The Transmission of Monetary Policy through Bank Lending: The Floating Rate Channel

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-
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Monetary Policy Pass-through and Credit Markets
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Motivation and Question

- Transmission of monetary policy to real economy through financial intermediation
  - Existing literature:
    - ⋆ *Bank lending channel* (Bernanke and Blinder (1988), Bernanke and Gertler (1995), Stein (1998), and Bolton and Freixas (2006)), *bank risk-taking channel* (Adrian and Shin (2009), Borio and Zhu (2008), Dell'Ariccia, Laeven and Marquez (2014), Jimenez, Ongena, Peydro and Saurina (2014), Angeloni, Faia, and Lo Duca (2015)),....
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- Novel transmission mechanism (**floating rate channel**):
  - Monetary policy affects interest expense of *existing* loans $\Longrightarrow$ firms' liquidity positions and balance sheet strength $\Rightarrow$ ability to finance future projects
  - Component of *firm balance sheet channel* (Gertler and Gilchrist (1994), Bernanke and Gertler (1995), Mishkin (1995))

This Paper

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2. **Provide evidence of the floating rate channel**:
   - Compare reaction to monetary policy of firms that use bank debt but have different interest rate hedging policies
     - Create new database on firms' hedging activity, merge it with new Capital IQ database of usage of bank debt and floating rate debt
   - Study stock price, cash holdings, sales, inventory and fixed capital investment

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- Bank debt usage increases sensitivity of firms to monetary policy significantly
  - Strongest: subsample of *unhedged* and *financially constrained* bank debt users

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  - Strongest: subsample of *unhedged* and *financially constrained* bank debt users
- Effect disappears at ZLB: new limitation of unconventional monetary policy
- Mechanism is of a similar order of macroeconomic relevance as traditional bank lending channel

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- Business loans ($7.5 trillion) mostly floating rate (LIBOR, Prime Rate)
  - Corporate loans: $2.5 trillion
    - Our sample: 76% floating rate; FR Y-14 supervisory data: 75% floating rate; Faulkender (2005): 90% floating rate; syndicated loans (reported in Aslan and Kumar (2012)): $\sim$ 100% floating rate
  - Noncorporate business loans: $4.5 trillion
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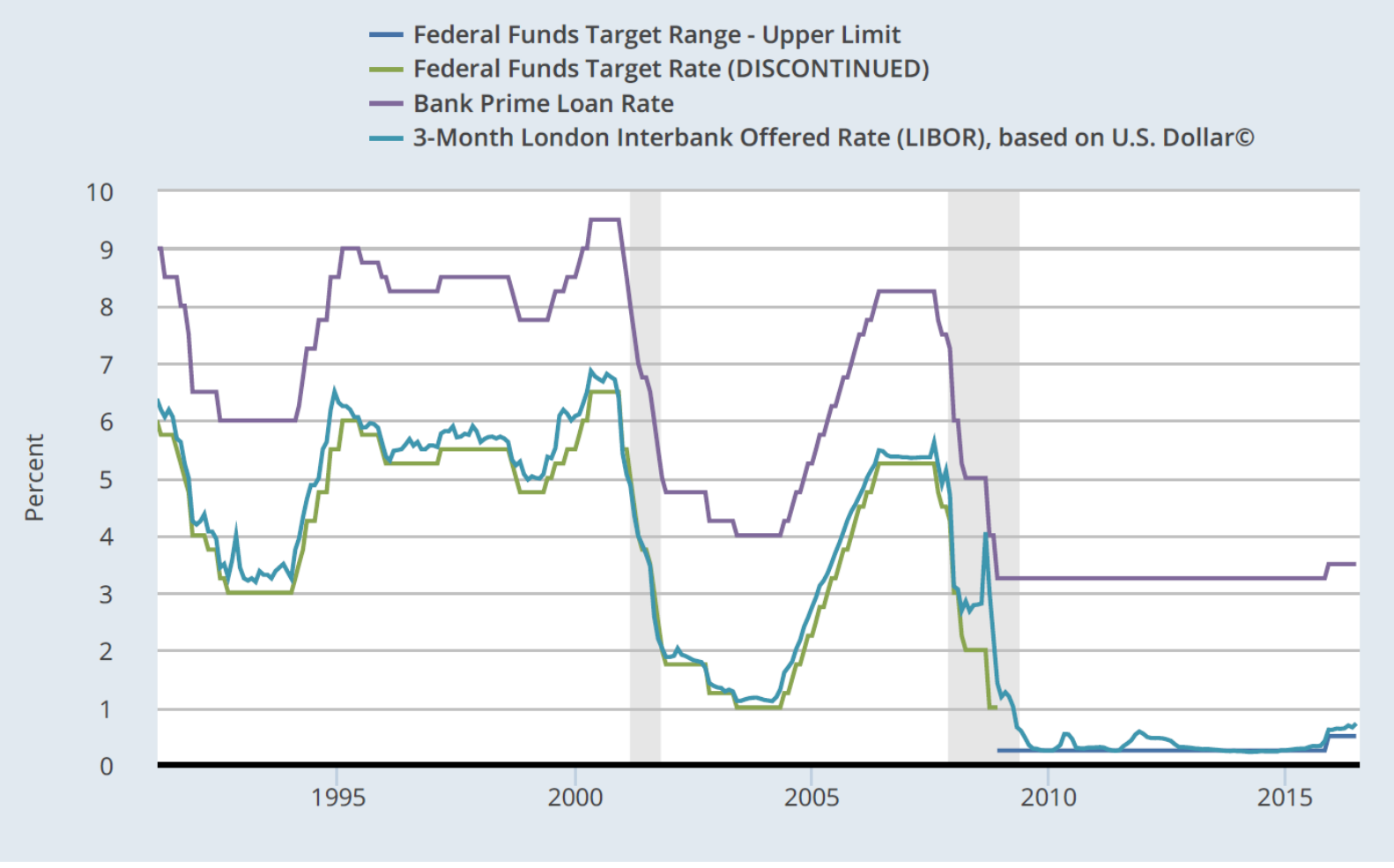
- Importance? Aggregate U.S. business nonfinancial debt exposed to rate fluctuations $\approx$ 20-25% of GDP ($18.0 trn) in 2015.

