The Deposits Channel of Monetary Policy

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This paper

We propose and test a new channel of monetary policy

1. Monetary policy has a powerful impact on the price and quantity of deposits supplied by the banking system
   - Higher nominal rate $\Rightarrow$ deposit supply $\downarrow$ deposit price (spread) $\uparrow$
2. Why? Banks have market power in supplying deposits. A higher nominal interest rate increases this market power
   - Deposits and cash are the two main sources of household liquidity
   - Higher nominal rate $\Rightarrow$ cash more expensive $\Rightarrow$ banks face less competition in liquidity provision $\Rightarrow$ act like monopolist
3. We show channel at aggregate, county, bank, and branch levels
   - Identification: exploit differences in deposit rates across branches within the *same* bank
   - Finding: Higher nominal rates lead to higher deposit prices and lower deposit growth in markets where banks have more market power

Implications

Higher nominal rate ⇒ less deposits ⇒

For banks:

1. Deposits are the main source of funding for banks:
   \$10 trillion, 77% of bank liabilities (2014)
2. Less prone to runs than wholesale funding, very hard to replace

⇒ Bank lending channel ("without reserves")

⇒ Risky and illiquid assets especially affected
(Kashyap, Rajan, Stein 2002; Hanson, Shleifer, Stein, Vishny 2014)

For households:

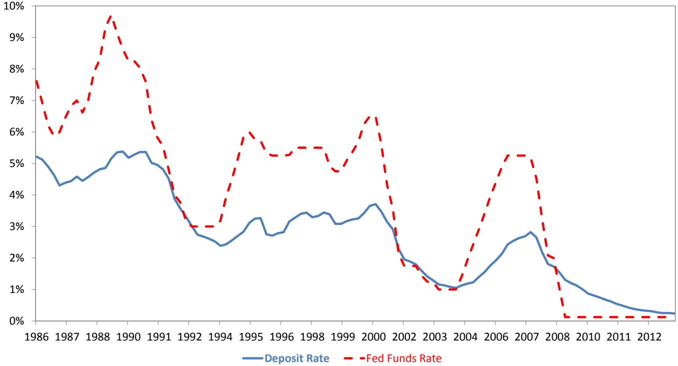
1. Deposits are the main source of liquidity for households

⇒ Reduces supply of safe assets and increases the liquidity premium

⇒ Affects leverage, risk-taking, and cost of capital

Higher nominal rate → higher price of deposits

Price of deposits: Deposit spread = Fed funds rate − deposit rate



1. Analyze average rate on core deposits (checking, savings, small time)

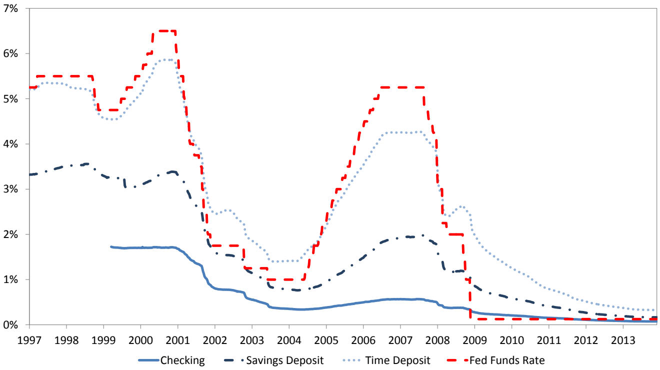
⇒ Price increases by 61 bps for each 100 bps increase in Fed funds rate

⇒ Large variation from 0 bps to to 500 bps

Drechsler, Savov, and Schnabl (2016)

Higher price increase for liquid deposits

Price of deposits: Deposit spread = Fed funds rate − deposit rate



1. Analyze average rate by deposit product (checking, savings, time)

⇒ Spread increases more for liquid deposits (checking, savings)

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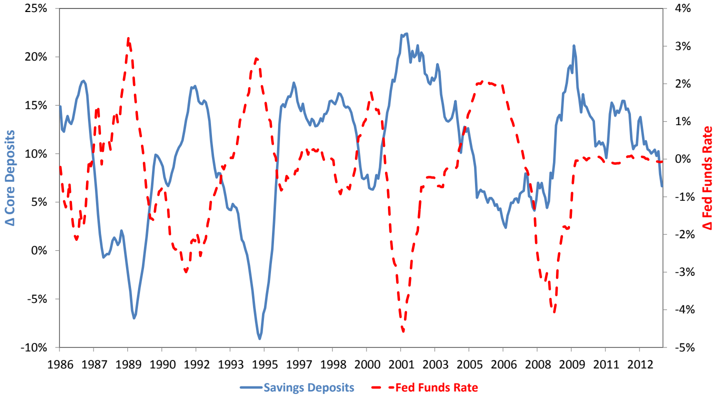
Higher nominal rate → large outflows of savings deposits

