Firm balance sheets and monetary policy transmission

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Abstract

The functioning of internal capital markets in financial conglomerates facilitates a novel identification strategy of the balance sheet channel of monetary policy. We look at small subsidiary banks that are affiliated with the *same* holding company but operate in *different* geographical areas. These banks face the same marginal cost of funds due to internal capital markets, but face different borrowers as they concentrate their lending with small local businesses. Exploring cross-sectional variation in local economic conditions across these subsidiaries, we investigate whether borrower creditworthiness influences the response of bank lending to monetary policy. Our results are consistent with a demand-driven transmission mechanism that works through firm balance sheets and is independent from the bank lending channel.

Keywords: Monetary Policy, Balance Sheet Channel, Financial Conglomerates, Internal Capital Markets, Financial Constraints

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1. Introduction

Why do small changes in short-term interest rates drive large responses of the aggregate economy? Recent theories emphasize the role played by financial frictions in amplifying the effects of interest rate changes (see Bernanke and Gertler (1995)). The *lending channel* view presumes that monetary policy affects the *supply* of bank loans. Draining deposits from the system will reduce lending if banks face frictions when issuing uninsured liabilities. Because firms may find the credit offered by other sources an imperfect substitute, monetary contractions have larger effects on the borrowing of bank-dependent firms. The *balance sheet channel* view presumes that monetary policy affects loan *demand*. Higher interest rates increase debt service, erode cash flows, and depress collateral values. The deterioration in firm creditworthiness increases the external finance premium and squeezes firm demand for loans.

The ideal strategy for identifying the lending channel is to look at cross-sectional variation in banks' ability to smooth policy-induced deposit outflows, while holding constant the characteristics of bank loan portfolios. In this vein, recent papers show that the lending of small subsidiaries of large BHCs is less sensitive to monetary contractions than the lending of comparable small, independent banks (see Ashcraft (2001) and Campello (2002)). Differently from stand-alone banks, members of large BHCs seem to resort to funds available from their conglomerates' internal capital markets to sustain their supply of loans during a contraction.

The ideal strategy for identifying the balance sheet channel is to look at cross-sectional variation in firms' financial condition, while holding constant the policy-sensitivity of their lenders. This paper pursues such a strategy, building on the functioning of internal capital markets in BHCs. When lending is determined by the cost of funds of the BHC, differences in the response of lending to monetary policy *across* subsidiaries will be driven by differences in the response of loan demand rather then loan supply. If we shut down the loan supply channel by looking at large BHCs, we can look for evidence that within-BHC shifts in lend-

ing activity are influenced by the creditworthiness of the firms to which banks lend. We do this by comparing the monetary policy responses of similar-size banks that are affiliated with the *same* large financial conglomerate but that face *different* pools of borrowers. The borrowing clienteles are distinguished by looking at the lending of (same-BHC) small affiliates that reside in distinct geographical locations. Since small subsidiary banks concentrate their lending with small businesses (whose fortunes are tied to their local economies), we can exploit cross-sectional variation in local economic indicators at the time of a monetary policy shock to gauge whether borrowers' financial strength drives changes in bank lending.

Our empirical tests relate the sensitivity of bank lending to local economic conditions and the stance of monetary policy by combining cross-sectional and time series regressions. We show that the negative responses of loan growth to monetary contractions are much stronger for subsidiary banks operating during state-recessions than for subsidiaries of the same BHC that operate in state-booms. Put differently, our evidence implies that *borrowers' strength* drives the allocation of loanable funds. We also look at the implied aggregate magnitudes of our empirical estimates. In particular, we estimate that, while the balance sheet channel accounts for only 14% of the aggregate response of bank lending to a policy innovation after four quarters, it explains about one-third of the aggregate response after eight quarters.

Overall, our study suggests the existence of an independent, demand-driven credit channel in the transmission mechanism of monetary policy. Our evidence implies that when engaging in monetary policy the central bank should consider the amplification effects of changes in interest rates on the economy that are triggered by borrowers' financial strength. More concretely, our evidence suggests that monetary policy will have a stronger effect on economic activity during recessions (when balance sheets are weak) than during booms. By using bank organizational form as a way to identify the transmission of monetary policy, our findings also add to the growing literature on the role that internal capital markets play in the allocation of funds inside financial conglomerates.

The next section describes our empirical strategy. Section 3 reports our main results. Robustness checks are discussed in Section 4. Section 5 concludes.

2. Empirical Strategy

We now describe in detail our testing strategy and the characteristics of our sample.

2.1. Identification

The case for the balance sheet channel is based on the joint predictions that (a) financial factors affect investment and (b) innovations to monetary policy affect financial factors. In the existing literature, Gertler and Gilchrist (1994) document differences in the response of small and large firms to monetary contractions. Under the assumption that financial factors have a larger effect on small firms, the differential response of investment across firm size is ascribed to financing frictions. The difficulty with this strategy is that small firms are also more likely to be bank dependent. Thus, in the presence of a bank lending (supply) channel of monetary policy, this strategy may not isolate the role of firm balance sheets (demand) in the transmission mechanism.

