Local Monetary Policy*

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Abstract

When Federal Reserve districts experience high inflation but lack voting rights to influence FOMC decisions, Federal Reserve Banks reduce the amount of credit extended via the discount window (DW). The identification strategy is based on the exogenous rotation of voting rights among Reserve Banks and on within borrower-time and district-time variations in DW loans and Federal Home Loan Bank (FHLB) loans, implying that factors related to changes in local demand for credit or changes in borrower characteristics cannot drive the results. Our findings suggest the existence of local monetary policy (LMP) executed by the Federal Reserve Banks.

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1 Introduction

The Federal Reserve System (the Fed) is responsible for setting monetary policy in the United States, and the Federal Open Market Committee (FOMC) is the monetary policymaking body of the Fed. The FOMC consists of the governors who serve on the Board of Governors and the twelve presidents of the Federal Reserve Banks. Of those twelve, all attend FOMC meetings but only five vote at any one time. Therefore, the degree to which a Reserve Bank president can influence national monetary policy varies over time. Indeed, Fos and Xu (2024) show that economic conditions in Reserve Bank districts affect the Federal funds target rate (FFR) only when the presidents of those banks have voting rights at FOMC meetings.

Given the variation in the influence of Reserve Banks on national monetary policy, we ask whether Reserve Banks use *local* monetary tools when they have limited influence over national monetary policy. Specifically, we test whether Reserve Banks change the amount of liquidity loans extended at the discount window (DW) in response to changes in local inflation. We focus on the DW lending facility in our research because it is one of the few central bank functions under the direct oversight of local Reserve Banks. While the price of DW loans (i.e., the discount rate) is set by the Board of Governors for all twelve districts, if local monetary policy (LMP) exists, we should observe that Reserve Banks affect their local economy by controlling the quantity of DW loans. Our null hypothesis, that local inflation has no effect on DW loan amounts, is consistent with the FOMC being the sole maker of monetary policy in the U.S. However, a rejection of the null hypothesis implies that monetary policy is executed by the FOMC nationally and by the Reserve Banks at the local level. Our paper establishes that the latter exists.

Our empirical strategy must overcome the following challenges. First, we need to have measurable variation in the incentives of Federal Reserve Banks to rely on local monetary policy rather than national monetary policy to address local needs.

Second, we need to identify the actions taken *by* the Federal Reserve Banks, given that loan quantities are jointly determined by the Reserve Banks' supply side and the borrowers' demand side. Third, we need to ensure that the results are not driven by national inflation.

To address the first challenge, we use the exogenous yearly FOMC voting rotation established in 1942. This variation separates at the district-time level observations in which Federal Reserve Banks can react to changes in local inflation by affecting aggregate FFR decisions and observations for which such a national tool is less effective. To address the second challenge, we include in our main analysis other liquidity loans that are available to borrowers but not controlled by Federal Reserve Banks, such as Federal Home Loan Bank (FHLB) loans and Repurchase Agreement (REPO) loans. By focusing on the differential responses of DW loans and other liquidity loans to changes in local inflation, we isolate the incremental effect of Federal Reserve Banks on DW loans.[1] To address the third challenge, we use district-by-time fixed effects to absorb the variation resulting from changes in local (hence also aggregate) economic conditions. This allows us to better compare DW and other liquidity loan activities within each district-time. We also use borrower-by-time fixed effects to absorb variations due to changes in a borrower's characteristics.

We use various publicly available datasets. From the Federal Reserve website, we obtain DW loan-level data that is published quarterly from Q3 of 2010 with an approximately two-year delay. From the call reports, we obtain two other liquidity loan data available at the quarterly frequency: Federal Home Loan Bank (FHLB) loans and Repurchase Agreement (REPO) loans. In our main empirical analysis, we collapse the DW loan-level data into the borrower-quarter level and then stack it with the FHLB dataset in order to isolate the supply-side effect (see above). Our main dependent variable is liquidity loan amount scaled by the borrower's total assets at the last

[1]This empirical design draws inspiration from Khwaja and Mian (2008), who use a firm's relationship to multiple lenders to control for credit demand. In our setting, we study within-borrower borrowing from the DW and the FHLB.

quarter-end. Our main sample spans from Q3 of 2010 to Q4 of 2020 and covers 7,843 unique banks. About 35% of them have accessed the DW in their registered district and 28% have accessed it more than one time during our sample period. Close to 90% (40%) of the banks that have used the DW have also reported borrowing from FHLBs (REPOs). Finally, we use voting status data summarized by Fos and Xu (2024). We consider the main Reserve Bank office's Metropolitan Statistical Area (MSA) inflation rates as an empirical proxy for local inflation. Compared to other measures of economic activity, MSA inflation measures are more moderately correlated across districts and are available at a more timely release (i.e., monthly or bimonthly).

We begin by presenting the unconditional relationship between local inflation and liquidity loan activities. When we use within-district or within-borrower variation, there is a negative (positive) relationship between DW (FHLB) loan activity and local inflation. Indeed, when we stack the two samples and compare the differential responses of DW and FHLB loans to higher local inflation, we find that DW loan activities decrease significantly more than FHLB activities do. These results constitute the first indication that DW loan activities respond to local inflation differently from *local demand*-driven loan activities (such as the FHLB). The results continue to hold with district-time and borrower-loan-type fixed effects.

In our main test, we use the exogenous FOMC voting rotation to examine whether the differential responses of DW and FHLB loan activities to changes in local inflation arise from district-times when Reserve Banks do not have FOMC voting rights. We find that when a district has voting rights, the responses of DW and FHLB loans to changes in local inflation are statistically similar. This is expected because in these times local need can be addressed via national monetary policy (e.g., the FFR), and therefore LMP is less needed. On the other hand, when a district has no voting rights at FOMC meetings, higher local inflation leads to a larger decrease in DW activities (relative to FHLB activities). The results hold when we use fixed effects to absorb district-time variation and borrower-time fixed effects to absorb changing

bank characteristics.

We conduct three robustness tests to further strengthen our findings. First, when we explore heterogeneity in borrower size, we find that small borrowers drive our results. This is expected because liquidity borrowing by large borrowers is likely less sensitive to local inflation: large banks can better handle liquidity shocks and should have better cross-regional diversification. Our second robustness test verifies that the results are not sensitive to the sample-selection choices we make. For example, if we restrict the sample to borrowers that use both DW and FHLB loans, the main results hold and remain statistically significant. In the third robustness test, we substitute FHLB loans with REPO loans. While both types of loans address borrowers' liquidity needs (i.e., the demand), FHLB loans are supplied by a local federal lender and REPO loans are supplied by national markets. We find quantitatively similar coefficient estimates.

In the final part of the paper, we construct and examine two more granular measures of discount window activities, at the loan- and district-week-level. First, we use a loan-level DW sample from 2010 to 2020, covering about 3,730 unique borrowing institutions and 38,000 loans across the twelve districts. We find that when a district does not have a vote on the FOMC, higher local inflation leads to significantly lower loan quantities and higher collateral requirements. The second test is based on weekly H.4.1 balance sheets for each district from 2002 to 2020. This dataset is useful because we can observe weekly DW activities starting in 2002. The results are consistent with our main findings. In these tests, we cannot use FHLB or REPO loan activities as benchmarks given the frequency limitation; the best possible placebo is to examine the loan-level activities of the Term Auction Facility (TAF), a credit facility (December 12, 2007 – March 8, 2010) established by the Board of Governors to distribute loans directly to borrower banks but transacted through the discount window. As expected, we find no evidence that TAF loan activities respond to changes in local economic conditions.

Our paper contributes to three strands of the literature. First, this study contributes to the monetary policy literature that studies how the Federal Reserve reacts to changing economic conditions (e.g., Taylor (1993) and many that follow). To the best of our knowledge, Richardson and Troost (2009) is the only study that points to the idea that Reserve Banks use available tools to react to local economic conditions. The authors use the borders between the St. Louis and Atlanta districts to show that during a banking crisis in 1930 Atlanta extended credit and St. Louis did not. We contribute to this literature by documenting the robust effect of local economic conditions on Reserve Banks' decisions to use *local* monetary tools.

Second, our paper contributes to the literature that studies the functioning of the discount window. Most of the extant literature has focused on understanding who borrows from the "lender of last resort" (e.g., Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016)).[2] A large number of papers in this literature discusses the "Discount Window Stigma," showing mixed evidence (see, e.g., Armantier, Ghysels, Sarkar, and Shrader (2015) versus Artuç and Demiralp (2010)). A more recent strand of the literature by several Federal Reserve System economists focuses on documenting the functioning of the DW during normal times (e.g., Ackon and Ennis (2017), Ennis, Ho, and Tobin (2019), Ennis and Klee (2021)). Our paper contributes to this strand of the literature by establishing the DW as an active *local* monetary policy tool. We find evidence that local inflation affects the supply of DW credit offered by Reserve Banks. One possibility is that Reserve Banks could change their position on whether a bank seeking a DW loan is solvent or not. This view challenges the interpretation of the Discount Window as an "open-door" credit facility.

Finally, this paper builds on the literature that studies the role of governance and voting in the Fed system. One traditional strand of this literature studies how FOMC member background characteristics explain their voting behaviors (e.g., Belden

[2]The literature on FHLBs is relatively small, focusing mostly on documenting the FHLB as practically a "lender-of-next-to-last resort" (e.g., Stojanovic, Vaughan, and Yeager (2008), Ashcraft, Bech, and Frame (2010), Acharya and Mora (2015)).

(1989), Havrilesky and Schweitzer (1990), Havrilesky and Gildea (1991), Chappell Jr, Havrilesky, and McGregor (1993), Chappell Jr and McGregor (2000), Meade and Sheets (2005), Crowe and Meade (2008), Malmendier, Nagel, and Yan (2021), and Bordo and Istrefi (2023)). Two recent contemporaneous works use the exogenous FOMC voting rotation to study the causal effect of the hawk-dove balance on economic outcomes (Hack, Istrefi, and Meier (2023)) and the causal effect of presidents' voting rights on their communication behavior (Ehrmann, Tietz, and Visser (2022)). More relevant to our research, Fos and Xu (2024) show that economic conditions in Reserve Bank districts affect the Federal funds target rate (FFR) only when presidents of those banks hold voting seats at FOMC meetings. Our paper contributes to this literature by showing that the governance structure of the Fed system leads to a tension between national and local interests and that Reserve Banks take actions to more closely align monetary policy with local economic conditions.

2 Data

We use multiple datasets from a variety of sources. Our main sample spans from Q3 of 2010 to Q4 of 2020, due to the DW data availability. Given that we want to exploit cross-district variation in our research, the short sample period is less of an issue for us. In this section, we describe data sources and construction details for our main datasets and then discuss key summary statistics. We relegate other useful information to Appendix Section A.

2.1 Discount Window Loans

"The Discount Window is an instrument of monetary policy that allows eligible borrowers to borrow money, usually on a short-term basis, to meet temporary shortages of liquidity caused by internal or external disruptions."[3] It was established by

[3]Source: https://www.frbdiscountwindow.org/RightNavPages/Getting-Started.

the Federal Reserve Act of 1913. For the first 100 years of the discount window (DW), its activities are not easily observed by the public. However, following the implementation of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, the Board of Governors of the Federal Reserve System began disclosing loan-level information on discount window lending activity; the data is published quarterly on the Federal Reserve's website with an approximately two-year delay.[4]

We first explain what a DW loan is (e.g., credit types, discount rates, and sizes) in Section 2.1.1 and then discuss and motivate using DW as our local monetary policy gauge in Section 2.1.2. Finally, we explain how we prepare the raw datasets for our empirical framework in Section 2.1.3.

2.1.1 Characteristics of DW Loans

For each DW loan, we observe the origination date, the identity of the borrower (i.e., name, city, state, primary ABA routing number), the lending Federal Reserve Bank, the dollar amount, the amount of collateral on the borrower's balance sheet, the loan's maturity, and the type of credit. Discount window loans have three types: primary, secondary, and seasonal. In our raw loan-level dataset, 75% of all DW loans are primary loans (i.e., made to borrowers in sound financial condition), while seasonal and secondary loans make up 24% and 1% respectively. We consider all three types of DW loans in our research for completeness.[5]

Interest rates on DW loans are set homogeneously across the Reserve Banks and constitute an upper bound on the Federal funds rate since January 6, 2003, according to the regulatory change announced on October 31, 2002.[6] The implication for our research is that there is no local variation in the "price" among the 12 districts during

[4]Sources: https://www.federalreserve.gov/monetarypolicy/bst_reports.htm, https://www.federalreserve.gov/regreform/discount-window.htm. The initial reporting period covers loans made between July 22, 2010 and September 30, 2010, which marks the start of our sample period.

