located in counties with different degrees of concentration.

Table 6 reports similar results for HELOCs and 30-year fixed mortgage spreads.[37] Specifically, Panel A documents that spread on Home Equity Line of Credits (HELOCs) with less than 80% loan-to-value ratio (LTV) increases by 97 bps on average, yet it increases approximately 25 bps less for branches located in more concentrated markets.[38] Columns (2) to (5) present the results for the banks that operate at least in two counties for various fixed effect specifications, and the results remain robust. Mainly, Column (5) shows that among the branches of the same bank that operates in the same county, the one located in a more concentrated county increases its loan spread less for both products. Panel B reports similar results on 30-year fixed mortgage spreads. In particular, Column (5) shows that the loan spread increases around 33 bps less for branches located in more concentrated markets. That is, if a bank branch is located in a county with a 0.30 higher Herfindahl-Hirschman Index, the loan rate on mortgages increases by 9.9 bps less (33*0.30=9.9) on average.

Taken together, the results indicate that monetary policy pass-through to deposit and loan spreads are lower for bank branches located in more concentrated areas. In particular, these branches widen their deposit spreads more and offer lower deposit rates to their customers. At the same time, they also increase their markups on loans

[35] I use the personal loan rates for Tier 1 customers, which has the best credit score among all other customers.

[36] I calculate the automobile loan spread by subtracting the average of 5 and 7-year Treasury yields from the automobile loan rates.

[37] I report the results on the most responsive loan products for each category.

[38] HELOCs are loans that allow you to borrow against your home's equity.

less to alleviate the effect of contractionary monetary policy on loan demand.

The previous results document that banks operating in concentrated areas increase their deposit spreads more, allowing them to keep their loan demand more stable by reducing the pass-through of higher policy rates to loan rates. Therefore, if banks that operate in concentrated markets compensate for the decrease in deposit inflows by relying on wholesale funding, as the aggregate data in Section 3 suggest, I expect these banks' lending to decrease relatively less following a contractionary monetary policy. Thus, banks' reliance on wholesale funding can mitigate the impact of deposit outflows and result in less loan contraction for banks with higher market power that operate in highly concentrated local banking markets.

Since banks make their decisions on wholesale funding at the bank level and channel their funds across branches when needed, I test this hypothesis using aggregate balance sheet data from Call Reports in the next section. That is, I explore the impact of bank market power on the transmission of monetary policy on banks' wholesale funding spreads and funding composition. I also provide a complete picture of the underlying mechanism that leads to a lower monetary policy pass-through to loan spreads and lending for banks with higher market power.

5.2 Bank-level Estimation

In this section, I examine the effect of the bank market power on the aggregate bank-level variables to provide a comprehensive picture of the mechanism that diminishes the impact of monetary policy on bank lending. My theory suggests that banks that operate in highly concentrated markets adjust their deposit rates less and compensate for the decrease in their deposit by relying on wholesale funding as they access wholesale funding at a comparatively lower cost. Moreover, they increase the interest rates on their loans relatively less as funding costs increase less for them. Consequently, they dampen the effect of contractionary monetary policy on their lending.

In order to test this mechanism, I construct a bank-level measure of market power, Bank-HHI, by averaging the local concentration of the counties where the bank's branches operate (H_{ct}), weighing each branch by its lagged share of assets, and use this measure as a proxy for the bank market power. This measure specifically allows me to capture the impact of market power on banks' cost of accessing wholesale funding and wholesale funding reliance as decisions related to wholesale financing are conducted at the bank level. In addition, it further allows me to capture the impact of bank market power on lending.

$$BankHHI_{jt} = \sum_{i \in j} \left(\frac{assets_{it-1}}{\sum_{i \in j} assets_{it-1}} \times HHI_{ct} \right) \tag{3}$$

Equation (3) presents the calculation for the bank market power measure, where HHI_{ct} is the concentration of a particular county where branch i of bank j is located and $assets_{it-1}$ is the total assets of branch i of bank j.

To capture the impact of bank market power for the pass-through of monetary policy to bank-level outcomes, I run the following regression at the bank-quarter level:

$$\begin{aligned}\Delta y_{jt} =& \alpha_j + \beta_1 \Delta R_t + \beta_2 \Delta R_t \times BankHHI_{jt-1} + \gamma BankHHI_{jt-1} + \\ & \Gamma'(L) X_{jt-1} + \Omega'(L) Z_t + \epsilon_{jt}\end{aligned} \tag{4}$$

Where Δy_{jt} is the log change in a given balance sheet component of bank j from date *t-1* to t. ΔR_t is the change in the one-year Treasury yield from *t-1* to t instrumented with Bauer and Swanson (2022) shocks. $BankHHI_{jt-1}$ is the bank-level concentration of bank j, lagged by one period. α_j is bank fixed effects, and X_{jt-1} is bank-level controls such as the lagged change in the banks' assets, equity, and liquidity. Specifically, these bank-level variables enable me to control for differences that may stem from the bank size, liquidity, and bank soundness. They are added in log difference form to capture the time-series trend.[39] I also add bank fixed effects interacted with a dummy for the ZLB period to ensure that my results are not driven by the zero lower bound period. In addition, I add the following control variables: GDP growth, unemployment rate, inflation.[40] These variables are captured by the term Z_t. I cluster the standard errors at the bank level to control for correlation within banks.[41] I demeaned the Bank-HHI and all other control variables.[42]

Table 7 reports the results. Column (1) of Table 7 Panel A shows that after a 100 bps points increase in the one-year Treasury yield, deposit spreads of banks (measured as the fed funds rate minus domestic deposit interest expense divided by domestic

[39] Results are robust using lagged values of total assets, equity and liquidity to asset ratios.

[40] Results are robust, adding the change in the commercial paper spread and mortgage spread.

[41] My results are robust, including time f.e and reported in Section 7. As suggested in Cameron and Miller (2015), adding time fixed and clustering at the other dimension eliminates concerns on error correlation in multi-dimensions, if any.

[42] I winsorize all variables at the 1% and 99% level by quarter to isolate the effect of outliers following Drechsler, Savov, and Schnabl (2017).

deposits) increase by 88 bps on average. That is, the average deposit rate banks pay to their depositor's increases around 12 bps after a 100 bps increase in the policy rate. Notably, the increase in the average deposit rates is lower than the amount reported on time and saving deposits presented in the previous section, as it also includes the transaction deposits.[43] The interaction term on the change in the policy rate and bank-level concentration indicates that deposit spreads of banks with higher market power increase by 8 bps more, consistent with my branch-level results. That is, banks with higher market power partially pass the increase in interest rate to their depositors. As a result, they experience a slightly higher decrease in their growth of deposits, as reported in Table 7 Panel B Column (1). However, the change in the deposit growth does not significantly differ among banks at the bank level, indicating that these banks face a relatively inelastic supply of deposits due to their market power. [44]

Table 7 Panel A Column (2) shows that a 100 bps increase in the one-year Treasury yield leads to a 71 bps increase in the wholesale funding spreads (measured as the fed funds rate minus wholesale funding interest expense divided by total wholesale funding). However, banks with higher market power access wholesale funding with a lower cost as the wholesale funding spreads increase around 20 bps more for those banks. Table 7 Panel B Column (4) shows that banks partially compensate for the decrease in total deposit inflows by relying on wholesale funding. It also presents that wholesale funding reliance increases significantly more for banks with higher market power. Table 7 Column (5) indicates that the increase in wholesale funding reliance enables banks with higher market power to entirely offset their shortfalls in deposits, as liabilities do not significantly differ between banks with high versus lower market power. Specifically, the coefficient on the interaction term between the change in the interest rate and market power is positive. Taken together, the results indicate that monetary policy changes the funding composition of the banking sector by creating a dispersion among the funding spreads of the banks with different degrees of market power.

Table 7 Panel A Column (3) displays the results for bank funding spreads, which are calculated as the weighted average spread on deposits and wholesale funding. In particular, funding spreads increase more for banks with higher market power. This,

[43] Transaction deposits include interest and non-interest-bearing checking deposits, NOW accounts, ATS accounts, and telephone and preauthorized transfer accounts.

[44] My results suggest that the responsiveness of the deposits to change in the deposit spread decreased in my sample period compared to Drechsler, Savov, and Schnabl (2017) who center on the pre-ZLB period.

in turn, allows these banks to increase their loan spreads less to keep their loan demand stable, as shown in Column (4). Specifically, the average loan spread increases by 28 bps after a 100 bps increase in the one-year Treasury yield. However, it increases around 8 bps less for a bank with higher market power. Overall, the results confirm that bank market power mitigates monetary policy transmission to bank funding and lending rates.

Focusing on the impact of bank market power on bank profitability, I find that, on average, the banks' net interest margins decrease following a monetary contraction, as reported in Table 7 Panel A Column (5). Although there is a decline in the bank's net interest margins, the magnitude is small. Specifically, a 100 bps increase in the Federal funds rate decreases net interest margins by around 3 bps for an average bank. This result is consistent with Drechsler, Savov, and Schnabl (2021), who show that banks closely match the interest rate sensitivities of their interest income and expense. On the other hand, I document that net interest margins decrease significantly less for banks with higher market power due to the higher increase in their funding spreads, although the magnitude of the difference is small. Column (6) reports the results on ROA. Notably, bank profits are insensitive to fluctuations in interest rates, and the profits of the banks with higher market power slightly increase more for banks with higher market power.

As banks with higher market power increase their lending spreads less on average and increase wholesale funding reliance substantially more, I expect the lending of banks with higher market power decreases less. Table 8 Columns (1) and (2) show that total assets and loans reduce after policy tightening. However, total assets and loans decrease less for banks with higher market power. Similarly, securities also fall significantly less for banks with higher market power. In section B, I replicate my results using the LP-IV approach of Jordà (2005) and show that the impact of monetary policy on bank-level lending amplifies in longer horizons.

5.3 Bank-County Estimation

In the previous section, I have shown that funding spreads increase significantly more for banks with higher market power following a contractionary monetary policy. Consequently, these banks adjust their loan spreads less to mitigate the impact of contractionary monetary policy on their lending. Moreover, I document that the lower cost of accessing wholesale funding allows banks with higher market power to replace their deposit outflows with wholesale financing. Hence, lending of banks with market power decreases relatively less.

Next, I use branch-level small lending data from FDIC to investigate the link between bank lending and macroeconomic outcomes.[45] Usage of small lending data is particularly advantageous to establish causality between bank lending and county-level lending, and further county-level lending and unemployment as local businesses are highly dependent on small business lending to fund themselves. Moreover, bank-county level small business lending data allows me to control for differences in local lending opportunities and rule out the possibility that my results are driven by the local loan demand. Specifically, the main threat to identification in this setting is that borrowers in different counties might be distinctly affected by the macroeconomic environment resulting from the change in the policy rate. Consequently, a bank lending in a particular county might be influenced by the change in local lending opportunities independent of the bank's market power.

To tackle this issue, I add county-time fixed effects to my analysis that controls for the time-varying changes in the local loan demand. In addition, as banks execute wholesale funding decisions at the bank level and can allocate funds internally across their branches to fund their lending if needed, I use my bank-level concentration measure in my analysis which is a good indicator of how much funding a bank will raise and increase its profits from the funding side. In particular, if banks with higher market power can compensate for their shortfalls in deposits through cheaper access to wholesale funding and partially pass the increase in the policy rate to their borrowers, these banks' lending should decrease less compared to other banks.

To test this hypothesis, I estimate the following regression at the bank-county level:

$$\Delta y_{jct} = \alpha_{jc} + \beta_1 \Delta R_t + \beta_2 \Delta R_t \times BankHHI_{jt-1} + \gamma BankHHI_{jt-1} + \Omega'(L) Z_t + \epsilon_{jt} \quad (5)$$

Δy_{jct} is the percentage change in the small business lending by bank j in county c from year *t-1* to t.[46] $BankHHI_{jt-1}$ is the bank-level concentration of bank j in year *t-1*. ΔR_t is the change in the one-year Treasury yield from *t-1* to t instrumented with Bauer and Swanson (2022) shocks. α_{jc} are bank-county fixed effects that absorb time-

[45] I exclude 2008 from my analysis as small business lending decreased around 30 percent during this period due to the adverse effect of the financial crises.

[46] I use percentage change in loans rather than the level of loans to be able to account for differences in bank size, which considerably impacts banks' loan volumes.

invariant characteristics such as banks' brand effects.[47] This approach allows me to capture the average effect of an increase in the interest rate on bank lending and identify the impact of bank market power on the transmission of monetary policy to bank lending. I further add county-time fixed effects, which soaks up the changes in local lending opportunities into my regression. Although including county-time fixed effects is preferable because it isolates the effects that may stem from the change in local lending opportunities, it requires excluding the ΔR_t, which captures the average effect of monetary policy on bank lending outcomes. Hence, I report the results obtained through both approaches and show that my results are robust to different specifications. Z_t includes GDP growth, unemployment rate, inflation.[48] These controls are added into the regression to isolate the role of the level of interest rates from that of cyclical conditions whenever time or county-time fixed effects are excluded. Standard errors are double clustered at the bank and county levels.