In contrast to the previous literature, our study models the differential response of lending to monetary policy across banks by explicitly separating the demand- and supply-side effects. Let r_t denote the stance of monetary policy as of time t. Also, let *Lending* denote the partial derivative of bank loan growth with respect to monetary policy. Eq. (1) writes the response of loan growth to policy for an individual bank i that is part of BHC j at time t:

$$Lending_{ijt} = \alpha_0 + \alpha_1 d_{ijt}^{bs} + \alpha_2 d_{ijt}^{monbs} + \alpha_3 s_{ijt}^{bank} + \alpha_4 s_{ijt}^{BHC} + \varepsilon_{ijt}. \tag{1}$$

Differences in the response of loan *demand* across banks are captured by d_{ijt}^{bs} and d_{ijt}^{monbs}. The first of these components relates to the response of loan demand to monetary policy that is driven by borrower creditworthiness ("balance sheets"). The second captures demand

responses that are driven by underlying characteristics of the borrowers in a market, such as the sensitivity of product demand to interest rates. One can assume that such characteristics (given by industrial structure, demand elasticity, etc.) evolve slowly over time and are essentially fixed over very short intervals. Accordingly, our tests exploit high-frequency variations in borrowers' demand for loans that are induced by short-run shocks to local business conditions. Differences in the response of loan *supply* across banks are driven by differences in the severity of financial constraints at the bank level, s_{ijt}^{bank}, or at the holding company level, s_{jt}^{BHC}. These latter controls capture lending channel effects, where financial constraints affect the ability of banks to replace outflows of insured deposits with funds from other sources.

Given appropriate data on each of the regressors, estimating Eq. (1) via OLS will recover the correlation between firm balance sheet strength and the response of lending to monetary policy through the estimate of α_1. Unfortunately, one lacks information on relevant dimensions of some of those regressors. In particular, there are likely to be unobserved components of s_{ijt}^{bank} and s_{ijt}^{BHC} that are correlated with the observed dimensions of d_{ijt}^{bs}. As a result, the OLS estimation might be compromised by an omitted variables-type bias.

We minimize the problems involved in the estimation of α_1 in Eq. (1) through a series of devices. First, we restrict our sample to banks that are affiliated with large BHCs. Kashyap and Stein (2000) show that large banks are "immune" to policy shocks as their ability to resort to non-reservable sources of funds allows them to shield their lending from contractions. Ashcraft (2001) and Campello (2002) further show that, just like large banks, subsidiaries of large BHCs are less constrained than comparable stand-alone banks during contractions. According to those authors, this happens because of the workings of active, efficient internal capital markets inside large conglomerates. Therefore, our initial sample restriction should all but eliminate the importance of bank (supply-side) financial constraints in explaining the response of lending to policy, allowing us to disregard s_{ijt}^{bank} and s_{ijt}^{BHC}. We, however, weaken such an assumption and estimate Eq. (1) including a set of controls that, according to the

lending channel literature, should exhaust the sources of variation in bank-level financial constraints: capitalization, size, and liquidity. In the end, α_3 and α_4 should be very small (if not zero), so that even if there are unobserved dimensions of bank/BHC financial constraints, any correlation of these unobservables with firm balance sheet strength, d^{bs}_{ijt}, will be mitigated.[1]

Secondly, we focus on *differences* between a subsidiary's response to policy and that of the other banks in the *same* BHC. Focusing on within-conglomerate comparisons is useful because it purges financial constraints at the BHC-level from the equation. It also minimizes any residual differences in financial constraints across the sampled banks . For each bank i that is part of BHC j at time t, let D^{x}_{ijt} denote the difference between the subsidiary's x (or x_{ijt}) and its BHC average x ($x_{\bar{j}t}$). We can re-write (1) in *deviations* from the BHC mean:

$$D^{Lending}_{ijt} = \beta_1 D^{d^{bs}}_{ijt} + \beta_2 D^{d^{nonbs}}_{ijt} + \beta_3 D^{s^{bank}}_{ijt} + D^{\varepsilon}_{ijt}. \tag{2}$$

Finally, we isolate sources of variation in loan demand. Arguably, depressed economic activity in a region will lead to a deterioration in local borrowers' creditworthiness, as small local businesses' fortunes (cash flows, collateral values, etc.) are tied to their local economies. Our identification scheme is complete if we can assume that small local businesses concentrate their borrowing with small banks. Fortunately, this assumption is well-supported by research on the lending practices of small and large banks (Strahan and Weston (1998)). This allows us to isolate differences in borrowers' strength across members of a given banking conglomerate ($D^{d^{bs}}_{ijt}$) by looking at data from small subsidiaries of large multi-state BHCs — i.e., we compare policy responses of similar-size banks that tap into funds of the same conglomerate but that face different pools of borrowers. By design, our tests revolve around short-run cross-sectional variation in demand for loans that are unrelated to non-balance sheet effects.

[1] Notice that the omitted variables bias depends *both* on the correlation of the omitted variable with the variable of interest and on the coefficient on the omitted variable in the original model. As this coefficient goes to zero, the bias created by any correlation with the variable of interest also goes to zero.