[5]In unreported results, we also conduct robustness using just primary loans.

[6]See Appendix Section A.1 for details on the new regulation.

our sample period. We therefore focus on the quantity of DW loans. The average size of a DW loan is $7.5 million. However, there is a wide variation in the size of the loans, ranging from $1,000 to $5 billion. The very small loans are mostly testing exercises to ascertain the correct functioning of a bank's direct line of credit to the DW. Typically these tend to be overnight loans smaller than $10,000. Knowing that, we only consider individual DW loans above $100,000.

2.1.2 The discount window as a gauge for local monetary policy

The discount window is commonly viewed as a liquidity "backstop," a "lender-of-last-resort" guaranteed by the Fed to ensure the smooth functioning of the financial markets (Bernanke, 2008). Accessing the DW could be interpreted as a sign of financial weakness, a phenomenon widely accepted in the literature as the "Discount Window Stigma" (Armantier, Ghysels, Sarkar, and Shrader, 2015; Beyhaghi and Gerlach, 2023). However, more recent research from the Federal Reserve's own economists has advanced the possibility that some banks use the DW as their main liquidity management resource in regular times as well (e.g., Ennis, Ho, and Tobin (2019), Ennis and Klee (2021)). Our loan-level dataset shows consistent evidence. Figure 1 summarizes all discount window loans at a quarterly frequency and plots the logarithm of the total dollar amount over time from 2010 to 2020, nationally and regionally. The dataset shows heightened activity during the early 2020 stress period, as expected; we also observe non-trivial activities and variations during non-stress periods. In our sample, in a typical year before 2020, Reserve Banks extend around $6.5 billion of DW credit; during 2020, around $221 billion of DW loans were extended.

[Insert Figure 1 here]

The discount window lending facility is one of the few central bank functions still under the direct oversight of local Reserve Banks. While the "price" of DW loans is fixed by the Board (see discussions above), if local monetary policy exists,

we should observe that local Reserve Banks affect the local economy by controlling the quantity of DW loans, i.e., the supply of DW credit. As such, discount window lending constitutes a suitable and measurable gauge to test for the implementation of local monetary policy.

This view challenges the interpretation of the discount window as an "open-door" credit facility; instead, we advance the possibility that the supply of credit might be affected by Reserve Banks' consideration of local economic conditions. One possibility is that Reserve Banks change their position on whether a bank seeking a DW loan is solvent. In fact, a *Wall Street Journal* article from September 12, 2008 wrote, "Any borrower to the discount window must put up collateral that the Fed *values on its own* before making the loan. The Fed could decide not to put government money at risk by lending to a seriously troubled firm even against collateral."[7]

2.1.3 Discount window outcomes

Our main DW activity variable aggregates DW loans at a borrower-quarterly level by summing up all non-testing loans (i.e., > \$100K), scaled by the borrower's total assets at the last quarter-end. This variable is labeled "DW Loan > 100k % Assets." During our sample period (2010-2020), over 35% of all commercial banks in the U.S. use the discount window at least once.[8]

The borrower-quarter panel has the clear advantage of allowing us to test its differences with other liquidity loan types and also to control more flexibly for borrower characteristics. On the other hand, we lose some of the granularity. We supplement our main analysis with two more granular DW datasets. The first dataset is the aforementioned loan-level data. The second dataset is constructed from the weekly H.4.1 statistical release issued by the Board of Governors, which provides snapshots of local Reserve Banks' balance sheets, including an item showing the total amount of

[7]Source: https://www.wsj.com/articles/BL-REB-1952.

[8]We then use the primary ABA routing number to merge this dataset with commercial banks' call reports (i.e., FFIEC 031/041).

loans outstanding (i.e., "Loans"). This variable mostly captures the aggregate amount of DW lending activity in each Federal Reserve Bank district and does not include special credit facilities such as the TAF (Term Auction Facility). It does still include several emergency facilities such as the Primary Dealer Credit Facility (PDCF), which was extended through the New York Reserve Bank; however, we exclude New York in our main analysis. The longest downloadable sample spans from 2002 to March of 2020.[9]

2.2 Alternative Liquidity Loans

From the call reports, we obtain information on two liquidity loans available to commercial banks: Federal Home Loan Bank (FHLB) loans and Repurchase Agreements (REPOs). The objective of the FHLB system is to improve the efficiency of the housing market by providing easy access to liquidity to its member banks. Recent literature has dubbed the FHLB as a "Lender of Next-to-Last-Resort" (Ashcraft, Bech, and Frame (2010)). This government-sponsored entity divided the U.S. into 11 different districts with a strong parallel to the Federal Reserve district map. Appendix Section A.2 provides more details.

Both the DW and the FHLB are important sources of liquidity not only for the general financial sector during times of distress, but also for small banks that face barriers to participating in open markets. In fact, we observe that close to 90% of the banks that have used the discount window have also reported borrowing from FHLBs. This is a large fraction of the sample; in comparison, only 40% of this same subsample takes advantage of REPOs at least once between 2010 and 2020. Therefore, we prefer to focus on FHLB loans as an alternative source of funding in our main specification. Our results are robust to the inclusion of REPOs as an additional control for a bank's liquidity demand.

Specifically, we focus on FHLB advances maturing in less than one year (to

[9]Source: https://www.federalreserve.gov/datadownload/Choose.aspx?rel=h41.

better compare with DW loans, as FHLB loans can have much longer maturities) and construct a variable, "Chg FHLB % Assets," that captures the quarterly change in the level of outstanding FHLB advances, scaled by the borrower's last quarter-end total assets as before. Next, due to the extremely short timeline of Repurchase Agreements, our REPO variable, "Security REPOs % Assets," is defined as the outstanding amount of REPO securities during this quarter scaled by the borrower's last quarter-end total assets. While we can correctly measure the aggregate amount of DW borrowing for any given borrower, we can only observe a quarterly snapshot of outstanding FHLB or REPO credit.

2.3 Federal Reserve President Voting Rotation

The modern FOMC is comprised of twelve voting members: the seven individuals on the Board of Governors of the Federal Reserve System, the president of the Federal Reserve Bank of New York, and four of the other eleven Reserve Bank presidents, who assume their voting roles for one-year terms through a rotation system. The rotation rule is based on the 1942 amendment to the 1913 Federal Reserve Act. We use voting status data summarized by Fos and Xu (2024).

2.4 Macro Variables and Control Variables

We follow Fos and Xu (2024) and consider the main Reserve Bank office's MSA's inflation rates as an empirical proxy for local inflation. Compared to other measures of economic activity, MSA inflation measures are moderately correlated and are available at a more timely release (i.e., monthly or bimonthly). Ideally, in order to give our hypothesis the best chance, we would want to know when Reserve Banks make DW decisions and then use the most recent inflation measure to test whether it affects DW decisions. Unfortunately, the time when Reserve Banks discuss DW activities is not public knowledge. Therefore, our best chance is to use loan-level data to proxy for the

schedule, meaning when these loans are granted and transacted.

Figure 2 shows the schedule within one calendar quarter using the longest possible year sample (2010-2020). The majority of DW loans are granted in the last month of each quarter. As a result, we use the weighted average of inflation in the first and second months of each quarter as our main measure of "Local Inflation" (labeled as Infl_{jt-1}).

[Insert Figure 2 here]

An important robustness test is to use the second month's inflation only. This measure can be further motivated from the patterns of scheduled FOMC meetings within one quarter. The FOMC meets about eight times a year, and Figure 3 shows that these meetings typically occur at the end of the first month and in the middle of the last month within a quarter. Therefore, the first month's inflation could well have been addressed, making the second month's inflation relatively more "pure" information.[10]

[Insert Figure 3 here]

Finally, the main analysis also has the option to control for continuous borrower-quarterly characteristics. We consider standard variables such as ln(Assets), Tier 1 capital ratio, return on assets, total deposits as a percent of bank's liabilities, and the amount of commercial and industrial loans outstanding scaled by the bank's assets. Appendix Table A.1 provides details.

[10]We considered other measures of economic activity. For example, district-quarter real personal income growth, used by Fos and Xu (2024), is not suitable for our research. Suppose that our hypothesis that Federal Reserve Banks take actions when local macro conditions change is true; in that case, the last quarter-end macro conditions could be outdated information for current quarter-end DW decisions, resulting in falsely weaker-to-insignificant empirical findings. As another example, unemployment rates can be obtained at monthly frequency. However, they are highly correlated (>0.9) among states (and districts), which is precisely the variation dimension we want to exploit, so unemployment rates are not suitable for our tests.

2.5 Summary Statistics

Our main borrower-quarter sample spans from Q3 of 2010 to Q4 of 2020 and covers 7,843 unique banks. About 35% of them access the DW in their registered district and 28% access it more than one time during our sample period (20% when we exclude any loans below \$100k). Among borrower-quarters with non-zero DW transactions, the average quarterly DW loan amount is around \$37 million, or 4.8% of the total assets outstanding, both with economically sizable magnitude. Due to the presence of test loans, we construct the first dependent variable as total DW loans greater than \$100K during quarter t scaled by the bank's total assets from the last quarter, $t-1$. On average, 5% of the borrower-quarters from 2010 to 2020 in the U.S. (N=261K) access their respective district discount windows (see rows labeled "DW Loan $>$ 100k % Assets").

[Insert Table 1 here]

Panel C of Table 1 provides useful summary statistics for the logarithm of loan-level DW transaction amounts. The median loan amount corresponds to about \$315K, while the lower 30% can be interpreted as test transactions (with amounts of exactly 1K, 10K, and so on). From Panel D, DW loan amounts on average account for 0.04% of total Reserve Bank assets; during times of financial distress, DW loan amounts can account for up to 9.7% of assets, which is economically sizable.

Table 1, Panel B, shows that local inflation (in units of monthly percents) from 2010 to 2020 is an average of 1.96 per annum. In addition, 60% of the data points correspond to periods in which the district has no voting right at FOMC meetings. To conserve space, summary statistics for control variables such as borrower characteristics are relegated to Appendix Table B.1.

3 Empirical Strategy

In this section, we describe the empirical strategy used to identify actions taken by Reserve Banks. That is, our goal is to identify the actions of Federal Reserve Banks in response to local conditions, which defines what we call local monetary policy (LMP). As a proxy for actions taken by Federal Reserve Banks, we use loan quantities extended via discount windows. Any attempt to identify the existence of LMP faces the following challenges. First, we need to have measurable variation in the incentives of Federal Reserve Banks to rely on local monetary policy, rather than national monetary policy. Second, we need to identify the actions taken by Federal Reserve Banks, even though loan quantities are jointly determined by the Reserve Banks (the supply side) and the borrowers (the demand side). Third, we need to isolate the variation in local economic conditions that is not driven by aggregate conditions. That is, we need to make sure that local economic conditions do not simply reflect national economic conditions.

To address the first challenge, we use the exogenous yearly FOMC voting rotation. This variation *separates* observations at the district-time level in which Federal Reserve Banks can react to changes in local economic conditions by affecting aggregate FFR decisions (the voting sample) *and* observations for which such a tool is less effective (the non-voting sample). In fact, Fos and Xu (2024) provide evidence for the former case and show that local economic conditions affect FFR decisions only when a president of the Federal Reserve Bank can vote in the FOMC.

We next present evidence in support of the exogeneity of the FOMC rotation. Table 2 shows that a Reserve Bank's voting status is uncorrelated with the *recent* local economic conditions and loan activities. In Panel A, we focus on Q4's measures of inflation, DW activities, and FHLB activities. The results show that, as expected, the relationship between these variables and a district's voting status is insignificant across all specifications. Panel B further shows similar results using last year's economic and

loan activity variables.

[Insert Table 2 here]

To address the aforementioned second challenge, we include in our main panel variables that capture liquidity loans that are not controlled by Federal Reserve Banks, such as FHLB and REPO loans. While these liquidity loans are often used by borrowers to manage liquidity needs (see our discussion in Section 2), Federal Reserve Banks do not have a direct impact on whether a borrower receives such a loan. Therefore, by focusing on the differential responses of DW loans and other liquidity loans to changes in local economic conditions, we can isolate the incremental effect of Federal Reserve Banks on DW loans.