Stylized Fact 2: Reference Rates and Monetary Policy



THEORY

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  - Two-period (three-date) economy ($t = \{0, 1, 2\}$)

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- Finance
  - K_0 financed exclusively with long-term debt

$$K_0 = L_0 + B_0 = lK_0 + (1 - l) K_0$$

  - Internal funds end of first period ($t = 1$)

$$N_1 = f(K_0) - r_c B_0 - r_1 L_0$$

  - Firm can borrow b_1 in $t = 1$, subject to

$$b_1 \leq \bar{b},$$

    so that firm invests again in $t = 1$ an amount

$$K_1 = N_1 + b_1 - d_1.$$

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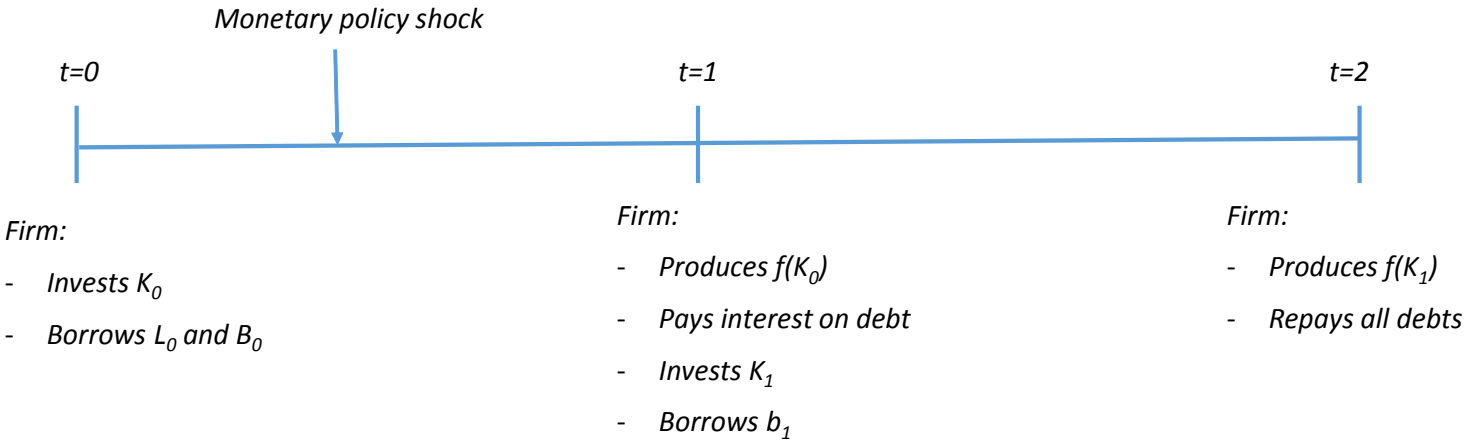

- Financially constrained firm in $t = 1$ ($b = \bar{b}$) will optimally set $d_1 = 0$ and invest

$$K_1 = N_1 + \bar{b}$$

- Unconstrained firm instead invests according to

$$f'(K_1) = 1 + r_2$$

Simple 2-period Model

Proposition *Floating rate debt usage increases the monetary policy sensitivity of stock prices and investment of financially constrained firms. In particular,*
(i) floating rate debt usage increases the policy rate sensitivity of stock prices for all firms, but the effect is stronger for financially constrained firms, and
(ii) floating rate debt usage increases the policy rate sensitivity of investment (K_1) of financially constrained firms, while it does not affect the sensitivity of investment of financially unconstrained firms

