

Transmission Of Quantity-based Monetary Policy Through Heterogeneous Banks In China

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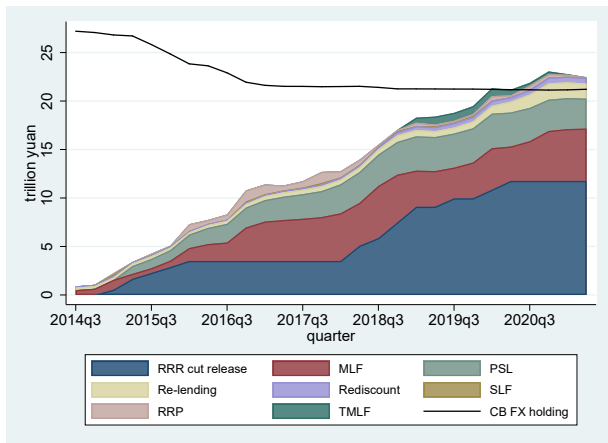
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CESI, 2023

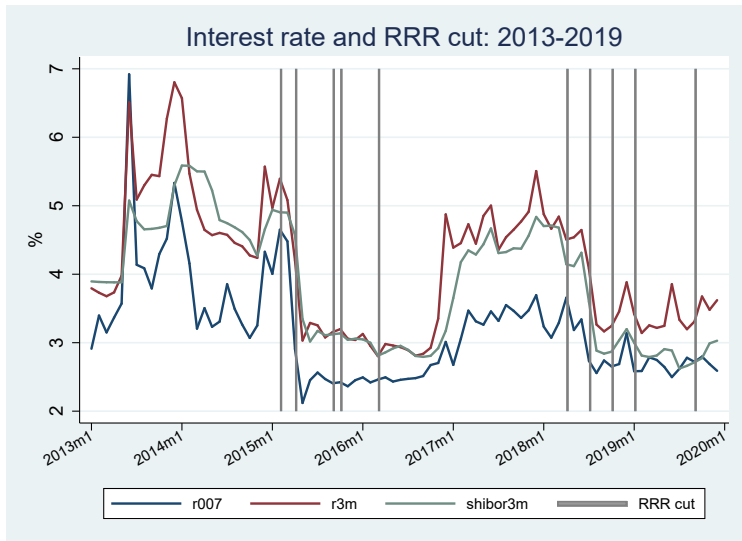
Chinese Monetary Policy

- Since 2013, PBC's active money supply becomes important.
 - ▶ due to the slower growth of funds outstanding for foreign exchange
- Two main instruments
- Required Reserve Ratio (RRR) cuts
- Medium-term Lending Facility (MLF).
 - ▶ Provide medium-term collateralized loans mainly for primary dealers.



Chinese Monetary Policy

- RRR cuts are effective in lowering interest rates.



Motivation

- RRR cuts & MLF do not inject funds to banks according to their needs.
 - ▶ RRR cuts inject funds proportional to banks' deposits.
 - ▶ MLF injects funds to only primary dealers.
- **Uneven** Chinese monetary policy results in systematic funding imbalance within the banking system.
 - ▶ Largely **even** U.S. monetary policy: IORB, ON RRP, discount window
- Reallocation of funds among banks constitutes a crucial part of monetary policy transmission in China.
- Interbank markets are of first-order importance.

MLF

Questions

- In what channel does reallocation of funds operate within Chinese banking system?
- What are the roles of different types of banks and institutions?
- How does the reallocation affect the lending to the real economy?

This Paper

- Build a simple model of Chinese banking system based on stylized facts
 - ▶ Heterogeneous banks: state banks (SOB) are more conservative in lending than non-state banks (NSB).
 - ▶ Conservatism prevents full reallocation of state banks' "redundant" resources.
 - ▶ Endowment of deposits and central bank funds matters for the final distribution of resources.
 - ▶ Implications for monetary policy implementation and financial liberalization.

