Hazardous Times for Monetary Policy: What do 23 Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk?

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“The root cause of this credit correction was the Federal Reserve's willingness to keep money too easy for too long. The federal funds rate was probably negative in real terms for close to two years between 2003 and 2005. This led to a misallocation of capital. (...) An emergency rate cut, as some in the market seem to be anticipating or hoping for carries the risk of introducing even greater moral hazard into the financial system”


“Loose monetary policy is partly responsible for the mess the central bankers are now trying to clear up… Central banks kept interest rates too low for too long. That is most true for the Fed, which slashed rates between 2001 and 2003, held them at 1% for a year.”

Motivation

Wrt the current credit market turmoil:

1. The long period of *too low levels* of short-term interest rates created high risk taking (?)
2. Defaults happened *after* rates were very low, i.e. when rates were significantly rising
3. *Banks* are in the centre of the credit market turmoil

*Necessary condition* is to understand the impact of short-term interest rates on bank appetite for risk and credit risk
Question

- Does monetary policy affect risk taking?
  Do short-term interest rates affect credit risk-taking of banks?
  And if so, how?

Also:
  i. Do the level and the path of short-term interest rates affect bank loan credit risk?
  ii. Does GDP growth affect bank risk?
More specifically

• Does monetary policy have real affects? If so, how?

Monetary policy

<table>
<thead>
<tr>
<th>Bank Loan Volume</th>
<th>Bank Loan Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bernanke &amp; Blinder, <em>AER</em> 88</td>
<td>Matsuyama, <em>AER</em> 07</td>
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<td>Diamond &amp; Rajan, <em>AER</em> 06</td>
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<td>Bernanke &amp; Gertler, <em>JEP</em> 95</td>
<td>Dell’Ariccia &amp; Marques, <em>JF</em> 06</td>
</tr>
</tbody>
</table>

**Theory**

| Bernanke, Gertler & Gilchrist, *RESTat* 96 |

**Empirics**

| Bernanke & Blinder, *AER* 92 |
| Kashyap & Stein, *AER* 00 |
| Bernanke & Gertler, *JEP* 95 |

| Jiménez, Ogena, Peydró & Saurina 07 |
| Ioannidou, Ongena & Peydró 07 |

Den Haan et al., *JME* 07
Econometric Identification Strategy

- Exogenous monetary policy
- Very detailed/disaggregated loan data (Credit Register)
- Measures of risk
- Interactions of bank characteristics with MP
- GDP growth effects vs. MP effects on risk
• Find:
  – Baseline results also hold in Bolivian credit market
    • Maybe even more a *Mundell-Fleming* type of economy
  – Further steps in overall identification of the basic hypothesis:
    • Lower short-term rates increase bank risk-taking and reduce loan spreads!

• This paper analyzes the dynamic implications of monetary policy and GDP growth for bank credit risk
  – 22 years, 300 banks, 23 million banks loans, monthly data
  – In a larger and more developed financial market (data from Spain)
  – Better suited for testing different channels/theories of MP transmission (how monetary policy works)
Empirical Strategy

- Exogenous monetary policy
- Individual bank loan contract information
- Econometric tests:
  - Complementary measures of bank risk-taking
    - Individual loan hazard rate
      - Yields measure that is normalized per unit of time
      - Dynamic effects of monetary policy
      - Interaction effects of bank characteristics with MP
    - Multiple ex ante measures of bank risk taking
Exogenous Monetary Policy

- From second half of 88 to 99, Spain pegged the currency to the German DM
- From 99, MP run by the ECB (≥ 12 countries)
  - Spanish GDP growth and inflation higher than the average
Database

• *Central de Información de Riesgos* (CIR)
  – Public credit registry of Spain
  – Managed by the Bank of Spain (regulator)
  – All banks have to participate by regulation

  – Detailed loan contract & repayment information, on a monthly basis, on *all* outstanding C&I loans granted by banks operating in the country, from 1985-2007
  – Measures of risk: loan performance & type of borrower
  – Also borrower and bank characteristics

Used in Jiménez, Salas & Saurina, *JFE* 2006
Empirical Strategy

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What do we do?

- Random sample of C&I loans
- Quarterly frequency
- 1988:II-2006:IV

\[ \tau \leftarrow \text{life of the loan} \rightarrow \tau + T \]

Loan Risk

Overnight rates \((\tau - 1)\)

Controls

where loan risk is either:

- Loan performance \(\rightarrow\) hazard rate
- Ex-ante prob. that the loan goes to a borrower with
  - bad credit history (non-prime)
  - no credit history (new)

Controlling for loan, borrower, bank and macro characteristics
Empirical Strategy

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Loan Performance through Duration Analysis

- We measure it with hazard rate
- Hazard: $\lambda(t) = \frac{f(t)}{S(t)}$ at each quarter

Why is useful?
- Occurrence & timing of default (sooner worse than later)
- Normalized per unit of time (loan maturity may not be constant)
- Impact of macro and other variables over the life of the loan
- Can distinguish between defaults (occurrence & timing), repayments and censored loan observations
Hazard Specifications

\[ \lambda(t) = \lambda_0(t) \exp(\beta'X_t) \]

\( \lambda_0(t) \): baseline hazard function determines shape of hazard function with respect to time