2.2. Data

We collect quarterly accounting information on the population of insured commercial banks from the Federal Reserve's *Call Report of Income and Condition* over the 1976:I-1998:II period. Details about the formation of consistent time series using the Call Reports data are given in Appendix A of the working paper version of this study.[2] Our sampling disregards bank-quarters involved in merger events and retains only those banks with positive values for total assets, loans, and deposits. In addition, we eliminate bank-quarters with loan growth (i.e., the differenced log of total loans) exceeding five standard deviations from the mean. Since the regression models we estimate include four lags of loan growth as explanatory variables, the sample is limited to banks having at least five consecutive quarters of data.

Our testing strategy focuses on the lending of small banks. We define as "small banks" those banks at or below the 95th percentile of the assets size distribution in a given quarter (cf., e.g., Kashyap and Stein (2000)). We further restrict our focus to small banks that are part of multi-bank holding companies controlling at least one large bank (i.e., a bank in the top 5% of the asset distribution). Next, we require that the sampled banks be affiliated with BHCs with subsidiaries residing in at least two different U.S. states during the same quarter. There are 39,892 observations in our baseline sample. The distribution of bank-quarters in our data is reported in Table 1. The table shows a steady increase in the number of observations until the late 1980s. During the 1990s, consolidation in the industry (and inside BHCs) reduces the number of small banks affiliated with large BHCs.

The first column of Table 2 reports the mean and standard deviation of the bank-level variables used in our tests. The figures for basic balance sheet information such as asset size, loan growth, capital ratio, etc., resemble those of other studies on small subsidiary banks (e.g., Campello (2002)). To check whether the observations in our sample are "unique" in

[2] The working paper version can be found online on the authors' web pages as well as on SSRN and IDEAS.

some obvious fashion, we also compute descriptive statistics for the variables of interest using the population of small banks that are left out of our sample. These are reported in the second column of Table 2. Comparisons based on those statistics suggest that small subsidiaries of multi-state BHCs are not much different from other banks in the same size category. We, however, later revisit the issue of sample selection.

Finally, our analysis also necessitates data on the stance of monetary policy and on the business environments in which the small affiliate banks in our sample operate. While we focus our analysis on the federal funds rate, we also use several alternative measures of monetary policy (the CP-Bill spread, the Funds-Bill spread, Non-borrowed Reserves, and Strogin's measure). In order to measure local business conditions we use nominal state income series available from the Bureau of Economic Analysis. Deviations from the long-run economic growth trend in each state are used to characterize state-recessions and state-booms. Specifically, a state income gap ($YGap$) is constructed by applying a Hodrick-Prescott filter (bandwidth of 1600) to the time series difference of the change in log state income. In our tests, a positive (negative) $YGap$ — i.e., a positive (negative) short-term deviation from a state's secular growth trend — indicates a "state-boom" ("state-recession").

3. Results

To demonstrate that the data support our strategy of relating local area income to borrower creditworthiness, we document that state income is correlated with borrowers' loan performance. We do this in Section 3.1. Sections 3.2 and 3.3 report our main results.

3.1. Local Business Conditions and Bad Loans

In establishing a link between local economic environments and borrowers' balance sheets, we must verify that a deterioration of borrowers' circumstances will eventually be manifested

in the quality of their banks' loan portfolios. For each bank i in BHC j at time t, let $D_{ijt}^{BadLoans}$ denote the difference between a subsidiary's bad loans (i.e., the ratio of non-performing to total loans) and the average bad loans of all other small banks in the BHC. Similarly, define D_{ijt}^{YGap} as the difference between a subsidiary's state income gap and the average income gap of all other small banks in BHC j at time t:

$$D_{ijt}^{BadLoans} = BadLoans_{ijt} - BadLoans_{\bar{j}t}, \tag{3}$$

$$D_{ijt}^{YGap} = YGap_{ijt} - YGap_{\bar{j}t}. \tag{4}$$

We use the following empirical model to determine if subsidiaries operating in states with poorer economic conditions indeed report a greater fraction of problem loans:

$$D_{ijt}^{BadLoans} = \eta + \sum_{k=1}^{4} \lambda_k \; Local \; Shock_{ijt-k} + \boldsymbol{\beta} D_{ijt-1}^{\mathbf{X}} + \sum_t \mu_t 1_t + \xi_{ijt}. \tag{5}$$

The four lags of shocks to local economic conditions (*Local Shock*) are meant to capture the relative strength of the balance sheets of borrowers. For robustness, we measure these shocks in two ways: (a) as the state income gap ($YGap$) and (b) as the "relative-to-BHC" income gap (D_{ijt}^{YGap}, from Eq. (4)). The controls in $\mathbf{X}$ include the lag of log assets, the lag of the equity ratio, and the lag of the liquid-to-total assets ratio. The coefficients associated with these control variables are collected by the vector $\boldsymbol{\beta}$. The μ coefficients absorb time-fixed effects. We are, of course, interested in the relationship between a small subsidiary's ratio of bad loans and the financial status of the borrowers in its market, captured by $\sum \lambda_k$.

