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Monetary Policy, Risk-Taking, and Pricing: Evidence from a Quasi-Natural Experiment

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- Observers have argued that the very low interest rates that preceded the subprime crisis have contributed to the recent turmoil by giving incentives (or enabling) banks to originate riskier loans

- “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”.

“Lessons from the Credit Crunch,”
The Economist, Oct. 18, 2007

Question

- This paper examines whether monetary policy affect's bank's risk-taking

Literature

Lower short-term interest rates

- Increase loan supply
  - e.g., Bernanke and Blinder (1988), Bernanke and Gertler (1989), Lang and Nakamura (1995), Kashyap and Stein (2000), …
  - **Compositional changes:** more loans to marginal borrowers
- Increase (decrease) incentives to originate riskier loans
  - More: e.g., Diamond and Rajan (2006), Dell'Ariccia and Marquez (2006), Stiglitz and Greenwald (2003), Rajan (2006)
  - Less: e.g., Smith (2002), Hellman, Murdock, and Stiglitz (2000)

Empirical Identification

- To empirically identify whether changes in monetary policy lead to changes in the supply of credit to riskier borrowers we need:
  - Exogenous changes in monetary policy (i.e., not driven by local economic conditions)
  - Detailed information on loan originations to assess risk-taking and control for other factors that might affect the quality of the pool of applicants

Empirical Identification

- We think that Bolivia offers the closest setting (that we know of) to this ideal econometric environment…

Monetary Policy

- Bolivia is a good approximation of a Mundell-Flemming economy

Monetary Policy

- Small open economy
  - lowest tariffs in the region and no restrictions on capital flows
- Crawling peg with the US$
  - the Bolivian Peso was depreciating at a constant rate over the US$
- Banking sector highly dollarized
  - more than 90% of deposits and credit are denominated in US$

Monetary Policy

- The Bolivian monetary policy is not independent of the US monetary policy
- Changes in U.S. monetary policy are transmitted exogenously in Bolivia
- To measure exogenous changes in monetary policy in Bolivia we use the variation in the US Federal Funds Rate

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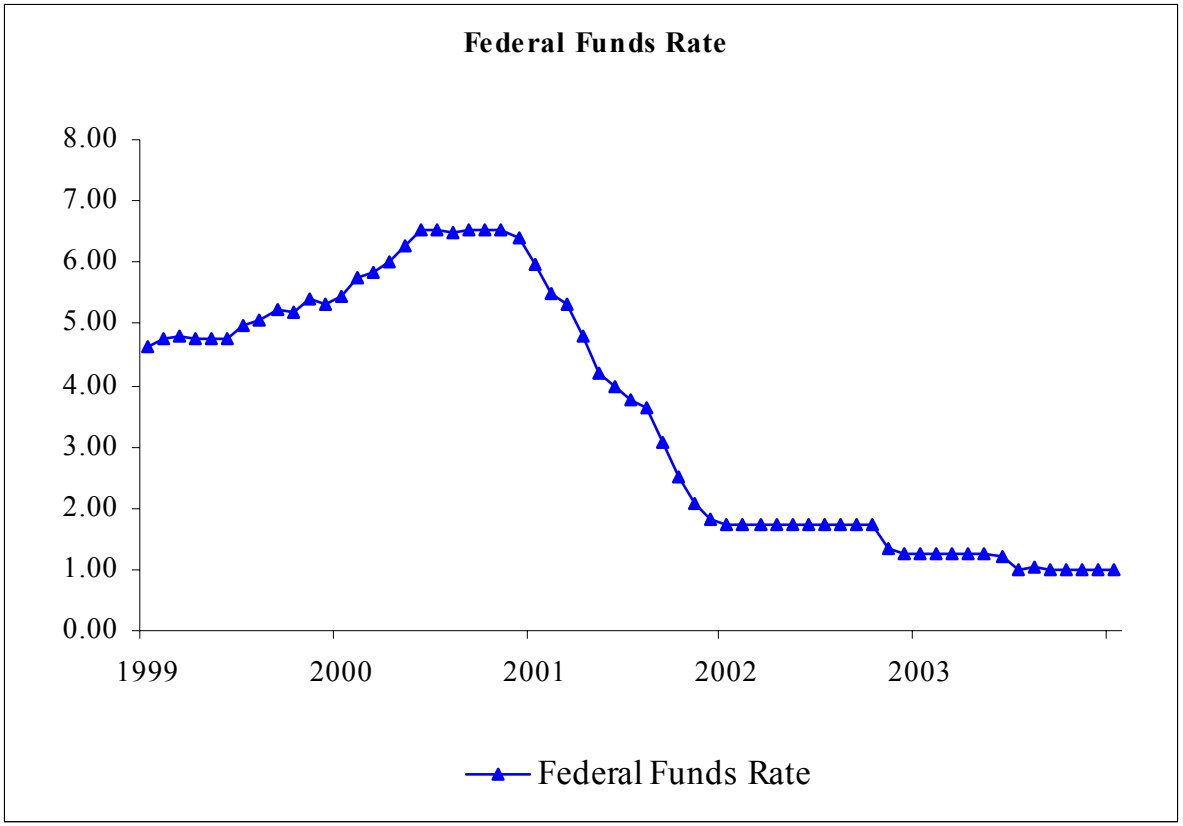
Bernanke and Mihov (1998, p. 899): "[For] practitioners looking for a simple indicator of monetary policy stance, our results suggest that using the federal funds rate… in the most recent period will give reasonable results."

