Banking Conditions and the Effects of Monetary Policy: Evidence from U.S. States

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The views presented are solely those of the author and do not necessarily represent those of the Federal Reserve Board or its staff.
Banking Conditions and the Effects of Monetary Policy

• Most macroeconomic models abstract from financial intermediation.
  o Justified if banks are ‘Modigliani-Miller’ agents.
  o But MM is a poor description of banking.
  o Evidence that bank lending depends on the financial condition of banks. (E.g. Hubbard, Kuttner and Palia; Peek and Rosengren; Banking Crises)

• Other theories suggest an important role for financial intermediaries.
  o Financial imperfections prevent frictionless intermediation.
  o Effects of monetary policy on real economy may depend on the financial structure of banks.
Banking Conditions and the Effects of Monetary Policy

- Two theories with this implication:
  - Bank lending channel [bank liquidity]
  - Bank capital channel [bank capital]

- This paper documents **if and how monetary policy effects on output depend on the financial conditions of the banking sector.**

- Use state-level data to address key identification issues.
Banking Conditions and the Effects of Monetary Policy

• Key finding: When a state’s banking sector starts out with a low capital-asset ratio, its subsequent output growth is more sensitive to changes in the Federal funds rate or other indicators of monetary policy.

• Consistent with bank capital channel and bank lending channel.

• Other evidence favors the capital channel.
Bank Lending Channel Redux
Bernanke and Blinder '88, Kashyap and Stein '95 and '00, Stein '98

Monetary policy tightens $\rightarrow$
Outflow of bank reserves $\rightarrow$
Less reservable deposits due to reserve requirements $\rightarrow$
Banks reduce lending $\rightarrow$
Lower economic activity.

Two necessary conditions:

1. Bank loans are special to some firms.
2. Banks cannot frictionlessly switch to nonreservable liabilities, such as large CDs. (Stein: asymmetric info.)

Key implication: stronger channel for less liquid banks.
(Kashyap and Stein 2000, etc)
Bank Capital Channel Redux

Monetary policy tightens →
Lower bank profits due to maturity transformation →
Lower bank **capital** →
Banks reduce lending to avoid **capital requirement** →
Lower economic activity.

Two necessary conditions:

1. Bank loans are special to some firms.
2. Banks cannot costlessly issue new equity.

**Key implication:** stronger channel for low-capital banks
Predictions

Expect stronger monetary policy effects when –

1. Aggregate bank capital is low.
   (Bank capital channel and bank lending channel)

2. Aggregate bank liquidity is low.
   (Bank lending channel)
Empirical Model (Bank Capital)

\[
\Delta y_{it} = \alpha_i + (\beta_{US} + \delta_{US} c_{it-1})\Delta y_{US t} + (\beta_M + \delta_M c_{it-1})\Delta M_t + \beta_{c1} c_{it-1} \\
+ (\beta_{US1} + \delta_{US1} c_{it-2})\Delta y_{US t-1} + (\beta_{M1} + \delta_{M1} c_{it-2})\Delta M_{t-1} \\
+ (\beta_{y1} + \delta_{y1} c_{it-2})\Delta y_{i t-1} + \beta_{c2} c_{it-2} + \varepsilon_{it}
\]

\(\Delta y_{it}\) real personal income growth in state \(i\), year \(t\)

\(\Delta y_{US t}\) US real personal income growth in year \(t\)

\(\Delta M_t\) change in monetary policy indicator

\(C_{it-1}\) capital ratio of banking sector of state \(i\), end of year \(t-1\)

Sample: 1969-1995 (= Riegle-Neal Act allows interstate branching and mergers)

Capital/lending channel: \(\delta_M < 0\) and \(\delta_{M1} < 0\)
Capital Asset Ratios and US Income Growth
**Capital Asset Ratio and Federal Funds Rate**

<table>
<thead>
<tr>
<th>Variable:</th>
<th>(a) Capital Asset Ratio: $c_{it} = C_{it}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$c_{it-1} \Delta M_t$</td>
<td>- 12.10** (4.37)</td>
</tr>
<tr>
<td>$c_{it-2} \Delta M_{t-1}$</td>
<td>2.88 (4.64)</td>
</tr>
<tr>
<td>$c_{it-1} \Delta y_{UST}$</td>
<td>- 19.50** (6.18)</td>
</tr>
<tr>
<td>$c_{it-2} \Delta y_{UST-1}$</td>
<td>- 6.74 (5.66)</td>
</tr>
</tbody>
</table>

- In state-years with low inherited bank capital, subsequent output growth is more sensitive to the federal funds rate.
- Also more sensitive to US output growth.
- So true differential impact of monetary policy is larger if $\Delta M_t > 0 \rightarrow \Delta y_{UST} > 0$.

*Note: $\Delta M$ equals the negative of the change in the Federal Funds rate. Standard errors are in parenthesis. * indicates significance at the 0.05 level; ** at the 0.01 level.*
Capital Asset Ratio and Federal Funds Rate

- Could these results be driven by specific states?
  - E.g. states with more cyclical industries could somehow have banks with lower capital ratios.