We report the estimates returned for $\sum \lambda_k$ from Eq. (5) in the first column of Table 3. Panel A uses the state income gap $YGap_{ijt}$ as the local income shock proxy, while Panel B uses D_{ijt}^{YGap}. The results from both panels agree with our hypothesis. The most conservative estimate in the table (-0.024) implies that an *increase* in the state income gap by one standard deviation (about 2.5%) for one quarter *reduces* the fraction of bad loans in a small

bank's loan portfolio by about 6 basis points after four quarters. This latter figure represents approximately 5% of the sample mean estimate for problem loans.

Although the results from Eq. (5) support our expectations, we note that one potential limitation of that specification is that it exploits both permanent and transitory differences in the fraction of bad loans across subsidiaries. In principle, we are interested in bad loans created by what are temporary changes in local economic conditions, so it makes sense to purge long-run individual subsidiary bank effects. This can be accomplished by separating out bank time-averaged differences relative to the BHC, defining $\Delta D_{ijt}^{BadLoans}$ as follows:

$$\Delta D_{ijt}^{BadLoans} = D_{ijt}^{BadLoans} - D_{\bar{ij}}^{BadLoans}. \tag{6}$$

We then re-examine our findings on loan performance via a "double-difference" equation:

$$\Delta D_{ijt}^{BadLoans} = \eta + \sum_{k=1}^{4} \lambda_k \; LocalShock_{ijt-k} + \boldsymbol{\beta} \Delta D_{ijt-1}^{\mathbf{X}} + \sum_t \mu_t 1_t + \rho_{ijt}. \tag{7}$$

The results from the estimation of (7) are reported in the second column of Table 3. There continues to exist strong evidence that differences in the state income gap are correlated with differences in non-performing loans across subsidiaries of multi-state BHCs.

3.2. Local Business Conditions and Monetary Policy Effects

To flesh out the balance sheet transmission mechanism we use a two-step approach similar to that of Kashyap and Stein (2000) and Campello (2002). The idea is to relate the sensitivity of bank lending to local economic conditions and the stance of monetary policy by combining cross-sectional and times series regressions. This approach sacrifices efficiency, but it reduces the odds of concluding that borrowers' finances matter when this proposition is false.[3]

Define $D_{ijt}^{Lending}$ as the difference between a small subsidiary loan growth and the average loan growth of all other small banks in its BHC. The first step of our procedure consists of

[3] A one-step specification (with Eq. (10) below nested in Eq. (8)) would impose a more constrained parameterization and have more power to reject the null. However, the data strongly reject that parameterization.

running the following cross-sectional regression at each quarter t in our sample period:

$$D_{ijt}^{Lending} = \eta + \sum_{k=1}^{4} \pi_k D_{ijt-k}^{Lending} + \sum_{k=1}^{4} \gamma_k \; Local \; Shock_{ijt-k} + \boldsymbol{\beta} D_{ijt-1}^{\mathbf{X}} + \epsilon_{ij}. \tag{8}$$

As in Eq. (5), *Local Shock* is alternatively measured as either (a) $YGap$ or (b) D_{ijt}^{YGap}. The set of controls in $\mathbf{X}$ includes the lag of log assets, the lag of the equity ratio, and the lag of the liquid-to-total assets ratio. To explicitly account for the individual idiosyncratic effects discussed in Section 3.1., we also estimate the following double-differenced equation:

$$\Delta D_{ijt}^{Lending} = \eta + \sum_{k=1}^{4} \pi_k \Delta D_{ijt-k}^{Lending} + \sum_{k=1}^{4} \gamma_k \; Local \; Shock_{ijt-k} + \boldsymbol{\beta} \Delta D_{ijt-1}^{\mathbf{X}} + \nu_{ij}, \tag{9}$$

where $\Delta D_{ijt}^{Lending} = D_{ijt}^{Lending} - D_{\bar{ij}}^{Lending}$, and similarly for the remaining bank variables.

From each sequence of cross-sectional regressions, we collect the coefficients returned for $\sum \gamma_k$ and 'stack' them into the vector Ψ_t, which is then used as the dependent variable in the following (second-stage) time series regression:

$$\Psi_t = \alpha + \sum_{k=1}^{8} \phi_k MP_{t-k} + \sum_{k=1}^{8} \mu_k \Delta ln(GDP)_{t-k} + \sum_{k=1}^{3} \sigma_k Q_k + \kappa Trend_t + u_t. \tag{10}$$

The economic and the statistical significance of the impact of monetary policy in Eq. (10) can be gauged from the sum of the coefficients for the eight lags of MP (i.e., $\sum \phi_k$) and from the p-value of this sum. Since there is no consensus about the best measure of the stance of monetary policy, we use five alternative proxies for MP in all estimations we perform: (a) the Fed funds rate (Fed Funds); (b) the spread between the rates paid on six-month prime rated commercial paper and 180-day Treasury bills (CP–Bill); (c) the spread between the Fed funds rate and the rate paid on 10-year Treasury bills (Funds–Bill); (d) the log change in non-borrowed reserves (NonBorrowed); and (e) Strongin's (1995) measure of unanticipated shocks to reserves (Strongin). All measures are transformed so that increases in their levels represent Fed tightenings. Because policy changes and other macroeconomic movements often coincide, we also include eight lags of the log change in real GDP in the specification. Q stands for quarter dummies and $Trend$ is a time trend.