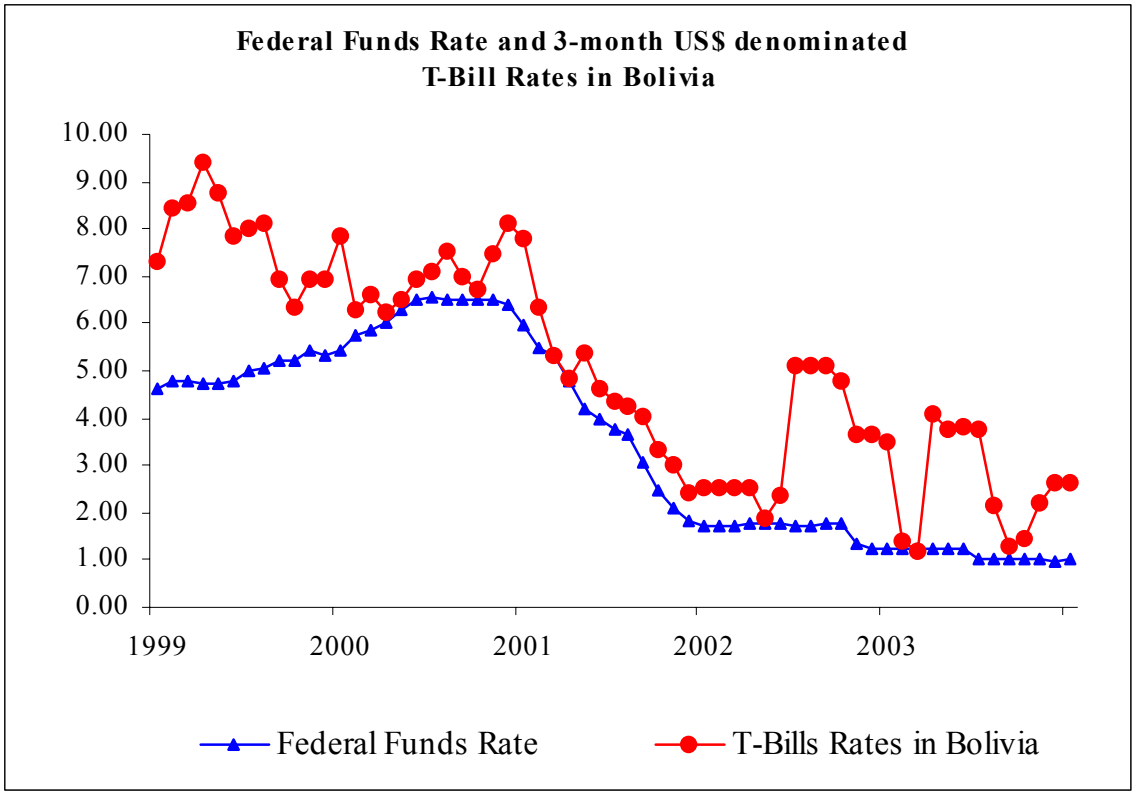
Monetary Policy

- Between 1999 and 2003 there was substantial variation in the federal funds rate



