The Deposits Channel of Monetary Policy
A Quantitative Assessment

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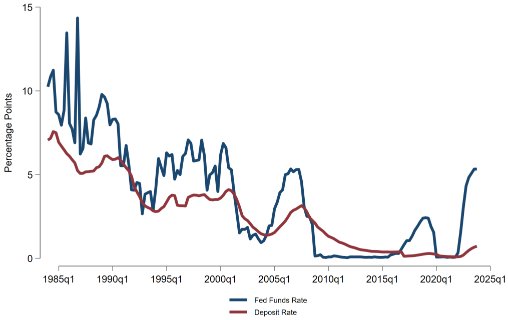
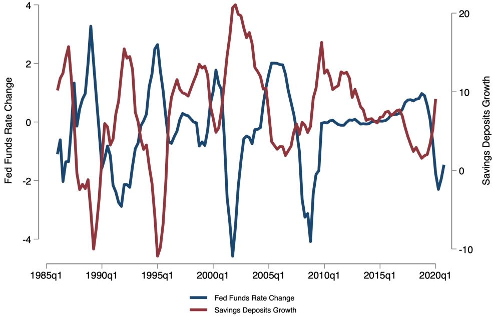
NUS

How does monetary policy work?

- Deposits channel of monetary policy (Drechsler, Savov, Schnabl 2017)
- Monetary policy affects the price and quantity of deposits
- policy rate $\uparrow$ (cash opportunity cost) $\xRightarrow{\text{Cash-Deposit substitution}}$ banks' market power $\uparrow$
- $\xRightarrow{\text{Monopoly pricing}}$ deposit spread (price) $\uparrow$, deposit (quantity) $\downarrow \Longrightarrow$ credit supply $\downarrow$





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- A standard NK model embedded with bank market power and deposits channel
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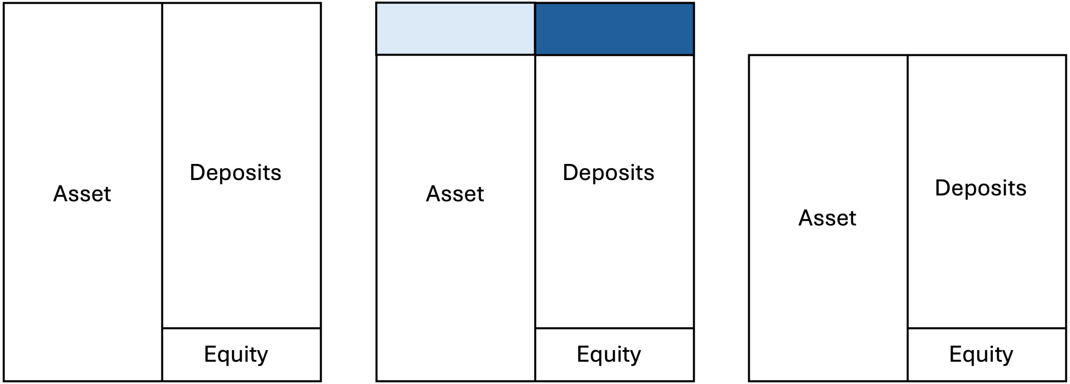
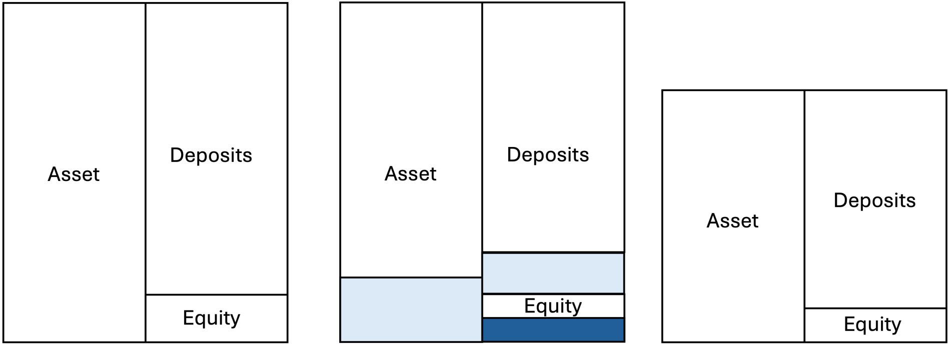
- Balance sheet channel
  - Standard models imply counterfactually large responses of bank net worth
- Interest rate risk in banking