Year-on-year change in Fed funds and savings deposits



1. Savings deposits are largest category \$8.2 trillion, 79% of total
2. Large flows: from −12% to +24% per year

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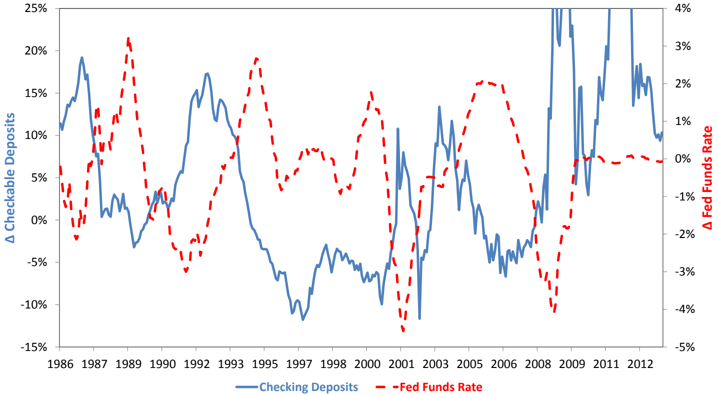
Higher nominal rate → large outflows of checking deposits

Year-on-year change in Fed funds and checking deposits



1. Checking deposits are \$1.7 trillion, 16% of total
2. Large flows: from −11% to +21% per year

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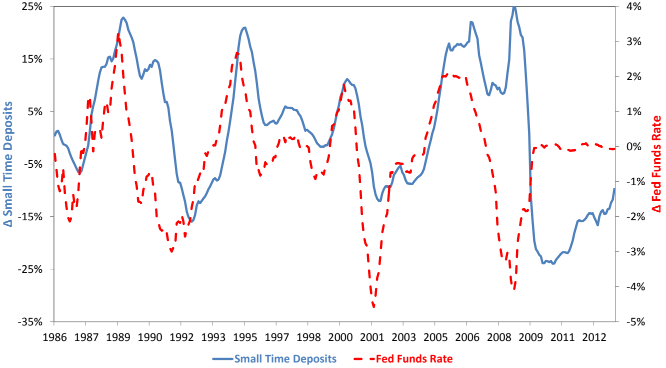
Higher nominal rate → inflows of small time deposits

Year-on-year change in Fed funds and time deposits



1. Small time deposits are \$0.4 trillion, 4% of total
2. Large flows: from -15% to $+21\%$ per year

⇒ Reallocation from liquid deposits to less liquid deposits

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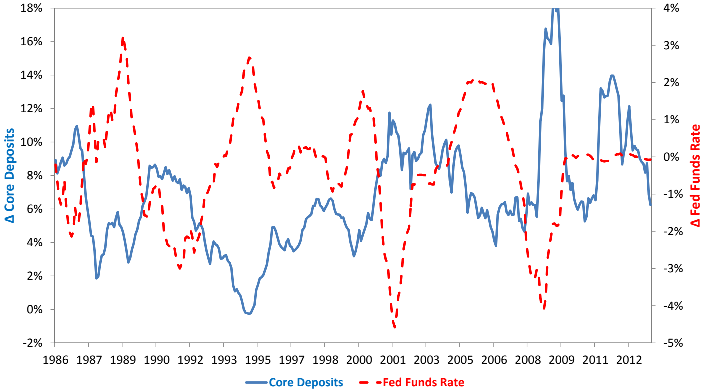
Higher nominal rate → less total deposits

Total core deposits (checking + savings + small time)



1. Total deposits are $10.3 trillion
2. Large flows: from -1% to $+12\%$ per year

Drechsler, Savov, and Schnabl (2016)

Aggregate results bottom line

1. Deposits are **large**
   - \$10.3 trillion (savings \$8.2t; checkable \$1.6t; time \$0.4t)
2. Deposit spreads increase (**price** $\uparrow$) with nominal rate
   - 100 bps Fed funds increase $\Rightarrow$ deposit spread increases by 61 bps
3. Deposits shrink (**quantity** $\downarrow$) with nominal rate
   - 400 bps Fed funds increase $\Rightarrow$ yoy outflows of -5%

$\Rightarrow$ Monetary policy appears to shift the **supply** of deposits

Drechsler, Savov, and Schnabl (2016)

Related literature

1. **Bank lending/balance sheet channel theory:** Bernanke (1983); Bernanke and Blinder (1988); Bernanke and Gertler (1989); Kashyap and Stein (1994); Kiyotaki and Moore (1997); Stein (1998, 2012)