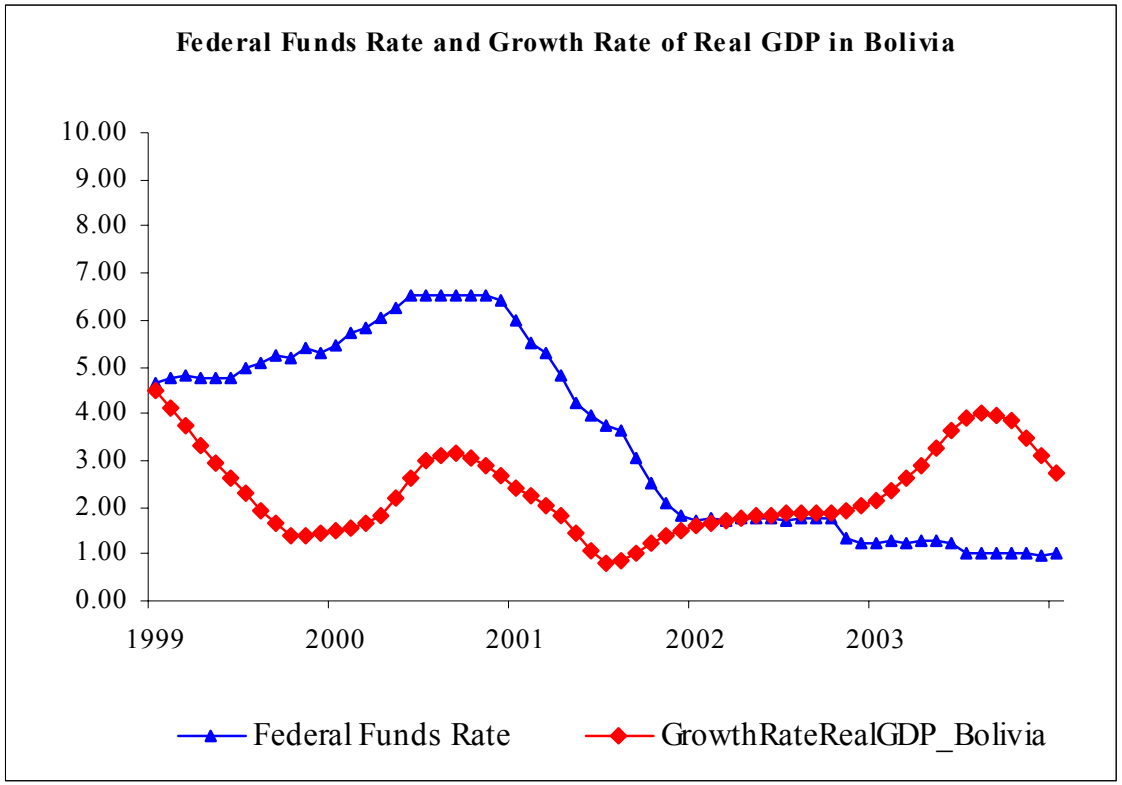
Monetary Policy

- Corr(Federal Funds Rate, US$ Denominated T-Bill Rates in Bolivia) = 0.87



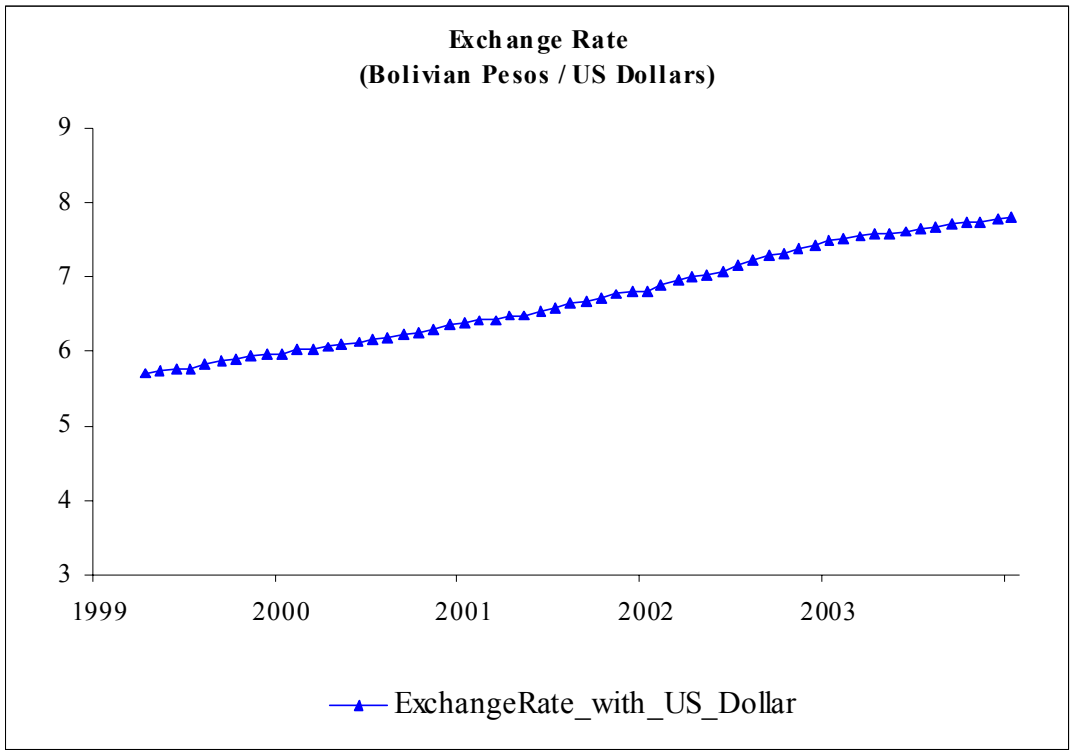
Monetary Policy

- Corr(Federal Funds Rate, Growth Rate of GDP in Bolivia) = -0.14



Monetary Policy