The Deposits Channel



The Balance Sheet Channel



Panel Evidence: Bank Responses

- Bank-level regression

$$X_t^i = \alpha^X + \sum_{\tau=0}^{3} \beta_\tau^X \Delta i_{t-\tau} + \delta^i + \epsilon_t^{iX}$$

	$\Delta \log A$	$\Delta \log D$	$\Delta \log N$	s	NIM
β	-0.588^{**}	-0.659^{*}	0.179	0.629^{***}	0.022
	(-0.352)	(-0.397)	(0.571)	(0.028)	(0.015)
FE	Bank	Bank	Bank	Bank	Bank
R^2	0.05	0.04	0.02	0.81	0.01
N	$664,239$	$664,230$	$664,043$	$500,907$	$520,590$

- Deposit $\downarrow$, asset (loan) $\downarrow$, net worth $\rightarrow$
- Deposit spread $\uparrow$, NIM $\rightarrow$, as $(i^A - i) \downarrow + (i - i^D) \uparrow$

Literature

- **Deposits channel**: Drechsler, Savov and Schnabl (2017, 2018, 2021, 2024), Kurlat (2019), Di Tella and Kurlat (2021), Wang, Whited, Wu and Xiao (2022), Abadi, Brunnermeier and Koby (2023), Demarzo, Krishnamurthy and Nagel (2024), Begenau and Stafford (2025)
- **Bank lending channel**: Bernanke and Blinder (1988), Kashyap and Stein (1994), Oliner and Rudebusch(1995), Jiménez et al (2020), Benetton and Fantino (2021), Ivashina et al (2022)
- **Balance sheet channel**: Gertler and Kiyotaki (2010, 2015), Gertler and Karadi (2011), Boissay, Collard and Smets (2016), Gertler, Kiyotaki and Prestipino (2020), Elenev, Landvoigt and Van Nieuwerburgh (2022), Coimbra and Rey (2023)
- **Credit channel:** Bernanke, Gertler and Gilchrist (1999), Kiyotaki and Moore (2018), Ottonello and Winberry (2020)

Households: Preferences

- Period utility from consumption C_t and liquidity holding F_t, disutility from labor L_t

$$\ln(C_t - \chi^c C_{t-1}) - \frac{\varsigma}{1+\frac{1}{\varphi}} L_t^{1+\frac{1}{\varphi}} + \frac{\zeta}{1-\frac{1}{\chi^f}} F_t^{1-\frac{1}{\chi^f}}$$

- Liquidity F_t includes money M_t and deposits D_t (from N^b banks)

$$F_t = \left[(M_t)^{\frac{\epsilon-1}{\epsilon}} + \delta^D (D_t)^{\frac{\epsilon-1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon-1}}, \; D_t = \left[\frac{1}{N^b} \sum_{j=1}^{N^b} \left(D_t^j \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

- ϵ imperfect substitution between money and deposit
- η deposit market power

Households: Budget Constraint

- Households maximize lifetime utility subject to budget constraint

$$C_t + B_t + M_t + \sum_{j=1}^{N^b} D_t^j = w_t L_t + \frac{1 + i_{t-1}}{\Pi_t} B_{t-1} + \frac{M_{t-1}}{\Pi_t} + \sum_{j=1}^{N^b} \frac{1 + i_{t-1}^{D,j}}{\Pi_t} D_{t-1}^j + TR_t$$

- i_t: nominal policy rate for benchmark risk-free asset (government bond) B_t
- $i_t^{D,j}$: nominal deposit rate offered by bank j
- Derive bank j's deposit demand function $D^j(s_t^j; s_t, D_t)$, where $s_t^j = i_t - i_t^{D,j}$

Households' Optimality Conditions

- Aggregate demand elasticity for deposits

$$-\frac{\partial \log D_t}{\partial \log s_t} = \chi^f \left[1 + \left(\frac{\varepsilon}{\chi^f} - 1\right) \frac{(\delta^D)^{1-\varepsilon} \left(\frac{s_t}{i_t}\right)^{\varepsilon-1}}{(\delta^D)^{1-\varepsilon} \left(\frac{s_t}{i_t}\right)^{\varepsilon-1} + \delta^D}\right]$$