2. **Bank lending channel empirics:** Kashyap, Stein, and Wilcox (1992); Kashyap and Stein (2000); Campello (2002); Dell'Ariccia, Laeven, and Suarez (2013); Jiménez, Ongena, Peydró, and Saurina (2014); Scharfstein and Sunderam (2014)

3. **Banks as liquidity providers:** Diamond and Dybvig (1983); Gorton and Pennacchi (1990); Kashyap, Rajan, and Stein (2002); Krishnamurthy and Vissing-Jorgensen (2012); Driscoll and Judson (2013); Hanson, Shleifer, Stein, and Vishny (2014); Drechsler, Savov, and Schnabl (2014); Nagel (2014)

Theory: intuition

Setup:

1. A representative household has utility over wealth and liquidity
2. Three types of assets
   - **Bonds**: provide no liquidity, pay competitive rate f (Fed funds rate)
   - **Cash**: provides liquidity, pays no interest
     $\Rightarrow$ opportunity cost $= f$
   - **Deposits**: provide partial liquidity ($\delta < 1$), pay rate $f - s$
     $\Rightarrow$ opportunity cost $= s$
3. Deposits created by N monopolistically competitive banks

Mechanism:

$\uparrow$ Fed funds rate $\Rightarrow$ cash becomes a more expensive source of liquidity

$\Rightarrow$ Banks face less competition in liquidity provision (market power $\uparrow$)

$\Rightarrow$ Banks optimally increase deposit spread s

$\Rightarrow$ Households substitute away from deposits (and cash) and into bonds

Theory: results

$$\begin{aligned} \rho < 1 &\quad = \text{elasticity between liquidity and wealth (complements)} \\ \epsilon > 1 &\quad = \text{elasticity between deposits and cash} \quad \text{(substitutes)} \\ \eta > 1 &\quad = \text{elasticity of substitution across banks} \quad \text{(substitutes)} \end{aligned}$$

The composite parameter $\mathcal{M} = 1 - (\eta - 1)(N - 1)$ captures banks' market power in deposit creation; $\mathcal{M}$ is decreasing in the number of banks N and the elasticity of substitution across banks η.

If $\mathcal{M}$ is sufficiently low ($< \rho$), the deposit spread $s = 0$. Otherwise,

$$\mathbf{s} \quad = \quad \delta^{\frac{\epsilon}{\epsilon-1}} \left(\frac{\mathcal{M} - \rho}{\epsilon - \mathcal{M}} \right)^{\frac{1}{\epsilon-1}} \mathbf{f}$$

The deposit spread s

(*i*) *increases with Fed funds rate f*

(*ii*) *increases more with Fed funds rate f where market power $\mathcal{M}$ is high*

Empirical strategy on deposits

Does monetary policy have a direct effect on deposit supply?

Identification challenge:

1. Deposit supply and monetary policy may be reacting to economic conditions (omitted variable)
2. Deposit supply may be reacting to monetary policy through bank assets or capital (indirect effect)

⇒ Exploit cross-sectional variation in competitiveness

⇒ Within-bank estimation, event study methodology, other tests to rule out alternatives

Data and measures

Data:

1. Branch- and product-level deposit rates: Ratewatch (1996–2013)
2. Branch-level deposits: FDIC (1994–2013)
3. Bank-level data: U.S. Call Reports
4. County characteristics: County Business Patterns, IRS, FDIC

Measures:

1. Use most common deposit products: \$25k Money Market account (savings deposits); \$10k one-year CDs (time deposits)
2. Competition: County-level deposit Herfindahl (Branch-HHI)
3. Deposit spread = Fed funds rate − deposits rate

Identification I: within-bank estimation

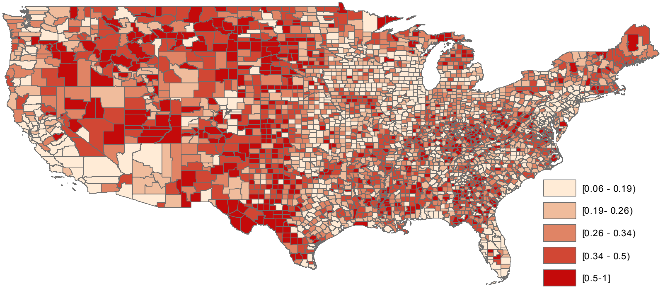
1. Lending opportunities are a potential omitted variable
   - Differences in lending opportunities need to be correlated with bank competition *and* changes in monetary policy

⇒ Control for bank lending opportunities by looking across branches of the *same* bank (and in the same state)

   - Multi-branch bank can lend at one branch, raise deposits at another
   - E.g. compare deposits at Citi branch in low-competition county with deposits at Citi branch in high-competition county
   - Identifying assumption:
     A deposit raised at one branch can be lent at another branch