To address the third challenge, we use granular sets of fixed effects. Specifically, we use district-by-time fixed effects to absorb the variation resulting from changes in local economic conditions (and hence also national economic conditions). This allows us to better compare DW and other liquidity loan activities within district-time. Moreover, this set of fixed effects absorbs any variation in banks' liquidity demand due to changes in local economic conditions. Importantly, we also include borrower-by-time fixed effects to absorb variations due to changes in a borrower's characteristics. The inclusion of this set of fixed effects ensures that the estimates are not driven by changes in banks' liquidity needs (i.e., demand for liquidity).

4 Results

In Section 4.1 we examine the unconditional relationship between local economic conditions and liquidity loans. Our main findings on LMP are presented in Section 4.2. Finally, we discuss loan access criteria, an alternative demand-side proxy, and heterogeneous effects based on bank size in Section 4.3.

4.1 Unconditional Results

We begin by presenting the unconditional relationship between local inflation and liquidity loan activities at the borrower-quarter level for DW and FHLB types of liquidity loans. i denotes borrowers (banks), j or $j(i)$ denotes the borrower's Federal Reserve districts, and t denotes quarters. We estimate the following regressions:

$$Y_{ijt}^{DW} = \theta_i + \gamma_t + \beta^{DW} \times \text{Infl}_{jt-1} + \epsilon_{ijt}, \tag{1}$$

$$Y_{ijt}^{FHLB} = \theta_i + \gamma_t + \beta^{FHLB} \times \text{Infl}_{jt-1} + \epsilon_{ijt}, \tag{2}$$

where Y_{ijt}^{DW} denotes the total amount of new DW loans and Y_{ijt}^{FHLB} denotes the quarterly change in quarter-end FHLB balances for a borrower-district-quarter. For interpretation purposes, Y_{ijt}^{DW} and Y_{ijt}^{FHLB} are scaled by total asset amount at the end of the previous quarter for a borrower i. On the right hand side, Infl_{jt-1} is the weighted average local inflation in the first and second months of each quarter. θ_i is borrower fixed effects and γ_t is time fixed effects, which absorbs aggregate outcomes (e.g., FFR, inflation, inflation in voting districts). β^{DW} and β^{FHLB} are coefficients of interest.

Panels A and B of Table 3 present regression results for Equations (1) and (2), respectively. Columns (1) and (2) in Panel A show that when we use within-district or within-borrower variation, there is a negative and significant relationship between DW loan activity and local inflation. Specifically, the -0.101^{***} coefficients can be interpreted to mean that a one standard deviation (SD) increase in local inflation leads to a 0.034% decrease in the fraction of DW loans in a bank's asset amount, which is sizable as the average percent is 0.105%. Columns (3) and (4) show that the relationship remains negative, though less significant, when regressions include time-varying borrower characteristics (covering size, regulatory requirements, returns, and financial risk exposure), as well as when we drop the New York district from the

sample.[11]

[Insert Table 3 here]

The results in Panel B indicate that the relationship between FHLB loans and local inflation is positive. The 0.043** coefficient indicates that a one SD increase in local inflation is associated with an increase in the FHLB fraction in a bank's asset amount by 0.014%. The statistical significance in FHLB regressions is overall slightly weaker than in DW regressions. This is expected for two reasons. First, economically, these loans often mature after 3 months. Second, while we observe the arrivals of DW loans, the best granular data we can obtain about FHLB loans are quarterly snapshots, resulting in a more noisy measurement of FHLB loan activity.

Next, we formally test the difference between β^{DW} and β^{FHLB}. We stack the two samples (the number of observations therefore doubles), use l to denote the loan type (i.e., DW or FHLB), and estimate the following regression:

$$Y_{ijtl} = \gamma_t \times \omega_l + \gamma_t \times \phi_j + \theta_i \times \omega_l + \beta \times \mathbf{1}_{l=DW} \times \text{Infl}_{jt-1} + \epsilon_{ijtl}, \tag{3}$$

where $\mathbf{1}_{l=DW}$ denotes a loan type indicator that equals one if the loan type is DW. Therefore, β captures the difference in the sensitivities of the two types of loans, DW and FHLB, to local inflation. In this specification, $\gamma_t \times \omega_l$ absorbs aggregate time trends (e.g., FFR, inflation, inflation in voting districts) as well as differential aggregate time trends for the types of loans. Furthermore, in some more restrictive specifications, we include $\gamma_t \times \phi_j$ to absorb any time-by-district variation.

Table 3, Panel C, presents the regression results. Our research focuses on the double interaction coefficient in the first row, which is negative and significant across various specifications. Column (1) controls for aggregate time variation and district

[11] The New York Fed is special, given its unique role in providing emergency liquidity (e.g., operating the Primary Dealer Credit Facility (PDCF) in 2008) and its strategic position within the Federal Reserve System (e.g., always voting at the FOMC). It is plausible that the incentives of the New York Fed could be different from other Reserve Banks.

variation in loan types and has the β estimate of -0.143^{***}. In economic magnitude, given a 1 SD increase in local inflation, the differential responses of DW%Assets and FHLB%Assets widen and grow to be more negative by around -0.047%; when we take this result together with the previous two panels, we find that the total effect of -0.047% comes from -0.034% in DW%Assets and +0.013% in FHLB%Assets. Column (2) reflects the estimation results of Equation 3 with district-time and borrower-loan-type fixed effects.[12] This specification is the baseline for the rest of the analysis in this table, with Column (3) adding other borrower characteristics and Column (4) dropping the New York district. The main result of interest remains intact, in terms of both economic magnitude and statistical significance.

These results constitute the first indication that discount window loan activities respond to local inflation differently from *local demand*-driven loan activities (such as FHLB). The overall *positive* FHLB-inflation response suggests that when recent local inflation increases, borrowers demand more liquidity to expand and grow. The overall *negative* DW-inflation response suggests a counteracting force. In fact, a *supply* mechanism has the potential to rationalize this negative relationship. Under the supply-side hypothesis, when local inflation increases, Reserve Banks tighten up the local economy by decreasing the supply of discount window loans to depository borrowers.

4.2 The Existence of Local Monetary Policy and FOMC Voting

To test for the existence of local monetary policy (LMP), we use the exogenous FOMC voting rotation to separate a subsample for which local economic needs can be addressed through FFR decisions (i.e., when a district has a voting right) and another subsample for which this national mechanism is not available. Specifically, we test whether the differential responses of DW and FHLB loan activities to changes in local

[12] The "borrower i × loan type" fixed effect is stricter than the "district j × loan type" fixed effect because i is more precisely $i(j)$.

inflation indeed arise from the subsample of districts whose Reserve Banks do not have FOMC voting rights.

We first split the main sample into two subsamples based on whether a district's Reserve Bank is voting in the current quarter. Panel A in Table 4 presents the results using non-voting district-quarters. The first three columns are the same specifications as those in Table 3, Panel C, which control for time trends in loan types (DW or FHLB), time trends in district conditions, borrower-loan characteristics, and borrower-level variables on size, regulatory requirement, returns, and financial risk exposure. Column (4) further absorbs all borrower-time-level variations. Across all specifications, the interaction coefficients of a DW loan type dummy and local inflation (see coefficients in the first row) are negative and significant at the 1% level. The coefficients are larger than those in Table 3's Panel C. In terms of economic magnitude, an estimate of -0.252^{***} indicates that a one SD increase in local inflation results in an around -0.081% more negative response of DW%Assets relative to that of FHLB%Assets. The same magnitude is -0.034% using the full sample.

[Insert Table 4 here]

Panel B in Table 4 considers voting district-quarters only. Because the president of the New York district always votes, we also add two specifications in Columns (5) and (6) that run the same analysis as in Columns (3) and (4), respectively, but drop the New York district. In all columns, insignificant interaction coefficient estimates mean that we do not find significantly differential responses of DW and FHLB loan activities to local inflation. This is in sharp contrast to Panel A, indicating that the lack of FOMC voting rights for districts likely triggers the usage of local tools to influence how the region responds to local inflation.

Next, we formally test whether the double interaction coefficients in the non-voting subsample are significantly different from the double interaction coefficients in the voting subsample. When a district has no voting rights at FOMC meetings, we

expect local inflation not to affect national monetary policy (e.g., FFR), and therefore LMP can emerge. The evidence is reported in Table 5. We find negative and significant coefficient estimates for the triple interaction terms across various regression specifications.

[Insert Table 5 here]

Figure 4 illustrates our regression findings, and moreover adds to our regression results by directly showing individual relationships. Two plots in the left (right) column depict the relationship between loan activities and recent local inflation when the district does not have (has) an FOMC voting right, whereas two plots in the first (second) row depict borrower-quarterly DW (FHLB) loan activities. Consistent with the main findings, the slope difference between the top and bottom plots is significantly *more negative* for district-quarters without voting rights (left) than for those with voting rights (right).

[Insert Figure 4 here]

FHLB loans represent a standard liquidity vehicle for borrowers. When local inflation is high and the district is voting, the voting mechanism documented in Fos and Xu (2024) implies a higher FFR. Therefore, standard borrowing and lending activities will decrease due to the tightening of national monetary policy. This is what we precisely observe in subfigure (D) in the lower right, consistent with the demand-side story. A similar, though less significant pattern is present for DW loans (subfigure (B)).

The two left panels of Figure 4 show results for non-voting districts. Due to the lack of FOMC voting, local conditions cannot be effectively addressed through national monetary policy. Thus, when local inflation increases and the local economy booms, borrowers continue to grow and demand more FHLB liquidity, as evident from the positive and significant slope in subfigure (C). In sharp contrast, subfigure (A)

shows that higher inflation is accompanied by less DW activity, suggesting change to the "supply" of DW credit.

4.3 Robustness

In this section, we present three robustness tests using Column (4) in Table 5 as the baseline specification. First, Table 6 explores heterogeneity in borrower size. We expect liquidity borrowing by large borrowers to be less sensitive to local inflation: large banks can better handle liquidity shocks and should have better cross-regional diversification. We use two asset-based cutoff points to classify borrowers into size groups: $1 billion in assets and the median asset size. Results in Table 6 consistently show that small borrowers drive our results, although the coefficients for large banks show similar signs.

[Insert Table 6 here]

Our main sample includes all borrowers from the call reports, and therefore could include those with zero DW or FHLB loans. Our second set of robustness tests verify that the results are not sensitive to this sample-selection choice. Table 7 presents the results. Column (1) is the baseline specification, i.e., Table 5's column (4). Column (2) ((3)) shows that if we require borrowers to use DW or (and) FHLB loans, the main coefficient increases from -0.246^{***} to -0.320^{***} (-0.540^{***}) and remains statistically significant.

[Insert Table 7 here]

In the third robustness test, we substitute FHLB loans with REPO loans. While both types of loans address borrowers' liquidity needs, FHLB loans are supplied by a local federal lender and REPO loans are supplied by national markets. In Columns (4)-(6) of Table 7, we use cumulative REPO%Assets within the quarter instead of changes in FHLB balances. The three columns consider the full sample, borrowers

with "access to either," and borrowers with "access to both," respectively. We find quantitatively similar coefficient estimates.

We also provide a placebo test comparing whether FHLB and REPO loans – interpreted as mostly not affected by Reserve Banks – respond to changes in local inflation in a non-voting district differently. Due to the absence of intervention from Reserve Banks, we expect similar responses for these two types of loans. Indeed, the first row of Appendix Table B.2 shows an insignificant coefficient in the first row using the full sample. The results remain intact (i.e., insignificant) if we consider borrowers who have accessed either or both loan types during our sample period.

5 Discount Window Borrowing: Additional Evidence

In the main specification, we use a quarterly measure of DW loan activity because data on FHLB loans is available at quarterly frequency. In this section, we construct and examine two more granular measures of discount window activities. Specifically, we explore granularity given loan-level data and district-week-level data (see descriptions in Section 2.1). Both are publicly available datasets.