Higher elasticity with high s (low D) and low i

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Higher elasticity with high s (low D) and low i

- Aggregate deposit demand elasticity and individual bank deposit demand elasticity

$$-\frac{\partial \log D_t^j}{\partial \log s_t^j} = \underbrace{\eta}_{\text{given } D_t, s_t} - \underbrace{\left[\frac{\eta}{N^b} + \frac{1}{N^b} \left(-\frac{\partial \log D_t}{\partial \log s_t} \right) \right]}_{\text{through } s_t}$$

Banks

- Banks take deposits at nominal cost $i_t^{D,j}$, combine with net worth to supply loans
- Deposits are subject to unit management cost c^D

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- With probability θ, the bank exits the market; the same measure entering with ωK_t net worth
- Bank j take household deposit demand as given, chooses s_t^j and D_t^j

Banks' Balance Sheet and Their Evolution

$$N_{t+1}^{j} = \frac{1}{\Pi_{t+1}} \left[(1 + i_t^A) A_t^j - (1 + i_t^{D,j} + c^D) D_t^j - \Psi^A(A_t^j) \right]$$

- Loan rate $i_t^A = \alpha^A + \beta^A i_t$, exogenously specified
  - $\beta^A < 1$ is the share of repriced loans, capturing the long-term nature of bank loans
  - c^D deposit franchise cost (nominal)
  - $\Psi^A(\cdot)$ loan adjustment cost, to reflect the sticky adjustment of bank balance sheet to match data

Main Result: Banks' Deposit Spread Choice

- Banks' deposit price setting

$$s_t \equiv i_t - i_t^D = \underbrace{(\delta^D)^{\frac{\epsilon}{\epsilon-1}} \left(\frac{\mathcal{M} - \iota_t - \chi^f}{\epsilon - \mathcal{M} + \iota_t}\right)^{\frac{1}{\epsilon-1}}}_{\beta_{s,t}} \times i_t$$

where ι_t is a function of excess return of loans

- Key result: s_t increases with i_t

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- Key result: s_t increases with i_t
- $\beta_{s,t}$ increase with higher banks' market power $\mathcal{M}$, lower excess return of loans ι_t
- Intuition (simplified)
  - Suppose deposit rate = loan rate, bank j chooses deposit elasticity at -1
  - Higher i makes $-\frac{\partial D}{\partial s}\frac{s}{D}$ lower for each (D, s), so all banks choose lower D

Intermediate Firms

- Intermediate firms choose loans A_t^m, investment I_t, equity issuance e_t^p, labor L_t

$$V_t^p = \max_{A_t^m, e_t, I_t, L_t} \phi^p N_t^p - e_t^p + \beta E_t \left[\Lambda_{t+1} V_{t+1}^p \right]$$

- ϕ^p share of book equity N^p paid out

$$N_t^p = P_t^m Y_t^m(Z_t, K_{t-1}, L_t) - w_t L_t - \frac{1 + i_{t-1}^A}{\Pi_t} A_{t-1}^m + K_t - I_t$$

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- Firms' balance sheet (subject to equity issuance cost Ψ^e)

$$K_t = A_t^m + \left[(1 - \phi^p) N_t^p + e_t^p - \Psi^e (e_t^p ; N_t^p) \right]$$

- A pecker order: $A_t^m \leq A_t$, debt financing is determined by banks' credit supply
- Capital accumulation $K_t = (1 - \delta) K_{t-1} + [1 - \Psi_t^I (I_t, I_{t-1})] I_t$

The Rest of The Economy

Standard New Keynesian model:

- Intermediate firm i sets product price, facing price rigidity
- Final output is a CES aggregation of intermediate goods

$$Y_t = \left[\int_0^1 (Y_t^{i,m})^{\frac{\Xi - 1}{\Xi}} di \right]^{\frac{\Xi}{\Xi - 1}}$$