Descriptive statistics

County competition (HHI) map

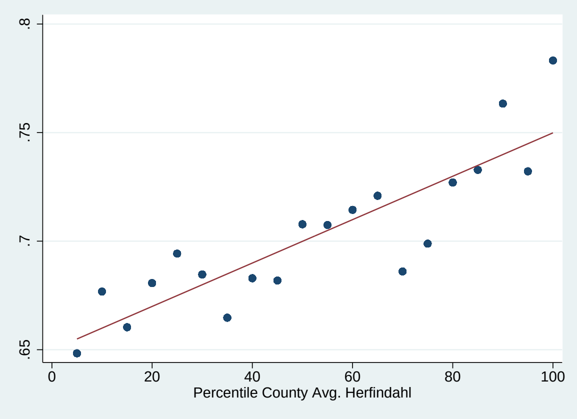


	All		High Competition		Low Competition	
	Mean	Median	Mean	Median	Mean	Median
Population	90,845	25,329	150,081	25,981	28,717	13,097
Area (sq. mile)	1,057	613	903	619	1,217	605
Median income	36,406	34,787	39,332	37,611	33,343	32,242
Over age 65 (in %)	14.78	14.4	14.22	13.9	15.35	14.9
College degree (in %)	16.55	14.5	18.69	16.2	14.3	12.8
Branch-HHI	0.36	0.29	0.21	0.21	0.51	0.44
Obs. (counties)	3,104		1,589		1,515	

Drechsler, Savov, and Schnabl (2016)

Cross-sectional evidence: savings deposit spreads

1. For each branch, run $\Delta Spread = \alpha + \beta \Delta FF + \varepsilon$
2. Plot average β in 20 competition bins ($\approx$ 130 counties per bin)

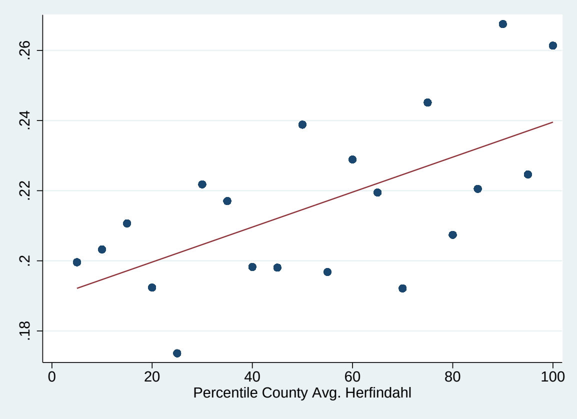


$\Rightarrow$ As Fed funds rises, savings deposit spreads increase more in uncompetitive counties

Drechsler, Savov, and Schnabl (2016)

Cross-sectional evidence: time deposit spreads

1. For each branch, run $\Delta \mathit{Spread} = \alpha + \beta \Delta \mathit{FF} + \varepsilon$
2. Plot average β in 20 competition bins ($\approx$ 130 counties per bin)

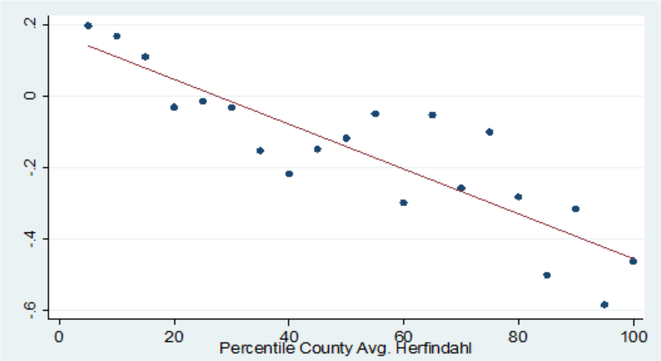


$\Rightarrow$ As Fed funds rises, time deposit spreads increase more in uncompetitive counties

Drechsler, Savov, and Schnabl (2016)

Cross-sectional evidence: deposit flows

1. For each branch, run $Flow = \alpha + \beta \Delta FF + \varepsilon$
2. Plot average β in 20 competition bins



$\Rightarrow$ As Fed funds rises, deposit growth is lower in uncompetitive counties

Identification I: within-bank estimation

1. Estimation in first differences:

$$\Delta y_{it} = \alpha_i + \zeta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta FF_t \times \mathrm{HHI}_i + \varepsilon_{it},$$

$$\begin{aligned}
\Delta y_{it} &= \text{Branch-level change in deposit spread/deposit flow} \\
\Delta FF_t &= \text{Change in Fed funds target rate} \\
HHI_i &= \text{County-level competition (Branch-HHI)} \\
\delta_{j(i)t} &= \text{Bank-time fixed effects} \\
\zeta_{c(i)} &= \text{County fixed effects} \\
\lambda_{s(i)t} &= \text{State-time fixed effects}
\end{aligned}$$