- The exchange rate was stable, with the Bolivian Pesos depreciating at a constant rate over the US$



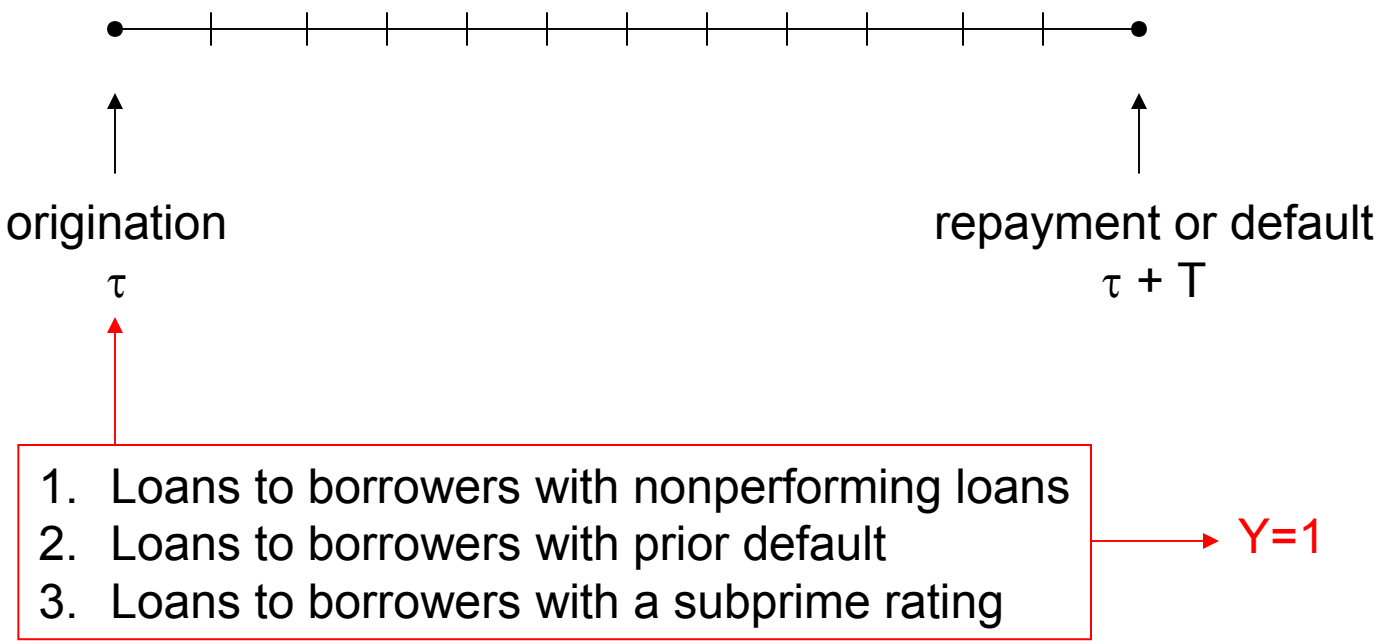
Bank Risk-Taking

- To assess bank risk-taking we will use Bolivian public credit registry (includes detailed information on all loans granted by any bank operating in the country)