The central results of the paper are shown in Table 4. The table reports the sum of the coefficients for the eight lags of the monetary policy measure ($\sum \phi_k$) from Eq. (10), along with the p-values for the sum. Heteroskedasticity- and autocorrelation-consistent errors are computed via Newey-West. The table summarizes the results of twenty two-step estimations (four alternative first-stage regressions $\times$ five monetary policy measures). The estimations in Panel A use the state income gap $YGap_{ijt}$ as the proxy for local borrowers' financial condition, while those in Panel B use D_{ijt}^{YGap}. The first row of each panel reports results from regressions that use $D_{ijt}^{Lending}$ (the relative-to-BHC loan growth) as the dependent variable (see Eq. (8)), while those in the second row use $\Delta D_{ijt}^{Lending}$ (the double-differenced $Lending_{ijt}$) (cf. Eq. (9)).

All of the estimates reported in Table 4 indicate that borrowers' financial status drive the response of bank lending to monetary policy along the lines of the balance sheet channel. This is remarkable given the relatively limited time dimensionality of our sample — our times series regressions have only 84 observations — and the well-known differences in the time series properties of our policy measures. Of those estimates, ten (five) are significant at the 9.6% (3.9%) test level or better. The coefficients for the most conventional measure of policy, the Fed funds rate, are all significant at better than the 6.5% level.

Table 5 describes the 'impulse-response' of the amplification mechanism reported in Table 4, focusing on the Fed funds rate as the measure of monetary policy. The rows of Table 5 are similar to those of Table 4. Across columns, one reads the point estimates and p-values for the sum of coefficients of different lags of the funds rate. Those estimates indicate that the bulk of the amplification effect implied by the balance sheet channel takes place immediately after a policy change. They also show that the effects of monetary policy on bank lending that are induced by the weakening of borrowers' financial condition is very persistent through time.

Using coefficients on the Fed funds rate from a regression of bank loan growth on lags of loan growth, the funds rate, and output growth, Fig. 1 illustrates the average response of bank loans to monetary policy for banks in the baseline sample when output gap is zero

($YGap = 0$). We then use the coefficients from the first row of Table 5 in order to compute the path of lending when banks are faced a one-standard deviation decline in $YGap$ ($= -0.025$). The figure makes it clear that variations in borrowers' balance sheets have an economically significant effect on the response of bank loans to monetary policy. For example, after only four quarters following a Fed-induced tightening banks facing weaker borrowers contract their loans by 50% *more* than banks facing borrowers with "average" balance sheet strength.

3.3. Monetary Policy Transmission across other Samples of Small Banks

To show the importance of shutting down the loan supply channel, we replicate our tests in other samples of small banks: (a) affiliates of BHCs that are not in our baseline sample and (b) stand-alones. To implement these tests, for each bank in our baseline sample, we first identify direct matches in the other two samples; the matches are based on whether banks operate in the same state during the same quarter. We then use the affiliation information of the baseline banks to which these other banks are matched to form fictional multi-state BHCs.

As the banks in the other two samples are likely to be financially constrained, one should expect the presence of a (supply-side) lending channel to boost the coefficients reported in Table 4. Table 6 shows that this is indeed the case. Focusing on the funds rate, column (1) replicates the baseline results of Table 4, while columns (2) and (3) report the results from the alternative samples.[4] The cross-sample differences validate our strategy of focusing on likely financially unconstrained banks. It is significant that we find larger responses of lending to monetary policy for out-of-sample banks, as this implies that the decline in lending induced by weak balance sheets is not offset elsewhere in the system. In other words, the effects that

[4] Noteworthy, the difference in coefficients across columns can be seen as new evidence of a lending channel of monetary policy. In particular, column (1) estimates the effect of borrower balance sheets on the response of lending to monetary policy. On the other hand, since column (3) uses a sample of arguably constrained banks, the estimates reported there capture the effect of borrower balance sheets combined with the pass-through effect on lender balance sheets. The difference between columns (1) and (3) thus isolates the effect of lender balance sheet strength on the response of lending to monetary policy, which is part of the loan supply channel.

we identify likely have a direct impact on aggregate lending and macroeconomic activity.

3.4. Gauging the Macroeconomic Impact of the Balance Sheet Channel

To characterize the overall economic significance of our results, we compare the effect of borrowers' balance sheets on the response of loan growth to monetary policy to the *aggregate* response of loan growth to monetary policy. We do this via a structural VAR estimation (similar to Bernanke and Blinder (1992)). Using quarterly data from 1947 to 2002, the VAR contains eight lags of three variables: (a) bank loans, (b) real GDP, and (c) the Fed funds rate.[5] Our VAR estimates imply that a 1% increase in the Fed funds rate leads to reductions in real output and aggregate bank loans of 0.45% and 0.28%, respectively, after one year. After the same period, the Fed funds rate has been cut by about 0.33%.