First, we use a loan-level discount window sample from 2010 to 2020, covering about 3,730 unique borrowing institutions and 38,000 loans (with 22,000 loans larger than \$100k) across the twelve districts. We test whether a DW loan amount responds to recent local inflation using the following regression specification:

$$\begin{aligned} Y_{ijk} = \phi_j \times \omega_{l(k)} + \gamma_{t(k)} \times \omega_{l(k)} + \beta_1 \text{Infl}_{j,t(k)-1} + \beta_2 \text{NoVote}_{j,m(k)} \\ + \beta_3 \text{Infl}_{j,t(k)-1} \times \text{NoVote}_{j,m(k)} + \epsilon_{ijk}, \end{aligned} \tag{4}$$

where Y_{ijk} denotes the characteristics of the loan k extended to borrower i by Reserve Bank $j(i)$. We consider ln(1+loan amount) and ln(Collateral ratio) as dependent

variables. $\text{Infl}_{j,t(k)-1}$ denotes the monthly local inflation rate from one month prior. $\text{NoVote}_{j,m(k)}$ equals one if Reserve Bank j lacks voting rights at the previous FOMC meeting and zero otherwise. The two fixed effects capture reserve-bank-by-credit-type and time-by-credit-type fixed effects,[13] respectively, which absorbs a Reserve Bank's discretion and the aggregate time series.

Panel A of Table 8 presents the results. We find that when a district does not have a vote on the FOMC, higher recent past local inflation leads to significantly lower loan quantities and higher collateral requirements. Specifically, the -0.642^{***} (0.493^{***}) coefficient from Column (3) ((6)) indicates that a one SD increase in local inflation leads to a 0.23 (0.18) lower (higher) log loan quantity (log collateral ratio) when a district does not have a vote compared to when a district does have a vote in the FOMC.

[Insert Table 8 here]

The second test is based on the weekly H.4.1 balance sheets which cover the 2002-2020 period. This dataset is useful because we can measure DW activities starting in 2002. Panel B of Table 8 shows results that are consistent with our main findings: higher local inflation leads to lower DW activity in non-voting districts relative to voting districts.

Finally, we use Term Auction Facility (TAF) loan-level activities as a placebo test for Panel A of Table 8. From late 2007 to early 2010, TAF was a credit facility established by the Board of Governors to distribute loans directly to borrower banks, transacted through the discount window. Importantly, the Board decided the total amount of funds to be lent at the national level and individual loans were then extended based on an auction process. Although loans were distributed via a local vehicle, Reserve banks had no effective way to control the supply of TAF loans, which makes this an ideal one-on-one placebo for the discount window loans. Because the

[13] As mentioned in Section 2.1, there are primary, secondary, and seasonal credit types at the discount window.

facility ended on March 8, 2010, we are not able to collapse the TAF loan-level data into borrower-quarterly level, as in Table 5. Instead, we conduct the same loan-level analysis and report detailed results in Appendix Table B.3. We find an insignificant coefficient in the first row, validating that TAF – though distributed locally via the same DW tool and knowingly determined by the Board – indeed does not exhibit a strong relationship with local inflation when districts lack voting rights or aggregate rights to address local needs.

6 Conclusion

In this paper, we show that when Federal Reserve districts experience high inflation but lack voting rights to influence FOMC decisions, Federal Reserve Banks decrease the credit they extend through the discount window (DW). Our identification approach is based on the exogenous rotation of voting rights among Reserve Banks and on within borrower-time and district-time variations in DW loans and Federal Home Loan Bank (FHLB) loans, implying that factors related to changes in local demand for credit or changes in borrower characteristics cannot drive the results. Our results indicate the presence of a local monetary policy (LMP) implemented by Federal Reserve Banks.

Our findings point to several important questions for future research. To what degree are Federal Reserve banks effective in closing the gap between national monetary policy and the interests of their districts? Would studying district-level Taylor rule regressions help with our understanding of the full effectiveness of U.S. monetary policy? Does the tension between national and local monetary policies have implications for the stability of financial markets and asset prices? Answers to these questions will not only contribute to academic research, but also be useful for policymakers.

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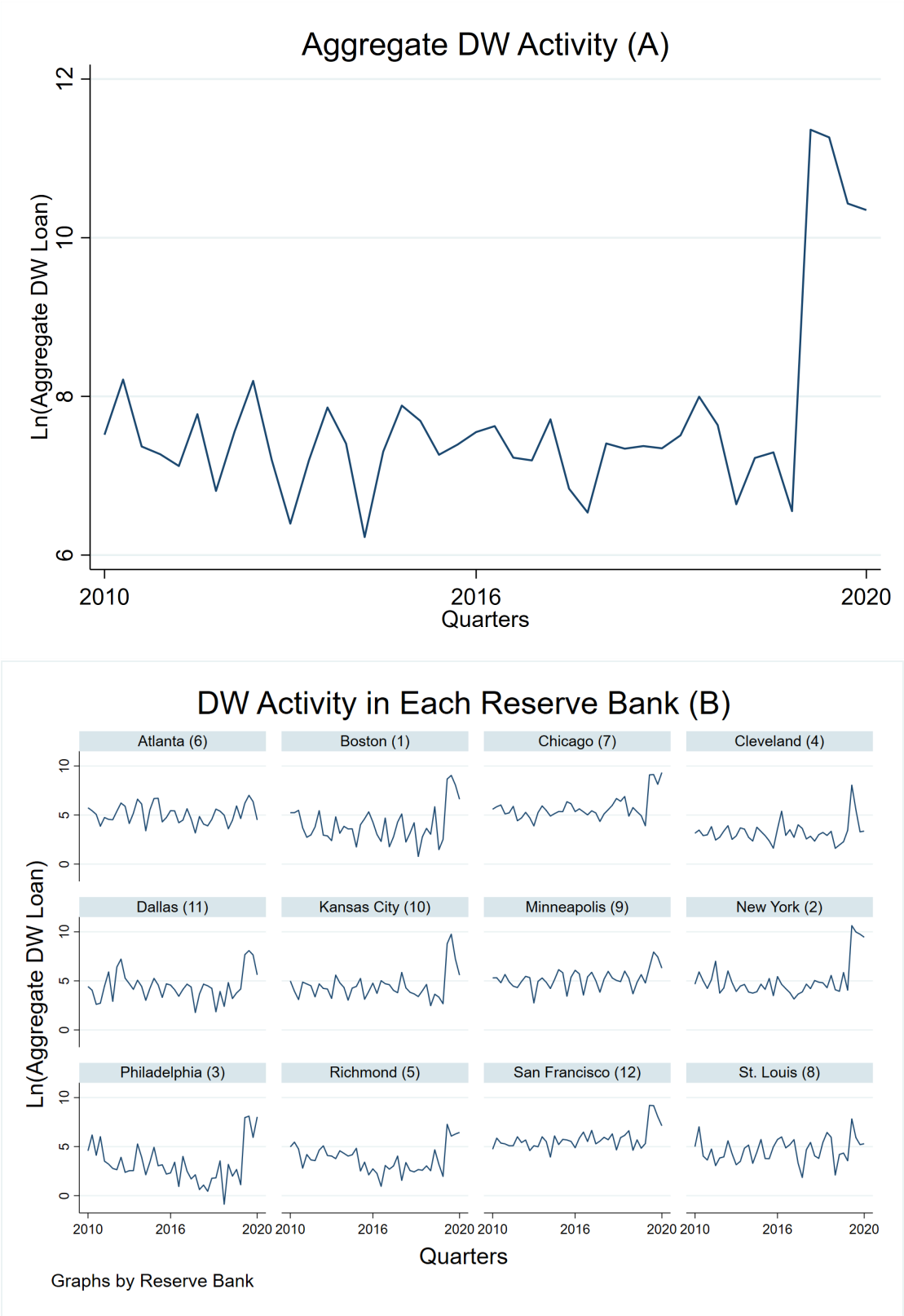


Figure 1: **DW activities: national and regional.** This figure summarizes all discount window loans (at a quarterly frequency) and plots the natural logarithm of the total dollar amount from 2010 to 2020. Panel A depicts the national series and Panel B shows the series for each Reserve Bank district.

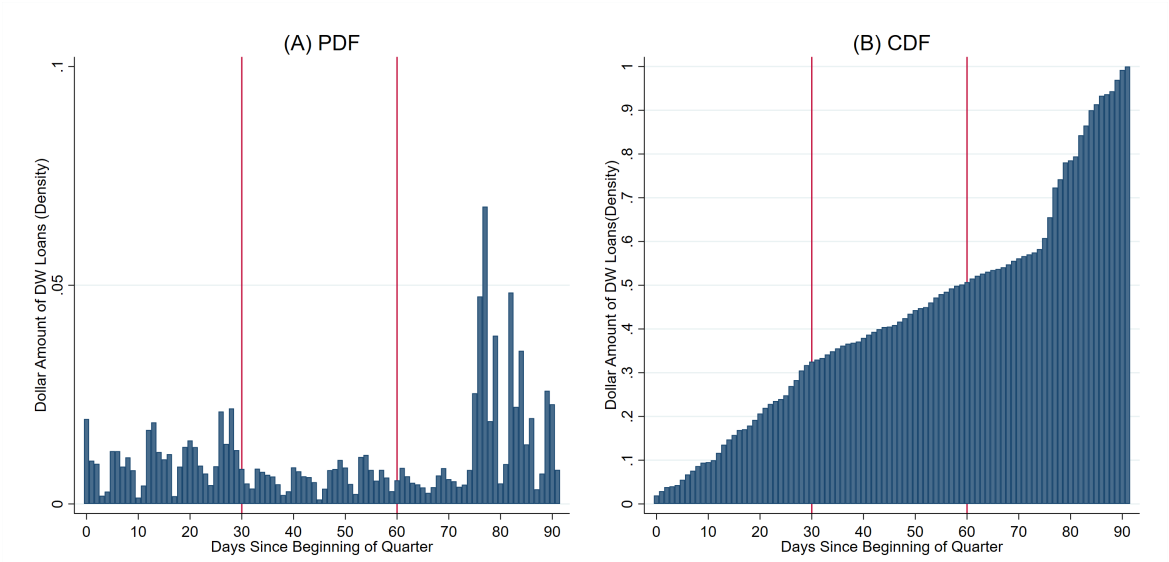
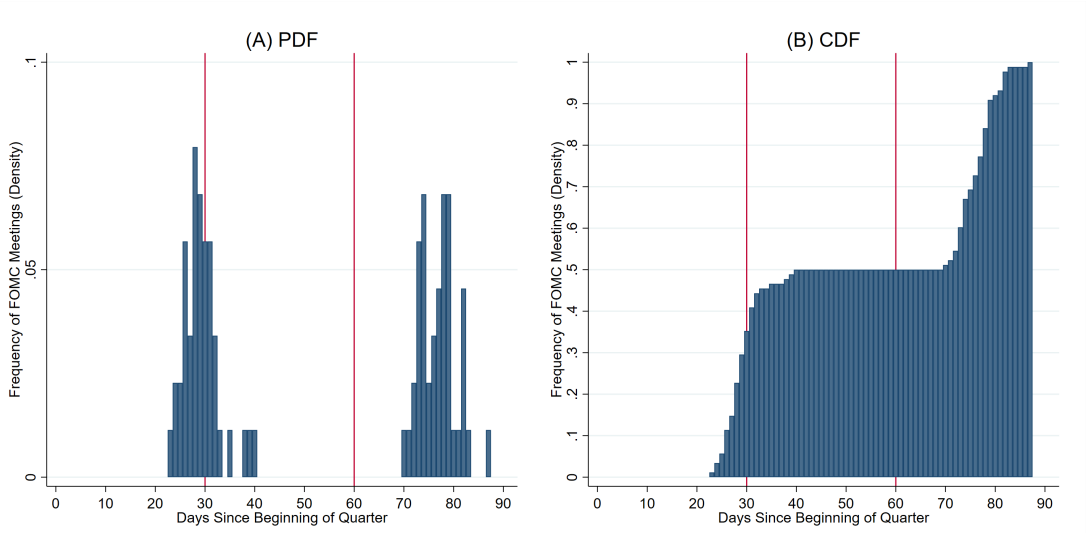
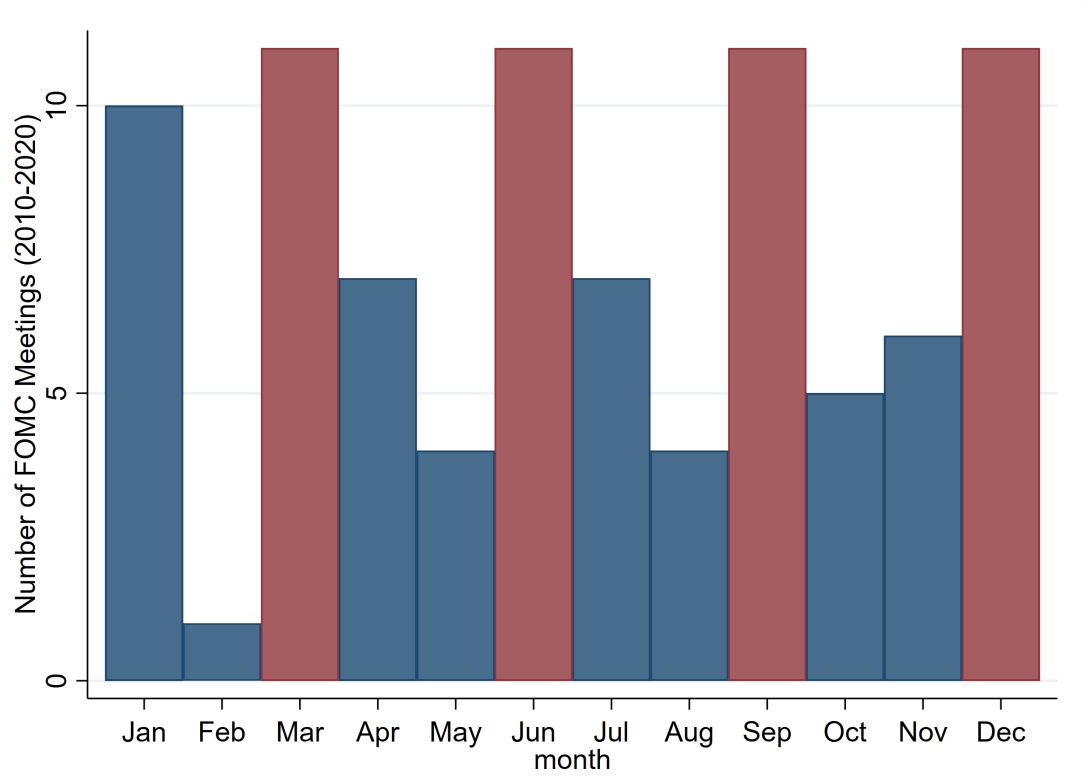