Measures:
Ex Ante & Ex Post

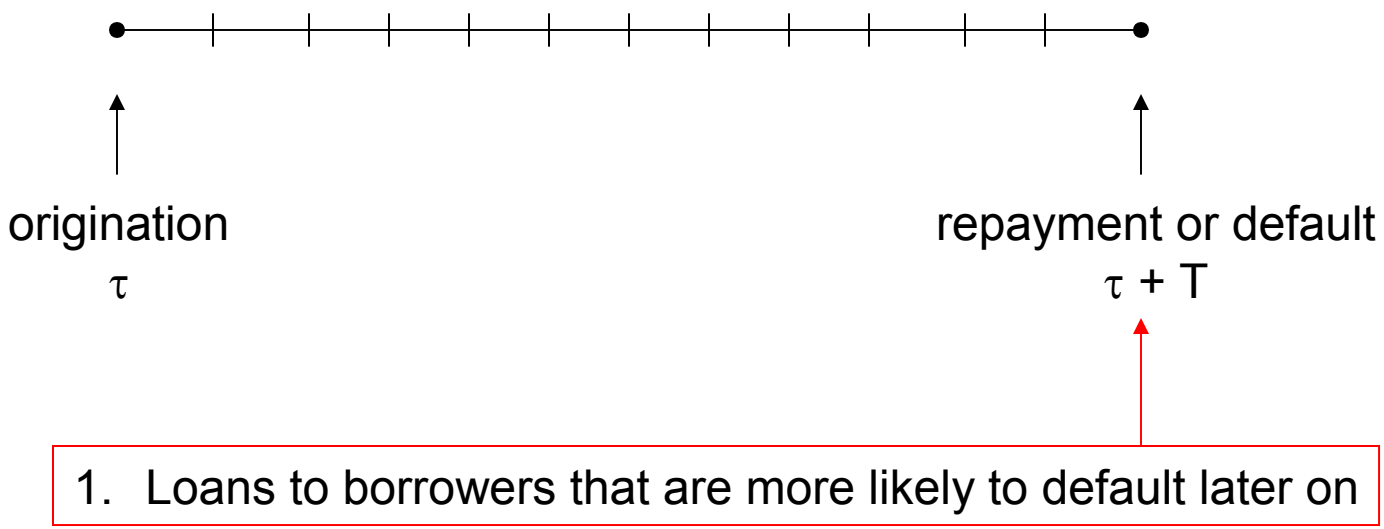
Bank Risk-Taking: Ex Ante

- For every loan origination during the sample period we observe the entire loan-spell on a monthly basis:



Bank Risk-Taking: Ex Post

- For every loan origination during the sample period we observe the entire loan-spell on a monthly basis:



Model: Ex Ante

- Estimate the following Probit model:

$$P(Y=1) = F(\alpha + \beta FF_{\tau-1} + \gamma Controls_{\tau-1})$$

- Working Hypothesis: if an accommodative monetary policy increases bank's risk-taking we should find that $\beta < 0$

- *Controls:*
  - Bank Characteristics at τ-1
  - Macroeconomic Conditions at τ-1
  - Borrower Characteristics at τ-1
  - Bank-Firm Relationship Characteristics at τ-1
  - Contract Characteristics at τ

→ Pool of applicants and other factors that affect bank's risk-taking

Model: Ex Post

- Estimate probability of default in period *t*, conditional on surviving *t*:

$$\lambda(t) = \lambda_0(t) \exp(\alpha + \beta FF_{\tau-1} + \gamma Controls_{\tau-1+t})$$

- Working Hypothesis: if an accommodative monetary policy increases bank's risk-taking we should find that $\beta < 0$

- *Controls:*
  - Monetary policy stance at τ-1+t
  - Macroeconomic Conditions at τ-1+t
  - Bank Characteristics at τ-1
  - Borrower Characteristics at τ-1
  - Bank-Firm Relationship Characteristics at τ-1
  - Loan Characteristics at τ

→ affect loan performance and may be correlated with $FF_{\tau-1}$

Sample

- Period: 1999:03 – 2003:12
- Commercial loans to Firms
  - US$ denominated loans
  - Installment or single-payment loans
- Approximately 30,000 loan originations to 2,600 different firms

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Similar analysis for Spain:
The results that I am about to present are very similar…
even if they are drawn from an entirely different financial system