2. Standard errors clustered at the county level

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Results: savings deposit spreads

$$\Delta Spread_{it} = \alpha_i + \zeta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta FF_t \times \text{HHI}_i + \varepsilon_{it}$$

	Banks in $\geq$ 2 counties			All banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ FF $\times$ HHI	0.141***	0.101***	0.100***	0.199***	0.155***	0.159***
	[0.033]	[0.031]	[0.043]	[0.028]	[0.026]	[0.026]
Bank $\times$ qtr f.e.	Y	Y	N	N	N	N
State $\times$ qtr f.e.	Y	N	N	Y	N	N
Branch f.e.	Y	Y	N	Y	Y	N
County f.e.	Y	Y	Y	Y	Y	Y
Quarter f.e.	Y	Y	Y	Y	Y	Y
Obs.	117,701	117,701	117,701	412,037	412,037	412,037
R^2	0.810	0.799	0.559	0.659	0.650	0.645

$\Rightarrow$ 100 bps Fed Funds rate increase $\rightarrow$ 14 bps increase in low- vs. high-competition areas ($\approx 1/3$ standard deviation)

Results: time deposit spreads

$$\Delta Spread_{it} = \alpha_i + \zeta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta \text{T-Bill}_t \times \text{HHI}_i + \varepsilon_{it}$$

	Banks in $\geq$ 2 counties			All banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ T-Bill $\times$ HHI	0.073***	0.073***	0.155***	0.156***	0.119***	0.119***
	[0.025]	[0.026]	[0.037]	[0.026]	[0.024]	[0.023]
Bank $\times$ qtr f.e.	Y	Y	N	N	N	N
State $\times$ qtr f.e.	Y	N	N	Y	N	N
Branch f.e.	Y	Y	N	Y	Y	N
County f.e.	Y	Y	Y	Y	Y	Y
Quarter f.e.	Y	Y	Y	Y	Y	Y
Obs.	122,008	122,008	122,008	430,080	430,080	430,080
R^2	0.808	0.796	0.442	0.513	0.492	0.488

$\Rightarrow$ 100 bps Fed Funds rate increase $\rightarrow$ 7 bps increase in low- vs. high-competition areas ($\approx 1/4$ standard deviation)

Results: deposit growth

$$\Delta Log(\text{Deposits}_{it}) = \alpha_i + \zeta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta FF_t \times \text{HHI}_i + \varepsilon_{it}$$

	Banks in $\geq$ 2 counties			All banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ FF $\times$ Herf.	-0.661***	-1.008***	-0.827***	-1.827***	-1.796***	-0.963***
	[0.254]	[0.331]	[0.247]	[0.198]	[0.242]	[0.212]
Bank $\times$ qtr f.e.	Y	Y	N	N	N	N
State $\times$ qtr f.e.	Y	N	N	Y	N	N
Branch f.e.	Y	Y	N	Y	Y	N
County f.e.	Y	Y	Y	Y	Y	Y
Quarter f.e.	Y	Y	Y	Y	Y	Y
Obs.	1,150,049	1,150,049	1,150,049	1,310,111	1,310,111	1,310,111
R^2	0.344	0.336	0.025	0.230	0.221	0.025

$\Rightarrow$ 100 bps Fed Funds rate increase $\rightarrow$ 66 bps lower deposit growth in low- vs. high-competition areas

Interpretation

Supply shock: Results indicate *supply shock* controlling for lending opportunities

$\uparrow$ Fed funds rate $\Rightarrow$ deposit price $\uparrow$ deposit quantity $\downarrow$

- Inconsistent with demand-driven explanations (e.g. wealthy vs. poor counties)

Economic magnitude: 100 bps Fed Funds rate increase $\rightarrow$

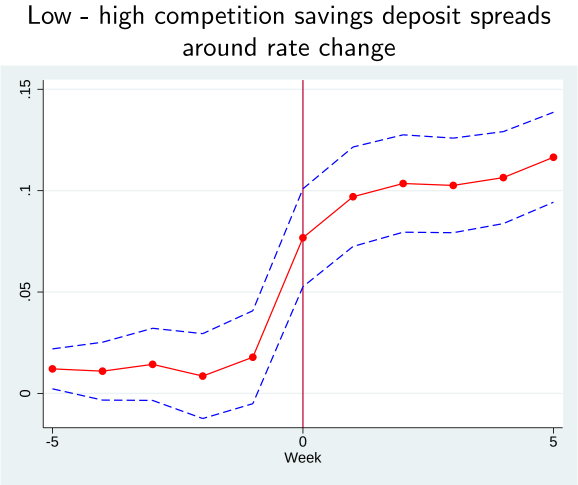
- 14 bps relative increase in savings deposit spread in low-competition counties; 7 bps for time deposits $\rightarrow$ weighted average 12.4 bps
- 66 bps greater annual outflow of deposits in high Herf counties