- - -

- Investment of financially constrained:

$$\frac{\partial \ln K_1}{\partial \ln R_1 \partial I} = -\frac{K_0}{K_1},$$

while investment of financially unconstrained:

$$\frac{\partial \ln K_1}{\partial \ln R_1 \partial I} = 0$$

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- Stock value reaction:

$$\frac{\partial^2 \ln V_0}{\partial \ln R_1 \partial I} = -\frac{K_0}{V_0} \frac{f'(K_1)}{R_2},$$

where

$$V_0 = \frac{f(K_1) - R_2(K_0 + b_1)}{R_1 R_2}$$

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  - Run regressions on simulated data
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- Dynamic model suggests a very general notion of financial constraints is sufficient to generate our results

EVIDENCE

Data Sources and Sample

- Sample: U.S. publicly listed firms, 2003-2008
  - No detailed firm debt structure data pre 2003
  - No conventional monetary policy post 2008
  - Extend sample until 2011 to analyze unconventional monetary policy
- Firm characteristics: Capital IQ and Compustat
- Stock returns: CRSP
- Monetary policy surprises: calculated as in Kuttner (2001) and Bernanke and Kuttner (2005)
- New database on interest rate hedging activities of U.S. firms using text-search algorithm that scans 10-K corporate SEC filings

DESCRIPTIVE STATISTICS

HEDGED AND UNHEDGED BANK DEBT USERS VS NON BANK DEBT USERS

			Leveraged Firms w Bank Debt	
	Entire Sample	Leveraged Firms w/out Bank Debt	Hedgers	Nonhedgers
	Mean	Mean	Mean	Mean
Bank Debt /At	7.22%	0.00%	15.52%	10.33%
Bank Debt / Total Debt	37.51%	0.00%	50.35%	58.89%
Float-Rate Debt / Tot. Debt	38.31%	8.95%	47.04%	50.62%
Short-Term Debt /At	2.55%	1.85%	3.65%	3.71%
Profitability	4.94%	4.35%	8.91%	4.31%
Size (Total Assets, Million $)	4,274.32	5,404.67	5,071.905	4,677.73
Book Leverage	28.15%	26.87%	45.19%	31.07%
Earnings-Interest Rate Sensitivity	-13.23%	-11.82%	-15.63%	-12.98%
Rated Dummy	32.98%	36.23%	57%	28.76%
Market-to-Book Assets	1.98	2.13	1.42	1.79
Cash/At	22.35%	27.19%	7.44%	17.44%
CAPM Beta (Monthly)	1.32	1.37	1.11	1.35
Age	16.78	18.08	20.20	16.63
Hedging Dummy	34.80%	26.46%	100.00%	0.00%
Observations (annual)	9,746	2,509	2,463	2,647

Floating Rate Channel: Empirical Specification

- Main regression specification

$$\begin{aligned} Dep_{i,t} \quad = \quad & \beta_0 + \beta_1 Surprise_t + \beta_2 \left(BankDebt/At\right)_{i,t-1} \\ & + \beta_3 Surprise_t * \left(BankDebt/At\right)_{i,t-1} \\ & + \gamma Controls_{i,t-1} + \lambda Surprise_t * Controls_{i,t-1} + \varepsilon_{i,t}, \end{aligned}$$

  where $Dep_{i,t}$ is any firm-level outcome, and $Surprise_t$ is a monetary policy shock

- Coefficient of interest is β_3

- Restrict sample to firms with floating-rate debt/assets $> 1\%$

- Run specification in 4 subsamples: hedgers vs non hedgers, financially constrained vs unconstrained

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- Predictions:
  - $\beta_1 < 0$: tighter monetary policy has a negative impact on stock returns, sales, investment,...
  - $\beta_3 < 0$: bank debt usage increases firm responsiveness to monetary policy
  - $\beta_{3,unhedged} - \beta_{3,hedged} < 0$: responsiveness of unhedged bank debt users stronger

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  where $Dep_{i,t}$ is any firm-level outcome, and $Surprise_t$ is a monetary policy shock

- Main hypothesis: exposure to interest rate risk through bank debt usage has a significantly stronger impact for financially constrained firms

$$\left(\beta_{3,unhedged} - \beta_{3,hedged}\right)_{constrained} < \left(\beta_{3,unhedged} - \beta_{3,hedged}\right)_{unconstrained}$$

1. Stock Price Evidence

Stock Price Evidence

- Specification

$$\begin{aligned} Ret_{i,t} &= \beta_0 + \beta_1 Surprise_t + \beta_2 \left(BankDebt/At\right)_{i,t-1} \\ &\quad + \beta_3 Surprise_t * \left(BankDebt/At\right)_{i,t-1} \\ &\quad + \gamma Controls_{i,t-1} + \lambda Surprise_t * Controls_{i,t-1} + \varepsilon_{i,t}, \end{aligned}$$

  where dependent variable = firm i's stock price change $Ret_{i,t}$ over the day t of a monetary policy shock $Surprise_t$ and day after
  - takes more than a day for the full effect to be incorporated in stock prices

- $Controls_{i,t-1}$: book leverage, firm size, market-to-book ratio, profitability, and interest rate sensitivity

- Run specification in 4 subsamples: hedgers vs non hedgers, financially constrained vs unconstrained