(Main) Results

- Ex-Ante – Table 3

Independent Variables	I	II	III
Model	Probit	Probit	Probit
Dependent Variable	Current NPL	Past Default	Subprime
Monetary Conditions			
Federal Funds $_{-1}$	-0.092 [0.025] ***	-0.145 [0.064] **	-0.059 [0.030] **
1 st. dev increase in $FF_{\tau-1}$ (1.96%)	51%	87%	29%

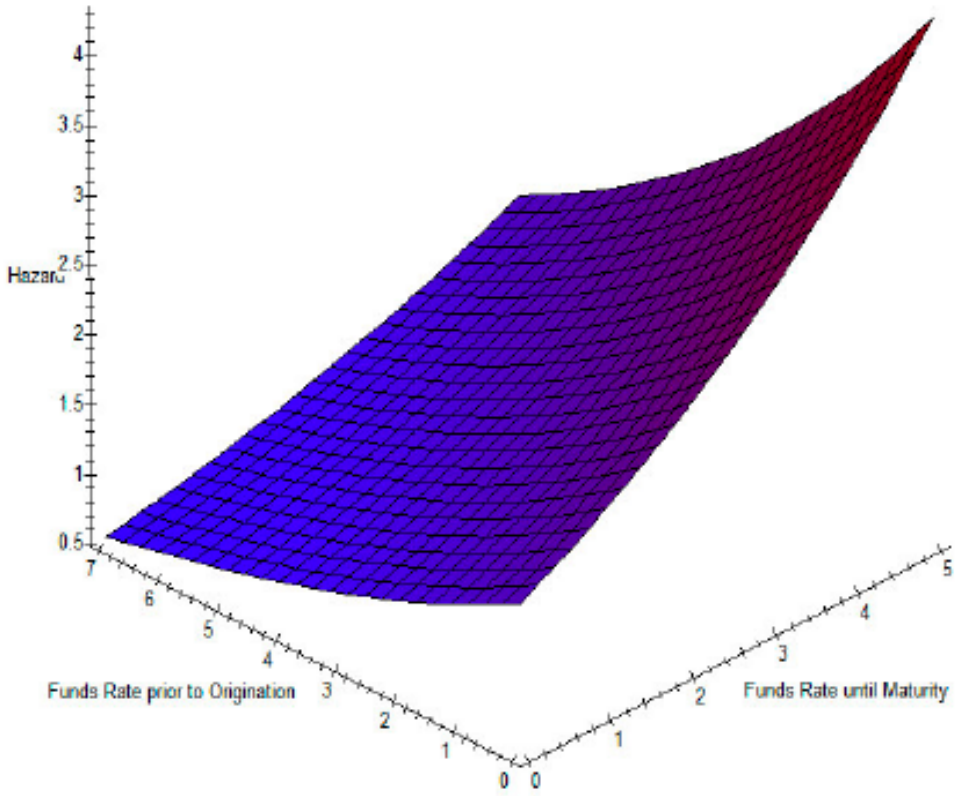
- Ex Post – Table 2

Independent Variables	I	II	III
Monetary Conditions			
Federal Funds $_{-1}$	-0.137 [0.056] **	-0.150 [0.057] ***	-0.133 [0.057] **
Federal Funds $_{+t}$		0.195 [0.092] **	
Federal Funds $_{+t}$			1.056 [0.417] **

  - Expansionary monetary policy encourages the initiation of riskier loans, but decreases the hazard rate of outstanding loans!!!

Implications

- How different combinations of $FF_{\tau-1}$ and $FF_{\tau-1+t}$ affect the hazard rate (Figure 4)