We use the VAR-implied path of the Fed funds rate, output growth, and the estimated coefficients on the funds rate from Table 4 to compute the fraction of the response of lending to policy that is driven by balance sheets. Fig. 2 plots the estimated aggregate response of bank lending to a 100-basis-point innovation in the funds rate as well as the response of bank lending that can be attributed to borrowers' balance sheets. While balance sheets explain about 14% of the response of aggregate lending to monetary policy after four quarters, that proportion grows to about 33% after eight quarters. These results indicate that a large fraction of the "broad credit channel" of monetary policy transmission can be assigned to changes in *borrowers' creditworthiness* over the monetary policy cycle.

4. Robustness

We conduct a thorough examination of the robustness of our results. These are detailed in the working paper version of this study. Here, we briefly summarize some of those checks.

[5] The effect of monetary policy is identified under the standard ordering assumption that the Fed funds rate has no immediate impact on loans or GDP. The data is differenced to ensure system stationarity.

First, we examine whether a standard interest channel could underlie our results. We do this since one could interpret our findings as just saying that investment is more sensitive to the cost of capital when the expected profitability is low, where weak local business conditions are simply a proxy for low expected returns. This story cannot fully account for our results, but we minimize its plausibility by including proxies for profits associated with local business financing in the first stage of our two-stage procedure. Our results remain the same.

Second, we consider the issue of sample selection bias. Since financial institutions may choose to organize their business as multi-bank firms and decide whether or not to operate in diverse markets, one could be concerned with the effect of sampling on our findings. For instance, one could argue that expansionary monetary policies might prompt BHCs to expand into new markets (states), thereby entering our sample and somehow contaminating our results. We deal with this issue in two ways. First, we employ multiple Heckman-correction strategies that deal specifically with sample selection that can be attributed to the stance of monetary policy and to deregulation of bank entry across states. Second, to see if the patterns in affiliate lending we observe are robust to changes in the structure of the data, we "intervene" in the formation of conglomerates by randomly re-assigning affiliates to different BHCs and re-estimating our models. Our findings are insensitive to either of these treatments for sample selectivity concerns.

5. Conclusions

This paper adds to our undesrtanding of the transmission of monetary policy by devising an empirical strategy that more effectively isolates the effect of policy on bank credit through borrower creditworthiness. We interpret our empirical findings as evidence that the balance sheet channel is an important part of how monetary policy works. In fact, our results suggest that borrowers' balance sheet status can explain a significant fraction of the overall response

of bank lending to monetary policy. Our results also add to the growing literature on the role that internal capital markets play in the allocation of funds inside financial conglomerates. They point at the need to understand in more detail the influence that bank conglomeration exerts on the impact of Fed policies on aggregate lending and investment.

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Table 1: Banks Affiliated with Large Multi-State Holding Companies

Year	Quarter				
	I	II	III	IV	Total
1977	-	195	194	195	584
1978	195	195	196	196	782
1979	196	196	198	197	787
1980	198	199	199	200	796
1981	202	202	204	195	803
1982	197	197	198	198	790
1983	208	213	206	195	822
1984	206	189	200	189	784
1985	237	234	293	286	1,050
1986	320	357	411	576	1,664
1987	665	778	739	801	2,983
1988	892	883	854	823	3,452
1989	862	859	871	849	3,441
1990	835	800	794	751	3,180
1991	733	762	745	722	2,962
1992	693	713	724	717	2,847
1993	684	737	717	713	2,851
1994	695	706	631	656	2,688
1995	596	597	599	575	2,367
1996	578	520	490	480	2,068
1997	468	430	344	329	1,571
1998	301	319	-	-	620
Total					39,892

Table Notes: The table reports the number of small banks that are affiliated with a large multi-state bank holding company in each quarter and contain enough consecutive quarters of data (five) to be used in the analysis.

Table 2: Descriptive Statistics on Small Banks

	In the Sample	Not in the Sample
$LoanGrowth_{ijt}$	0.0157	0.0211
	(0.0764)	(0.0680)
$BadLoans_{ijt}$	0.0144	0.0156
	(0.0259)	(0.0267)
$LogAssets_{ijt-1}$	11.4992	10.3804
	(0.8750)	(0.9803)
$(Equity/Assets)_{ijt-1}$	0.0811	0.0912
	(0.0406)	(0.0340)
$(Securities/Assets)_{ijt-1}$	0.2378	0.2987
	(0.1406)	(0.1447)
$LoanGrowth_{\bar{i}j}$	0.0240	0.0245
	(0.0222)	(0.0189)
$BadLoans_{\bar{i}j}$	0.0118	0.0148
	(0.0143)	(0.0119)
$LoanGrowth_{ijt} - LoanGrowth_{\bar{i}j}$	–0.0084	–0.0034
	(0.0748)	(0.0668)
$BadLoans_{ijt} - BadLoans_{\bar{i}j}$	0.0026	0.0008
	(0.0222)	(0.0235)
N	39,892	926,845

Table Notes: The table refers to the sample mean and standard deviation for a number of variables in the population of small insured commercial banks. The first column refers to small banks that are part of large multi-state bank holding companies while the second column refers to all other small banks. Reading down, the measures include quarterly loan growth, bad loans as a fraction of total loans, one lag of log bank assets, one lag of bank leverage, one lag of bank liquidity, average quarterly loan growth and bad loans for the bank, and the difference in quarterly loan growth and bad loans from its long-run average.