- Monetary policy following Taylor rule

$$i_t = (1 - \rho^i) \left[\bar{i} + \kappa^\pi \pi_t + \kappa^y (\log Y_t - \log \bar{Y}) \right] + \rho^i i_{t-1} + \epsilon_t^i$$

Calibration: Households

$$\ln(C_t - \chi^c C_{t-1}) - \frac{\varsigma}{1+\frac{1}{\varphi}} L_t^{1+\frac{1}{\varphi}} + \frac{\zeta}{1-\frac{1}{\chi^f}} F_t^{1-\frac{1}{\chi^f}}$$

- Liquidity elasticity $\chi^f = 0.11$: sensitivity of cash-to-GDP to interest change -0.088

$$F_t = \left[(M_t)^{\frac{\epsilon-1}{\epsilon}} + \delta^D (D_t)^{\frac{\epsilon-1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon-1}}, \; D_t = [\frac{1}{N^b} \sum_{j=1}^{N^b} (D_t^j)^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}}$$

- Deposit weight $\delta^D = 0.79$ and liquidity weight $\zeta = 10.67$: average deposit spread and aggregate deposit demand elasticity
- Elasticity of substitution $\epsilon = 6.6$: Di Tella and Kurlat (2021)
- Cross-bank substitution $\eta = 2.55$: inferred

Calibration: Banks

$$N_{t+1}^{j} = \frac{1}{\Pi_{t+1}} \left[(1 + i_t^A) A_t^j - (1 + i_t^{D,j} + c^D) D_t^j - \Psi^A(A_t^j) \right]$$

- Deposit management cost $c^D = 1.3\%$ per annum: Drechsler et al. (2023)
- Loan adjustment cost $\Psi^A(A_t^j)$: volatility of bank credit growth 0.86%

$$i_t^A = \alpha^A + \beta^A i_t$$

- Fixed comp of loan rate $\alpha^A = 1.79\%$ per annum: average NIM 1.87% per annum
- Floating comp of loan rate $\beta^A = 0.406$: interest income sensitivity

Calibration: Firms

$$K_t = A_t^m + \left[(1-\phi^p)N_t^p + e_t^p - \Psi^e(e_t^p; N_t^p)\right]$$

- Payout rate $\phi^p = 7.8\%$ per annum: Elenev, Landvoigt, Van Nieuwerburgh (2021)
- Equity issuance cost $\Psi^e(e_t^p; N_t^p)$: the net equity issuance to GDP ratio 3.80%

$$K_t = (1-\delta)K_{t-1} + [1 - \Psi_t^I(I_t, I_{t-1})]I_t$$

- Capital adjustment cost $\Psi^I(I_t, I_{t-1})$: volatility of investment growth

Targeted Moments

Moment	Data	Model	Parameter	Value
$\partial(M/Y)/\partial i$	-0.087	-0.088	χ^f	0.11
s	1.27%	1.28%	δ^D	0.793
$\partial \log D/\partial \log s$	-1.86	-1.86	ζ	10.67
NIM	1.87%	1.88%	α^A	0.45%
$std(\Delta \log A)$	0.86%	0.86%	ϕ^A	0.052
Net Payout to GDP	3.80%	3.76%	ϕ^e	10.38
$std(\Delta \log I)/std(\Delta \log Y)$	4.5	4.5	ϕ^I	1.40
Inferred			η	2.55

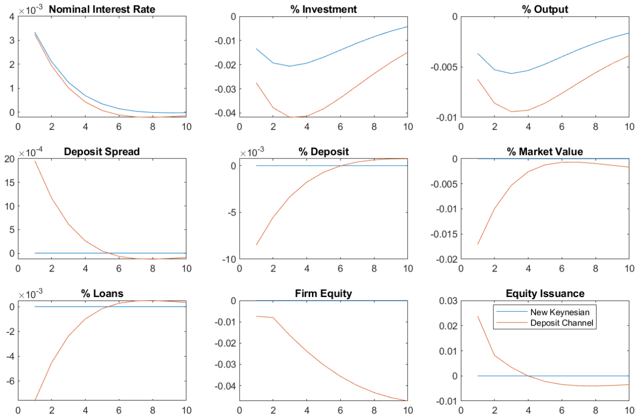
- Matches the targeted moment well ▸ Details