Stock Price Evidence

VARIABLES	(1) Non-Hedgers OLD	(2) Non-Hedgers YOUNG	(3) Hedgers OLD	(4) Hedgers YOUNG
Surprise	-6.23***	-3.05	-6.33**	-7.03***
	(-3.73)	(-1.48)	(-2.52)	(-2.74)
Surprise*(BankDebt/At)	-20.30	-56.73***	3.81	3.20
	(-1.49)	(-3.49)	(0.37)	(0.29)
Surprise*(BankDebt/At)*Constrained	-36.43*		-0.61	
	(-1.74)		(-0.04)	
Firm FE	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES
Observations	6,713	5,075	7,303	5,032
R-squared	0.01	0.01	0.01	0.02
Number of gvkey	432	409	407	337

- Effect of bank debt usage on the responsiveness to monetary policy concentrated in financially constrained unhedged bank debt users

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- Surprise 1% increase in feds funds rate causes stock price of firm with average bank debt (7.22% of assets) to decrease about 5%
- 1 s.d. increase in bank debt usage (0.114) causes stock price to decrease 6.5 $(= -56.7 * 0.114)$ percentage points *more* in response to same surprise, in sample of *unhedged constrained*

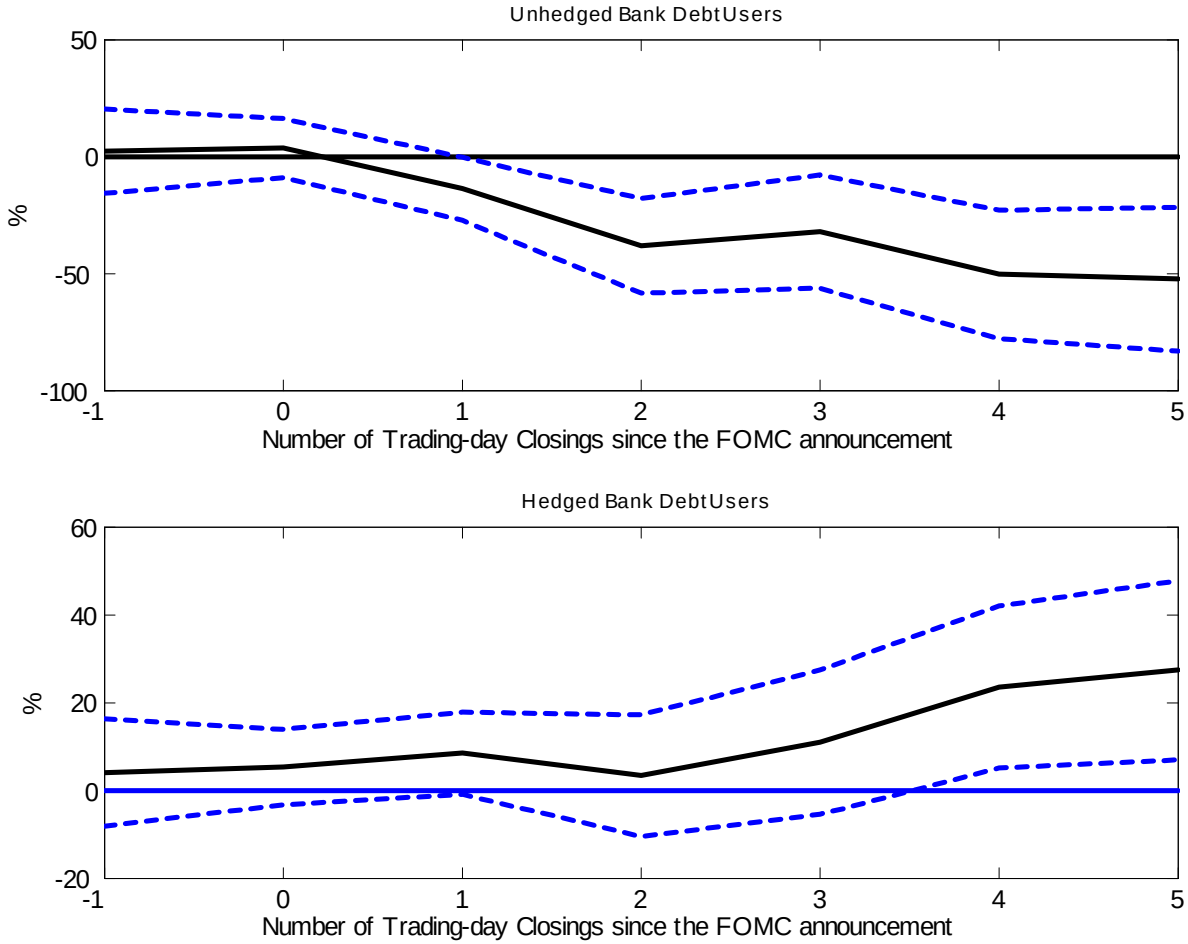
Robustness (I)