Table 8 displays the results on bank-county level lending. Column (1) presents the results across banks and regions. Specifically, it shows that bank-level small business lending decreases approximately by 14 bps after a 100 bps increase in the one-year Treasury yield, yet lending of banks with higher market power falls around 29 bps less in line with my hypothesis. In particular, small business lending decreases by 8.7 bps (28*0.30=8.7) less for banks with a 0.30 higher Bank-HHI. Column (2) includes the local concentration of the counties to the regression, and the interaction term between the change in the policy indicator and Bank-HHI remains economically and statistically significant. This result confirms that the bank-level market power rather than the county-level market power drives the wholesale funding channel. Column (3) adds time-fixed effects, and the interaction term coefficient remains significant. Column (4) repeats the same analysis by controlling for the local concentration of the counties and reports similar results. Finally, Column (5) presents the results with county-time fixed effects that absorb the impact of loan demand. The magnitude of the coefficient on the interaction term remains similar to Columns (1) and (2); additionally, it is still significant.

The results confirm that market power enables banks to increase their funding spreads, and banks with higher market power offset the higher decrease in deposit outflows by increasing their wholesale financing. This also allows banks with higher to increase

[47] County fixed effects interacted with a dummy variable for the zero-lower bound period is also added to control for differences that may stem from the ZLB period.

[48] Results are robust adding the change in the commercial paper spread, and 30-year mortgage spread.

their loan rates less on average. Consequently, their lending decreases relatively less after Fed raises the policy rate. In the next section, I aggregate my data to the county level to show that my results on bank-level lending have implications for the transmission of monetary policy to county-level small business lending and real economic outcomes.

5.4 County-level Analysis

In the previous section, I've shown that small business lending of the banks with higher market power decreases less compared to other banks. This result suggests that total lending in counties where banks with higher market power operate should decrease less after an increase in the policy rate. Thus, real economic outcomes such as unemployment should be affected less negatively in these regions as small business lending constitutes a substantial amount of the funding of the local businesses.

To test this prediction, I aggregate my bank-level small business lending data at the county level and construct a county-level concentration measure, County-HHI, defined as the weighted average of Bank-HHI across all banks lending in a given county, using their lagged lending shares as weights to alleviate concerns regarding the endogeneity of the measure.

$$CountyHHI_{ct} = \sum_{j \in c} \left(\frac{lending_{jct-1}}{\sum_{j \in c} lending_{jct-1}} \times BankHHI_{jt} \right) \tag{6}$$

In particular, County-HHI measures the extent to which a county is served by banks with higher market power and allows me to test the impact of bank market power on county-level outcomes.

As county-level macroeconomic outcomes such as unemployment might respond to monetary policy with a lag, I use the local projection (LP-IV) method of Jordà (2005) which allows me to capture the impact of bank market power in longer horizons. Equation (7) presents the baseline LP-IV specification, which estimates the dynamic causal effects of monetary policy changes subject to the alternative banking concentration of the counties.

$$
\begin{aligned}
\Delta_h log(y_{ct+h}) =& \alpha_c^h + \beta^h \Delta R_t + \Gamma^h \Delta R_t \times CountyHHI_{ct-1} + \theta^h CountyHHI_{ct-1} \\
&+ \Omega'(L) Z_t + \epsilon_{ct+h}
\end{aligned} \tag{7}
$$

Where the horizon is h = *0, 1, ..4* years, and c and t denote county and time, respectively. The left-hand side of equation (7) is the cumulative change in the outcome variable y, $\Delta_h log(y_{c,t+h}) = log(y_{c,t+h}) - log(y_{c,t-1})$, where y is the total county-level small business lending or unemployment.[49] The specification regresses the dynamic cumulative change in variable y on monetary policy changes subject to the banking concentration of counties. α_c^h denotes county fixed effect, which absorbs permanent differences across counties.[50] ΔR_t refers to the change in the one-year Treasury yield from year *t-1* to t instrumented with Bauer and Swanson (2022) shocks. β^h captures the impulse response of the left-hand side variable at time *t+h* to a monetary policy change at time t. Γ^h gives the marginal effect of concentration on the responsiveness to monetary policy. I instrument the interaction term with the interaction of Bauer and Swanson (2022) shocks and the County-HHI variable.[51]

Z_t includes the following control variables: change in the national level GDP, unemployment rate, inflation.[52] Standard errors are clustered by county level to control for correlation within counties. The estimation is calculated up to a horizon of four years, and the lag structure on all right-hand-side variables is one year.

Figure 7 plots the estimated coefficients as well as their 95% confidence intervals on the total county-level small business lending. Figure 7a shows that total lending decreases by around 10 bps percent after a 100 bps increase in the policy rate. Moreover, the peak effect reaches 40 bps four years after the contractionary monetary policy. In contrast, Figure 7b shows sizable heterogeneity in monetary policy outcomes conditional on the County-HHI of the counties. Specifically, county-level lending decreases around 10 bps less in counties in which banks with higher credit market power operate. The peak effect is about 50 bps, occurring three years after the monetary policy

[49]Using the level of loans as a left-hand side variable is particularly problematic in this case as the marginal effects implied by the level specification are implausible for any cross-section of markets that vary substantially in size. A change in the federal funds rate will have a much greater effect on loan volume in a large market than in a small market, as argued by Adams and Amel (2011).

[50]I further include county fixed effects interacted with a dummy variable for the ZLB period to control the effect of the low interest rate environment.

[51]I further add the local concentration of the county interacted with the change in the policy instrument.

[52]Results are robust adding mortgage and commercial paper spread.

shock. Figure 7c plots the results for counties with County-HHI 0, 0.15, 0.20 and 0.30, respectively.[53] As shown in the Figure, county-level small business lending decreases around 10 bps following a 100 bps increase in the one-year Treasury yield. However, it reduces by around 3 bps less in counties with a County-HHI of 0.30. These findings highlight that small business lending in counties where banks with higher market power operate is less negatively affected by contractionary monetary policy relative to other counties. As small businesses are highly dependent on local lending and have a sizeable effect on the county's real economy, unemployment should also increase less in counties served by banks with higher market power following an increase in the policy rate.

Figure 8 presents the results on unemployment. Specifically, Figure 8a shows that the increase in unemployment reaches up to 15 bps after a 100 bps increase in the one-year Treasury yield. Figure 8b suggests that the unemployment rate rises less in counties with higher County-HHI, and it is more sizeable starting from a year after the interest rate hike. Overall, the results provide evidence that market power alleviates the negative impact of interest rate hikes on county-level lending and unemployment. Hence, market power has a crucial effect on the transmission of monetary policy to real economic activity.

The following section presents a partial equilibrium model of monopolistic competition that rationalizes my findings on the partial pass-through of monetary policy to the bank deposit and lending rates for the banks with higher market power.

6 A Simple Model of Monopolistic Competition

To provide intuition for the underlying mechanism and rationalize my empirical findings, I build a simple model of monopolistic competition and take it to the data. The model allows me to look at the simultaneous exercise of market power on both the deposit and lending side-necessary to understand previous empirical results on the lending channel for monetary policy.

The model assumes that deposits and loans are baskets of differentiated products with constant elasticity of substitution, which leads to a constant markup on the retail rates. The building block of the model comes from Ulate (2021) where the deposit supply and loan demand for each bank rise from the fact that depositors and borrow-

[53] These values correspond to the 25th, 50th, and 75th percentile of the County-HHI distribution.

ers have CES preferences across banks. The model takes the aggregate amounts of deposits supplied, and loans demanded as given since this is a partial equilibrium exercise. It predicts that pass-through to loan and deposit rates decrease for banks with higher market power which access the wholesale funding markets at a cheaper cost. That is, the model suggests that pass-through to the retail rates is determined by the cost of accessing wholesale funding, which is a function of bank market power.

6.1 The Model:

Assume that banks' cost of accessing wholesale funding is exogenously determined, and banks with higher market power access wholesale funding markets at a lower cost, consistent with the data. Banks operate under monopolistic competition, where market power could arise from product differentiation. Table 1 shows a bank's balance sheet with loans, L_j, securities G_j, as assets; and deposits D_j and wholesale funding WF_j, as liabilities.

Table 1: Balance Sheet

Assets	Liabilities
Loans L_j	Deposits D_j
Securities G_j	Wholesale Funding WF_j

Each bank j maximize profits given by equation (8):

$$\max_{i_j^L, i_j^D} \Pi_j = (1+i_j^L)L_j + (1+f)G_j - (1+i_j^D)D_j - \left(1+f-\phi_j^{WF}\right)WF_j \tag{8}$$

subject to the loan and deposit demand and the bank balance sheet constraint given by

$$L_j = \left(\frac{1+i_j^L}{1+i^L}\right)^{-\theta^\ell} L \tag{9}$$

$$D_j = \left(\frac{1+i_j^D}{1+i^D}\right)^{-\theta^d} D \tag{10}$$

$$L_j + G_j = D_j + WF_j \tag{11}$$

Where ${\phi_j}^{WF}$ is the wholesale funding spread of the banks, assumed to be exogenously higher for banks with higher market power as wholesale funding is cheaper for them.[54] $1 < -\theta^{\ell}$ is the elasticity of substitution for loans between banks, and L is the aggregate loan in the economy. i^L is the aggregate loan rate index. $\theta^d < -1$ is the elasticity of substitution for deposits between banks, D is the aggregate deposit in the economy, and i^D is the aggregate deposit rate index. The loan and deposit demand functions are derived by solving the saver and the borrower problems, where both agents have CES demand functions. These demand functions are driven in Appendix C.

The maximization problem of the bank can be solved by substituting equations (9) to (11) into equation (8) and taking first-order conditions with respect to deposit and loan rates. The solution of the problem yields the loan and deposit rates as markup and markdown over the federal funds rate and the bank's wholesale funding spread, ${\phi_j}^{WF}$.[55]

$$1 + i_j^L = \underbrace{\frac{\theta^{\ell}}{\theta^{\ell} - 1}}_{\text{markup}} \left(1 + f - \phi_j^{WF}\right) \tag{12}$$

$$1 + i_j^D = \underbrace{\frac{\theta^{d}}{\theta^{d} - 1}}_{\text{markdown}} \left(1 + f - \phi_j^{WF}\right) \tag{13}$$

As $1 < \theta^{\ell}$ and $\theta^d < -1$ which indicates that

$$\frac{\theta^{\ell}}{\theta^{\ell} - 1} > 1$$

$$0 < \frac{\theta^{d}}{\theta^{d} - 1} < 1$$

Equation (12) shows that the loan rate is a markup over the federal funds rate and the bank's wholesale-funding spread, ${\phi_j}^{WF}$. On the other hand, equation (13) shows that the deposit rate is a markdown over the federal funds rate and the bank's wholesale-funding spread, ${\phi_j}^{WF}$. Since wholesale funding spreads, ${\phi_j}^{WF}$ are higher for banks with higher market power, both equations (12) and (13) indicate that deposit and loan rates are lower for banks with higher market power. In order to capture the impact of market power on banks' wholesale funding, deposit and loan volumes, we can now turn to equations (9), (10), and (11). In particular, equation (9) suggests that the loan demand of the banks with higher market power is higher as these banks offer lower

[54]Note that ${\phi_j}^{WF}$ is assumed to be a function of the federal funds rate and widens more for banks with higher market power after policy tightening in line with the data.

[55]Note that higher ${\phi_j}^{WF}$ indicates that the bank accesses wholesale funding with a lower cost.

loan rates. On the other hand, equation (10) indicates that the deposit supply of banks with higher market power is lower due to the lower deposit rate they offer. Hence, banks with higher market power rely more on wholesale funding, which can be seen through equation (11).[56] Overall, the results show that the model matches with the data in terms of the response of deposit and loan rates as well as the response of banks' funding and lending volumes.

The paper's main focus is the monetary policy pass-through to deposit and loan rates; thus, I differentiate the loan and deposit rate equations with respect to the policy rate, f. Equations (14) and (15) suggest that monetary policy transmission to deposit and loan rates depend on pass-through to banks' wholesale funding spreads. As $\frac{d\phi_j^{WF}}{df}$ is higher for banks with higher market power, in other words, wholesale funding spreads widen more for banks with higher market power after an increase in the policy rate, pass-through to retail rates is lower for these banks. That is, banks with higher market power increase both the loan and the deposit rates less after an increase in the policy rate, verifying the predictions of my empirical analysis.

$$\frac{di_j^L}{df} = \frac{\theta^\ell}{\theta^\ell - 1} - \frac{\theta^\ell}{\theta^\ell - 1}\frac{d\phi_j^{WF}}{df} \tag{14}$$

$$\frac{di_j^D}{df} = \frac{\theta^d}{\theta^d - 1} - \frac{\theta^d}{\theta^d - 1}\frac{d\phi_j^{WF}}{df} \tag{15}$$

The next section test model predictions by taking the model into data. That is it shows that:

1. Monetary policy pass-through to loan rates decreases with market power.
2. Monetary policy pass-through to deposit rates decreases with market power.