Monetary Policy Response

Interest rate sensitivity	Data	Model
Deposit Spread	0.629	0.603
Asset	−0.588	−0.586
Deposit	−0.659	−0.727
Net worth	0.179	0.408
NIM	0.022	0.017
Bank franchise value	−4.240	−1.717
Deposit franchise		2.661

- Replicates the untargeted, salient bank responses to policy rate change
- Though deposit franchise has negative duration, the franchise value has positive duration (Demarzo, Krishnamurthy, Nagel 2024)

Main Result: Monetary Policy Transmission and Amplification



- The deposits channel amplifies the real effect of monetary policy by 100%
- Internal equity ↓(NK) + loan ↓ (Dep channel) + Costly equity issuance

Details

Models of Balance Sheet Channel

- A conventional approach to model monetary transmission through banks is the balance sheet channel (Gertler and Karadi, 2011)
- Banks face a balance sheet constraint that the franchise value should be larger than λ fraction of their assets

$$V_t \geq \lambda A_t$$

- Monetary tightening lowers banks' franchise value, net worth, credit supply

Balance Sheet Channel Models: Counterfactual Net Worth and Cash Flow

- GK features exaggerated drop in banks' net worth and franchise value
  - Maybe a good description of the crisis, but not normal times
  - Maybe appropriate for shadow banks, but not commercial banks ▸ Details

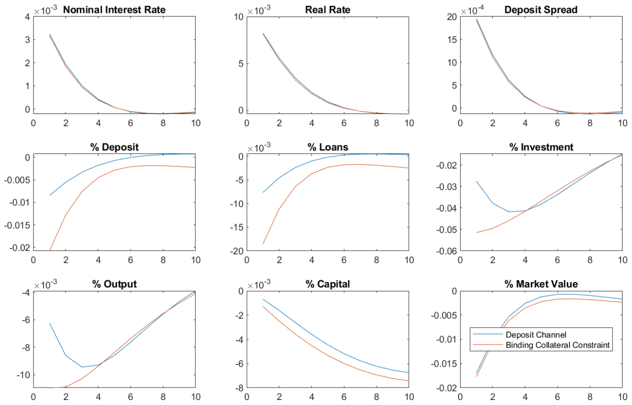
Interest rate sensitivity	Data	Dep Channel	GK	GK + Exo Loan
Spread	0.629	0.603		
Deposit	−0.659	−0.727	−0.153	−2.967
Asset	−0.588	−0.586	−5.107	−2.335
Net worth	0.179	0.408	−19.97	−0.440
NIM	0.022	0.017	5.622	−0.590
Bank value	−4.240	−1.717	−4.720	−2.600
Investment		−2.114	−3.010	−5.519
Output		−0.480	−0.623	−1.151

Deposits and Balance Sheet Channel Interactions

- Add an occasionally binding balance sheet constraint into our benchmark model
- Simulate the economy until the constraint almost binds, then give it an interest rate rise
  - Trigger the constraint to bind
- In response to a MP shock, loan change is completely determined by franchise value change

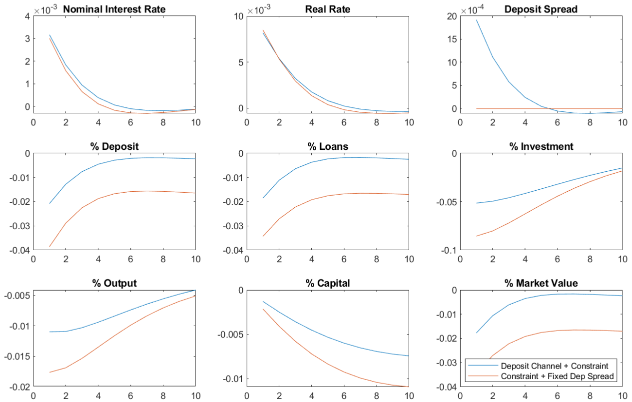
Deposits Channel Interacting with Balance Sheet Channel

- Immediate larger drop in deposits, investment, and output
- More like a crisis event, not normal times