Figure 2: **The timing of discount window (DW) loans.** This figure shows the daily fraction of the total dollar amount of discount window loans extended in a typical quarter between 2010 and 2020. The y-axis is the partial (panel A) or cumulative (panel B) percentage of quarterly discount window credit extended on a given day. The x-axis is the number of days since the beginning of each quarter.



Panel A.



Panel B.

Figure 3: **The timing of FOMC meetings.** Panel A shows the daily fraction of the total number of FOMC meetings held in a typical quarter. The y-axis is the partial (left) or cumulative (right) fraction of the quarterly number of FOMC meetings held on a given day. The x-axis is the number of days since the beginning of each quarter. Panel B shows the number of FOMC meetings held in each calendar month. The sample covers 2010-2020.

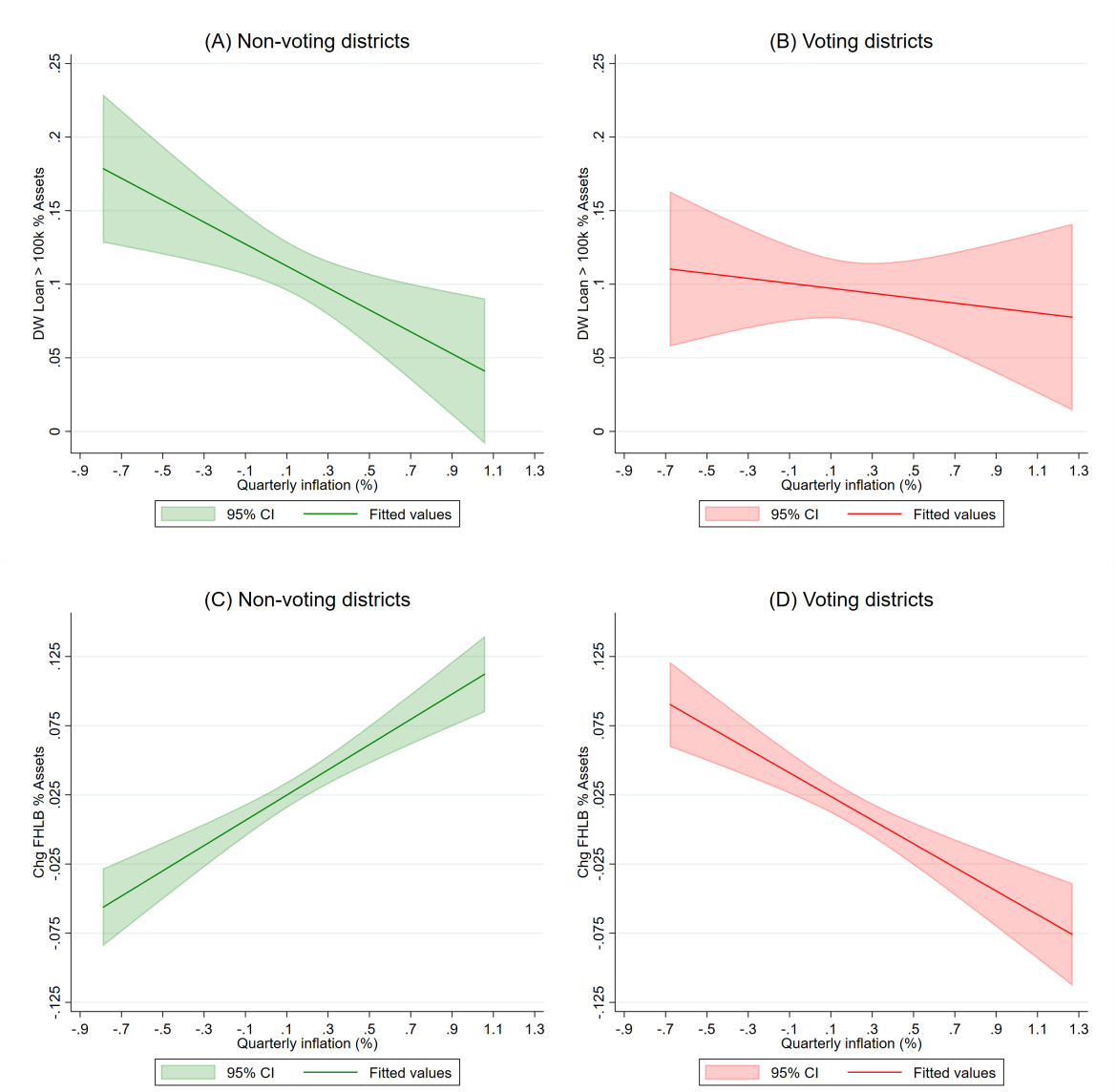


Figure 4: **Relationship between local inflation and DW and FHLB loans.** This figure depicts the relationship between local inflation and loan activities, using all commercial banks that file a call report. Left (right) figures show the relationship for non-voting (voting) districts. Upper (lower) figures show the relationship for DW (FHLB) loans.

Table 1: **Summary statistics.** This table reports summary statistics for datasets used in this paper. The sample covers all banks that filed call reports between 2010-2020. The unit of observation is the borrower-quarter level. $DW\ Loan > 100k\ \%\ Assets$ is the total amount of DW loans greater than $100,000 extended to a single borrower (bank) in a given quarter, expressed as the percentage of the borrower's last quarter's assets. $Chg\ FHLB\ \%\ Assets$ is the quarterly change in FHLB loan balances, similarly expressed as the percentage of the previous quarter's assets (FHLB advances maturing in less than one year). $Security\ REPOs\ \%\ Assets$ is the amount of securities sold with agreements to be repurchased that are outstanding at the end of the quarter, scaled by the bank's assets. $Local\ Inflation$ is weighted average inflation, calculated using inflation in the first and second months of each quarter. $No\ Vote$ is a dummy variable, indicating the lack of FOMC voting rights for a district in a given current quarter.

	COUNT	MEAN	SD	P1	P5	P25	P50	P75	P95	P99
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A(1). Borrower-Quarter level for each loan type; All district-quarters										
DW Loan > 100k % Assets	261282	0.105	2.589	0	0	0	0	0	0	1.173
Chg FHLB % Assets	260535	0.024	1.589	-4.916	-1.846	0	0	0	2.015	5.332
Security REPOs % Assets	261284	0.650	1.962	0	0	0	0	0	4.061	9.269
Panel A(2). Borrower-Quarter level for each loan type; District-quarters without voting rights (60.3%)										
DW Loan > 100k % Assets	157466	0.111	2.675	0	0	0	0	0	0	1.246
Chg FHLB % Assets	157090	0.027	1.603	-4.969	-1.831	0	0	0	2.043	5.432
Security REPOs % Assets	157466	0.637	1.936	0	0	0	0	0	3.988	9.162
Panel A(3). Borrower-Quarter level for each loan type; District-quarters with voting rights (39.7%)										
DW Loan > 100k % Assets	103816	0.097	2.453	0	0	0	0	0	0	1.051
Chg FHLB % Assets	103445	0.019	1.568	-4.853	-1.865	0	0	0	1.983	5.211
Security REPOs % Assets	103818	0.669	2.001	0	0	0	0	0	4.173	9.408
Panel B. Local inflation merged into the Borrower-Quarter level										
Local Inflation, Panel A(1)	205121	0.163	0.332	-0.730	-0.390	-0.060	0.170	0.370	0.660	1.090
Local Inflation, Panel A(2)	121591	0.145	0.325	-0.79	-0.37	-0.07	0.15	0.37	0.66	0.95
Local Inflation, Panel A(3)	83530	0.188	0.340	-0.520	-0.400	-0.040	0.230	0.370	0.680	1.270
Panel C. Loan-level dataset										
ln(DW Loan)	38981	11.842	3.491	6.908	6.908	9.210	12.663	14.509	16.951	18.721
ln(Collateral Ratio)	38981	4.393	3.459	0.031	0.299	1.652	3.174	6.964	10.873	13.222
Local Inflation	31863	0.119	0.357	-0.820	-0.520	-0.100	0.130	0.360	0.650	0.950
Panel D. Reserve Bank-Week-level dataset										
DW Loans % Reserve Bank Assets	10764	0.042	4.438	0	0	0	0.003	0.028	0.716	9.730
Local Inflation	8562	0.172	0.403	-1.160	-0.460	-0.050	0.180	0.410	0.790	1.120

Table 2: **Exogenous Federal Reserve district voting rotation.** This table reports evidence on the exogeneity of FOMC voting rights with respect to the main explanatory and outcome variables used in our study. Panel A reports the results using only aggregate data from the last quarter of the previous year. Panel B reports the results using cumulative yearly data. *Local inflation* is the cumulative monthly inflation for a given Reserve Bank district during the fourth quarter (Panel A) or during the whole year (Panel B). *DW Activity* is the aggregate amount of all DW credit extended to commercial banks by a Reserve Bank during the fourth quarter (Panel A) or during the whole year (Panel B), scaled by the total amount of commercial banks' assets in that district. *FHLB Activity* is the aggregate amount of all DW credit extended to commercial banks by a Reserve Bank during the fourth quarter (Panel A) or during the whole year (Panel B), scaled by the total amount of commercial banks' assets in that district. Robust t-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

Panel A. Last Quarter Information

Dependent variable:	**1=District Voting Next Year; 0=Otherwise**				
	(1)	(2)	(3)	(4)	(5)
Recent Q4 Local Inflation	-0.141			-0.160	-0.108
	(-0.399)			(-0.456)	(-0.191)
Recent Q4 DW Activity		-0.582		0.774	0.247
		(-0.936)		(0.227)	(0.062)
Recent Q4 FHLB Activity			0.153	0.177	0.176
			(1.163)	(1.289)	(1.143)
Observations	99	120	120	99	99
R-squared	0.19	0.16	0.17	0.20	0.22
District FEs	YES	YES	YES	YES	YES
Time FEs	NO	NO	NO	NO	YES