Table 3: Local Economic Conditions and Bank Loan Quality

Dependent Variable	$D_{ijt}^{BadLoans}$	$\Delta D_{ijt}^{BadLoans}$
A. Borrower's Balance Sheet proxied by $YGap_{ijt}$		
	–0.0244	–0.0289
	(1.93)	(2.92)
B. Borrower's Balance Sheet proxied by D_{ijt}^{YGap}		
	–0.0420	–0.0286
	(2.50)	(2.33)
N	36,090	36,090

Table Notes: The table refers a regression of a function of bank-level bad loans on on state economic activity and other covariates (Eqs. (5) and (7) in the text). This measure of economic activity includes the state income gap in the first row and the difference in state income gap from the average gap faced by banks in the subsidiary in the second row. In the first column the dependent variable is the difference in bad loans from the holding company mean while in the second column it is this variable differenced again against its long-run mean. The coefficient on state economic activity is reported as well as t-statistics, which have been corrected for error heteroskedasticity and individual bank clustering.

Table 4: Monetary Policy and the Balance Sheet Channel

First-Stage	Measure of Monetary Policy				
Dep. Variable	Fed Funds	CP–Bill	Funds–Bill	NonBorrow	Strongin
A. Borrower's Balance Sheet proxied by $YGap_{ijt}$					
$D_{ijt}^{Lending}$	0.041	0.200	0.036	0.941	0.793
	(0.020)	(0.021)	(0.246)	(0.604)	(0.185)
$\Delta D_{ijt}^{Lending}$	0.042	0.143	0.054	2.125	0.931
	(0.009)	(0.127)	(0.039)	(0.194)	(0.181)
B. Borrower's Balance Sheet proxied by D_{ijt}^{YGap}					
$D_{ijt}^{Lending}$	0.032	0.215	0.039	2.184	1.070
	(0.063)	(0.024)	(0.323)	(0.410)	(0.009)
$\Delta D_{ijt}^{Lending}$	0.031	0.100	0.055	5.166	0.942
	(0.065)	(0.266)	(0.124)	(0.013)	(0.096)

Table Notes: The table refers to the second-stage regression described in the text (Eq. (10)). The dependent variable is the average sensitivity of bank loan growth to the state economic activity, while explanatory variables include 8 lags of monetary policy measures, 8 lags of aggregate output growth, a time trend, and quarter effects. The estimation period is 1977:II through 1998:II. The table reports the sum of coefficients on the 8 lags of each measure of monetary policy and the p-value for the hypothesis test that this sum is no different from zero. Heteroskedasticity- and autocorrelation-consistent errors are computed via Newey-West lag window of size 8. Each of the last five columns refers to specifications characterized by the employed measure of monetary policy. In Panel A, borrowers' balance sheet strength is proxied by $YGap_{ijt}$, while in Panel B the relevant proxy is D_{ijt}^{YGap}.

Table 5: Cumulative Balance Sheet Effect of the Funds Rate on Lending

First-Stage	Cumulative Lags of the Fed Funds Rate							
Dep. Variable	1	2	3	4	5	6	7	8
A. Borrower's Balance Sheet proxied by $YGap_{ijt}$								
$D_{ijt}^{Lending}$	0.017	0.024	0.021	0.024	0.026	0.029	0.039	0.041
	(0.175)	(0.144)	(0.239)	(0.173)	(0.142)	(0.102)	(0.034)	(0.020)
$\Delta D_{ijt}^{Lending}$	0.016	0.023	0.022	0.026	0.026	0.030	0.039	0.042
	(0.149)	(0.107)	(0.162)	(0.124)	(0.137)	(0.112)	(0.028)	(0.009)
B. Borrower's Balance Sheet proxied by D_{ijt}^{YGap}								
$D_{ijt}^{Lending}$	0.023	0.024	0.019	0.025	0.027	0.029	0.036	0.032
	(0.133)	(0.158)	(0.299)	(0.157)	(0.087)	(0.049)	(0.049)	(0.063)
$\Delta D_{ijt}^{Lending}$	0.019	0.020	0.017	0.022	0.022	0.025	0.033	0.031
	(0.118)	(0.147)	(0.327)	(0.223)	(0.210)	(0.160)	(0.083)	(0.065)

Table Notes: The table refers to the second-stage regression described in the text (Eq. (10)). The dependent variable is the average sensitivity of bank loan growth to the state economic activity, while explanatory variables include 8 lags of monetary policy measures, 8 lags of aggregate output growth, a time trend, and quarter effects. The estimation period is 1977:II through 1998:II. The table reports the sum of coefficients on lags of the funds rate and the p-value for the hypothesis test that this sum is no different from zero. Heteroskedasticity- and autocorrelation-consistent errors are computed via Newey-West lag window of size 8. Each of the last eight columns refers to statistics characterized by the number of lags over which to sum. In Panel A, borrowers' balance sheet strength is proxied by $YGap_{ijt}$, while in Panel B the relevant proxy is D_{ijt}^{YGap}.