- Additional firm level controls: cash-flow vol, tangibility, cash holdings
- CAPM correction of stock returns
- Firm/industry/year fixed effects
- Error clustering at industry and Fed event date level
- Alternative financial constraints measures: firm age, firm size, Whited-Wu index, Hadlock and Pierce (2012) index
- Instrumental variable regression for bank debt usage
  - visibility (membership of NYSE or SP500), uniqueness (% rated in the same industry), tangibility
  - Faulkender and Petersen (2008, RFS), Santos and Winton (2008,JF)
- Debt maturity
  - Could be simple interest channel because bank debt is relatively short term: but higher short-term debt does not imply higher responsiveness

Robustness (II)

- Replace bank debt with floating rate debt variable from Capital IQ
- Control for bank characteristics, by using LPC Dealscan data to construct a database of bank-firm relationships
- Restricting to FOMC statements with non-positive rate changes
- Placebo: replace dependent variable with the last two-day returns before the FOMC
- Instrumental variables analysis for hedging
  - Instrument for hedging: tax convexity (Graham and Smith (1999), Campello, Lin, Ma, and Zou (2011))
  - Relevance condition: incentive to hedge
  - Exclusion restriction: unlikely to have direct first-order effect on sensitivity of stock prices to monetary policy

Results: Cumulative Effects 5-day Horizon



- All additional stock price decline due to use of bank debt in sample of unhedged

2. Evidence Using Balance Sheet Variables

Floating Rate Channel: Additional Evidence and Real Implications

- **Questions**:
  - Is stronger effect of floating rate channel for financially constrained firms associated with financial and real outcomes in the affected firms?
  - What is the economic magnitude and duration of effects of the floating rate channel?
- Focus on implications for *interest rate coverage ratio*, *cash holdings*, *inventory investment*, *fixed investment*, and *sales*
- Regression:

$$\begin{aligned}\Delta Dep_{t-1,t+x} &= \beta_0 + \beta_1 \widehat{Change}_t \\ &+ \beta_2 \left(BankDebt/At\right)_{t-1} + \beta_3 \widehat{Change}_t \left(BankDebt/At\right)_{t-1} \\ &+ \gamma Controls_{t-1} + \lambda \widehat{Change}_t \left(Controls_{t-1}\right) + \varepsilon_t,\end{aligned}$$

  - $\widehat{Change}_t$ is cumulative quarterly change in interest rate
  - Study effects up to 6 quarters ahead

Impact on Firms' Liquidity Position

- Explore floating rate mechanism
  - operates by impacting liquidity position of firms
- Impact on interest rate coverage ratio:

$$\text{coverage ratio} = \frac{\text{interest expense}}{\text{cash-flow} + \text{interest expense}}$$

  - often used proxy for firm financial distress (Whited (1992), Gertler and Gilchrist (1994), and Campello and Chen (2010), for example)
  - high coverage ratio indicates firm may face difficulties trying to meet interest rate payments
- Impact on cash holdings:

$$Cash_t = \frac{(\text{Cash \& S-t inv})_t}{\text{Assets}_{t-1}}.$$

Impact on Firms' Liquidity Position: Coverage Ratio

Dep variable: $CoverageRatio_{t+x}$ - $CoverageRatio_{t-1}$	(1) x=1 quarter ahead	(2) x=2 quarters ahead	(3) x=3 quarters ahead	(4) x=4 quarters ahead	(5) x=5 quarters ahead	(6) x=6 quarters ahead
Non-hedgers						
(Sum) Change* BankDebt/At	-0.11	3.56	6.04*	4.69	8.72**	7.88
	(-0.04)	(1.00)	(1.71)	(1.46)	(2.28)	(1.14)
Hedgers	-3.05	-0.18	1.82	-1.06	-0.33	-3.89
(Sum) Change* BankDebt/At	(-0.71)	(-0.08)	(0.54)	(-0.29)	(-0.15)	(-1.15)
Hedger(Sum) Change* BankDebt/At*	-2.93	-3.74	-4.21	-5.74	-9.05**	-11.77**
	(-0.72)	(-0.87)	(-0.76)	(-1.01)	(-1.98)	(-2.08)
Firm Controls	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES	YES	YES
Observations (non-hedgers regressions)	7,669	7,511	7,332	7,193	7,076	6,963
Observations (hedgers regressions)	7,445	7,351	7,238	7,134	7,036	6,941

- 100bp tightening associated with increase in coverage ratio of 0.09 (0.12) for an unhedged firm fully financed with bank debt, relative to an identical but hedged firm, at a horizon of 5 (6) quarters

Impact on Firms' Liquidity Position: Cash Holdings

Dependent variable: $(Cash_{t+x} - Cash_{t-1})/Assets_{t-1}$				
	x=6 quarters ahead			
	Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
(Sum) Change (*ommited*)				
BankDebt/At	420.47	496.87	358.07*	241.59
	(0.81)	(1.36)	(1.74)	(1.48)
(Sum) Change *BankDebt/At	-7.06**	2.39	-1.00	1.00
	(-2.37)	(1.54)	(-0.57)	(1.06)
(Sum) Change BankDebt/At*Constrained*	-9.45***		-1.99	
	(-3.15)		(-1.08)	
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Firm FE	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES
Observations	3,663	3,667	1,934	5,075