Panel B. Last Year Information

Dependent variable:	**1=District Voting Next Year; 0=Otherwise**				
	(1)	(2)	(3)	(4)	(5)
Recent Year Local Inflation	0.004			-0.002	-0.029
	(0.055)			(-0.031)	(-0.317)
Recent Year DW Activity		-0.388		-0.213	-0.288
		(-0.587)		(-0.263)	(-0.331)
Recent Year FHLB Activity			0.077	0.107	0.133
			(0.863)	(1.105)	(1.277)
Observations	90	108	108	90	90
R-squared	0.18	0.16	0.16	0.19	0.22
District FEs	YES	YES	YES	YES	YES
Time FEs	NO	NO	NO	NO	YES

Table 3: **The unconditional relationship between local inflation and liquidity loans.** This table reports estimates of Equations (1), (2), and (3). Panel A reports the results of using only quarterly cumulative DW loans as the dependent variable. Panel B reports the results of using only quarterly changes in FHLB advances as the dependent variable. Panel C reports the results of using a stacked sample where the dependent variable is equal to both FHLB loans and DW loans. DW then becomes a dummy that identifies discount window credit. Bank-level control variables include the natural logarithm of a bank's assets, the Tier 1 capital ratio, ROA, total deposits as a fraction of total liabilities, and commercial and industrial loans as a fraction of a bank's assets. All control variables are lagged by one quarter. Standard errors are clustered at the borrower level. *t*-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

	(1)	(2)	(3)	(4)
Panel A: DW Loan ≥ 100k % Assets				
Local Inflation	-0.101***	-0.101***	-0.084*	-0.081*
	(-2.854)	(-2.814)	(-1.885)	(-1.771)
Observations	205,119	205,032	190,976	181,709
R-squared	0.001	0.22	0.23	0.23
District FEs	YES	NO	NO	NO
Time FEs	YES	YES	YES	YES
Borrower FEs	NO	YES	YES	YES
Controls	NO	NO	YES	YES
NY Excluded	NO	NO	NO	YES
Panel B: Chg FHLB % Assets				
Local Inflation	0.043**	0.043**	0.032	0.028
	(2.147)	(2.137)	(1.505)	(1.285)
Observations	204,498	204,411	190,976	181,709
R-squared	0.008	0.019	0.044	0.045
District FEs	YES	NO	NO	NO
Time FEs	YES	YES	YES	YES
Borrower FEs	NO	YES	YES	YES
Controls	NO	NO	YES	YES
NY Excluded	NO	NO	NO	YES
Panel C: Liquidity Loan % Assets				
DW × Local Inflation	-0.143***	-0.144***	-0.114**	-0.108**
	(-3.514)	(-3.476)	(-2.312)	(-2.131)
Local Inflation	0.043**			
	(2.147)			
Observations	410,242	410,068	381,952	363,418
R-squared	0.003	0.17	0.17	0.18
District × Loan Type FEs	YES	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES	YES
District × Time FEs	NO	YES	YES	YES
Borrower × Loan Type FEs	NO	YES	YES	YES
Controls	NO	NO	YES	YES
NY Excluded	NO	NO	NO	YES

Table 4: **Liquidity loans and inflation by voting status.** This table reports estimates of Equation (3). Panel A is restricted to borrower-quarter observations of Reserve Bank regions that lack voting rights in a specific quarter. Panel B uses the sample of borrower-quarter observations of Reserve Bank regions that have voting rights in a specific quarter. Bank-level control variables include the natural logarithm of a bank's assets, the Tier 1 capital ratio, ROA, total deposits as a fraction of total liabilities, and commercial and industrial loans as a fraction of a bank's assets. All control variables are lagged as of the previous quarter. Standard errors are clustered at the borrower level. t-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

Panel A. Non-voting district-quarters

Dependent variable: Liquidity Loan % Assets	(1)	(2)	(3)	(4)
DW × Local Inflation	-0.249***	-0.252***	-0.250***	-0.252***
	(-3.543)	(-3.537)	(-3.173)	(-3.539)
Local Inflation	0.063**			
	(2.235)			
Observations	243,182	243,004	223,124	243,004
R-squared	0.0035	0.20	0.20	0.60
District × Loan Type FEs	YES	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES	YES
District × Time FEs	NO	YES	YES	NO
Borrower × Loan Type FEs	NO	YES	YES	YES
Borrower × Time FEs	NO	NO	NO	YES
Controls	NO	NO	YES	NO

Panel B. Voting district-quarters

Dependent variable: Liquidity Loan % Assets	(1)	(2)	(3)	(4)	(5)	(6)
DW × Local Inflation	-0.049	-0.045	-0.001	-0.045	0.044	-0.007
	(-1.074)	(-0.999)	(-0.019)	(-0.999)	(0.762)	(-0.147)
Local Inflation	0.018					
	(0.617)					
Observations	167,060	166,914	158,462	166,914	139,928	145,900
R-squared	0.0042	0.22	0.20	0.61	0.21	0.62
District × Loan Type FEs	YES	NO	NO	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES	YES	YES	YES
District × Time FEs	NO	YES	YES	NO	YES	NO
Borrower × Loan Type FEs	NO	YES	YES	YES	YES	YES
Borrower × Time FEs	NO	NO	NO	YES	NO	YES
Controls	NO	NO	YES	NO	YES	NO
NY Excluded	NO	NO	NO	NO	YES	YES

Table 5: **Liquidity loans and inflation: full sample.** This table reports estimates of the empirical setting described in Section 4.2. "DW" is a dummy variable that identifies discount window loans and "No Vote" is a dummy variable that identifies quarters in which a regional Reserve Bank *lacks* voting rights. Standard errors are clustered at the borrower level. t-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

Dependent variable: Liquidity Loan % Assets	(1)	(2)	(3)	(4)
DW × No Vote × Local Inflation	-0.203***	-0.203***	-0.183***	-0.246***
	(-3.979)	(-3.908)	(-3.489)	(-3.023)
DW × Local Inflation	-0.035	-0.035	-0.041	-0.007
	(-1.126)	(-1.129)	(-1.307)	(-0.147)
DW × No Vote	0.010	0.012	0.009	
	(0.585)	(0.705)	(0.535)	
Observations	410,242	410,068	389,052	388,904
R-squared	0.0047	0.58	0.59	0.60
District × Loan Type FEs	YES	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES	YES
District × Time FEs	YES	NO	NO	NO
Borrower × Loan Type FEs	NO	YES	YES	YES
Borrower × Time FEs	NO	YES	YES	YES
NY Excluded	NO	NO	YES	YES
FEs Interacted with Voting Dummy	NO	NO	NO	YES

Table 6: **Liquidity loans and inflation: the role of bank size.** This table repeats the analysis in Column (4) of Table 5 for various size-based groups of banks. Standard errors are clustered at the borrower level. t-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

Small vs. big banks:	*Small*	*Big*	*Small*	*Big*
Bank asset criterion:	*≤ $1b*	*> $1b*	*≤ Median*	*> Median*
Dependent variable: Liquidity Loan % Assets				
	(1)	(2)	(3)	(4)
DW × No Vote × Local Inflation	-0.151**	-0.425	-0.229***	-0.188
	(-2.381)	(-1.247)	(-2.944)	(-1.480)
DW × Local Inflation	-0.023	0.032	-0.015	-0.024
	(-0.474)	(0.220)	(-0.220)	(-0.365)
Observations	341,562	47,104	181,542	206,786
R-squared	0.61	0.60	0.65	0.58
District × Loan Type FEs	NO	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES	YES
District × Time FEs	NO	NO	NO	NO
Borrower × Loan Type FEs	YES	YES	YES	YES
Borrower × Time FEs	YES	YES	YES	YES
NY Excluded	YES	YES	YES	YES
FEs Interacted with Voting Dummy	YES	YES	YES	YES

Table 7: **Liquidity loans and inflation: additional robustness tests.** This table studies the robustness of our results to various borrower selection criteria. Across columns, we condition the sample on having used various types of credit during the sample period. In Columns (1)-(3) we focus on DW and FHLB loans. In Column (1) we report the main result from Table 5, where we use all banks in the U.S. call reports. In Column (2), we select borrowers that access either type of loan at least once during the sample period. In Column (3), we require borrowers to access both types of loans during the sample period. Columns (4)-(6) perform similar analyses for DW and REPO loans. Standard errors are clustered at the borrower level. Placebo tests comparing FHLB and REPO are shown in the Appendix Table B.2. t-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

Liquidity loan types:	*DW & FHLB*	*DW & FHLB*	*DW & FHLB*	*DW & REPO*	*DW & REPO*	*DW & REPO*
Bank access criterion:	*Full (paper)*	*Either*	*Both*	*Full*	*Either*	*Both*
Dependent variable: Liquidity Loan % Assets						
	(1)	(2)	(3)	(4)	(5)	(6)
DW × No Vote × Local Inflation	-0.246***	-0.320***	-0.540**	-0.204***	-0.392***	-0.682**
	(-3.023)	(-3.130)	(-2.382)	(-2.952)	(-2.945)	(-2.134)
DW × Local Inflation	-0.007	-0.003	-0.027	0.005	0.014	0.04
	(-0.147)	(-0.056)	(-0.239)	-0.163	-0.233	-0.321
Observations	388,904	310,378	123,700	388,904	203,384	65,748
R-squared	0.60	0.60	0.60	0.71	0.7	0.71
District × Loan Type FEs	NO	NO	NO	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES	YES	YES	YES
District × Time FEs	NO	NO	NO	NO	NO	NO
Borrower × Loan Type FEs	YES	YES	YES	YES	YES	YES
Borrower × Time FEs	YES	YES	YES	YES	YES	YES
NY Excluded	YES	YES	YES	YES	YES	YES
FEs Interacted with Voting Dummy	YES	YES	YES	YES	YES	YES

Table 8: **Discount window activities using more granular evidence.** This table reports estimates of the empirical specification described in Section 5. Panel A, in particular, reflects Equation (4). The unit of observation is a discount window loan extended between 2010 and 2020. In Columns (1) to (3) the dependent variable is the natural logarithm of the dollar amount of the DW loan. In Columns (4) to (6) the dependent variable is the natural logarithm of the collateral ratio of the DW loan, calculated as the amount of available collateral on the borrower's balance sheet divided by the dollar amount of the loan. Standard errors are double clustered at the borrower and day-of-the-loan level. A placebo test using Term Auction Facility (TAF) loans is shown in the Appendix Table B.3. Panel B uses a different dataset compiled from weekly snapshots of individual Reserve Bank balance sheets. The dependent variable is the weekly amount of discount window loans outstanding scaled by the total amount of Reserve Bank assets. Standard errors are clustered at the weekly level. *t*-statistics are reported in parentheses. ***, *p*-value <1%; **, <5%; *, <10%.

Panel A. Loan-level evidence

Dependent variable:	DW Loan (log)			Collateral Ratio (log)		
	(1)	(2)	(3)	(4)	(5)	(6)
No Vote × Local Inflation	-0.373**	-0.648***	-0.642***	0.488***	0.493**	0.493**
	(-2.035)	(-3.237)	(-3.108)	(2.686)	(2.523)	(2.523)
Local Inflation	0.087	0.284*	0.221	-0.282**	-0.271*	-0.271*
	(0.607)	(1.834)	(1.410)	(-1.964)	(-1.753)	(-1.753)
No Vote	-0.037	-0.008	-0.002	-0.019	-0.042	-0.042
	(-0.378)	(-0.087)	(-0.026)	(-0.237)	(-0.493)	(-0.493)
Observations	30,717	21,319	20,037	27,940	20,037	20,037
R-squared	0.42	0.50	0.51	0.37	0.49	0.49
District × Loan Type FEs	YES	YES	YES	YES	YES	YES
Time × Loan Type FEs	YES	YES	YES	YES	YES	YES
Controls	NO	YES	YES	NO	YES	YES
NY Excluded	NO	NO	YES	NO	NO	YES

Panel B. District-week-level evidence

Dependent variable: DW Loans % Reserve Bank Assets	(1)	(2)
No Vote × Local Inflation	-1.657***	-1.935***
	(-4.142)	(-4.217)
Local Inflation	0.426***	0.558***
	(2.843)	(2.953)
No Vote	0.731***	0.766***
	(4.910)	(4.835)
Observations	8,562	7,665
R-squared	0.22	0.19
District FEs	YES	YES
Time FEs	YES	YES
NY Excluded	NO	YES

Appendices for "Local Monetary Policy"

A Data Appendix

This appendix section complements and provides more details on the material covered in Section 2.