- Could these results be driven by specific years?
  - Small upward shift of capital ratios towards end of sample.
### Capital Asset Ratio and Federal Funds Rate

<table>
<thead>
<tr>
<th>Variable:</th>
<th>(a) Capital Asset Ratio: ( c_{it} = C_{it} )</th>
<th>(b) Deviation from state mean: ( c_{it} = C_{it} - \bar{C}_i )</th>
<th>(c) Dev. from state and time mean: ( c_{it} = C_{it} - \bar{C}_i - \bar{C}_t + \bar{C} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( c_{it-1} \Delta M_t )</td>
<td>-12.10** ((4.37))</td>
<td>-26.30** ((6.74))</td>
<td>-30.81** ((7.96))</td>
</tr>
<tr>
<td>( c_{it-2} \Delta M_{t-1} )</td>
<td>2.88 ((4.64))</td>
<td>14.48* ((6.77))</td>
<td>7.41 ((7.96))</td>
</tr>
<tr>
<td>( c_{it-1} \Delta y_{US t} )</td>
<td>-19.50** ((6.18))</td>
<td>-30.15** ((8.73))</td>
<td>-28.04** ((9.89))</td>
</tr>
<tr>
<td>( c_{it-2} \Delta y_{US t-1} )</td>
<td>-6.74 ((5.66))</td>
<td>-12.34 ((7.53))</td>
<td>-22.56** ((8.67))</td>
</tr>
</tbody>
</table>

**Note:** \( \Delta M \) equals the negative of the change in the Federal Funds rate. Standard errors are in parenthesis. * indicates significance at the 0.05 level; ** at the 0.01 level.

- Results are stronger.
Capital Asset Ratio and Federal Funds Rate

Economic Significance: Difference in output effect between states with the lowest and highest capital ratios, following a 1 standard deviation increase in the federal funds rate (240bps):

1 year: - 2.5 %
2 years: - 1.9 %
## Capital Asset Ratio and Bernanke Mihov Indicator

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>( c_{it-1}\Delta M_t )</td>
<td>-3.96</td>
<td>-6.53*</td>
<td>-9.39*</td>
</tr>
<tr>
<td></td>
<td>(2.24)</td>
<td>(2.97)</td>
<td>(3.82)</td>
</tr>
<tr>
<td>( c_{it-2}\Delta M_{t-1} )</td>
<td>1.75</td>
<td>1.12</td>
<td>-0.27</td>
</tr>
<tr>
<td></td>
<td>(2.16)</td>
<td>(2.75)</td>
<td>(3.41)</td>
</tr>
<tr>
<td>( c_{it-1}\Delta y_{US,t} )</td>
<td>-16.25**</td>
<td>-16.12*</td>
<td>-20.16*</td>
</tr>
<tr>
<td></td>
<td>(5.81)</td>
<td>(8.19)</td>
<td>(9.74)</td>
</tr>
<tr>
<td>( c_{it-2}\Delta y_{US,t-1} )</td>
<td>-4.09</td>
<td>-13.73</td>
<td>-20.82*</td>
</tr>
<tr>
<td></td>
<td>(5.98)</td>
<td>(7.80)</td>
<td>(9.09)</td>
</tr>
</tbody>
</table>

*Note: \( \Delta M \) equals the change in the Bernanke Mihov indicator. Standard errors are in parenthesis. * indicates significance at the 0.05 level; ** at the 0.01 level.*

- Results are similar.
### Liquidity Ratio and Bernanke Mihov Indicator

<table>
<thead>
<tr>
<th>Variable:</th>
<th>(a) Capital Asset Ratio:</th>
<th>(b) Deviation from state mean:</th>
<th>(c) Dev. from state and time mean:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( s_{it-1} \Delta M_t )</td>
<td>-0.33</td>
<td>0.03</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.59)</td>
<td>(0.71)</td>
</tr>
<tr>
<td>( s_{it-2} \Delta M_{t-1} )</td>
<td>1.11**</td>
<td>1.34*</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>(0.36)</td>
<td>(0.55)</td>
<td>(0.65)</td>
</tr>
<tr>
<td>( s_{it-1} \Delta y_{UST} )</td>
<td>0.43</td>
<td>2.81</td>
<td>2.30</td>
</tr>
<tr>
<td></td>
<td>(0.94)</td>
<td>(1.50)</td>
<td>(1.79)</td>
</tr>
<tr>
<td>( s_{it-2} \Delta y_{UST-1} )</td>
<td>3.21**</td>
<td>3.68*</td>
<td>2.12</td>
</tr>
<tr>
<td></td>
<td>(1.02)</td>
<td>(1.58)</td>
<td>(1.85)</td>
</tr>
</tbody>
</table>

**Note:** \( \Delta M \) equals the change in the Bernanke Mihov indicator. Standard errors are in parenthesis. * indicates significance at the 0.05 level; ** at the 0.01 level.

- Liquidity interactions are either insignificant, or have the ‘wrong’ sign.
- Including capital alongside liquidity does not alter these results.
Local Business Cycles

• Findings consistent with a bank capital channel, while support for the lending channel is more mixed.

• Bank capital reflects local business cycle conditions.

• As alternative interpretation: Could the results reflect nonlinearities in local business cycle dynamics?

• Include lagged state income growth alongside bank capital in the interactions.
  - Estimated effects of bank capital little changed.
  - State-years with high lagged growth are more sensitive to changes in US growth and the monetary policy indicators.
Conclusion

• When a state’s banking sector starts out with a low capital-asset ratio, its subsequent output growth is more sensitive to changes in the Federal funds rate.

• This is consistent with a bank capital channel, whereby monetary policy affects lending in part through its effects on bank capital.