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 - ▶ Endowment of deposits and central bank funds matters for the final distribution of resources.
 - ▶ Implications for monetary policy implementation and financial liberalization.
- Reallocation of funds following MLF and RRR cuts
 - ▶ Substitution effects & GE effects
 - ▶ Negotiable certificate of deposit (NCD) is the main channel of reallocation.
 - ▶ Evidence suggesting SOBs' conservatism on lending, but not on borrowing

This Paper

- A shift in 2018: SBs moved from the lending side on the IB market to the borrowing side.
 - ▶ Allow us to identify the effects the reallocation on the lending to the real economy
- Banks' asset allocation
 - ▶ Before the shift, SOBs' use of resources was less "efficient" than NSBs.
 - ▶ Since the shift, the difference dwindled and became insignificant.
- NSBs' lending to the real economy experienced a higher growth than SBs'
 - ▶ Bank level, city level, firm level

Related Literature

- Monetary policy transmission:
 - ▶ **Bank lending**: Bernanke, 83; Bernanke and Blinder, 88, 92; Kashyap and Stein, 94
 - ▶ **Balance sheet**: Bernanke and Gertler, 89; Kiyotaki and Moore, 97; Gertler and Kiyotaki, 10; He and Krishnamurthy, 13; Brunnermeier and Sannikov, 14
 - ▶ **Market power**: Scharfstein and Sunderam, 16; Drechsler et al., 17; Xiao, 20; Wang et al., 22
 - ▶ **Interbank market**: Vari, 20; Bianchi and Bigio, 22; Eisenschmidt et al., 22; Altavilla et al., 22
- Chinese banking system and regulation
 - ▶ Hachem and Song, 21: IB market power and liquidity regulation
 - ▶ Chen et al., 22: the role of NCDs in a target-rate monetary policy framework
 - ▶ Chen et al., 18; Li et al., 22; Fang et al., 20; Gu and Yun, 19

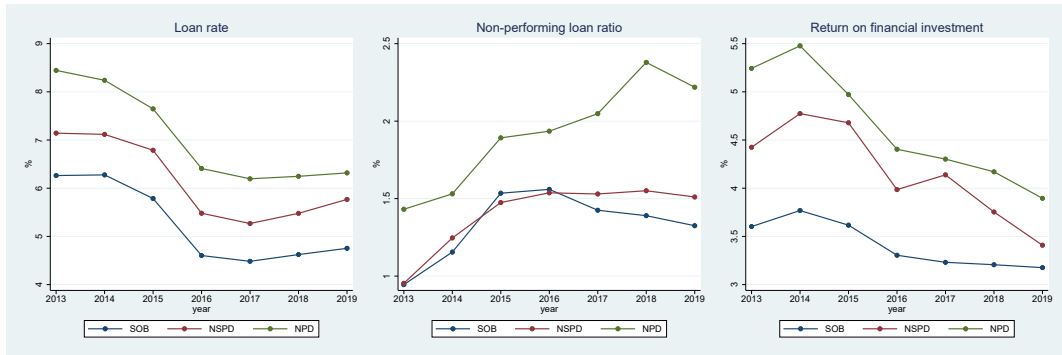
Contributions

- Consider the nature of **China's major quantity-based monetary policy instruments** and analyze their transmission within the banking system.
- Highlight **state banks' conservatism in lending** and illustrate how it impedes reallocation of funds and further affects the lending to the real economy.
- Uncover the impact of **the specifics of the implementation of monetary policy** on the allocation of financial resources in China.

Stylized Facts

Heterogeneous Banks: State vs. Non-state

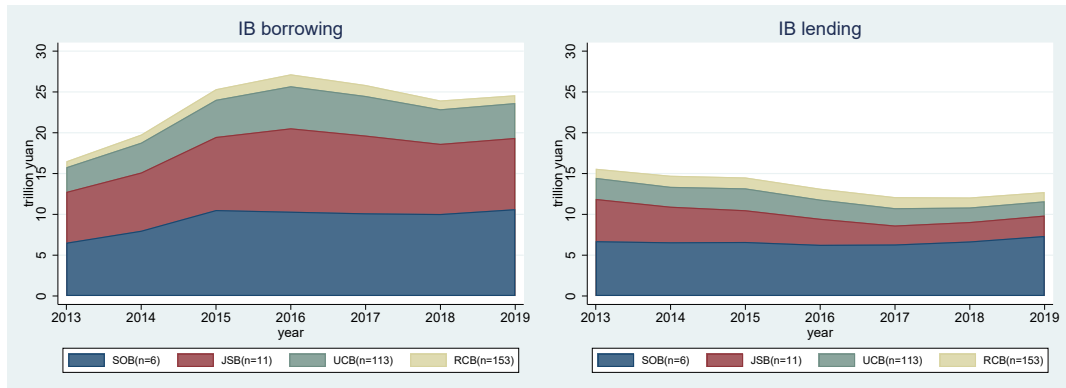
- Non-market behavior prevails in banks, especially state banks. (Deng et al., 2011; Huang et al., 2020; Gao et al., 2020)