6.2 Model Assessment

In this section, I test whether the model performs well in matching the data by using data from the Call Reports .

First, I estimate the average markup and markdown of the U.S banking system by using the following equations, which simply assume that the loan and deposit rate is

[56] Banks use any extra funding to issue securities as also suggested by equation (11).

a constant markup/markdown over the federal funds rate.

$$1 + i^L = \underbrace{\frac{\theta^\ell}{\theta^\ell - 1}}_{\text{markup}} (1 + f) \tag{16}$$

$$1 + i^D = \underbrace{\frac{\theta^d}{\theta^d - 1}}_{\text{markdown}} (1 + f) \tag{17}$$

Where i^L is the average loan rate for all banks, i^D is the average deposit rate for all banks from the Call Reports, and f is the federal funds rate. The average markup for loans is found as 2.47, whereas the average markup on deposits is found to be 1.17, which is slightly higher than 1 as the deposit rates exceed the federal funds rate from time to time, as shown in Figures 3a and 3c.[57]

Next, I cross-validate the model to find the model implied loan and deposit rates. To do so, I obtain the average change in the wholesale funding spread, $\Delta\phi^{WF}(WF)$ from the Call Reports using equation (18). I then plug it into equations (19) and (20). I perform this exercise both for the banks above and below the 75th percentile of Bank-HHI distribution.

$$\Delta(1 + i^{WF}) = \Delta(1 + f - \phi^{WF}) \rightarrow \Delta\phi^{WF}(WF) \tag{18}$$

$$\Delta\Big[1 + i^L\Big] = \Delta\left[\frac{\theta^\ell}{\theta^\ell - 1}\Big(1 + f - \phi^{WF}(WF)\Big)\right] \rightarrow \Delta i^L \tag{19}$$

$$\Delta\Big[1 + i^D\Big] = \Delta\left[\frac{\theta^d}{\theta^d - 1}\Big(1 + f - \phi^{WF}(WF)\Big)\right] \rightarrow \Delta i^D \tag{20}$$

Figure 9a presents the results for the change in the loan rate, where the left-hand-side panel reports the model implied change in the loan rate and the right-hand side is the actual change in the loan rate from the Call Reports, where the average loan rate for the High-HHI group is calculated by averaging the loan rate of all banks that are above the 75th percentile of the Bank-HHI distribution for a given year. Again, both the replications using the model and the actual data suggest that the loan rate changes less for the banks with higher market power. Similarly, Figure 9b reports the results

[57] Note that I averaged these markups/markdowns over time.

for the deposit rate. It shows that both the actual data and the model indicate that the deposit rate changes less for the banks with higher market power. These exercises show that the simple model performs well in matching the data as monetary policy pass-through to deposit and loan rates decreasing with market power.

7 Robustness

This section conducts a large number of checks that confirm the baseline results are robust to alternative estimation strategies, usage of different market power measures, monetary policy shocks, and samples.

Usage of Alternative Loan and Deposit Products

I confirm the robustness of my results using the alternative loan and deposit products. In particular, I add 6-month certificates of deposits, 10K money market funds and 15-year fixed-rate mortgages to my analysis. Table B.1 and B.2 in Appendix report the results and indicates that banks that operate in more concentrated areas increase their deposit spreads more, whereas their lending spreads less, verifying my main findings.

Usage of an Alternative Concentration Measure

Figure 6a and Figure 6b show that the loan and deposit market powers are highly correlated. Hence, both measures provide a good proxy for bank concentration. I re-estimate Equation (2) using the deposit market power measure to confirm that my results are robust using both concentration measures. Table B.3 shows that deposit spreads widen more whereas loan spreads less in more concentrated banking regions, consistent with my main results.

Estimation of Bank-level Results using LP-IV strategy

In general, funding and lending rates respond to monetary policy more rapidly. On the other hand, the transmission of monetary policy to bank-level assets and liabilities may take time. To address this issue, I repeat my analysis on bank-level balance sheet variables using the LP-IV approach of Jordà (2005). The LP-IV strategy enables me to capture the impact of monetary policy on bank-level variables over more extended periods. Equation (21) presents my estimation strategy:

$$\begin{aligned}\Delta_h log(y_{jt+h}) =& \alpha_j^h + \beta^h \Delta R_t + \Gamma^h \Delta R_t \times BankHHI_{jt-1} + \theta^h BankHHI_{jt-1} \\ &+ \Gamma'(L) X_{jt-1} + \Omega'(L) Z_t + \epsilon_{jt+h}\end{aligned} \tag{21}$$

Where the horizon is h = 0, 1, ..8 quarters, and j and t denote bank and time, respectively. The left-hand side of equation (21) is the cumulative change in the bank-balance sheet variable y calculated as: $\Delta_h log(y_{ct+h}) = log(y_{ct+h}) - log(y_{ct-1})$. ΔR_t refers to the instrumented change in the one-year Treasury yield. $BankHHI_{jt-1}$ is the lagged bank-level concentration of bank j given by equation (3). X_{jt-1} includes the lagged change in the bank-level assets, liquidity, and equity. Z_t includes the following control variables: change in the national level GDP, unemployment rate, inflation.[58] The lag structure on the control variable is set to be two quarters, and standard errors are clustered at the bank level.[59] Figures B.1 to B.10 in Appendix plot the response of bank-level variables to monetary policy conditional on bank market power. Figures B.1 to B.3 show that my results hold using funding and lending rates rather than spreads. The Figures reveal that interest pass-through to bank retail and wholesale funding rates decreases even more for the banks with higher market power over time. Figure B.9 present that wholesale funding reliance is much higher for the banks with higher market power after two quarters of the monetary policy contraction. Figures B.5 and B.6 suggest that both bank-level assets and loans decrease less for banks with higher market power, where the effect becomes notable two years after the monetary policy shock, at the time the impact on wholesale-funding starts to amplify, verifying my baseline findings. For other bank-balance sheet variables, I also obtain results similar to the ones reported in Table 7 and confirm that my results are robust to alternative specifications.

Usage of Additional of Bank-level Controls

I also test whether heterogeneity in other observable bank characteristics, such as bank size, can drive my main results. To do so, I re-estimate the main results using the specification in Equation (4), where monetary shocks are interacted with various bank characteristics. Specifically, I interact with the monetary policy with bank size, equity, and liquidity measures to ensure that my results are not driven by the differences in bank characteristics, especially the differences in bank size. Table B.6 in Appendix report the results. In each case, the coefficient on monetary policy and bank concentration interaction remains similar to the reported in the base line specification, suggesting that the main results are not driven by bank size, leverage, or liquidity differences across the banks.

Usage of the Time Fixed Effect Specification

I test the robustness of my results by adding time fixed effects to my analysis on bank

[58] Results are robust including the change in the commercial paper spread, and change in the mortgage spread.

[59] I also include a dummy for the ZLB period to control for the changes this may stem from this period.

balance sheet variables as in Drechsler, Savov, and Schnabl (2017). Tables B.7 in Appendix present that results are robust using either approaches.

Usage of Alternative Monetary Policy Shocks

I checked the robustness of my results by using the pure change in the one-year Treasury yield and orthogonalized monetary policy shocks from Bauer and Swanson (2022) and obtained similar results. In particular, usage of orthogonalized Bauer and Swanson (2022) shocks addresses the concerns on the potential correlation between monetary policy surprises and macroeconomic or financial data that becomes publicly available before the FOMC announcements. These shocks are obtained through regressing the standard Bauer and Swanson (2022) shocks, constructed by the first principal component analysis to ED1-ED4, on the economic and financial variables that predate the announcements and then taking the residuals. Tables B.4 and B.5 in Appendix re-estimate results on deposit and loan spreads with both the pure change in the one-year Treasury yield and orthogonalized Bauer and Swanson (2022) shocks. The findings confirm the baseline findings, although the magnitude of the coefficients slightly increases for the specification with orthogonalized shocks.

Usage of Full Small Lending Sample:

I verify the robustness of my result by using the full sample on bank-county level small business lending. That is, I include the loan originations less than $100,000 in value in my sample. Table B.8 in Appendix reports the results. As seen from the table, lending of banks with higher market power decreases less compared to other banks, consistent with my main findings in Table 8.

8 Conclusion

In this paper, I study the importance of bank market power for the monetary policy pass-through to bank funding dynamics, lending, and profitability. First, I document that monetary policy creates a considerable variation in banks' funding spreads depending on banks' market power. I find that both the wholesale funding and deposit spreads increase more for banks with higher market power after a policy tightening, and the funding composition of these banks changes substantially. In particular, I show that deposit inflows of banks with higher market power decrease slightly more due to a lower pass-through of the increase in the policy rate to their deposit rates, and these banks compensate for their funding shortfalls through wholesale funding as they access wholesale financing at a lower cost. Moreover, I document that the rise in funding spreads enables banks with higher market power to alter their loan rates less and smooth their lending and profitability. I further report that bank market power affects monetary policy transmission to the macroeconomy by showing that county-level lending and employment are less adversely affected by the monetary contraction in regions where banks with higher market power operate. Lastly, I build a theoretical model featuring monopolistic competition and rationalize my empirical findings.

The findings of this paper are crucial for the following reasons. Firstly, this study is the first paper evaluating the impact of bank market power on the transmission of monetary policy to banks' interest spreads, lending, and profitability, considering the interdependence among the deposit, wholesale funding, and credit markets which is crucial to achieving clear understanding on monetary policy transmission mechanism. Importantly, this paper provides a complete picture of the role of bank market power on the monetary policy transmission to bank-level outcomes by revealing the importance of the wholesale funding channel. Finally, the results of this paper have significant implications for policy-making as it presents new insights into the effect of market power on the pass-through of monetary policy to real economic outcomes.

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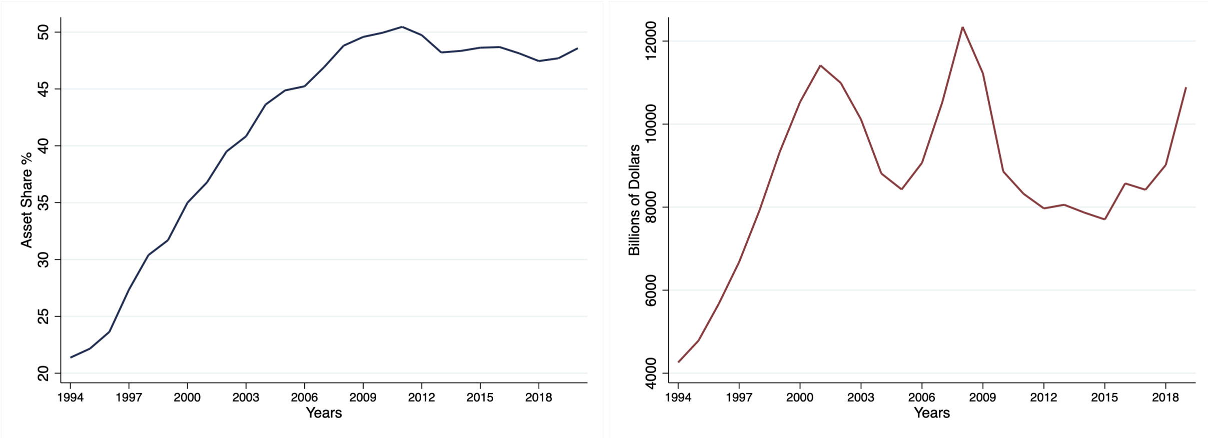
Figure 1: The U.S Financial Markets

Figures (a) and (b) plot the recent economic phenomenons of U.S financial markets. Figure (a) plots the asset share of the top 5 banks, whereas Figure (b) plots the total assets of Money Market Funds over time. The data are from the U.S. Call Reports and FRED, covering 1994 to 2019.



(a) Asset share of the Top 5 Banks

(b) Total Assets of MMFs

Figure 2: Outline of the Monetary Policy Transmission Mechanism to Bank Lending

Figures (a) and (b) outline the Monetary Policy Transmission Mechanism to Bank Lending. Figure (a) illustrates the average effect of the monetary policy, whereas Figure (b) illustrates the effect of market power on monetary policy transmission to bank lending.