$\Rightarrow$ implied demand semi-elasticity of -5.3

Identification II: event study methodology

1. Can local economic trends explain change in deposit supply?
   - Hard to think of local deposit supply shocks $\Rightarrow$ would need to correlate with monetary policy and HHI
2. Examine whether response occurs quickly around Fed funds changes

Results: event study

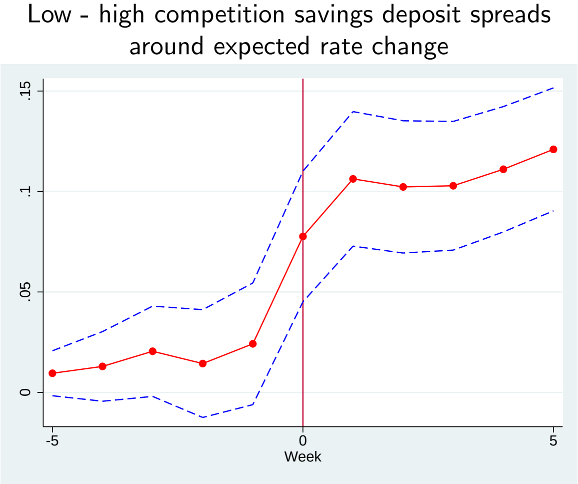


⇒ Timing indicates differential response is due to Fed

Identification III: expected rate changes

1. Results show that Fed affects deposit supply
   - In our model this is due to the rate change itself
   - Alternative mechanism: release of private macro information
2. Hold information fixed by looking at *expected* rate changes
   - Unique feature of our setting: price of zero-maturity deposits should respond even to expected rate change
   - Expected rate changes computed from Fed funds futures
   - Testing whether rate itself matters versus private information release

Results: expected rate changes



⇒ Rate change causes differential response

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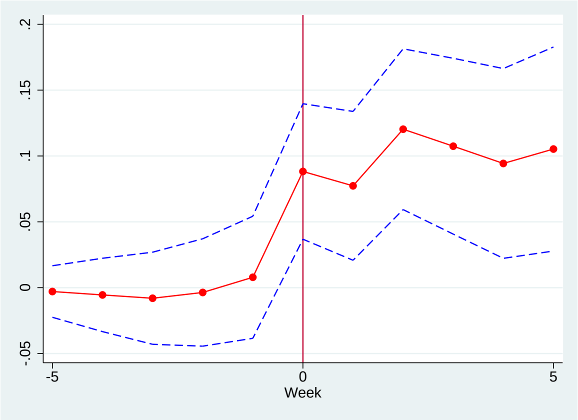
Results: unexpected rate changes

Low - high competition savings deposit spreads
around unexpected rate change



⇒ Unexpected and expected rate changes have similar effect

Results: expected rate changes

$$\Delta Spread_{it} = \alpha_i + \zeta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta \text{Expected FF}_t \times \text{HHI}_i + \varepsilon_{it}$$

	Banks in $\geq$ 2 counties			All banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Exp. FF $\times$ HHI	0.218***	0.151**	0.177**	0.256***	0.187***	0.190***
	[0.074]	[0.071]	[0.075]	[0.047]	[0.046]	[0.045]
Δ Unexp. FF $\times$ HHI	0.114*	0.080	0.040	0.200***	0.156***	0.161***
	[0.061]	[0.056]	[0.069]	[0.040]	[0.035]	[0.036]
Bank $\times$ qtr f.e.	Y	Y	N	N	N	N
State $\times$ qtr f.e.	Y	N	N	Y	N	N
Branch f.e.	Y	Y	N	Y	Y	N
County f.e.	Y	Y	Y	Y	Y	Y
Quarter f.e.	Y	Y	Y	Y	Y	Y
Obs.	117,701	117,701	117,701	412,037	412,037	412,037
R^2	0.810	0.799	0.556	0.659	0.650	0.644

$\Rightarrow$ Expected 100 bps Fed Funds rate increase $\rightarrow$ 22 bps savings deposit spread increase in low- versus high-competition counties

Empirical strategy on lending

Do changes in deposit supply affect lending?