Implications

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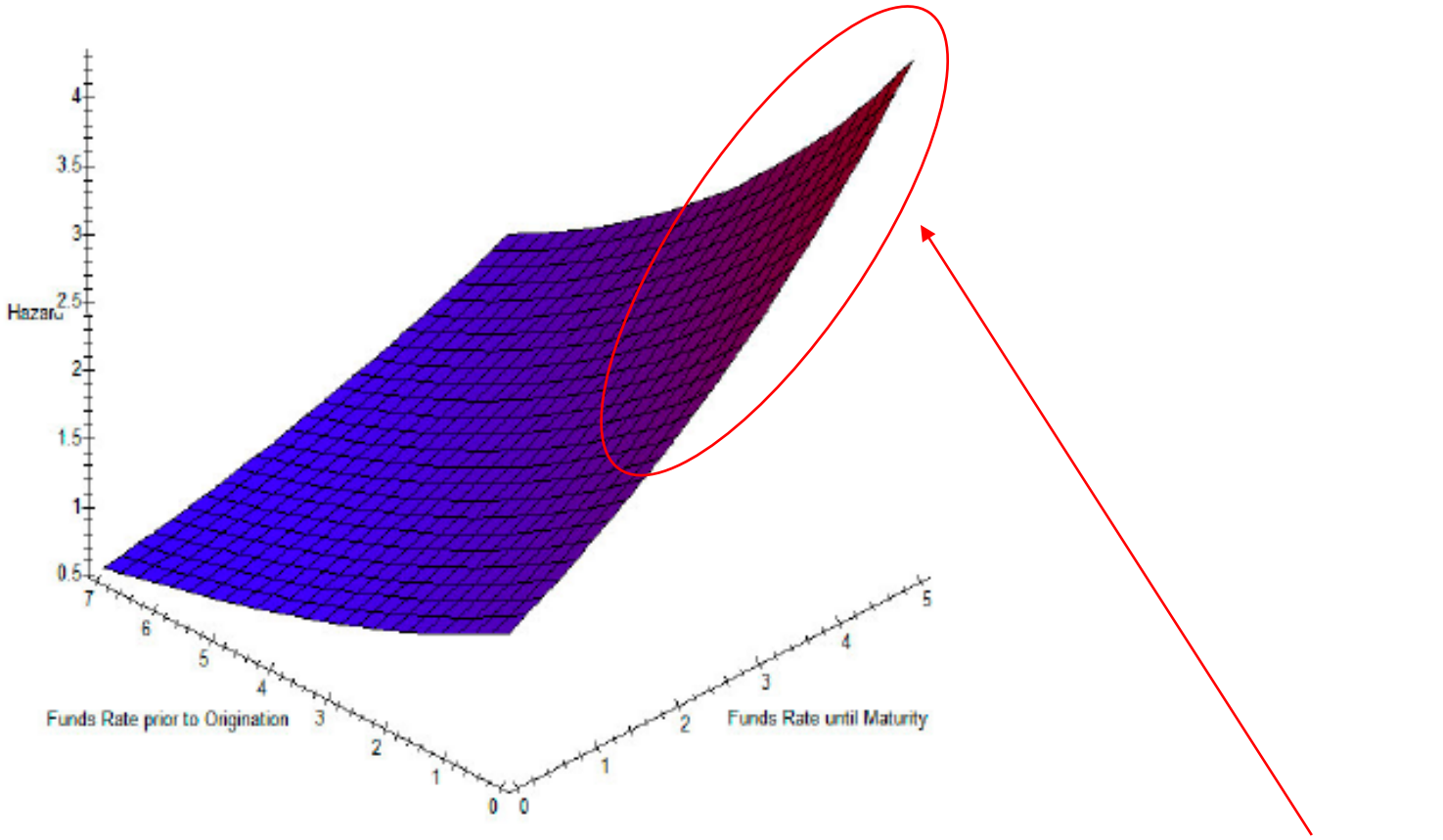

Low rates for a prolonged period of time, followed by substantially higher rates, lead to high default rates

(Additional) Results

- Bank Characteristics
  - Larger banks, more loans, more capital, more nonperforming loans are more likely to originate riskier loans…
- Market Conditions
  - Banks in less concentrated markets are more likely to originate riskier loans
    - Consistent also with the findings of Dell'Arricia, Igan, and Laeven (2008)
- Loan Conditions
  - Riskier loans have higher rates, more likely to be collateralized, suggesting that banks adjust loan conditions when they take risk

Demand vs. Supply

1. Cross-sectional analysis
2. Pricing of risk

Cross-Sectional

- Interact $FF_{\tau-1}$ with key bank characteristics
  - Banks with more liquidity take more risk when interest rates are low
  - Banks with more foreign financing take on less risk when interest rates are low, … either because foreign financial institutions discipline more or because only the more prudent banks have access to foreign funds
  - **Also:** larger banks, banks with less capital, and banks with higher non-performing loans ratios take more risk when rates are low…

Pricing of Risk

- Decompose the hazard rate into two components:
  - HR_{mp}: The stance of monetary policy at origination
  - HR_{other}: Everything else…

- Examine how the loan interest rates relate to these two components risk:

$$\text{Loan interest rate} = \alpha + \beta * \text{LIBOR} + \gamma * HR_{other} + \delta * HR_{mp} + \varepsilon$$

- HR_{other} = estimated hazard rate when all variables are set at their actual values except for $FF_{\tau-1}$ which is set to some fixed value for all loans (sample median)

- HR_{mp} = the estimated hazard when all variables are at their actual values – HR_{other}

- Working Hypothesis = if the effect of monetary policy on the origination of riskier loans is due to a supply effect, then $\gamma > \delta$.