A.1 More Details on the Discount Window

The main lending facility is the primary credit facility. To receive a primary loan, a borrower must be in sound financial shape (CAMELS ratings of 1, 2, or 3). Financial borrowers with weaker balance sheets can access funding at a penalty rate using the secondary credit facility (typically 50 basis points over the primary rate). Seasonal credit is the cheapest among the three, and this credit facility is mostly used by small banks who are unable to access more common sources of funding and face recurring liquidity shocks; a typical case would be a small bank in a farming community that has highly seasonal asset and liability flows.

Under the new primary and secondary credit programs approved by the Federal Reserve Board on October 31, 2002 (effective starting 2003), all three rates are set homogeneously across the United States and constitute an upper bound on the Federal Funds Rate. In fact, initially the primary credit rate was explicitly pegged at 100 basis points above the FOMC target rate. The press release on January 6, 2003 (when the new regulation was first implemented) can be found at https://www.federalreserve.gov/boarddocs/press/monetary/2003/20030106/default.htm. The Press Release on October 31, 2002 can be found at https://www.federalreserve.gov/boarddocs/press/bcreg/2002/200210312/default.htm. The main takeaway is as follows:

> The rule replaces adjustment credit, which currently is extended at a below-market rate, with a new type of discount window credit called primary credit that will be broadly similar to credit programs offered by many other major central banks. Primary credit will be available for very short terms as a backup source of liquidity to depository institutions that are in generally sound financial condition in the judgment of the lending Federal Reserve Bank. The Board expects that most depository institutions will qualify for primary credit.
>
> Reserve Banks will extend primary credit at a rate above the federal funds rate, which should eliminate the incentive for institutions to borrow for the purpose of exploiting the positive spread of money market rates over the discount rate. The Board anticipates that the primary credit rate will be set initially at 100 basis points above the FOMC's target federal funds rate.

The 10/31/2002 press release explains that the reason for this regulatory change is to eliminate the stigma and encourage DW usage:

> By employing an above-market rate and restricting eligibility to generally sound institutions, the primary credit program should considerably reduce the need for the Federal Reserve to review the funding situations of borrowers and monitor the use of borrowed funds. This reduced administration in turn should make the discount window a more attractive funding source for depository institutions when money markets tighten.

The secondary credit rate is pegged against the primary credit rate:

> The Board's final rule also establishes a secondary credit program that will be available in appropriate circumstances to depository institutions that do not qualify for primary credit. The Board anticipates that Reserve Banks will initially establish a secondary credit rate at a level 50 basis points above the primary credit rate.

This regulatory change should not change how the FOMC makes decisions about the target rate set for the national open market operations:

> The rule does not entail a change in the stance of monetary policy. The Federal Open Market Committee's target for the federal funds rate will not change as a result of the adoption of these programs, and the level of market interest rates more generally will be unaffected.

In terms of borrower profiles at the DW, commercial banks are the most frequent and most important borrowers, as documented in Ennis (2021). However, there are other financial borrowers that can access the DW, such as credit unions, thrift borrowers, and foreign banking organizations.

A.2 More Details on Other Liquidity Loans

There used to be 12 FHLB districts, roughly mirroring the geographical organization of the Federal Reserve system. However, in 2014, the FHLB of Seattle agreed to be acquired by the much larger FHLB of Des Moines, resulting in the current 11 FHLBs. Figures A.1 and A.2 show the current map of FHLB and Federal Reserve districts. Our district fixed effects always refer to the borrower's corresponding DW district.

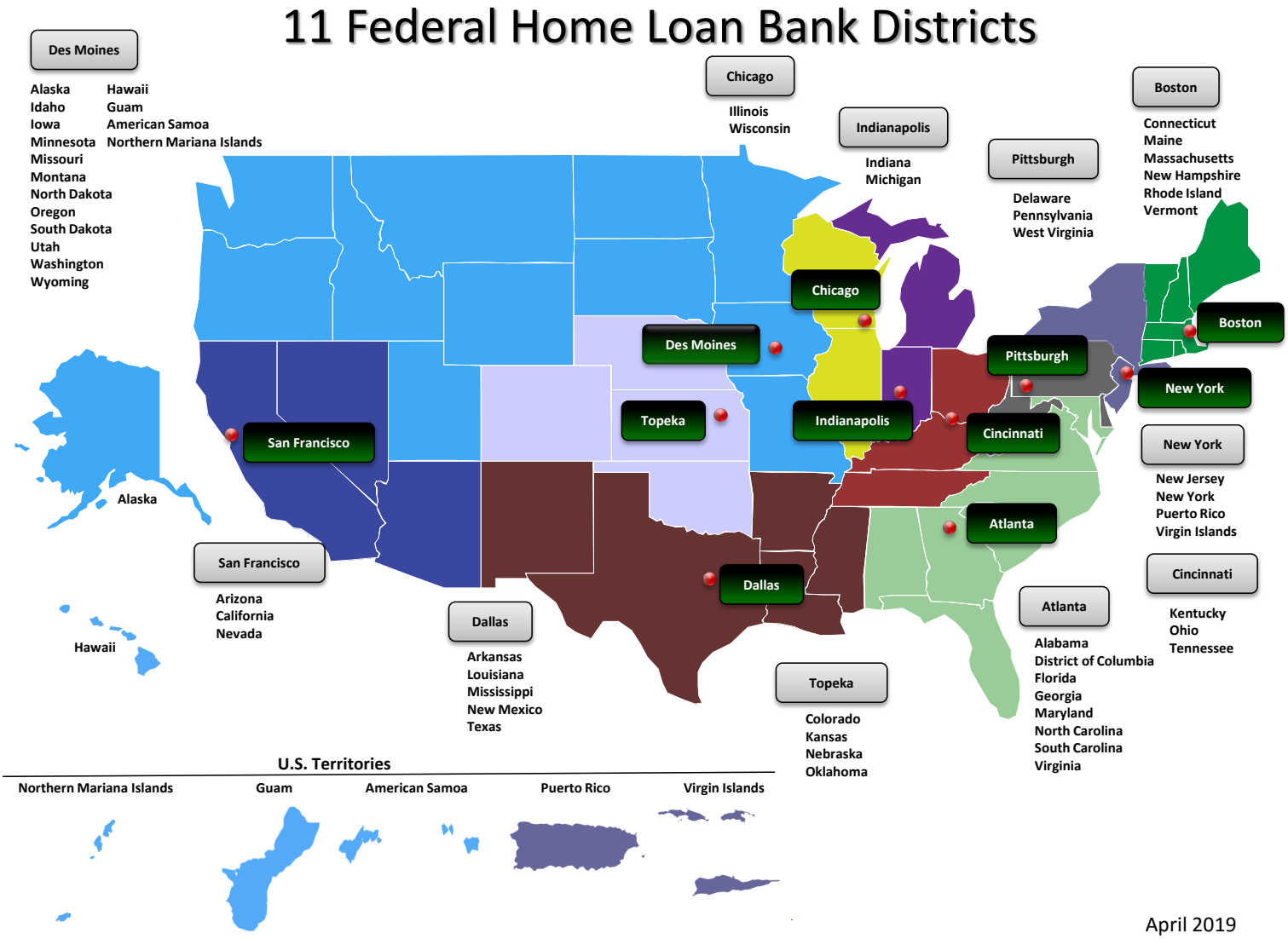


Figure A.1: Map of the 11 FHLB districts. https://www.fhfa.gov/SupervisionRegulation/FederalHomeLoanBanks/Pages/About-FHL-Banks.aspx

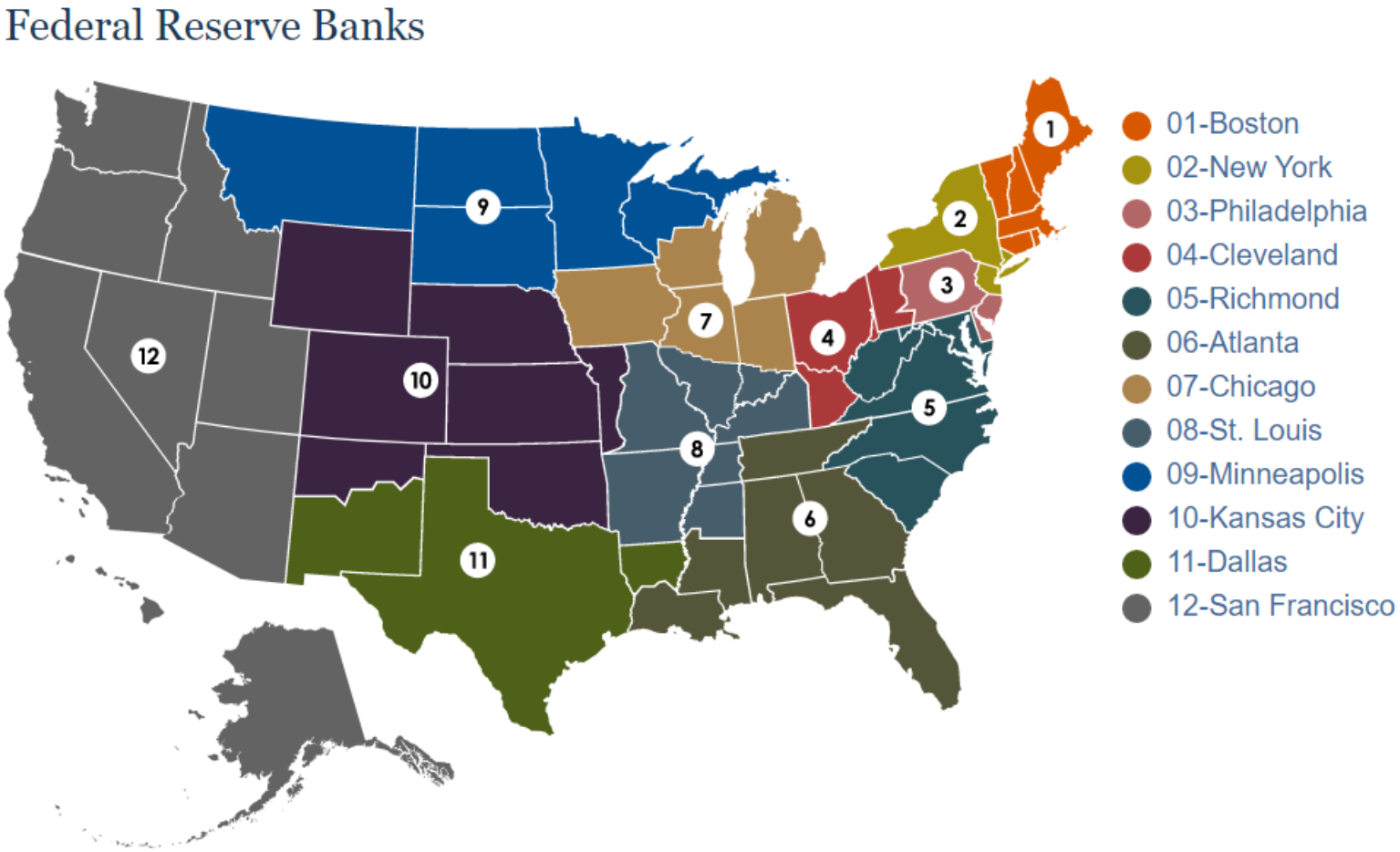


Figure A.2: Map of the 12 Federal Reserve districts. https://www.federalreserve.gov/aboutthefed/federal-reserve-system.htm

Table A.1: Summary of variables.

Label	Variable Description
DW Loan > 100k % Assets	Total amount of DW loans greater than $100,000 extended to a single borrower bank in a given quarter, expressed as a percentage of the borrower's last quarter's assets.
Chg FHLB % Assets	Quarterly change in FHLB loan balances expressed as a percentage of the previous quarter's assets. (Includes only FHLB advances maturing in less than one year).
Security REPOs % Assets	The amount of securities sold with an agreement to be repurchased that are outstanding at the end of the quarter, scaled by the bank's assets.
Local Inflation	Weighted average inflation calculated using inflation in the first and second months of each quarter.
No Vote	Dummy variable indicating the lack of an FOMC voting right for a district in a given quarter.
Ln(Assets)	The natural logarithm of the assets held on a borrower bank's balance sheet.
Tier 1	Basel III Tier 1 capital ratio expressed as a percentage of risk-weighted assets.
ROA	Return on assets expressed as the percentage of net income over assets.
Deposits % Liabilities	Total deposits (includes time deposits, savings deposits, etc.) expressed as a percent of total liabilities.
C&I Loans % Assets	Commercial and industrial loans outstanding on a bank's balance sheet expressed as a percent of total assets.
DW	Dummy variable that identifies a discount window loan.