Deposits Channel Interacting with Balance Sheet Channel

- Deposits channel reduces the decline of bank value when interest rate rise and weakens the balance sheet channel
- Deposit franchise increases as bank deposit rents rise with interest rates



Wholesale Fundings

$$A_t^j = N_t^j + D_t^j + H_t^j$$

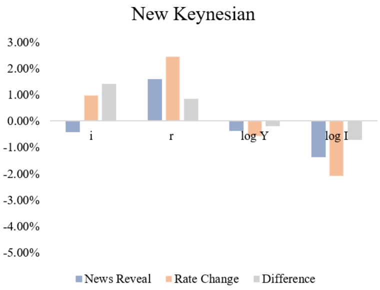
$$N_{t+1}^j = \frac{1+i_t^A}{\Pi_{t+1}} A_t^j - \left(\frac{1+i_t^{D,j}}{\Pi_{t+1}} + \frac{c^D}{\Pi_{t+1}} \right) D_t^j - \frac{1+i_t^H}{\Pi_{t+1}} H_t^j - \Phi^A(A_t^j) - \Phi^H(H_t^j)$$

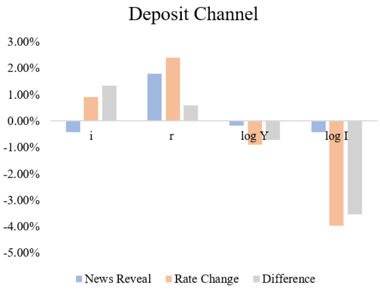
- Deposits channel: wholesale funding increase partially offset a decrease in deposits
- Balance sheet channel: banks reduce all fundings

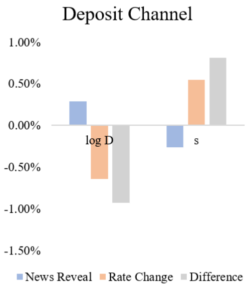
	Data	Deposits Channel	GK
Wholesale/Asset Sensitivity	0.220	0.233	0
Wholesale Sensitivity	1.474	1.236	−0.153

Expected vs. Unexpected Rate Change

- Upon a rate hike in 1 quarter ahead:
- In NK, large responses upon news reveal
- In deposits channel, response of spreads, deposits, and loans mostly after rate change (evidence in Drechsler et al 2017)







Interest Rate Risk in Banking

- As rates rise, banks earn a higher spread

$$s_t \equiv i_t - i_t^D = \beta_{s,t} \times i_t$$

- This increase in profits, it is argued, raises the value of deposits and leads to a negative deposit duration

$$Duration = -\frac{1}{V}\frac{dV}{di}$$

- The franchise value of deposits (floating) is

$$V_{d,fl} = E_t\left[D_t\beta_{s,t}i_t + M_{t+1}D_{t+1}\beta_{s,t+1}i_{t+1} + M_{t+2}D_{t+2}\beta_{s,t+2}i_{t+2} + ...\right]$$

- Although the deposit spread increases, so does the implied cost of capital
- Assuming fixed D and permanent i, then $V = D\beta_s$ and its duration is zero

Interest Rate Risk in Banking

- The franchise value of deposits (fixed) is

$$V_{d,fi} = D_t(-c^D) + \frac{D_{t+1}(c^D)}{1+i_{t+1}} + \frac{D_{t+2}(c^D)}{(1+i_{t+2})^2} + \dots$$

	V	ΔV	$\Delta V/V$
Floating	1.431	-0.010	
Fixed	-1.216	0.018	
Sum	0.215	0.008	0.739%

Interest Rate Risk in Banking

- The franchise value of loan is

$$V_l = E_t \left[A_t(\alpha^A + \beta^A i_t) + M_{t+1} A_{t+1}(\alpha^A + \beta^A i_{t+1}) + ... \right]$$

- Banks generate a positive fixed spread from their lending portfolio that exceeds their operating costs
- Taken together, it leads to a positive duration

	Loan			Bank: Loan + Deposit		
	V	ΔV	$\Delta V / V$	V	ΔV	$\Delta V / V$
Floating	-1.725	0.012		-0.294	0.002	
Fixed	2.591	-0.039		1.375	-0.021	
Sum	0.867	-0.027	-2.495%	1.082	-0.019	-1.756%