Table 6: Results for Different Bank Samples

First-Stage Dep. Variable	Bank Subpopulation		
	In-Sample BHC Affiliates	Out-of-Sample BHC Affiliates	Out-of-sample Stand-Alone Banks
$D_{ijt}^{Lending}$	0.041	0.049	0.078
	(0.020)	(0.051)	(0.008)
$\Delta D_{ijt}^{Lending}$	0.042	0.062	0.065
	(0.065)	(0.009)	(0.018)

Table Notes: The table refers to the second-stage regression described in the text (Eq. (10)). The dependent variable is the average sensitivity of bank loan growth to the state economic activity $YGap_{ijt}$, while explanatory variables include 8 lags of the Fed funds rate (the monetary policy measure), 8 lags of aggregate output growth, a time trend, and quarter effects. The estimation period is 1977:II through 1998:II. The table reports the sum of coefficients on the 8 lags of the Fed funds rate and the p-value for the hypothesis test that this sum is no different from zero. Heteroskedasticity- and autocorrelation-consistent errors are computed via Newey-West lag window of size 8. Each of the last five columns refers to specifications characterized by the employed measure of monetary policy. The first column reports results for the in-sample BHC affiliates, the second reports results for the out-of-sample BHC affiliates, the third columns collects results for stand-alone banks.

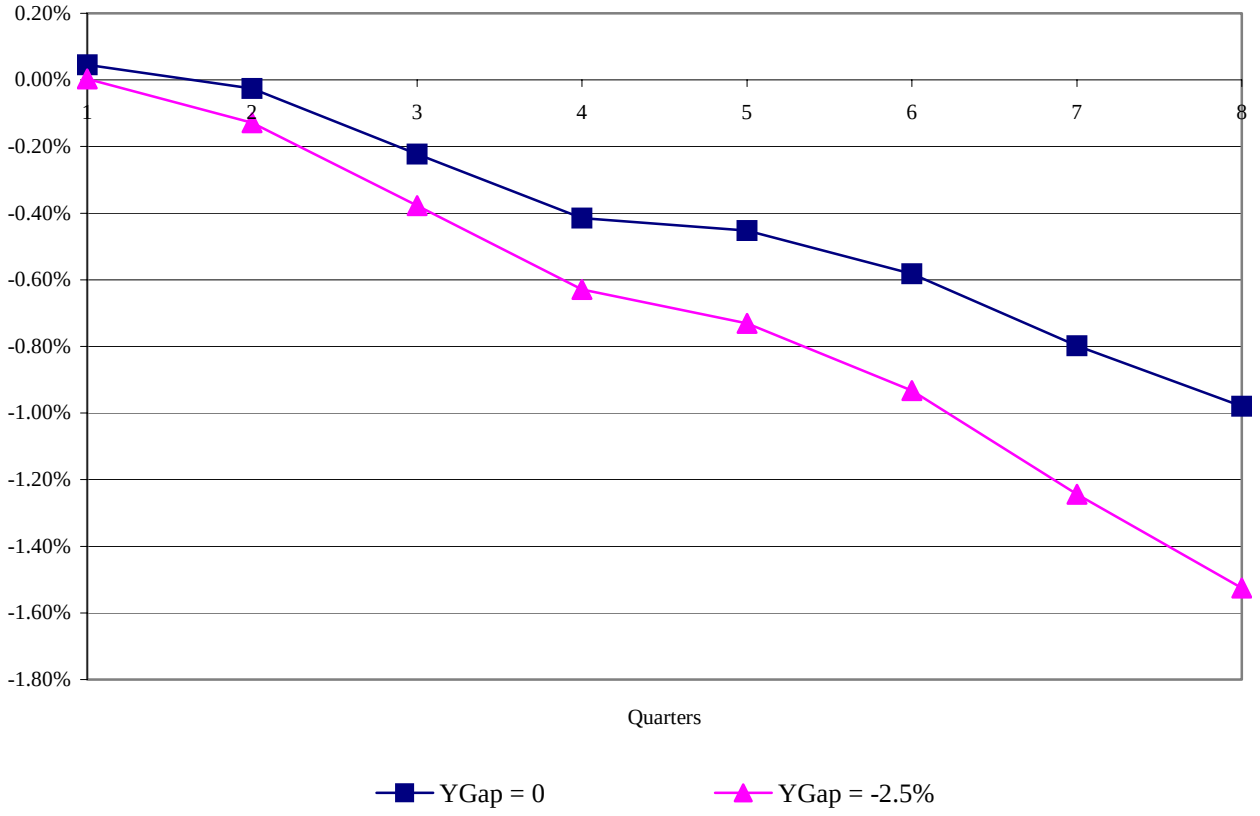

Figure 1: The Response of Bank Lending to Monetary Policy Across Balance Sheet Strength.

Figure 2: The Aggregate Effect of the Balance Sheet Channel on Bank Lending.