- State banks are more conservative in investment than non-state banks.
 - ▶ more emphasis on stability than profitability
 - ▶ corporate governance

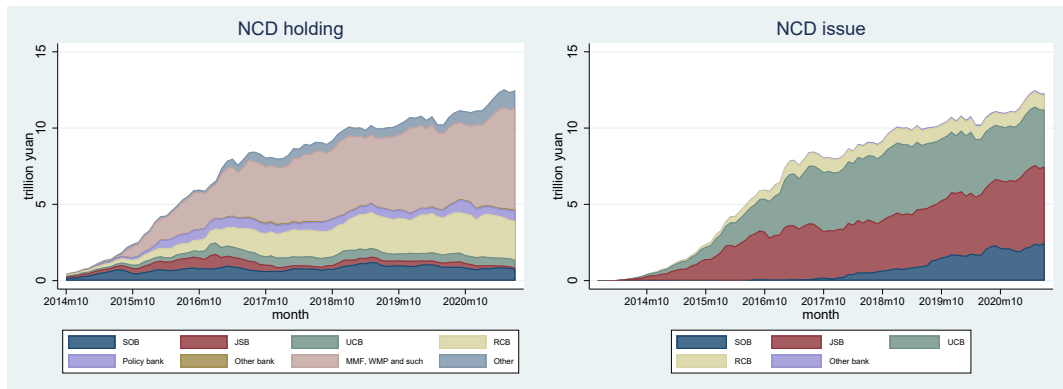
Traditional IB Borrowing & Lending

- Banks with complete annual data of **IB deposits, IB placement, Repo**



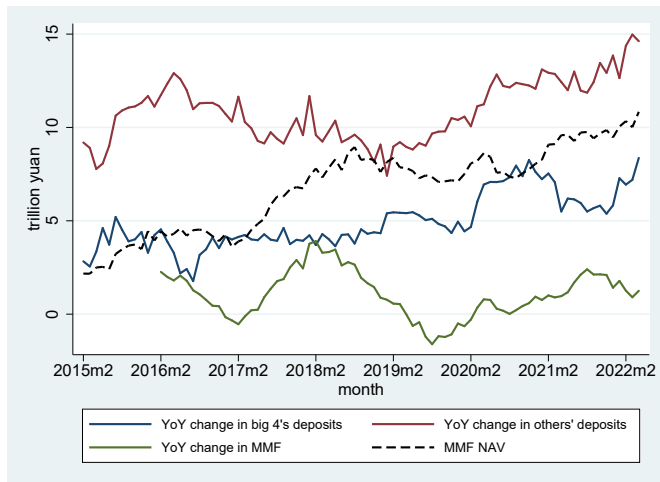
- Many banks are heavily engaged in both sides
 - a sign of market power: information frictions, convenience (Hachem and Song, 21)

NCD Holding & Issuance



- Competitive: tradable & have excellent secondary market liquidity (Amsted and He, 2020)
- State banks began to issue in 2018 and has become net issuers since 2019.

MMF & Bank Deposits



$$\Delta deposit_yoy_{i,t} = \alpha + \beta \Delta mmf_yoy_t + u_{i,t}$$

	(1)	(2)
	Big 4	Others
Δmmf_yoy_t	-0.224*** (0.074)	0.097 (0.120)
Constant	4.431*** (0.136)	9.958*** (0.220)
Observations	47	47
R-squared	0.169	0.014

- Speculation: MMFs attracted deposits mainly from state banks. (Buchak, Hu, and Shang-Jin Wei, 2021)

A Simple Model of Chinese Banking System

Environment

- A two-period model with
 - ▶ N_s state banks, symmetric
 - ▶ N_{ns} non-state banks
- Banks' balance sheets at date 0

Asset		Liability	
Required reserves	ρd_j	Deposits	d_j
Excess reserves	x_j	CB borrowing	m_j
IB lending	l_j	IB borrowing	b_j
Investment	k_j	Equity	0

- ▶ ρ : required reserve ratio (RRR)
- ▶ $m_j + (1 - \rho)d_j$: bank j 's endowed funds exogenously given.