- 100bp tightening associated with decrease in cash holdings of 9.5 percentage points for an unhedged financially constrained firm fully financed with bank debt, relative to an identical but unconstrained firm, at a horizon of 6 quarters
- Constraints do not affect responsiveness of cash holdings of hedged bank debt users

Floating Rate Channel: Real Implications

- Are floating rate channel effects identified using stock prices, interest rate coverage ratio, and cash holdings, also associated with significant real outcomes?
- Focus on
  - inventory investment: nature of our floating rate mechanism as a liquidity event means it is particularly likely to manifest itself in inventory investment, a very liquid components of firms' balance sheets
  - sales: we interpret, in line with existing literature, as a proxy for firm-level output (Gertler and Gilchrist (1994), Bond, Elston, Mairesse, and Mulkay (2003))
  - fixed investment: difficulty of finding a relationship between fixed investment and interest rates (Caballero (1999), Sharpe and Suarez (2014)), suggesting that impact of monetary policy on fixed investment might occur mostly through indirect channels such as ours

Floating Rate Channel: Inventory Investment

Dependent variable (in basis points): 10,000*(ln(Inventory$_{t+x}$) - ln(Inventory$_{t-1}$))				
	x=6 quarters ahead			
	Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
BankDebt/At	1,204.72	-2,817.44	-473.70	1,068.42
	(0.60)	(-1.60)	(-0.38)	(0.84)
(Sum) Change	-21.20***	0.99	5.31	-2.44
*BankDebt/At	(-2.83)	(0.09)	(1.07)	(-0.49)
(Sum) Change BankDebt/At*Constrained*	-22.18*		7.74	
	(-1.72)		(1.39)	
ln(Inventory$_{t-1}$/ Sales$_{t-1}$)	-3,626.21***	-4,301.13***	-6,462.38***	-1,388.76
	(-10.78)	(-7.70)	(-9.68)	(-1.53)
ln(Sales$_{t-1,t+x}$)	0.54***	0.60***	0.87***	0.82***
	(11.63)	(12.14)	(10.30)	(15.00)
Cash$_{t-1}$/At$_{t-1}$	6,494.47***	7,590.74***	15,304.41***	7,736.34***
	(4.78)	(5.36)	(4.85)	(3.79)
Firm Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES
Observations	2,863	3,082	1,371	4,130

- For unhedged bank debt users, constraints matter (statistically and economically) significantly for the impact on inventory investment of an increase in the fed policy rate. No significant effect for hedged bank debt users.

Floating Rate Channel: Sales

Dependent variable (in basis points): 10,000*(ln(Sales$_{t, t+x}$) - ln(Sales$_{t-x-1, t-1}$))				
	x=6 quarters ahead			
	Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
BankDebt/At	-2,671.31***	-392.00	938.17**	-516.16
	(-2.95)	(-0.43)	(2.03)	(-0.95)
(Sum) Change *BankDebt/At	-6.29	16.89**	-5.51***	6.31**
	(-1.60)	(2.23)	(-2.87)	(2.39)
(Sum) Change BankDebt/At*Constrained*	-23.18***		-11.82***	
	(-3.59)		(-3.84)	
Firm Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES
Observations	3,664	3,671	1,940	5,078

- Being financially constrained has double the impact on sensitivity of sales to monetary policy of unhedged bank debt users than of hedged

Floating Rate Channel: Fixed Investment

Dependent variable (in basis points): 10,000*(ln(PPE_{t+x}) - ln(PPE_{t-1}))				
	x=6 quarters ahead			
	Non-hedgers		Hedgers	
	Constrained (high HP)	Unconstrained (low HP)	Constrained (high HP)	Unconstrained (low HP)
BankDebt/At	-717.06	-483.32	831.46	-245.13
	(-0.34)	(-0.49)	(0.97)	(-0.56)
(Sum) Change *BankDebt/At	-1.39	14.44***	1.52	1.30
	(-0.20)	(2.84)	(0.74)	(0.62)
(Sum) Change BankDebt/At*Constrained*	-15.82**		0.21	
	(-2.03)		(0.07)	
Market-to-Book	330.31*	481.26***	-26.30	866.56***
	(1.93)	(5.27)	(-0.13)	(7.30)
CashFlow/Capital	11,226.57***	5,846.00***	3,430.26	5,405.10***
	(2.93)	(2.91)	(1.33)	(3.26)
Lagged Investment/Capital	17,210.22***	13,567.38***	9,220.25***	12,262.66***
	(5.06)	(8.17)	(4.53)	(6.72)
Firm Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Change*Firm Controls	YES	YES	YES	YES
Year-quarter dummies	YES	YES	YES	YES
Industry-Quarter Clustering	YES	YES	YES	YES
Observations	3,664	3,671	1,940	5,078

- 1 percentage point tightening causes a change in total capital for a financially constrained unhedged bank debt user which is on average 15.8 percentage points lower than for an unconstrained peer. No significant effect for hedged firms.