(a) Average Effect of the Monetary Policy

(b) Effect for the Banks with Higher Market Power

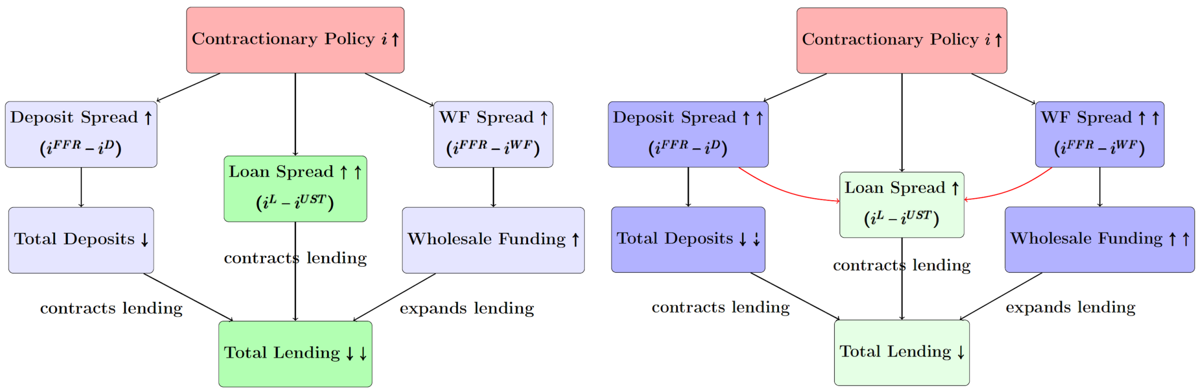
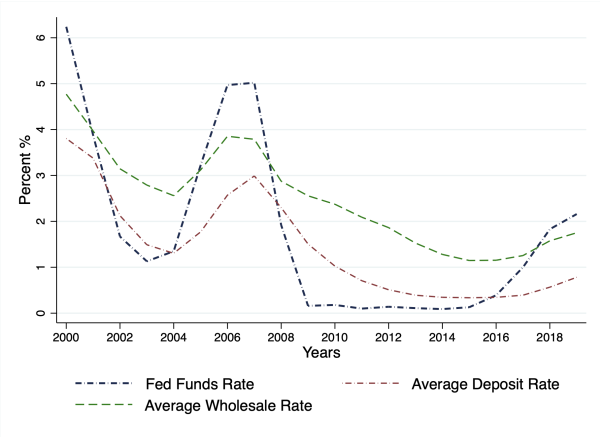


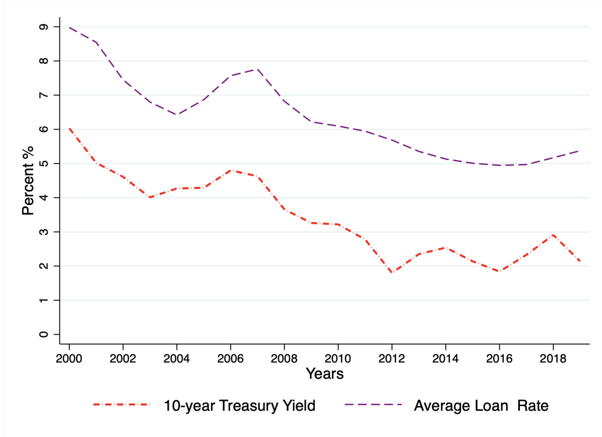
Figure 3: Bank Retail Rates, Profitability and Monetary Policy

Figures (a) and (b) plot the commercial banking sector's average deposit, wholesale funding, and loan rate. The data are from the U.S. Call Reports covering 2000 to 2019. Figure (c) plots the deposit rate on the most widely-offered deposit products using RateWatch data from 2000 to 2019. Lastly, Figure (d) plots the profitability of the U.S. banking system over time.

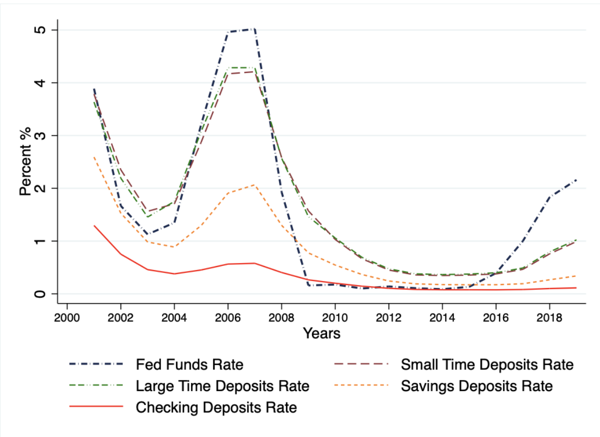
(a) Average Funding Rates



(b) Average Loan Rate



(c) Average Deposit Rate by Product



(d) Bank Profitability

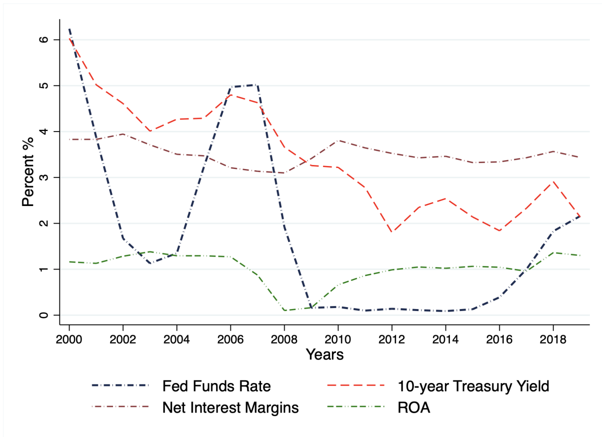
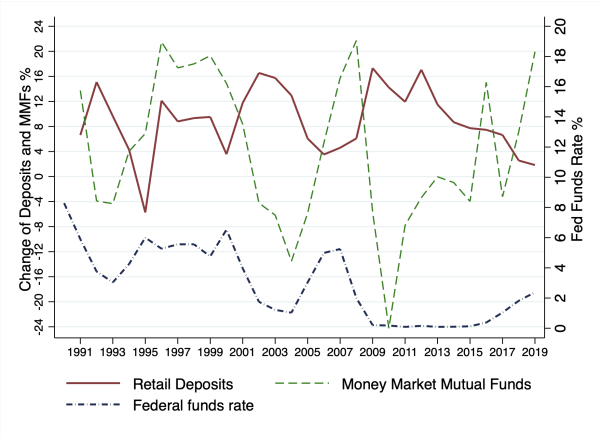


Figure 4: Retail Deposits, Wholesale Funding, MMFs and Federal Funds Rate

Figure (a) plots the time series of the federal funds rate against the change in the aggregate amount of retail deposits and the aggregate amount of money market funds. Similarly, Figure (b) plots the wholesale funding to retail deposits ratio for the U.S. commercial banks.

(a) Retail Deposits and Federal Funds Rate



(b) Wholesale Funding to Retail Deposits Ratio

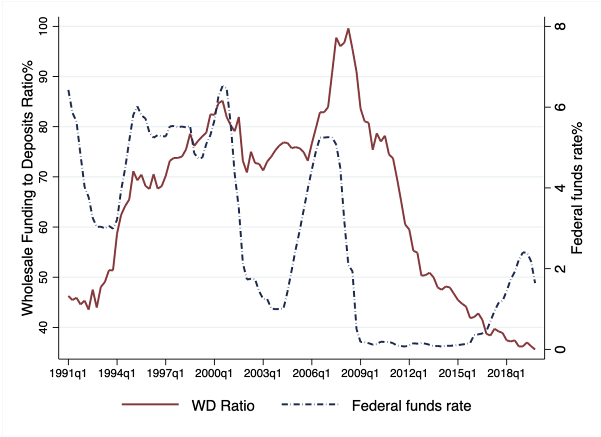
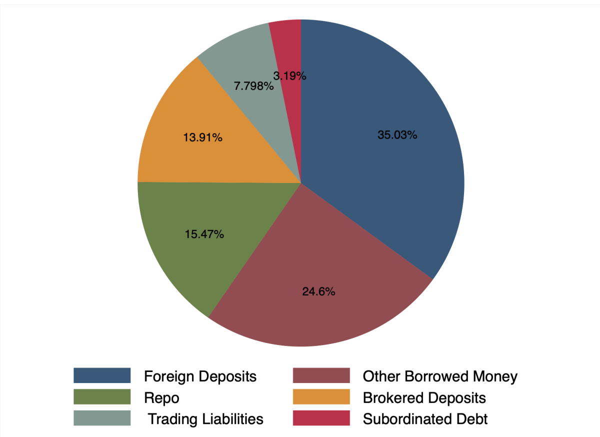


Figure 5: Composition of Wholesale Funding and U.S. Small Business Lending

Figure (a) plots the components of the wholesale funding for U.S. commercial banks. The data source is U.S. Call Reports, covering the period between 1997 to 2019. Figure (b) plots the time series of bank lending to small businesses: The red line plots the total volume of loans in billions of dollars, and the blue line plots the number of new loans in billions. Data is from FDIC and covers between 1997 to 2019.

(a) Composition of the Wholesale Funding



(b) U.S Small Business Lending

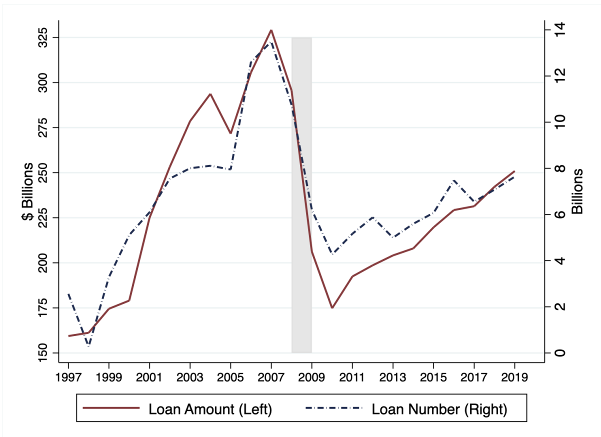
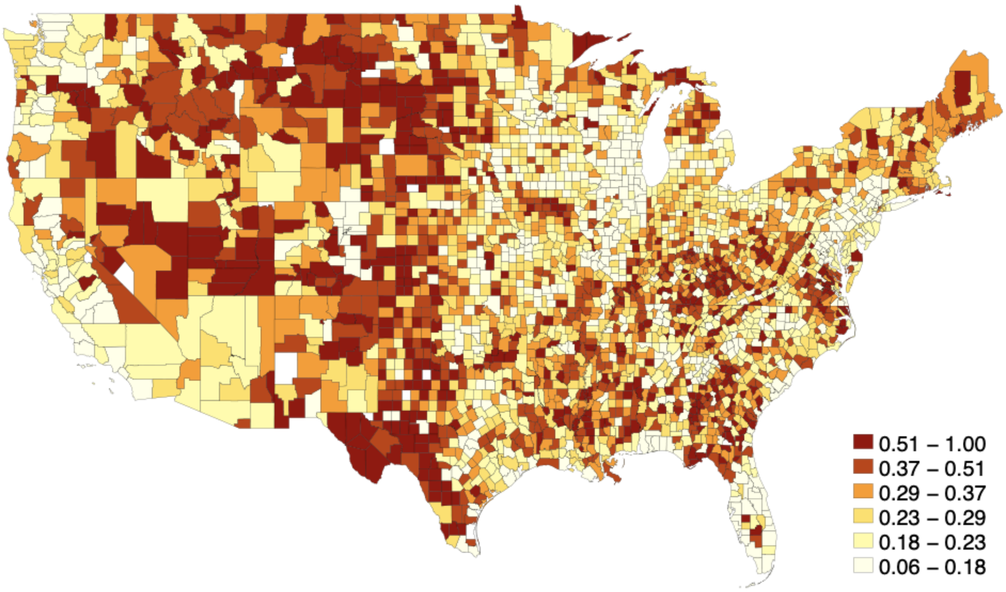


Figure 6: U.S. Banking Market Concentration

This map shows the average Herfindahl index for each U.S. county. The Herfindahl Hirschman Index is calculated each year using the asset market shares of all banks with branches in a given county and then averaged over the period from 1994 to 2019 for local credit market concentration. On the other hand, Figure (b) reports the Herfindahl Hirschman Index calculated using the deposit market shares of all banks with branches in a given county and then averaged over time. The data source is FDIC.