Banks' Problems

- Non-state banks' problem

$$\max_{x_i, k_i, l_i, b_i} [\rho d_i + x_i + \gamma(x_i)] + [R_k k_i - \eta(k_i)] + R_{IB}(l_i - b_i) - d_i - m_i.$$

- ▶ $\gamma(x_i)$: liquidity value of excess reserves, increasing and concave
- ▶ $R_k k_i - \eta(k_i)$: increasing and convex $\eta(k_i)$ implies decreasing return of investment,
- ▶ R_{IB} : the IB rate, endogenous
- ▶ No interest on deposits and CB borrowing

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- ▶ No interest on deposits and CB borrowing

- State banks' problem

$$\max_{x_s, k_s, l_s, b_s} [\rho d_s + x_s + \gamma(x_s)] + [R_k k_s - \eta(k_s) - \delta_k(k_s)] + [R_{IB}(l_s - b_s) - \delta_f(l_s)] - d_s - m_s$$

- ▶ δ_k and δ_f : aversion to investment and lending, increasing and convex.

Two Effects of Monetary Policy

- Substitution: endowed funds $(1 - \rho)d_j + m_j \implies$ interbank positions, i.e.,

$$\frac{\partial (b_j - l_j)}{\partial [(1 - \rho)d_j + m_j]} < 0.$$

- GE: the interbank rate $R_{IB} \implies$ asset allocation \implies interbank positions, i.e.,

$$\frac{\partial (b_j - l_j)}{\partial R_{IB}} < 0.$$

Implications: MLF

- MLF increases mainly primary dealers' (PDs) central bank borrowing, and state banks are all PDs

Implication 1

Consider banks that borrow on the interbank market. The substitution of endowed funds for interbank borrowing is the same for state banks and non-state PD banks:

$$\frac{\partial \Delta b_s}{\partial \Delta e_s} = \frac{\partial \Delta b_{nspd}}{\partial \Delta e_{nspd}} = -1.$$

Consider banks that lend on the interbank market. The substitution of endowed funds for interbank lending is smaller for state banks than for non-state PD banks:

$$\frac{\partial \Delta l_s}{\partial \Delta e_s} < \frac{\partial \Delta l_{nspd}}{\partial \Delta e_{nspd}} = 1.$$

- Conservatism prevents full substitution only when state banks lend on the market.

MLF: borrowing

MLF: lending

derivation

Implications: RRR Cuts

- RRR cuts essentially inject funds proportional to bank deposits.

Implication 2

Suppose that banks with higher deposits are affected by the GE effect to a lesser extent. Absent other monetary policy shocks, **interbank borrowing is more negatively correlated with deposits following RRR cuts**. That is, for any two banks j_1 and j_2 ,

$$\Delta \frac{b_{j_1} - b_{j_2}}{d_{j_1} - d_{j_2}} / \Delta \rho > 1.$$

RRR

Implications: Banks' Asset Allocation

- Two scenarios
 - ▶ In Scenario 1, SBs are endowed with ample deposits so that they lend on the interbank market.
 - ▶ In Scenario 2, SBs are endowed with limited deposits so that they borrow on the interbank market.

Implication 3

Given the interbank rate, as balance sheets expand, state banks allocate more (the same) to excess reserves or have lower (the same) utilization of funds than non-state banks in Scenario 1 (2). That is,

$$\frac{\Delta x_s^1}{\Delta L_s^1} - \frac{\Delta x_i^1}{\Delta L_i^1} > 0 = \frac{\Delta x_s^2}{\Delta L_s^2} - \frac{\Delta x_i^2}{\Delta L_i^2},$$

where $L = m + (1 - \rho)d + b$ represents the total liabilities less required reserves.