3. Evidence from the Unconventional Policy Period

Evidence from the Unconventional Policy Period

- Alternative approach to importance of floating rate channel: study a period during which we do not expect the floating rate channel to be operative, so any remaining effect can be attributed to other banking channels
- Challenge: find measure of overall stance of unconventional monetary policy, and surprise component in particular
  - we follow Wright (2012) and use the high-frequency price changes in longer-maturity Treasury futures on a very tight event window around FOMC announcements during the unconventional period
  - announcement dates range from November 25, 2008 to September 21, 2011
- We repeat our benchmark regression by substituting conventional monetary policy surprise with unconventional monetary surprise

How Important is the Floating Rate Channel? Evidence from the Unconventional Policy Period

VARIABLES	(1) ALL	(2) ALL	(3) ALL	(4) Hedgers	(5) Non-Hedgers
Surprise	-0.33***	-0.35***	-0.31***	-0.24***	-0.24***
	(-11.67)	(-12.19)	(-10.63)	(-3.36)	(-5.42)
Surprise*(BankDebt/At)		0.43**	0.00	-0.23	0.15
		(1.98)	(0.00)	(-0.61)	(0.28)
Surprise*LnAssets			-0.11***	-0.12***	-0.08***
			(-5.27)	(-3.46)	(-2.89)
Surprise*Book Leverage			0.24*	0.65***	0.14
			(1.92)	(3.03)	(0.74)
Surprise*Profitability			-0.15	-0.87	-0.05
			(-0.69)	(-1.40)	(-0.18)
Surprise*M/B			-0.12***	-0.19***	-0.09***
			(-5.05)	(-2.89)	(-2.97)
Observations	38,097	36,736	36,568	10,918	15,256
R-squared	0.00	0.00	0.01	0.02	0.01
Number of gvkey	1,903	1,792	1,779	679	1,030

- Effect of bank debt usage on transmission of monetary policy to stock prices absent, or of opposite direction of what we observe in the conventional period

Conclusion

- Important reason why bank lending matters for transmission of monetary policy to firms is mechanical relationship between monetary policy and reference rates of floating rate arrangements underlying most bank loans to businesses
- New floating rate channel distinct from earlier channels in that it works through existing debt rather than new debt
- Results contribute to debate about efficacy of large scale asset purchases (LSAP) as an alternative tool of monetary policy, and more broadly about how conventional and unconventional monetary policies differ

4. APPENDIX

Time Series of Surprises and Changes in Federal Fund Rates

- Anticipated and surprise changes in Federal funds rate between 29 January 2002 and 25 June 2008
- Surprise changes calculated from federal funds futures as in Kuttner (2002)
- Only FOMC meeting dates shown

Monetary Policy Data

- Approach of Kuttner (2001) and Bernanke and Kuttner (2005) to extract unexpected (surprise) component of monetary policy actions
- Identification relies on price of current month 30-day federal funds futures contracts
  - evaluate one-day change in federal funds futures
- Advantages
  - federal funds futures outperform target rate forecasts based on other financial market instruments or sophisticated time series specifications and monetary policy rules
  - federal funds futures do not exhibit predictable time-varying risk premia (and forecast errors) over daily frequencies

Floating Rate Channel: Testing Strategy

- Test: all else equal, bank debt using firms that engage in interest rate risk hedging should be less responsive to monetary policy

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Floating Rate Channel: Testing Strategy

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- Use text-search algorithm to collect floating-to-fixed rate hedging from SEC 10-K filings
- Example

COMPANY NAME: NETSMART TECHNOLOGIES INC

"The term loan bears interest at LIBOR plus 2.25%. We have entered into an interest rate swap agreement with the Bank for the amount outstanding under the term loan whereby we **converted our variable rate on the term loan to a fixed rate** of 7.1% in order to reduce the interest rate risk associated with these borrowings."

Hedging and Financial Constraints

- Hedging possibly related to financing constraints (Froot, Scharfstein, and Stein (1993), Rampini, Sufi, and Viswanathan (2012))

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- Hedging possibly related to financing constraints (Froot, Scharfstein, and Stein (1993), Rampini, Sufi, and Viswanathan (2012))
- We first confirm that our floating rate channel survives if we control for financing constraints (Firm age, and Hadlock and Pierce (2010) measure)
- Regression specification:

$$\begin{aligned} Ret_{i,t} = \beta_0 &+ \beta_1 Surprise_t \\ &+ \beta_2 Surprise_t * (BankDebt/At)_{i,t-1} * Hedge_{i,t-1} \\ &+ \beta_3 Surprise_t * (BankDebt/At)_{i,t-1} * FinConstraint_{i,t-1} \\ &+ (\text{second order terms}) \\ &+ \gamma Controls_{i,t-1} + \lambda Surprise_t * Controls_{i,t-1} + \varepsilon_{i,t} \end{aligned}$$

Floating rate channel: $\beta_2 > 0$

Financial Constraints Measure

- Follow Hadlock and Pierce (2010)
  - show that firm size and age are very useful predictors of the severity of financial constraints
  - introduce a measure based solely on these two firm characteristics

$$HP\ index = -0.548 Size + 0.025 Size^2 - 0.031 Age$$

- We classify firms as financially constrained (unconstrained) if their value of the Hadlock and Pierce (2010) (HP) index is above (below) the median