(a) Local Market Concentration Using Asset Shares



(b) Local Market Concentration Using Deposit Shares

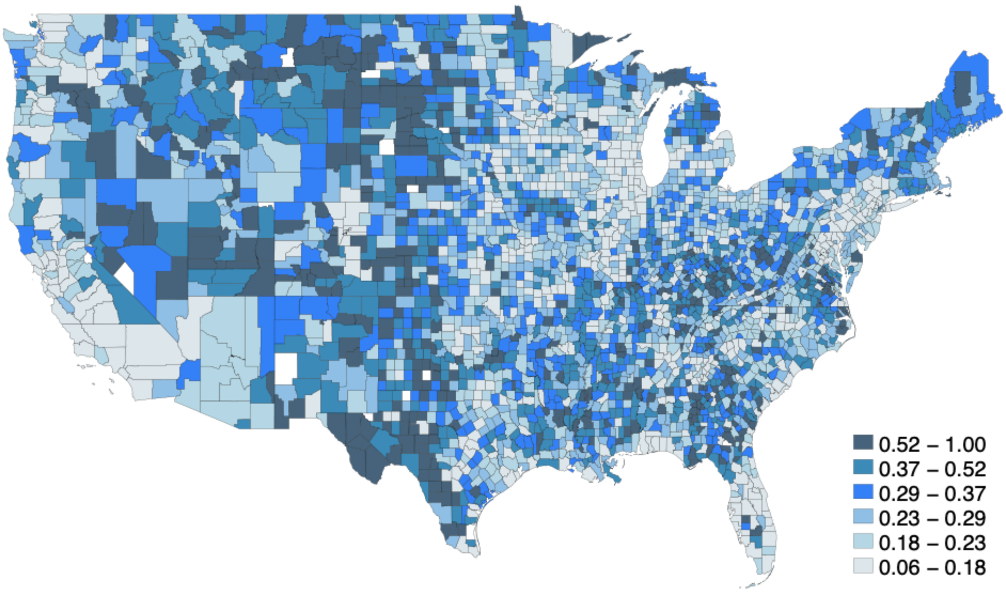


Table 2: Summary Statistics for Deposit and Loan Spreads-*Ratewatch*

Panel A: Deposit Spreads

	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
Δ12MCDspread	0.02	0.25	0.02	0.25	0.01	0.25
Δ06MCDspread	0.01	0.26	0.01	0.25	0.00	0.26
ΔMM25Kspread	-0.01	0.36	-0.02	0.35	-0.03	0.37
ΔMM10Kspread	-0.01	0.37	0.00	0.36	-0.01	0.37
HHI_c	0.18	0.12	0.10	0.03	0.25	0.12
Obs.(branch×quarter)	513,437		256,245		257,192	

Panel B: Personal Loan Spread

	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
ΔPersonal Loan Sprd	0.04	1.17	0.04	1.16	0.03	1.18
HHI_c	0.24	0.11	0.16	0.03	0.32	0.12
Obs.(branch×quarter)	162,173		81,050		81,123	

Panel C: Auto Loan Spread

	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
ΔAuto Loan Sprd	0.01	0.49	0.01	0.50	0.01	0.48
HHI_c	0.24	0.11	0.16	0.03	0.32	0.12
Obs.(branch×quarter)	76,695		38,289		38,406	

Panel D: Mortgage Spreads

	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
Δ15Yr Mtg Sprd	-0.00	0.35	-0.01	0.34	-0.01	0.36
Δ30Yr Mtg Sprd	-0.02	0.31	-0.03	0.30	-0.02	0.31
HHI_c	0.24	0.10	0.16	0.03	0.31	0.10
Obs.(branch×quarter)	39,554		19,766		19,788	

Panel E: HELOC Spreads

	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
Δ%80 LTV HELOC Sprd	-0.06	0.66	-0.06	0.68	-0.06	0.64
HHI_c	0.23	0.11	0.16	0.03	0.30	0.10
Obs.(branch×quarter)	143,330		71,597		71,733	

Table 3: Summary Statistics for Bank and County Level Variables

Panel A: Bank Level Interest Spreads	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
ΔDeposit sprd	0.02	0.40	0.02	0.39	0.02	0.41
ΔLoan sprd	-0.00	0.77	-0.00	0.77	-0.00	0.77
ΔWholesale-funding sprd	0.00	1.46	0.01	1.41	0.00	1.50
Bank-HHI	0.24	0.13	0.16	0.03	0.33	0.13
Observations	455,487		211,492		211,501	

Panel B: Small Business Lending	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
$\Delta Log(Lending)$	0.07	1.16	0.06	1.18	0.08	1.14
Bank-HHI	0.27	0.17	0.18	0.03	0.37	0.21
Observations	921,233		460,612		460,621	

Panel C: County Level Characteristics	All		Low HHI		High HHI	
	Mean	Std	Mean	Std	Mean	Std
Population	90,109	293,227	148,798	392,3864	31,457	105,871
Gdp (in mill $)	4,959	22,257	6,722	27,204	3,387	15,656
Wages (in mill $)	2,067	9,343	2,695	11,082	1,440	7,140
Unemp. rate	5.75	1.75	5.71	1.74	5.78	1.77
County-HHI	0.240	0.05	0.201	0.02	0.280	0.05
Obs. (counties)	3,219		1,510		1,709	

This table provides summary statistics on bank-level interest spreads, bank-county level small business lending, county-level lending, GDP, unemployment and wages. In addition, it provides a breakdown by high and low Herfindahl (HHI) using the median HHI for the respective sample. The underlying data is from the FDIC for lending, the U.S. Bureau of Economic Analysis for GDP, and the Bureau of Labor Statistics for other variables. It covers January 2000 to December 2019. GDP data is available starting from 2001.

Table 4: Time and Saving Deposit Spreads

Panel A: 12-Month CD

	ΔDeposit Spread				
	All	≥ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.342***	0.320***			
	(0.00432)	(0.00524)			
$\Delta R_t \times HHI_c$	0.135***	0.230***	0.244***	0.0892**	0.103***
	(0.0295)	(0.0409)	(0.0353)	(0.0382)	(0.0378)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	475,942	205,920	205,920	205,920	205,920
R-squared	0.346	0.315	0.002	0.000	0.000

Panel B: 25K Money Market Funds

	ΔDeposit Spread				
	All	≥ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.855***	0.831***			
	(0.00421)	(0.00565)			
$\Delta R_t \times HHI_c$	0.246***	0.215***	0.302***	0.226***	0.250***
	(0.0306)	(0.0447)	(0.0443)	(0.0506)	(0.0498)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	513,437	226,722	226,722	226,722	226,722
R-squared	0.477	0.446	0.000	0.000	0.000

This table estimates the effect of the change in one-year Treasury rate on most common types of time and saving deposits using Bauer and Swanson (2022) shocks as an instrument. The sample covers between 2000-2019.

Table 5: Personal Loan and Automobile Loan Spreads

Panel A: Personal Loans					
	ΔLoan Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.179***	0.183***			
	(0.0222)	(0.0283)			
$\Delta R_t \times HHI_c$	-0.291*	-0.683***	-0.550**	-0.673**	-0.779**
	(0.154)	(0.251)	(0.271)	(0.302)	(0.317)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	162,173	66,253	66,253	66,253	66,253
R-squared	0.062	0.063	0.000	0.000	0.000
Panel B: Automobile Loans					
	ΔLoan Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.245***	0.420***			
	(0.0222)	(0.0325)			
$\Delta R_t \times HHI_c$	-0.189**	-0.341**	-0.385**	-0.165	-0.277*
	(0.0832)	(0.141)	(0.164)	(0.151)	(0.153)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	76,695	34,030	34,030	34,030	34,030
R-squared	0.059	0.077	0.001	0.000	0.000

This table estimates the effect of the change in one-year Treasury rate on Personal and Automobile Loan spreads using Bauer and Swanson (2022) shocks as an instrument. The sample covers between 2000-2019.

Table 6: HELOC and Fixed Rate Mortgage Spreads

Panel A: Home Equity Line of Credits (HELOC)

	ΔLoan Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.969***	0.990***			
	(0.0131)	(0.0179)			
$\Delta R_t \times HHI_c$	-0.250**	-0.359**	-0.357**	-0.433**	-0.513**
	(0.0981)	(0.149)	(0.168)	(0.191)	(0.208)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	143,330	64,526	64,526	64,526	64,526
R-squared	0.208	0.175	0.000	0.000	0.000

Panel B: 30-Year Fixed Rate Mortgages

	ΔLoan Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.0249**	0.00325			
	(0.0102)	(0.0120)			
$\Delta R_t \times HHI_c$	0.00855	-0.101	-0.210*	-0.205*	-0.327***
	(0.0823)	(0.109)	(0.113)	(0.111)	(0.116)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	39,554	23,195	23,195	23,195	23,195
R-squared	0.080	0.082	0.000	0.001	0.000

This table estimates the effect of the change in one-year Treasury rate on HELOCs and Fixed Rate Mortgage spreads using Bauer and Swanson (2022) shocks as an instrument. The sample covers between 2000-2019.

Table 7: Bank-level Results

Panel A: Bank Interest Spreads

	ΔDeposit Spread	ΔWF Spread	ΔFunding Spread	ΔLoan Spread	ΔNIM	ΔROA
	(1)	(2)	(3)	(4)	(5)	(6)
ΔR_t	.880***	.707***	.867***	.278***	-.0297***	.00108
	(.00247)	(.0168)	(.00248)	(.00506)	(.00313)	(.00813)
$\Delta R_t \times BankHHI_{jt-1}$	.0790***	.199*	.0996***	-.0767**	.0384**	.00961**
	(.0150)	(.104)	(.0150)	(.0327)	(.0196)	(.00489)
Bank f.e.	Y	Y	Y	Y	Y	Y
Bank-level controls	Y	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y	Y
Observations	455,505	455,505	455,505	455,505	455,505	455,505
R-squared	0.501	0.027	0.493	0.007	0.018	0.018

Panel B: Bank Assets and Liabilities

	ΔRetail Deposits	ΔW.sale Funding	ΔTotal Liabilities	ΔTotal Assets	ΔTotal Loans	ΔTotal Securities
	(1)	(2)	(3)	(4)	(5)	(6)
ΔR_t	-.267***	.743*	-.408***	-.325***	-.188***	-.135
	(.0438)	(.0430)	(.0437)	(.0387)	(.0432)	(.128)
$\Delta R_t \times BankHHI_{jt-1}$	-.0267	8.721***	.297	.109	.0325	2.719***
	(.284)	(2.458)	(.282)	(.251)	(.304)	(.749)
Bank f.e.	Y	Y	Y	Y	Y	Y
Bank-level controls	Y	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y	Y
Observations	455,505	455,505	455,505	455,505	455,505	455,505
R-squared	0.042	0.002	0.041	0.037	0.066	0.020

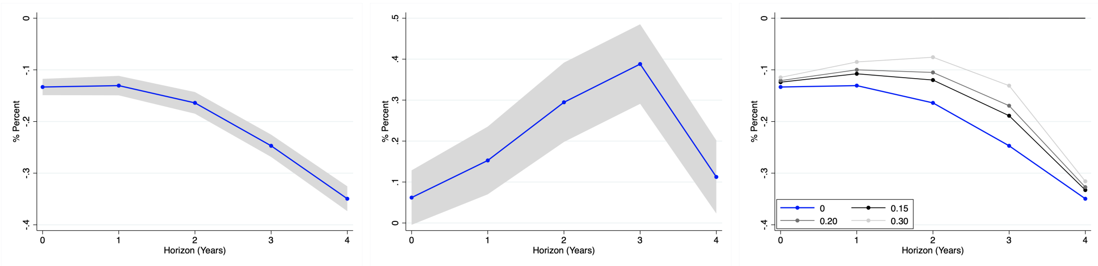
This table estimates the effect of the bank market power on bank-level outcomes. Panel A reports the results for the interest spreads and profitability. Panel B reports the results for assets and liabilities. ΔR_t is the change in the one-year Treasury Yield instrumented by Bauer and Swanson (2022) shocks. The sample covers between 2000-2019.

Table 8: Table : Change in Bank-County Level Small Business Lending

	(1) ΔLending	(2) ΔLending	(3) ΔLending	(4) ΔLending	(5) ΔLending
ΔR_t	-0.138***	-0.140***			
	(0.0134)	(0.0133)			
$\Delta R_t \times BankHHI_{jt-1}$	0.290**	0.295**	0.273**	0.280**	0.292**
	(0.118)	(0.120)	(0.125)	(0.128)	(0.128)
$\Delta R_t \times HHI_{ct-1}$		-0.0278		-0.0321	
		(0.0314)		(0.0315)	
County f.e	Y	Y	Y	Y	Y
Bank f.e	Y	Y	Y	Y	Y
County-bank f.e.	Y	Y	Y	Y	Y
County-time f.e.	N	N	N	N	Y
Time f.e.	N	N	Y	Y	Y
Macro-level controls	Y	Y	N	N	N
Observations	550,840	550,840	550,840	550,840	550,840
R-squared	0.031	0.031	0.003	0.003	0.003

This table estimates the effect of the bank market power on small business lending. ΔLending is the percentage change in the total amount of small business lending originated by a given bank in a given county compared to the previous year. Bank-HHI is the bank's market power, and HHI is the concentration of the county where the bank branch operates. ΔR_t is the change in the one-year Treasury Yield instrumented by Bauer and Swanson (2022) shocks. The sample covers between 2000-2019.