Implications: Banks' Asset Allocation

Implication 4

Compared with Scenario 1, state banks have smaller investment and excess reserves in Scenario 2, whereas non-state banks have greater ones. That is,

$$k_i^2 - k_i^1 > 0 > k_s^2 - k_s^1,$$

$$x_i^2 - x_i^1 > 0 > x_s^2 - x_s^1.$$

Lending

Empirical Analysis

Data

- Banks' quarterly financials
 - Source: public firms' quarterly reports, National interbank funding center
- NCD issuance data, Monthly NCD data aggregated at bank-type level
 - Source: Wind database, Shanghai clearing house
- Macro data
 - Source: PBC, Asset Management Association of China (AMAC)
- City-level data
 - Source: China City Statistical Yearbook
- Firm-level data
 - Source: NEEQ firms' annual reports, collected by BFI-China
- The sample period: 2013Q4—2019Q4
 - from the emergence of NCD to Covid-19

Table: Summary statistics of bank quarterly financials

	N	mean	sd	Median		N	mean	sd	Median
Panel A: State					Panel B: Non-state PD (NSPD)				
Assets (billion yuan)	139	17346.7	6446.03	18349.4	426	2637.88	2143.85	2016.62	
NCD outstanding/assets (%)	139	.38	.81	.04	426	8.23	4.84	8.56	
IB net borrowing/assets (%)	139	3.45	4.68	3.41	426	10.07	7.6	9.41	
CB borrowing/assets (%)	139	1.77	1.89	1.47	426	2.24	2.06	1.69	
Deposits/assets (%)	139	75.65	8.29	75.9	426	61.74	7.37	61.41	
Excess reserve/assets (%)	139	.94	.93	.98	426	.66	1.11	.41	
Investment/assets (%)	139	77.91	3.48	78.04	423	81.79	7.31	83.67	
ROA (%)	139	.68	.32	.64	426	.58	.27	.56	
Liquid ratio (%)	139	14.46	3.16	14.33	426	10.11	5.76	8.56	
Panel C: Non-PD (NPD)									
Assets (billion yuan)	1948	131.55	205.94	60.64					
NCD outstanding/assets (%)	1948	5.2	6.55	2.04					
IB net borrowing/assets (%)	1948	2.25	9.7	1.64					
CB borrowing/assets (%)	1948	1.04	1.76	.45					
Deposits/assets (%)	1946	74.72	11.69	75.22					
Excess reserve/assets (%)	1946	.93	2.55	.63					
Investment/assets (%)	1920	79.93	8.55	80.81					
ROA (%)	1947	.56	.34	.53					
Liquid ratio (%)	1948	9.1	5.48	9.1					

MLF: Substitution For IB Borrowing

- Implication 1: banks have 1-1 substitution of CB borrowing for IB borrowing Implication 1

$$\Delta Y_{i,t} = \beta_1 \Delta cb_borrow_{i,t} + \beta_2 cb_borrow_{i,t-1} + \alpha_i + \lambda_t + \kappa D_{i,t} + \gamma X_{i,t} + u_{i,t}$$

- Potential endogeneity
 - ▶ Omitted variables: banks' idiosyncratic demand for funds
 - ▶ Reverse causality: banks adjust CB borrowing in response to IB markets.

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- Potential endogeneity
 - ▶ Omitted variables: banks' idiosyncratic demand for funds
 - ▶ Reverse causality: banks adjust CB borrowing in response to IB markets.
- $\Delta cb_borrow_{i,t}$ instrumented by $\Delta MLF_t \times PD_{i,t}$
 - ▶ DiD or Bartik IV with exogenous shares: PDs are treated but non-PDs aren't.
 - ▶ Assumption: the central bank chooses aggregate MLF to respond to the aggregate condition, rather than cater to a subset of banks.

MLF: Substitution For IB Borrowing

- $\hat{\beta}_1$: The coefficient of $\Delta cb_borrow_{i,t}$ captures the average substitution of PDs in the sample
 - ▶ non-PDs are not exposed to ΔMLF_t .