Identification challenge:

1. Lending decided at the bank-level $\Rightarrow$ cannot control for lending opportunities using within-bank estimator

$\Rightarrow$ Control for bank lending opportunities by looking across different banks in the *same* county

- Compute bank-level average HHI (average competitiveness of deposit markets in which a bank is active)
- Identifying assumption:
  Banks face similar lending opportunities within counties

Identification IV: within-county estimation

1. Data: Small business lending data (1996–2013)
   - Available for all large banks ($\geq$ \$1 bn) at the county-bank level

2. Estimation:

$$\Delta L_{jct} = \alpha_{jc} + \delta_{ct} + \beta \mathrm{HHI}_{jt-1} + \gamma \Delta FF_t \times \mathrm{HHI}_{jt-1} + \varepsilon_{jct},$$

$$\begin{aligned}
\Delta L_{jct} &= \text{Total log value of loans originated} \\
\Delta FF_t &= \text{Change in Fed funds target rate} \\
HHI_{jt-1} &= \text{Bank-level exposure to deposit competition} \\
\delta_{ct} &= \text{County-time fixed effects}
\end{aligned}$$

Results: small business lending (bank-county)

$$\Delta Spread_{it} = \alpha_i + \zeta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta \text{Expected FF}_t \times \text{HHI}_i + \varepsilon_{it}$$

	Log(new lending)			
	(1)	(2)	(3)	(4)
Δ FF $\times$ Bank HHI	−0.174**	−0.172**	−0.125**	−0.125**
	[0.078]	[0.084]	[0.060]	[0.059]
Δ FF $\times$ Branch HHI		0.010	-0.003	
		[0.015]	[0.018]	
County-Time f.e.	Y	N	N	N
County-Bank f.e.	Y	Y	N	N
Bank f.e.	Y	Y	Y	Y
Time f.e.	Y	Y	Y	Y
County f.e.	Y	Y	Y	Y
Observations	512,576	512,576	512,576	512,576
R-squared	0.835	0.812	0.225	0.222

$\Rightarrow$ 100 bps Fed funds rate increase $\rightarrow$ 2.3% reduction in new small business loans for one-standard deviation increase in competiton

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Results: small business lending + employment (county)

$$\Delta y_{ct} = \zeta_c + \delta_t + \gamma \Delta \text{Expected FF}_t \times \text{HHI}_c + \varepsilon_{ct}$$

	Log(new lending) (1)	Δ Employment (2)	Δ Wage bill (3)
Δ FF $\times$ County-HHI	−0.167***	−0.008***	−0.010***
	[0.030]	[0.003]	[0.004]
Δ FF $\times$ Branch-HHI	−0.001	−0.004***	−0.001
	[0.009]	[0.001]	[0.001]
Time f.e.	Y	Y	Y
County f.e.	Y	Y	Y
Observations	57,181	57,181	57,181
R-squared	0.934	0.198	0.264

$\Rightarrow$ 100 bps Fed funds rate increase $\rightarrow$ 2.1% reduction in new small business loans for one-standard deviation increase in competition

Drechsler, Savov, and Schnabl (2016)

Measuring the deposit channel

How should we measure monetary policy exposure?

Novel measure: transmission depends on market power $\Rightarrow$ sufficient statistics is bank-level sensitivity of deposit spread to Fed funds rate

- Captures market power beyond HHI (e.g., consumer inattention)

1. Estimate time-series regression for each bank i:

$$\Delta Spread_{it} = \alpha_i + \sum_{\tau=0}^{4} \beta_i^{\tau} \Delta FF_{t-\tau} + \varepsilon_{it},$$

2. Compute bank-level spread beta: $\beta_i^{Spread} = \sum_{\tau=0}^{4} \beta_i^{\tau}$

3. Correlate with similarly constructed β for deposit, security, asset, and loan growth

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Do banks with more market power reduce assets?

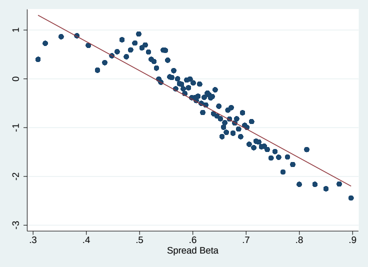


Figure: Deposits

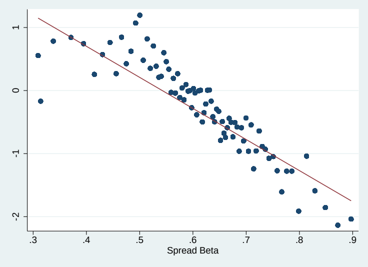


Figure: Assets

$\Rightarrow$ increase in spread beta (market power) from 10^{th} to 90^{th} percentile
$\rightarrow$ 276 bps lower deposit growth and 194 bps reduction in assets

Drechsler, Savov, and Schnabl (2016)

Do banks with more market power reduce loans?