Hedging and Financial Constraints

	(1)	(2)
VARIABLES	AGE	HP
Surprise	-4.92***	-2.31
	(-3.25)	(-1.18)
Surprise*Financial Constraint Measure	0.67	-3.85
	(0.36)	(-1.57)
Surprise*Hedging	-1.95	
	(-0.95)	
Surprise*(BankDebt/At)	-28.00**	-29.20**
	(-2.50)	(-2.46)
Surprise*(BankDebt/At)*Financial Constraint Measure	-16.79	-12.50
	(-1.43)	(-1.04)
Surprise*(BankDebt/At)*Hedging	41.25***	40.41***
	(3.36)	(3.27)
Firm FE	YES	YES
Firm Controls	YES	YES
Surprise*Firm Controls	YES	YES
Observations	24,123	24,123
R-squared	0.01	0.01
Number of gvkey	1,283	1,283

- Results are robust to controlling for financial constraints

Robustness: Instrumental Variables Analysis

- Instrument for hedging: tax convexity (Graham and Smith (1999), Campello, Lin, Ma, and Zou (2011))
- **Relevance condition**
  - convex corporate income tax schedule $\longrightarrow$ incentive to hedge
- **Exclusion restriction**
  - tax convexity unlikely to have direct first-order effect on sensitivity of stock prices to monetary policy shocks
- Tax convexity
  - a result of tax brackets in the corporate tax code, net operating loss carryforwards and carrybacks, investment tax credits, and the alternative minimum tax
  - a function of volatility of taxable income, serial correlation of taxable income, investment tax credits, net operating losses, and presence of small negative (positive) taxable income

Robustness: Instrumental Variables Analysis

	(1)	(2) IV1	(3) IV2	(4) IV3
Surprise	-5.79***	-3.43*	-3.92**	-3.31*
	(-3.34)	(-1.73)	(-1.97)	(-1.67)
Surprise*(BankDebt/At)	-49.30***	-122.79***	-104.77***	-123.59***
	(-3.72)	(-3.82)	(-3.18)	(-3.79)
Surprise*(BankDebt/At)*Hedging	59.25***	175.73***	147.08***	176.92***
	(3.55)	(3.56)	(2.90)	(3.53)
Hausman test (p-value)		1.000	0.999	0.995
Firm FE	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES
Surprise*Firm Controls	YES	YES	YES	YES
Observations	12,060	12,060	12,034	12,034

- Similar qualitative results: sum of coefficients of Surprise_t*$(\text{BankDebt/At})_{i,t-1}$ and Surprise_t*$(\text{BankDebt/At})_{i,t-1}$*$\text{Hedging}_{i,t}$ add up to a number not statistically significantly different from zero, implying that bank debt usage does not significantly affect sensitivity of stock prices to monetary policy shocks for hedgers
- Instrumental variable results seem quantitatively different, but Hausman test cannot reject hypothesis that they are the same, also suggesting endogeneity of hedging is not a big concern

Floating Rate Channel: Inventory Investment

- We follow Kashyap, Lamont and Stein (1994) and adopt their empirical specification for our inventory investment regressions:

$$\ln\left(\frac{Inventories_{t+x}}{Inventories_{t-1}}\right) = \beta_0 + \beta_1 \widehat{Change}_t$$
$$+\beta_2 \left(BankDebt/At\right)_{t-1} + \beta_3 \widehat{Change}_t \left(BankDebt/At\right)_{t-1}$$
$$+\gamma Controls_{t-1} + \lambda \widehat{Change}_t Controls_{t-1}$$
$$+\ln\left(\frac{Sales_{t,t+x}}{Sales_{t-x-1,t-1}}\right) + \ln\left(\frac{Inventories_{t-1}}{Sales_{t-1}}\right) + \varepsilon_t$$

- Our firm-level controls include, as before, book leverage, firm size, market-to-book ratio, profitability, interest rate sensitivity, and short-term debt

Floating Rate Channel: Fixed Investment

- Expand baseline empirical specification to include main factors identified in empirical literature on investment (Eberly, Rebelo and Vincent (2012))

- We run the following regression:

$$\begin{aligned}
\ln\left(\frac{K_{t+x}}{K_{t-1}}\right) &= \alpha_0 + \alpha_1 \widehat{Change}_t + \alpha_2 \left(BankDebt/At\right)_{t-1} \\
&\quad + \alpha_3 \widehat{Change}_t \left(BankDebt/At\right)_{t-1} \\
&\quad + \lambda \left(FirmControls\right)_{t-1} + \gamma \widehat{Change}_t \left(FirmControls\right)_{t-1} \\
&\quad + \alpha_4 Q_t + \alpha_5 \left(\frac{CF_t}{K_t}\right) + \alpha_6 \left(\frac{I_{t-1}}{K_{t-1}}\right) + \varepsilon_t,
\end{aligned}$$