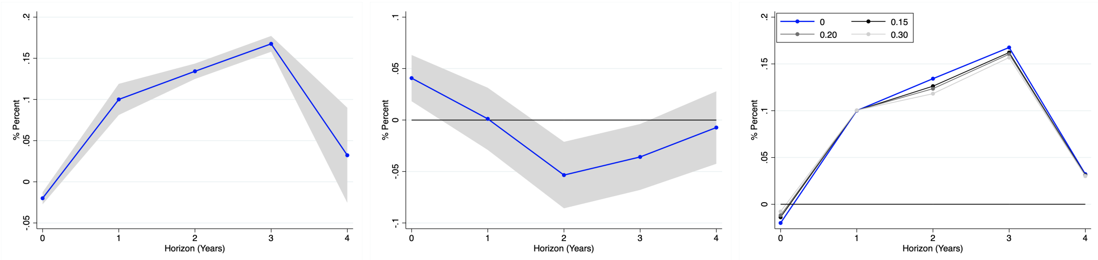
Figure 7: Impulse Responses of County-level Small Business Lending



(a) $\hat{\beta^h}$ (b) $\hat{\Gamma^h}$ (c) $\hat{\beta^h} + \hat{\Gamma^h}$

The plots show the impulse responses of total county-level small business lending using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is four years. The period is 1997-2019. The control variables are changes in the national level of GDP, unemployment rate, inflation, and HHI_c. Standard errors are clustered by bank and county. HHI-0.15, HHI-0.20, and HHI-0.30 refer to counties with County-HHI indexes of 0.15, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

Figure 8: Impulse Responses of County-level Unemployment



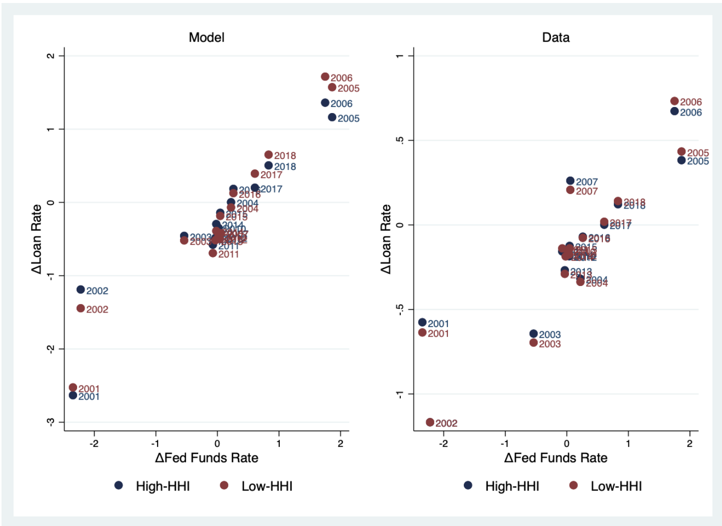
(a) $\hat{\beta^h}$ (b) $\hat{\Gamma^h}$ (c) $\hat{\beta^h} + \hat{\Gamma^h}$

The plots show the impulse responses of total county-level unemployment using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is four years. The period is 1997-2019. The control variables are changes in the national level of GDP, unemployment rate, inflation, and HHI_c. Standard errors are clustered by bank and county. HHI-0.15, HHI-0.20, and HHI-0.30 refer to counties with County-HHI indexes of 0.15, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

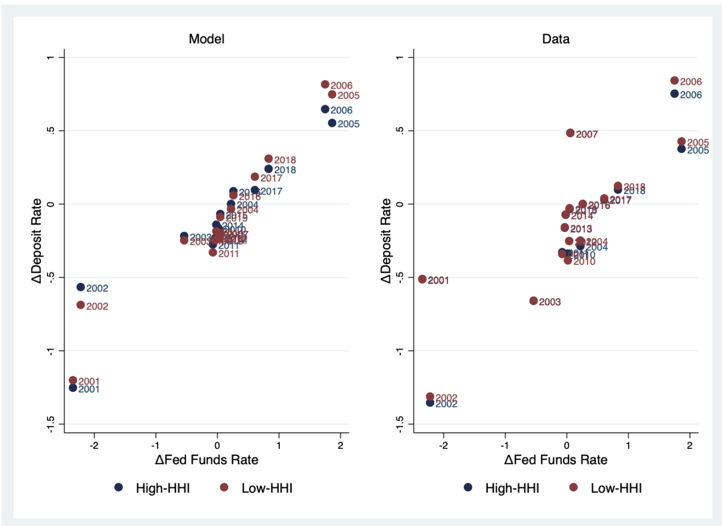
Figure 9: Comparison of Model with Data-Change in the Loan Rate

This figure compares the model's prediction for the change in the loan and deposit rates with the ones obtained from the data. The model predictions are obtained by plugging the wholesale funding spread obtained from actual data into the model implied loan and deposit rate equations (See equations (19) and (20)). High-HHI refers to banks above the 75th percentile of the Bank-HHI distribution, whereas Low-HHI refers to banks below the 75th percentile of the Bank-HHI distribution. The average loan rate for the High-HHI group is calculated by averaging the loan rate of all banks above the 75th percentile of the Bank-HHI distribution for a given year. The data is from Call Reports spanning the period between 2000-2019.

(a) Change in the Loan Rate



(b) Change in the Deposit Rate



Appendix

A Data

A.1 Definition of the Bank-level Variables

This section describes my data construction procedure from the quarterly Call Reports. When constructing my sample. I control for bank mergers in my analysis by excluding banks with an asset growth rate of more than %100 between quarters.

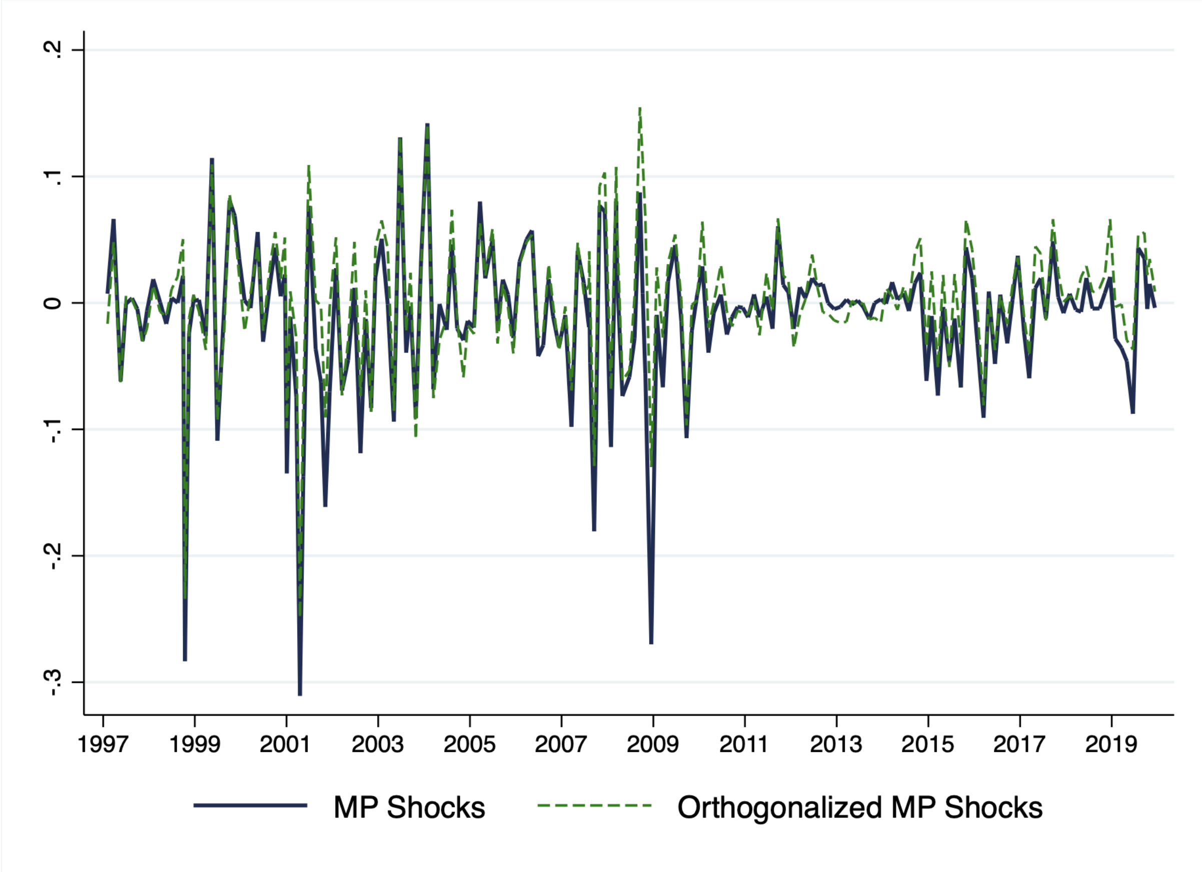
Table A.1: Description of Banking Variables

Variable Name	**Definition**
Domestic Deposits	Saving Deposits+Time Deposits+Transaction Deposits
Wholesale Funding	Liabilities-Domestic Deposits
Deposit Rate	Interest Expense on Domestic Deposits/Domestic Deposits
Wholesale F. Rate	Interest Expense on Wholesale Funding/Wholesale Funding
Loan Rate	Interest Income on Total Loans/Total Loans
Deposit Spread	Federal Funds Rate-Deposit Rate
Loan Spread	Loan Rate-Treasury Yield with the Respective Maturity
Wholesale F. Spread	Federal Funds Rate-Wholesale Funding Rate
Liquidity	Cash+Securities+Federal Funds Repos
ROA	Net Income/Assets
NIM	Interest Rate on Assets-Interest Rate on Liabilities

A.2 Monetary Policy Shocks

I use high-frequency monetary policy shocks from Bauer and Swanson (2022) obtained through the first principal component analysis of Eurodollar futures contracts, ED1–ED4. I confirm the robustness of my results by using the orthogonalized version of these shocks with respect to economic news before the announcement. Figure A.1 plots these shocks over time.

Figure A.1: Bauer and Swanson (2022) Shocks



This figure plots the Bauer and Swanson (2022) shocks over time.

B Robustness

This section provides results on various number of checks which confirm that the baseline results are robust to alternative estimation strategies, monetary policy shocks, usage of different samples, and market power measures. For the detailed discussion of the results see Section 7.

B.1 Results on Deposit and Loan Spreads

B.1.1 Using Alternative Products

Table B.1: Time and Saving Deposit Spreads

Panel A: 06-Month CD					
	ΔDeposit Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.380***	0.368***			
	(0.00426)	(0.00521)			
$\Delta R_t \times HHI_c$	0.140***	0.216***	0.199***	0.131***	0.123***
	(0.0295)	(0.0399)	(0.0367)	(0.0403)	(0.0399)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	483,946	211,039	211,039	211,039	211,039
R-squared	0.386	0.356	0.001	0.001	0.001
Panel B: 10K Money Market Funds					
	ΔLoan Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.890***	0.867***			
	(0.00399)	(0.00540)			
$\Delta R_t \times HHI_c$	0.214***	0.193***	0.260***	0.227***	0.229***
	(0.0289)	(0.0419)	(0.0430)	(0.0468)	(0.0463)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	512,650	226,212	226,212	226,212	226,212
R-squared	0.634	0.600	0.001	0.000	0.000

Table B.2: Loan Spreads

15-Year Fixed Rate Mortgages					
	ΔLoan Spread				
	All	$\geq$ 2 Counties			
	(1)	(2)	(3)	(4)	(5)
ΔR_t	0.140***	0.122***			
	(0.0119)	(0.0146)			
$\Delta R_t \times HHI_c$	-0.0371	-0.139	-0.245*	-0.236**	-0.321**
	(0.0828)	(0.115)	(0.128)	(0.117)	(0.133)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	N	N	N	Y	Y
State-time f.e.	N	N	Y	N	Y
Macro controls	Y	Y	N	N	N
Observations	34,352	18,923	18,923	18,923	18,923
R-squared	0.093	0.071	0.001	0.001	0.001

Tables B.1 and B.2 estimate the effect of the change in one-year Treasury rate on alternative deposit and loan products using Bauer and Swanson (2022) shocks as an instrument. The sample covers between 2000-2019.