In Progress: Endogenous Loan Rate

- Bank holds two types of assets
- a long-term loan, whose quantity is fixed, and the return equals to the policy rate
- The short-term (floating rate) loan rate is pinned down in equilibrium
- Bank's balance sheet:

$$\sum_{\tau=0}^{m-1} B_{t-\tau}^{L} + B_t^S = N_t + D_t$$

$$N_{t+1}^j = \frac{1}{\Pi_{t+1}} \left[\sum_{\tau=0}^{m-1} (1 + i_{t-\tau}) B_{t-\tau}^{L,j} + (1 + i_t^A) B_t^{S,j} - (1 + i_t^{D,j} + c^D) D_t^j - \Psi^A(A_t^j) \right]$$

- Interest Income; loan beta is smaller than 1

$$\frac{\sum_{\tau=0}^{m-1} i_{t-\tau} B_{t-\tau}^{L,j} + i_t^A B_t^{S,j}}{\sum_{\tau=0}^{m-1} B_{t-\tau}^{L} + B_t^S}$$

Conclusion

- A dynamic GE model quantifying the monetary policy transmission through banks
- Model disciplined by bank responses to monetary policy shocks
- Deposits channel generates substantial real amplification (100%)
- Deposits channel is more pronounced when rate change realizes
- Interest rate risk in banking

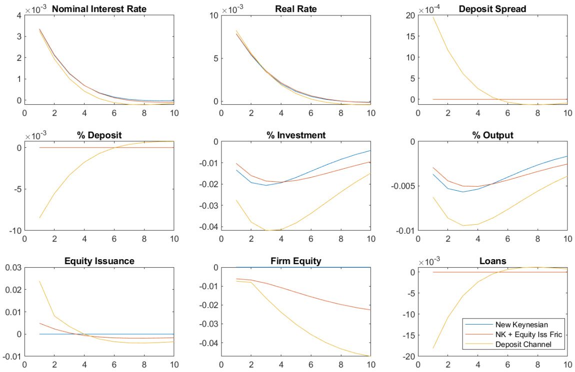
Calibration

Parameter	Value	Target
Household Preference		
χ^f	0.11	$\frac{\partial(M/Y)}{\partial i}$
ζ	10.67	Aggregate deposit elasticity
δ^D	0.818	Deposit spread
ϵ	6.6	Di Tella and Kurlat (2021)
Banks		
N^b	2	
η	2.55	Inferred
θ	0.93	Gertler, Kiyotaki and Prestipino(2020)
c^D	0.325%	Hanson et al (2015), Drechsler et al (2023)
α^A	0.45%	Average NIM
β^A	0.406	Interest expense beta
ϕ^A	0.053	Bank credit volatility
ω	0.090	Bank leverage
Productive Firms		
ϕ^p	0.0195	Elenev et al (2022)
ϕ^e	10.38	Net payout ratio
ϕ^I	1.40	$std(\Delta \log I)/std(\Delta \log Y)$

Back

The Role of Equity Issuance

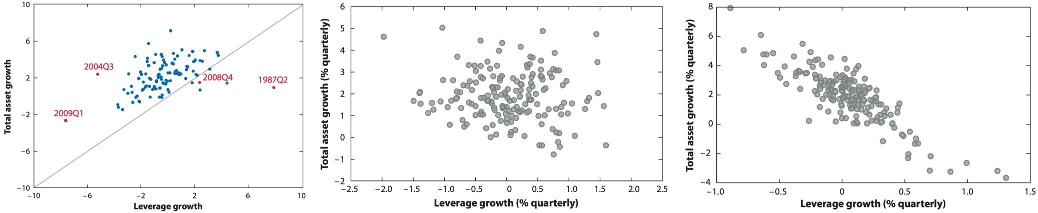
- Equity issuance friction plays a minor role without deposit channel



Back

Leverage Cyclicality

- asset growth $\Delta \log A_t$ against leverage (A_t/E_t) growth $\Delta \log A_t - \Delta \log E_t$
- deposits channel: 45-degree, procyclical leverage
- balance sheet channel: negative slope, countercyclical leverage



Source: Adrian and Shin (2011)

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