Pricing of Risk

- Decompose the hazard rate into two components:
  - HR_{mp}: The stance of monetary policy at origination
  - HR_{other}: Everything else…

Neutral Hazard Rate

Δ Neutral Hazard Rate

- Examine how the loan interest rates relate to these two components risk:

$$\text{Loan interest rate} = \alpha + \beta * \text{LIBOR} + \gamma * HR_{other} + \delta * HR_{mp} + \varepsilon$$

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- HR_{mp} = the estimated hazard when all variables are at their actual values – HR_{other}

- Working Hypothesis = if the effect of monetary policy on the origination of riskier loans is due to a supply effect, then $\gamma > \delta$.

Pricing of Risk

- Ex post - Table 4

Independent Variables	I	
Neutral Hazard Rate	3.708 [1.635]	**
Neutral Hazard Rate	-4.138 [2.193]	*
Neutral Hazard Rate * (Liquid Assets/Assets)		
Neutral Hazard Rate * (Foreign Funds/Assets)		
LIBOR	0.624 [0.009]	***
Constant	10.785 [0.043]	***
Number of Loan Observations	23,412	

  - Component of the hazard rate explained by monetary policy has a negative effect on the loan rate, while the remaining part has a positive effect

Pricing of Risk

- Ex post - Table 4

Independent Variables	I		II	
Neutral Hazard Rate	3.708 [1.635]	**	3.138 [1.551]	**
Neutral Hazard Rate	-4.138 [2.193]	*	17.785 [4.014]	***
Neutral Hazard Rate * (Liquid Assets/Assets)			-0.691 [0.103]	***
Neutral Hazard Rate * (Foreign Funds/Assets)				
LIBOR	0.624 [0.009]	***	0.646 [0.009]	***
Constant	10.785 [0.043]	***	10.675 [0.046]	***
Number of Loan Observations	23,412		23,412	

  - Component of the hazard rate explained by monetary policy has a negative effect on the loan rate, while the remaining part has a positive effect

  - Banks with more liquidity price the increment in the hazard rate less sharply

Pricing of Risk

- Ex post - Table 4

Independent Variables	I		II		III	
Neutral Hazard Rate	3.708 [1.635]	**	3.138 [1.551]	**	3.691 [1.638]	**
Neutral Hazard Rate	-4.138 [2.193]	*	17.785 [4.014]	***	-5.962 [2.300]	***
Neutral Hazard Rate * (Liquid Assets/Assets)			-0.691 [0.103]	***		
Neutral Hazard Rate * (Foreign Funds/Assets)					0.322 [0.126]	**
LIBOR	0.624 [0.009]	***	0.646 [0.009]	***	0.624 [0.009]	***
Constant	10.785 [0.043]	***	10.675 [0.046]	***	10.789 [0.043]	***
Number of Loan Observations	23,412		23,412		23,412	

  - Component of the hazard rate explained by monetary policy has a negative effect on the loan rate, while the remaining part has a positive effect
  - Banks with more liquidity price the increment in the hazard rate less sharply
  - The opposite is true for banks that borrow more from foreign institutions

Conclusion

Factors that contributed to the Subprime Crisis:

Rapid credit growth

Untested financial innovations

Government subsidies

Agency problems in asset management

Accommodative monetary policy

Conclusion

Factors that contributed to the Subprime Crisis:

Rapid credit growth

Untested financial innovations

Government subsidies

Agency problems in asset management

Accommodative monetary policy

… followed by a contractionary monetary policy

Conclusion

- **This is one factor among many…**
- **On its own, we doubt it could cause a crisis as large as this one…**
  - It doesn't in our sample… (but our sample draws from a recession when banks were contracting, so our estimates should be viewed as a lower bound on what an accommodative monetary policy can enable)
  - It doesn't during other periods in the U.S. (see Mian and Sufi (2008) for evidence during the 1990-1994 period when the economy was coming out of a recession and monetary policy was accommodative)
- **But, from a historical perspective, it is a recurrent feature preceding many crises over the last 200 years (see Calomiris (2008))**