B.1.2 Using Deposit Market Power

Table B.3: Loan and Deposit Spreads

Panel B:Deposit Spread

	ΔDeposit Spread			
	25K MMF	10K MMF	12-Month CD	6-Month CD
	(1)	(2)	(3)	(4)
$\Delta R_t \times HHI_c$	0.258***	0.232***	0.105***	0.126***
	(0.0507)	(0.0470)	(0.0383)	(0.0406)
Branch f.e.	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y
Bank-time f.e.	Y	Y	Y	Y
State-time f.e.	Y	Y	Y	Y
Observations	226,722	226,212	205,920	211,039
R-squared	0.000	0.000	0.000	0.001

Panel A:Loan Spreads

	ΔLoan Spread				
	Personal Loans	Auto Loans	15-Year Mortgages	30-Year Mortgages	80-LTV HELOCs
	(1)	(2)	(3)	(4)	(5)
$\Delta R_t \times HHI_c$	-0.840***	-0.248*	-0.305**	-0.307***	-0.486**
	(0.313)	(0.141)	(0.124)	(0.112)	(0.195)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	Y	Y	Y	Y	Y
State-time f.e.	Y	Y	Y	Y	Y
Observations	66,253	34,030	18,923	23,195	64,526
R-squared	0.000	0.000	0.001	0.000	0.000

This table estimates the effect of the change in one-year Treasury rate on loan and deposit spreads using Bauer and Swanson (2022) shocks as an instrument. HHI_c measures the market concentration of the county where the branch is located using deposit shares of the branches as a robustness exercise to Table 4 to 6. The sample covers between 2000-2019.

B.1.3 Using Alternative Policy Measures

Table B.4: Deposit Spreads

Panel A: 1-Year Treasury Yield				
	ΔDeposit Spread			
	25K MMF	10K MMF	12-Month CD	6-Month CD
	(1)	(2)	(3)	(4)
$\Delta R_t \times HHI_c$	0.152***	0.141***	0.0892***	0.128***
	(0.0265)	(0.0250)	(0.0249)	(0.0264)
Branch f.e.	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y
Bank-time f.e.	Y	Y	Y	Y
State-time f.e.	Y	Y	Y	Y
Observations	226,722	226,212	205,920	211,039
R-squared	0.789	0.824	0.705	0.699
Panel B: IV with orthogonalized shocks				
	ΔDeposit Spread			
	25K MMF	10K MMF	12-Month CD	6-Month CD
	(1)	(2)	(3)	(4)
$\Delta R_t \times HHI_c$	0.363***	0.348***	0.145*	0.120
	(0.0721)	(0.0965)	(0.0883)	(0.0855)
Branch f.e.	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y
Bank-time f.e.	Y	Y	Y	Y
State-time f.e.	Y	Y	Y	Y
Observations	226,722	226,212	205,920	211,039
R-squared	0.001	0.001	0.000	0.001

This table estimates the effect of the change in the one-year Treasury rate and orthogonalized Bauer and Swanson (2022) shocks on deposit rates as a robustness exercise to Table 4. The sample covers between 2000-2019.

Table B.5: Loan Spreads

Panel A: 1-Year Treasury Yield					
	ΔLoan Spread				
	Personal Loans	Auto Loans	15-Year Mortgages	30-Year Mortgages	80-LTV HELOCs
	(1)	(2)	(3)	(4)	(5)
$\Delta R_t \times HHI_c$	-0.330**	-0.0539	-0.169**	-0.231***	-0.448***
	(0.159)	(0.0678)	(0.0706)	(0.0667)	(0.116)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	Y	Y	Y	Y	Y
State-time f.e.	Y	Y	Y	Y	Y
Observations	66,253	34,030	18,923	23,195	64,526
R-squared	0.408	0.594	0.630	0.563	0.486

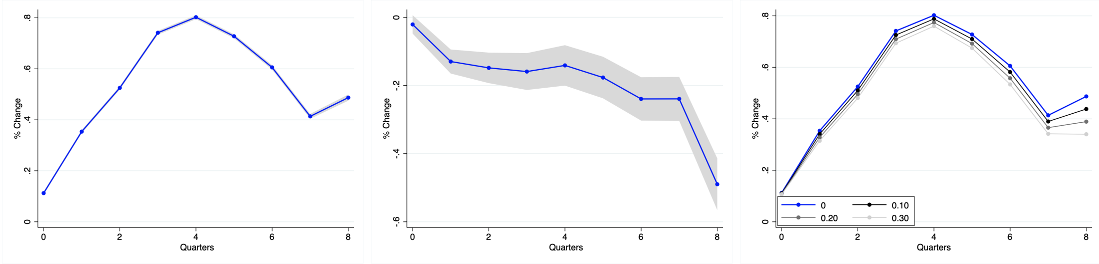
Panel B: IV with orthogonalized shocks					
	ΔLoan Spread				
	Personal Loans	Auto Loans	15-Year Mortgages	30-Year Mortgages	80-LTV HELOCs
	(1)	(2)	(3)	(4)	(5)
$\Delta R_t \times HHI_c$	-1.692*	-0.277*	-0.466	0.437	-1.408*
	(1.003)	(0.153)	(0.323)	(0.458)	(0.818)
Branch f.e.	Y	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y	Y
Bank-time f.e.	Y	Y	Y	Y	Y
State-time f.e.	Y	Y	Y	Y	Y
Observations	66,253	34,030	18,923	23,195	64,526
R-squared	0.002	0.000	0.001	0.000	0.001

This table estimates the effect of the change in the one-year Treasury rate and orthogonalized Bauer and Swanson (2022) shocks on loan rates as a robustness exercise to Tables 6 and 7. Δspread is the change in branch-level loan spread, which is equal to the change in loan rate minus the respective Treasury yield that matches the loan's maturity. HHI_c measures the market concentration of the county where the branch is located. The sample covers between 2000-2019.

B.2 Results on Bank-level Outcomes

B.2.1 Using LP-IV strategy

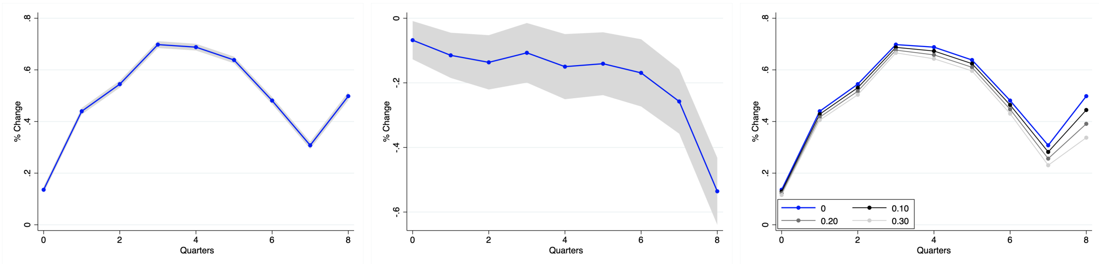
Figure B.1: Impulse Responses of Bank-level Deposit Rates



(a) $\hat{\beta}^h$ (b) $\hat{\Gamma}^h$ (c) $\hat{\beta}^h + \hat{\Gamma}^h$

The plots show the impulse responses of bank-level deposit rates using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

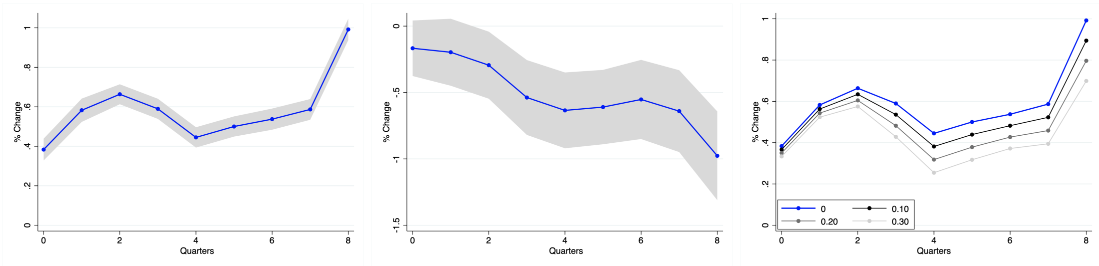
Figure B.2: Impulse Responses of Bank-level Loan Rates



(a) $\hat{\beta}^h$ (b) $\hat{\Gamma}^h$ (c) $\hat{\beta}^h + \hat{\Gamma}^h$

The plots show the impulse responses of bank-level loan rates using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

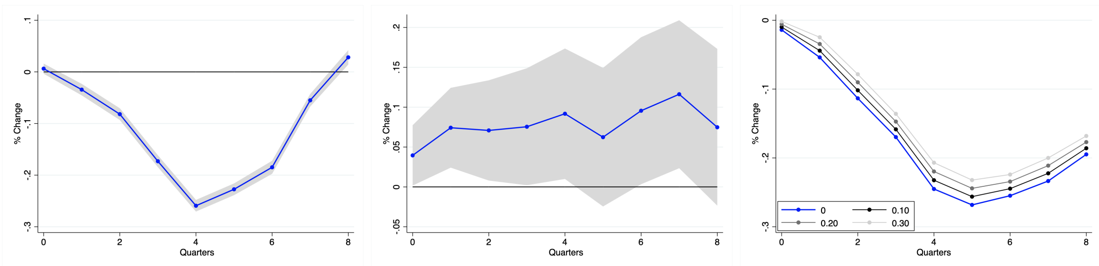
Figure B.3: Impulse Responses of Bank-level Wholesale Funding Rates



(a) $\hat{\beta}^h$ (b) $\hat{\Gamma}^h$ (c) $\hat{\beta}^h + \hat{\Gamma}^h$

The plots show the impulse responses of bank-level wholesale funding rates using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

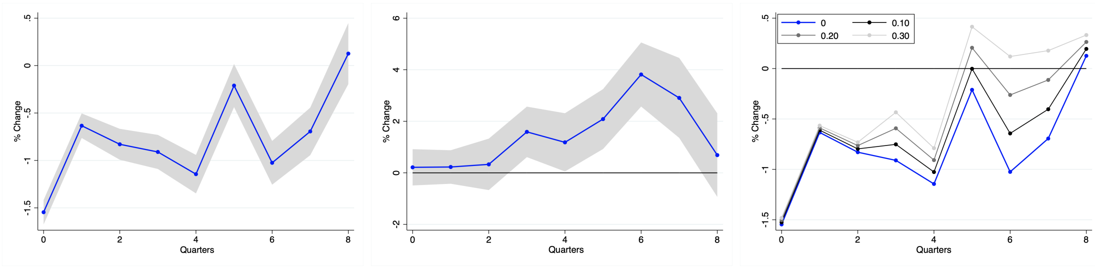
Figure B.4: Impulse Responses of Bank-level NIMs



(a) $\hat{\beta}^h$ (b) $\hat{\Gamma}^h$ (c) $\hat{\beta}^h + \hat{\Gamma}^h$

The plots show the impulse responses of bank-level net interest margins using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

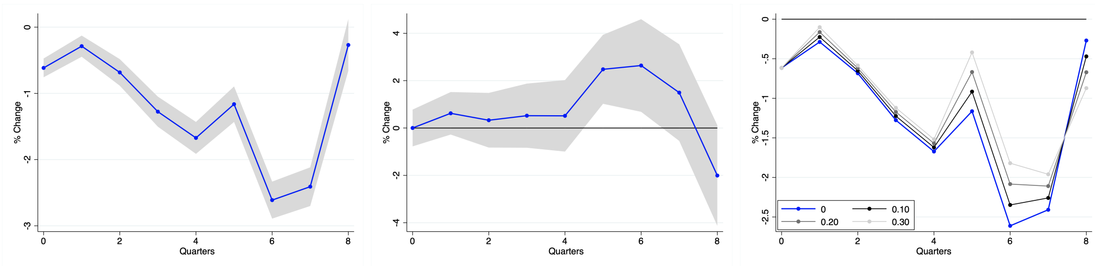
Figure B.5: Impulse Responses of Bank-level Assets



(a) $\hat{\beta^h}$ (b) $\hat{\Gamma^h}$ (c) $\hat{\beta^h} + \hat{\Gamma^h}$

The plots show the impulse responses of bank-level assets using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

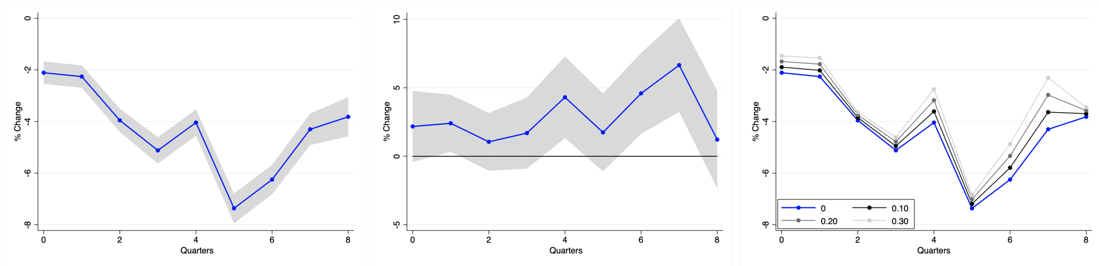
Figure B.6: Impulse Responses of Bank-level Loans