\( X_t \): observable (time-varying) explanatory variables

\( \beta \): unknown parameters, \( \log \lambda(t) \) is linear in \( \beta \)

\( \lambda_0(t) \): no functional form is specified \( \rightarrow \) semi-parametric Cox (1972)

\( \lambda_0(t) \): parametric: Weibull or log-logistic

We follow McDonald & Van de Gucht (REStat 1999), Shumway (JB 2001), Chava & Jarrow (RoF 2004), Duffie et al. (JFE 2007)
Timing of Variables

Loan origination

\( \tau - 1 \)  \( \tau \)  \( \tau + T - 1 \)  \( \tau + T \)

\( T: \) Time to repayment or default

**Non Time-Varying Duration Model**

INTEREST RATE\(_{\tau-1}\)

INTEREST RATE\(_{\tau}\)

INTEREST RATE\(_{\tau+T-1}\)

**Time-Varying Duration Model**

\( \lambda(t) \) Estimate of Hazard Rate

INTEREST RATE\(_{\tau}\)

INTEREST RATE\(_{\tau+1}\)

INTEREST RATE\(_{\tau+2}\)

INTEREST RATE\(_{\tau+3}\)

INTEREST RATE\(_{\tau+\ldots}\)

INTEREST RATE\(_{\tau+T-1}\)

**t: the monthly period (t:1 to T)**

INTEREST RATE\(_{\tau-1}\)
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**Time-Varying Duration Model**

**Table 3**

| Independent Variables | Time-varying HAZARD |  
|------------------------|---------------------|---|
| **INTEREST RATE**<sub>τ−1</sub> | Coefficient | z-statistic |
| | -0.102 | -6.350 *** |
| **INTEREST RATE**<sub>τ+t</sub> | 0.064 | 3.200 *** |

controlling for macro, bank, firm, bank-firm, loan characteristics
### Time-Varying Duration Model

**Table 3**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Time-varying HAZARD</th>
<th>Coefficient</th>
<th>z-statistic</th>
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<tr>
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<td>INTEREST RATE $\tau - 1$</td>
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Empirical Strategy

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    – Interaction effects of bank characteristics with MP
    • Multiple ex ante measures of bank risk taking
Interaction effects of bank characteristics with MP

1) The impact of short-term interest rates on the hazard depends on (table 3):
   - Type of bank ownership
   - Balance sheet strength
   - Type of depositors

2) The impact of GDP growth on the hazard rate is positive, both at initiation and during the life of the loan (table 2 and 3)

3) Currently introducing more interactions of bank characteristics and MP & GDP growth in order to further disentangle the different theories/ channels (credit, liquidity, “information” and behavioural channel of MP)
Empirical Strategy

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### Ex-Ante Risk Measures

**Table 4**

<table>
<thead>
<tr>
<th></th>
<th>BAD CREDIT HISTORY =1</th>
<th>NO CREDIT HISTORY =1</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTEREST RATE (τ−1)</td>
<td>-0.029***</td>
<td>-0.047***</td>
</tr>
</tbody>
</table>

controlling for macro, bank, firm, bank-firm, loan characteristics
Conclusion – Summary

- Monetary policy determines risk-taking by banks.
  Decrease in rate prior to loan origination raises:
    - the loan hazard rate
    - the likelihood of loans to borrowers with bad credit history or to borrowers with no credit history
- Higher GDP growth reduces risk.
- Decrease in short-term rates over the life of the loan decreases the loan hazard rate.
- The impact of short-term interest rates on the hazard depends on: type of bank ownership, balance sheet strength, and type of bank depositors.
- Work in progress: exploiting more interactions to better disentangle the different theories/ channels.
Appendix
Answers to Prof. Cecchetti

Point 1

• Theoretically, by CAPM e.g., if Rf ↓ → E(Risky) ↓
• We use C&I loans. Den Haan et al. (JME 07) find that contractive MP does not reduce loan volume
• We run the baseline regression (Table 2, column 2) with contemporaneous or lag loan volume growth. We find:

<table>
<thead>
<tr>
<th></th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTEREST RATE (τ−1)</td>
<td>-0.05***</td>
</tr>
<tr>
<td>INTEREST RATE (τ+T−1)</td>
<td>0.3***</td>
</tr>
<tr>
<td>LOAN VOLUME GROWTH τ</td>
<td>-0.007*</td>
</tr>
</tbody>
</table>
Answers to Prof. Cecchetti
Point 2&6

- Measures of risk: hazard rate and probits for quality of borrowers
- Hazard results work for all maturities, in particular for 1 quarter loans:

<table>
<thead>
<tr>
<th>INTEREST RATE ( (\tau-1) )</th>
<th>HAZARD ( -0.1^{***} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTEREST RATE ( (\tau+T-1) )</td>
<td>0.27***</td>
</tr>
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</table>
• Correlations of $R_{SP}$ and $R_{DE}$
• We run the baseline regression (Table 2, column 2) with GDP volatility. We find:

<table>
<thead>
<tr>
<th></th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>interest rate ($\tau-1$)</td>
<td>-0.09***</td>
</tr>
<tr>
<td>interest rate ($\tau+T-1$)</td>
<td>0.3***</td>
</tr>
<tr>
<td>GDP volatility ($\tau-1$)</td>
<td>0.09*</td>
</tr>
</tbody>
</table>