B Additional Tables and Figures

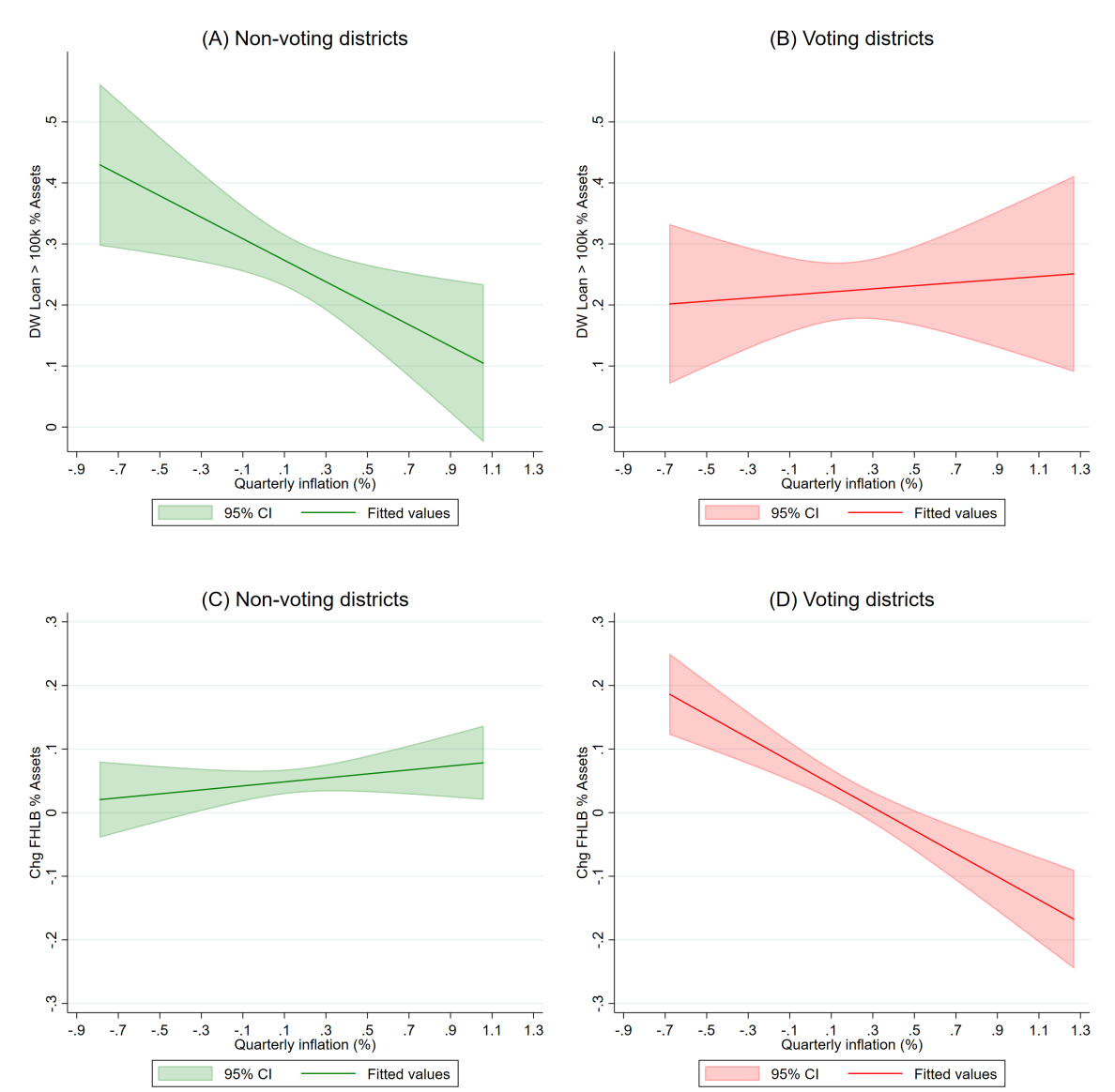


Figure B.1: **Relationship between local inflation and loan activities (all borrowers that have accessed both the DW and the FHLB)**. This figure complements Figure 4 and uses all borrowers that have accessed both the DW and the FHLB. This is also the sample used in Column (2) of Table 7, Panel A. The relationship before the split is relegated to Figure B.2.

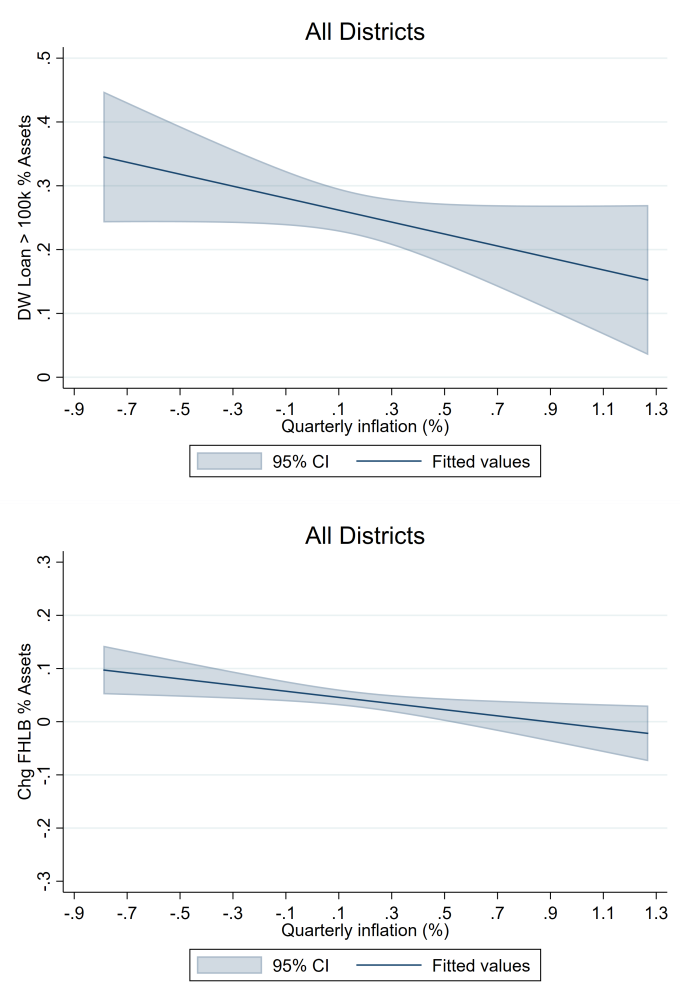


Figure B.2: **Unconditional relationship.** This figure complements Figure B.1 and depicts the unconditional relationship between local inflation and loan activities at all times (no split between voting and non-voting periods). The top and bottom figures show DW and FHLB activities, respectively.

Table B.1: **Summary statistics for the bank control variables.** This table reports summary statistics for the datasets used in this paper. The sample covers all banks that filed call reports between 2010-2020. Panel A(1) reports summary statistics for the full sample. Panels A(2) and A(3) split the sample between non-voting and voting district quarters, respectively. $Ln(Assets)$ is the natural logarithm of the assets held on a borrower bank's balance sheet. $Tier1$ is Basel III Tier 1capital ratio expressed as a percentage of risk-weighted assets. ROA is return on assets expressed as the percentage of net income over assets. $Deposits\ \%\ Liabilities$ is total deposits (time deposits, savings deposits, etc.) expressed as a percent of total liabilities. $C\&I\ Loans\ \%\ Assets$ is commercial and industrial loans outstanding on a bank's balance sheet expressed as a percent of total assets.

	COUNT	MEAN	SD	P1	P5	P25	P50	P75	P95	P99
Panel A(1). Borrower-Quarter level for each loan type; All district-quarters										
ln(Assets)	261283	12.294	1.423	9.536	10.356	11.398	12.136	12.988	14.775	17.031
Tier 1	253914	14.053	307.806	0.072	0.108	0.152	9.737	15.336	28.829	68.188
ROA	261283	0.598	7.655	-2.054	-0.227	0.220	0.468	0.837	1.583	3.297
Deposits % Liabilities	261261	93.518	11.770	6.279	80.714	91.803	96.753	99.260	99.835	99.935
C&I Loans % Assets	257880	8.119	6.903	0.000	0.086	3.577	6.627	10.822	20.832	32.985
Panel A(2). Borrower-Quarter level for each loan type; District-quarters without voting rights (60.3%)										
ln(Assets)	157466	12.262	1.383	9.537	10.352	11.387	12.116	12.952	14.652	16.801
Tier 1	152022	13.774	301.664	0.068	0.108	0.15	1.032	15.118	28.339	65.458
ROA	157466	0.6	2.92	-2.274	-0.269	0.22	0.471	0.842	1.593	3.334
Deposits % Liabilities	157459	93.66	11.572	11.896	81.154	91.975	96.839	99.28	99.838	99.937
C&I Loans % Assets	155801	8.226	6.91	0	0.198	3.704	6.718	10.906	20.945	33.146
Panel A(3). Borrower-Quarter level for each loan type; District-quarters with voting rights (39.7%)										
ln(Assets)	103817	12.343	1.479	9.534	10.361	11.414	12.164	13.041	14.965	17.390
Tier 1	101892	14.470	316.748	0.080	0.110	0.155	10.578	15.664	29.590	73.727
ROA	103817	0.594	11.600	-1.722	-0.169	0.220	0.464	0.830	1.567	3.242
Deposits % Liabilities	103802	93.301	12.062	1.130	80.025	91.557	96.606	99.229	99.832	99.934
C&I Loans % Assets	102079	7.956	6.888	0.000	0.010	3.382	6.475	10.689	20.621	32.700

Table B.2: **Liquidity loans and inflation: Placebo test for Table 7.** This table complements Table 7 by testing whether there are differential responses of the two demand proxies. Across columns, we condition the sample on having used various types of credit during the sample period. As before, in Columns (1)-(3) we focus on FHLB and REPO loans. In Column (1) we use all banks in the U.S. call reports. In Column (2), we select borrowers that access either type of loan at least once during the sample period. In Column (3), we require borrowers to access both types of loans during the sample period. Standard errors are clustered at the borrower level. t-statistics are reported in parentheses. ***, p-value <1%; **, <5%; *, <10%.

Dependent variable: Loan access, demand-side benchmark			
Liquidity loan types:	*FHLB & REPO*	*FHLB & REPO*	*FHLB & REPO*
Bank access criterion:	*Full*	*Either*	*Both*
	(1)	(2)	(3)
REPO × No Vote × Local Inflation	-0.041	-0.065	-0.033
	(-0.925)	(-1.134)	(-0.314)
REPO × Local Inflation	-0.012	-0.009	-0.003
	(-0.342)	(-0.195)	(-0.041)
Observations	388904	308106	114280
R-squared	0.74	0.74	0.81
District × Loan Type FEs	NO	NO	NO
Time × Loan Type FEs	YES	YES	YES
District × Time FEs	NO	NO	NO
Borrower × Loan Type FEs	YES	YES	YES
Borrower × Time FEs	YES	YES	YES
NY Excluded	YES	YES	YES
FEs Interacted with Voting Dummy	YES	YES	YES

Table B.3: **Discount window activities using more granular evidence.** This table complements Table 8 using Ln(TAF loan) as a placebo for Ln(DW loan). The unit of observation is a Term Auction Facility (TAF) loan extended between December 12, 2007 and March 8, 2010. The dependent variable is the natural logarithm of the dollar amount of the TAF loan. Standard errors are double clustered at the borrower and day-of-the-loan level. *t*-statistics are reported in parentheses. ***, *p*-value <1%; **, <5%; *, <10%.

Dependent variable:	TAF Loan (log)
No Vote × Local Inflation	-0.018
	(-0.122)
Local Inflation	-0.122
	(-1.029)
No Vote	-0.117
	(-0.577)
Observations	2082
R-squared	0.24
District FEs	YES
Time FEs	YES
NY Excluded	YES