(a) $\hat{\beta^h}$ (b) $\hat{\Gamma^h}$ (c) $\hat{\beta^h} + \hat{\Gamma^h}$

The plots show the impulse responses of bank-level loans using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

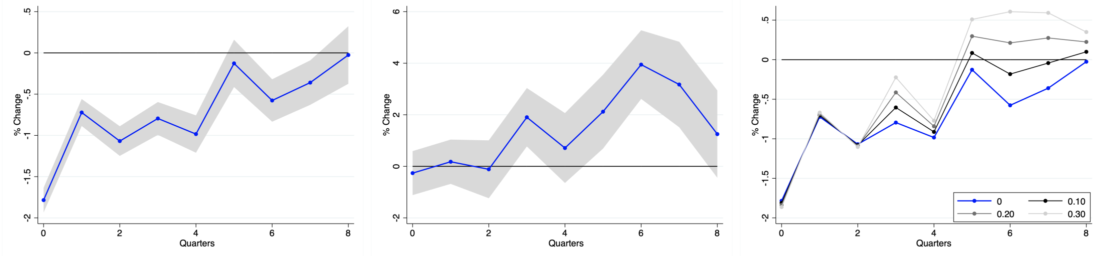
Figure B.7: Impulse Responses of Bank-level Securities



(a) $\hat{\beta^h}$ (b) $\hat{\Gamma^h}$ (c) $\hat{\beta^h} + \hat{\Gamma^h}$

The plots show the impulse responses of bank-level securities using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

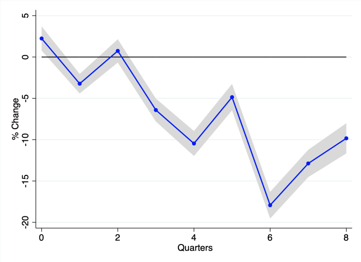
Figure B.8: Impulse Responses of Bank-level Deposits



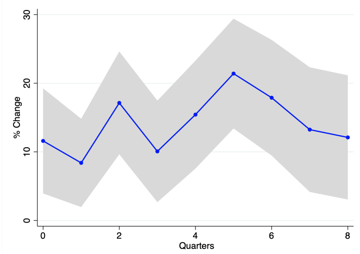
(a) $\hat{\beta^h}$ (b) $\hat{\Gamma^h}$ (c) $\hat{\beta^h} + \hat{\Gamma^h}$

The plots show the impulse responses of bank-level deposits using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

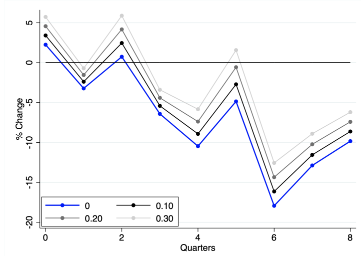
Figure B.9: Impulse Responses of Bank-level Wholesale Funding



(a) $\hat{\beta}^h$



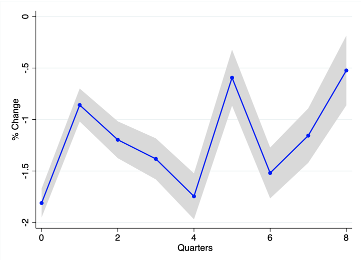
(b) $\hat{\Gamma}^h$



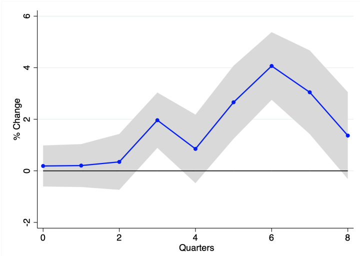
(c) $\hat{\beta}^h + \hat{\Gamma}^h$

The plots show the impulse responses of bank-level wholesale funding using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

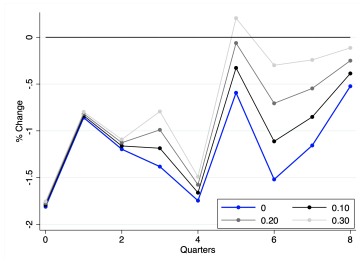
Figure B.10: Impulse Responses of Bank-level Liabilities



(a) $\hat{\beta}^h$



(b) $\hat{\Gamma}^h$



(c) $\hat{\beta}^h + \hat{\Gamma}^h$

The plots show the impulse responses of bank-level liabilities using local projection regressions with one-year Treasury yield instrumented by Bauer and Swanson (2022) shocks. The time horizon is eight quarters. The period is 2000-2019. The control variables are the change in the national level of GDP, unemployment rate, inflation, lagged change in assets, liquidity, and equity. Standard errors are clustered by bank. HHI-0.10, HHI-0.20, and HHI-0.30 refer to banks with Bank-HHI indexes of 0.10, 0.20, and 0.30, respectively. Shaded areas in panels (a) and (b) show 95% confidence intervals.

B.2.2 Using Additional Bank-level Controls

Table B.6: Bank-level Results

Panel A: Bank Interest Spreads

	ΔDeposit Spread	ΔWF Spread	ΔFunding Spread	ΔLoan Spread	ΔNIM	ΔROA
	(1)	(2)	(3)	(4)	(5)	(6)
ΔR_t	.838***	.676***	.825**	.206***	-.0273***	.00151*
	(.00247)	(.0162)	(.00248)	(.00495)	(.00309)	(.000795)
$\Delta R_t \times BankHHI_{jt-1}$	.0723***	.209*	.0775***	-.0658*	.0694***	.0138***
	(.0170)	(.108)	(.0157)	(.0336)	(.0199)	(.00504)
Bank f.e.	Y	Y	Y	Y	Y	Y
Bank-level controls	Y	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y	Y
Observations	455,505	455,505	455,505	455,505	455,505	455,505
R-squared	0.506	0.024	0.542	0.134	0.006	0.002

Panel B: Bank Assets and Liabilities

	ΔRetail Deposits	ΔW.sale Funding	ΔTotal Liabilities	ΔTotal Assets	ΔTotal Loans	ΔTotal Securities
	(1)	(2)	(3)	(4)	(5)	(6)
ΔR_t	-.613***	.0432	-.614***	-.514***	-.370***	-.218*
	(.0453)	(.413)	(.0445)	(.0392)	(.0443)	(.127)
$\Delta R_t \times BankHHI_{jt-1}$	.476	6.410**	.584*	.375	.0645	3.308***
	(.307)	(2.745)	(.307)	(.272)	(.329)	(.791)
Bank f.e.	Y	Y	Y	Y	Y	Y
Bank-level controls	Y	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y	Y
Observations	455,505	455,505	455,505	455,505	455,505	455,505
R-squared	0.007	0.004	0.004	0.004	0.007	0.005

This table estimates the effect of the bank market power on bank-level outcomes. Panel A reports the results for the interest spreads and profitability. Panel B reports the results for assets and liabilities. ΔR_t is the change in the one-year Treasury Yield instrumented by Bauer and Swanson (2022) shocks. The sample covers between 2000-2019.

B.3 Using Time Fixed Effect Specification

Table B.7: Bank-level Results

Panel A: Bank Interest Spreads

	ΔDeposit Spread	ΔWF Spread	ΔFunding Spread	ΔLoan Spread	ΔNIM	ΔROA
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta R_t \times BankHHI_{jt-1}$	.0570***	.149*	.0789***	-.104***	.0560***	.0132***
	(.0143)	(.0882)	(.0144)	(.0323)	(.0178)	(.00460)
Bank f.e.	Y	Y	Y	Y	Y	Y
Bank-level controls	Y	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y	Y
Observations	455,505	455,505	455,505	455,505	455,505	455,505
R-squared	0.051	0.006	0.063	0.037	0.015	0.019

Panel B: Bank Assets and Liabilities

	ΔRetail Deposits	ΔW.sale Funding	ΔTotal Liabilities	ΔTotal Assets	ΔTotal Loans	ΔTotal Securities
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta R_t \times BankHHI_{jt-1}$	-.0127	8.436***	.310	.114	.0756	1.869**
	(.283)	(2.461)	(.282)	(.303)	(.251)	(.745)
Bank f.e.	Y	Y	Y	Y	Y	Y
Bank-level controls	Y	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y	Y
Observations	455,505	455,505	455,505	455,505	455,505	455,505
R-squared	0.036	0.001	0.036	0.045	0.042	0.019

This table estimates the effect of the bank market power on bank-level outcomes. Panel A reports the results for the interest spreads and profitability. Panel B reports the results for assets and liabilities. ΔR_t is the change in the one-year Treasury Yield instrumented by Bauer and Swanson (2022) shocks. The sample covers between 2000-2019.

B.4 Results on Bank-County Level Small Business Lending

B.5 Using the Full Sample

This section provides results on the impact of the bank market power on new small business lending using the full sample that includes loan originations less than $100,000 in value.

Table B.8: Table Change in the Bank-County Level Small Business Lending

	(1) ΔLending	(2) ΔLending	(3) ΔLending	(4) ΔLending	(5) ΔLending
ΔR_t	-0.158***	-0.160***			
	(0.0438)	(0.0418)			
$\Delta R_t \times BankHHI_{jt-1}$	0.486**	0.490**	0.468**	0.472**	0.513**
	(0.197)	(0.198)	(0.195)	(0.195)	(0.202)
$\Delta R_t \times HHI_{ct-1}$		-0.0230		-0.0228	
		(0.0412)		(0.0374)	
County f.e	Y	Y	Y	Y	Y
Bank f.e	Y	Y	Y	Y	Y
County-bank f.e.	Y	Y	Y	Y	Y
County-time f.e.	N	N	N	N	Y
Time f.e.	N	N	Y	Y	Y
Macro-level controls	Y	Y	N	N	N
Observations	921,233	921,233	921,233	921,233	921,233
R-squared	0.022	0.022	0.002	0.002	0.002

This table estimates the effect of the bank market power on new small business lending using the full sample that includes loan originations less than $100,000 in value. ΔLending is the percent of the change in the total amount of small business lending originated by a given bank in a given county compared to the previous year. ΔR_t is the change in the one-year Treasury Yield instrumented by Bauer and Swanson (2022) shocks. Bank-HHI is the bank's market power, and HHI is the concentration of the county where the bank operates. The sample covers between 2000-2019.

C Model

In this section, I derived the CES demand functions used in 6.1

C.1 Dixit-Stiglitz Aggregator:

The solution to loan and deposit demand comes from the Dixit-Stiglitz aggregator illustrated below:

Loan Market:

Borrower seeks a total amount of loans equal to L; he borrows an amount L_j from each bank j and faces the following constraint:

$$L_j = \left(\frac{1}{N} \sum_{j=1}^{N} L_j^{\frac{\theta^\ell - 1}{\theta^\ell}} \right)^{\frac{\theta^\ell}{\theta^\ell - 1}} \tag{22}$$

Where $1 < \theta^\ell$ is the elasticity of substitution between banks.

Demand for the borrower can be derived from minimizing over L_j the total repayment (including principal) due to a continuum of banks j:

$$\min_{L_j} \frac{1}{N} \sum_{j=1}^{N} (1 + i_j^L) L_j$$

subject to

$$\left(\frac{1}{N} \sum_{j=1}^{N} L_j^{\frac{\theta^\ell - 1}{\theta^\ell}} \right)^{\frac{\theta^\ell}{\theta^\ell - 1}} \geq L$$

FOC with respect to L_j yields loan demand:

$$L_j = \left(\frac{1 + i_j^L}{1 + i^L} \right)^{-\theta^\ell} L$$

Where

$$1 + i^L = \left(\frac{1}{N} \sum_{j=1}^{N} {i_j^L}^{1-\theta^\ell} \right)^{\frac{1}{1-\theta^\ell}}$$

Deposit Market:

Savers want to maximize total repayment from deposits subject to total deposits as aggregated through a CES aggregator:

$$D_j = \left(\frac{1}{N} \sum_{j=1}^{N} D_j^{\frac{\theta^d - 1}{\theta^d}} \right)^{\frac{\theta^d}{\theta^d - 1}} \tag{23}$$

Where $\theta^d < -1$ is the elasticity of deposit substitution across banks.

$$\max_{D_j} \quad \frac{1}{N} \sum_{j=1}^{N} (1 + i_j^D) D_j$$

subject to

$$\left(\frac{1}{N} \sum_{j=1}^{N} D_j^{\frac{\theta^d - 1}{\theta^d}} \right)^{\frac{\theta^d}{\theta^d - 1}} \leq D$$

FOC with respect to D_j yields deposit supply:

$$D_j = \left(\frac{1 + i_j^D}{1 + i^D} \right)^{-\theta^d} D$$

Where

$$1 + i^D = \left(\frac{1}{N} \sum_{j=1}^{N} i_j^{D^{1-\theta^d}} \right)^{\frac{1}{1-\theta^d}}$$