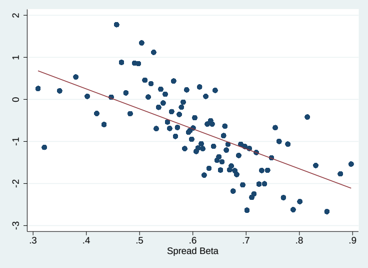


Figure: Securities

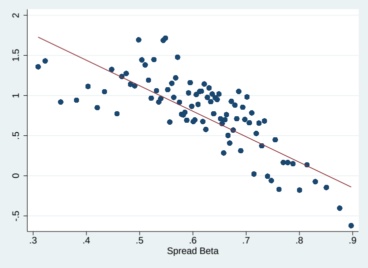


Figure: Loans

$\Rightarrow$ increase in spread beta (market power) from 10^{th} to 90^{th} percentile $\rightarrow$ 237 bps reduction in securities and 158 bps reduction in loans

Drechsler, Savov, and Schnabl (2016)

Implications for credit supply

Deposit channel: Reduction in lending by 9.5% over business cycle

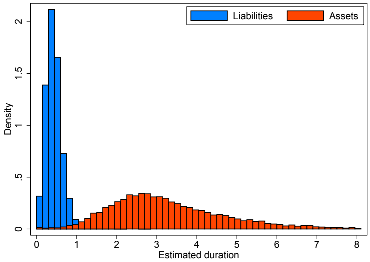
- Average deposit spread is 61 bps for each 100 bps Fed funds increase (banks at or above 95^{th} percentile)
- Loan-deposit spread semi-elasticity is -3.9
- Typical 400-bps Fed hiking cycle induces $0.61 \times 3.9 \times 400 = 948$ bps reduction in bank lending

Bank lending channel: Similar magnitude as earlier literature

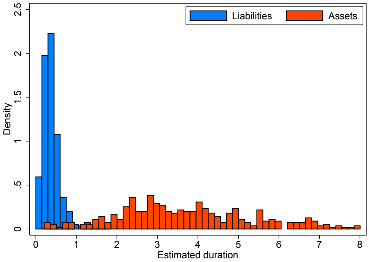
- Using time-series date, Bernanke and Blinder (1992) find that 31 bps Fed funds increase reduces deposits by 81 bps and lending by 57 bps
- Our corresponding estimates for deposits are 108 bps and 73 bps, respectively

Implications for maturity transformation

All banks



Top 5%



- Aggregate asset duration: 4.1 years (largest for big banks)
- Aggregate liability duration: 0.4 years → 3.7 years mismatch

Matching: Banks match interest rate sensitivity of deposits and assets

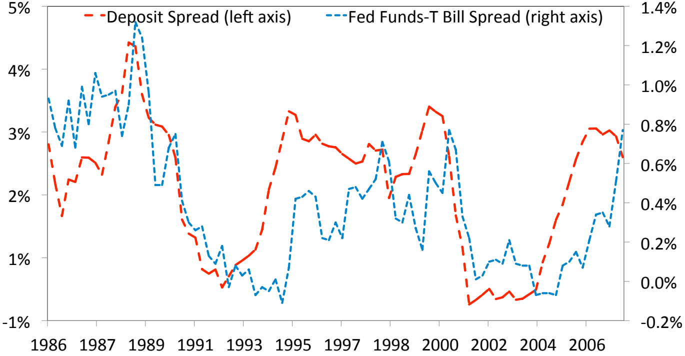
- choose asset duration to keep bank profitability stable
- hold long-term assets to **reduce** interest rate exposure

⇒ Explains coexistence of maturity transformation and deposit taking

Drechsler, Savov, and Schnabl (2016)

Implications for liquidity premium

⇒ As deposit supply shrinks and and the price of liquid deposits increases so do other liquidity premia



- Plots the aggregate deposit spread against the T-Bill liquidity premium (measured as Fed funds−T-Bill rate)

⇒ Higher liquidity premium raises cost of risk taking for financial sector (DSS 2015a)

Additional results

1. Financial literacy (age, income, education)

2. Bank-level results on HHI and FF Rate

2. Large banks (95hth percentile)

3. Competition measure (2- and 5-mile radius, hist. and yearly Herf.)

4. Alternative products (10K and 2.5K money market accounts, 10K 3- and 6-month CDs)

5. Estimation of spreads in levels

Takeaways

1. Propose and test a new channel of monetary policy
2. Deposits channel works through the effect of nominal interest rate on banks' market power over liquidity provision to households
3. Find strong support for deposits channel using within-bank estimation, expected rate changes, and others
4. Deposits are the main source of bank funding and household liquidity. The deposits channel has implications for lending and liquidity provision