	<i>NCD_outstanding_{i,t}</i>				<i>IB_netborrow_{i,t}</i>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SOB+NPD OLS	SOB+NPD 2SLS	NSPD+NPD OLS	NSPD+NPD 2SLS	SOB+NPD OLS	SOB+NPD 2SLS	NSPD+NPD OLS	NSPD+NPD 2SLS
<i>Δcb_borrow_{i,t}</i>	-0.060 (0.115)	-1.095*** (0.335)	-0.107 (0.088)	-1.058** (0.464)	-0.776*** (0.241)	-0.524 (0.527)	-0.733*** (0.180)	0.101 (0.945)
<i>cb_borrow_{i,t-1}</i>	0.014 (0.112)	-0.548** (0.248)	0.046 (0.072)	-0.297 (0.197)	-0.239 (0.147)	-0.102 (0.330)	-0.099 (0.095)	0.202 (0.365)
Deposit controls	Y	Y	Y	Y	Y	Y	Y	Y
Fundamental Controls	Y	Y	Y	Y	Y	Y	Y	Y
Bank FE & Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,270	1,270	1,618	1,618	1,270	1,270	1,618	1,618
R-squared	0.126		0.111		0.172		0.173	
Instruments' F-statistics		25.22		16.36		25.22		16.36

2SLS vs. OLS

- Consistent with the idea that
 - ▶ NCD market is competitive and used to accommodate other shocks
 - ▶ Traditional IB is not competitive and adjusted mildly to other shocks.
- Between NCD and CB borrowing
 - ▶ omitted variable: idiosyncratic demand for funds drives both in the same direction
 - ▶ $2SLS < OLS$
- Between Traditional IB and CB borrowing
 - ▶ reverse causality: adjust CB borrowing to Traditional IB
 - ▶ $2SLS > OLS$

[back](#)

The Diff In Substitution For IB Borrowing

- Implication 1: β_0 is close to 0.

$$\Delta Y_{i,t} = \beta_0 \Delta cb_borrow_{i,t} \times NSB_i + \beta_1 \Delta cb_borrow_{i,t} + \beta_2 cb_borrow_{i,t-1} + \alpha_i + \lambda_t + \kappa D_{i,t} + \gamma X_{i,t} + u_{i,t}$$

- ▶ $\{\Delta cb_borrow_{i,t}, \Delta cb_borrow_{i,t} \times NSB_i\}$ instrumented by $\{\Delta MLF_t, \Delta MLF_t \times NSB_i\}$

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- ▶ $\{\Delta cb_borrow_{i,t}, \Delta cb_borrow_{i,t} \times NSB_i\}$ instrumented by $\{\Delta MLF_t, \Delta MLF_t \times NSB_i\}$

	<i>NCD_outstanding_{i,t}</i>		<i>IB_netborrow_{i,t}</i>	
	(1) SB+NSPD OLS	(2) SB+NSPD 2SLS	(3) SB+NSPD OLS	(4) SB+NSPD 2SLS
<i>Δcb_borrow_{i,t}</i>	-0.277** (0.133)	-0.443* (0.263)	-0.644** (0.301)	-0.605 (0.426)
<i>Δcb_borrow_{i,t} × NSB_i</i>	-0.012 (0.163)	0.295 (0.289)	-0.014 (0.341)	0.284 (0.727)
<i>cb_borrow_{i,t-1}</i>	-0.112 (0.094)	-0.085 (0.104)	0.023 (0.135)	0.089 (0.160)
Deposit controls	Y	Y	Y	Y
Fundamental Controls	Y	Y	Y	Y
Bank FE & Year FE	Y	Y	Y	Y
Observations	456	456	456	456
R-squared	0.132		0.256	
Instruments' F-statistics		69.30/26.87		69.30/26.87

- No significant diff in the substitution for IB borrowing between SBs and NSPDs.

The Diff In Substitution For IB Lending

- Implication 1: NSBs have stronger substitution of CB borrowing for IB lending Implication 1
 - ▶ positive β_0 with $\Delta NCD_holding_{i,t}$ being the dependent variable
- Monthly data at the bank-type level
 - ▶ aggregated NCD holding: SB, JSB, UCB, RCB, other banks
 - ▶ aggregated CB borrowing: Big 4, NSB
- Matching strategy

	NCD holding	CB borrowing	Substitution
state banks	SB	Big 4	biased towards $+\infty$
non-state banks	JSB+UCB	NSB	biased towards 0

- $\hat{\beta}_0$ is biased towards 0.

The Diff In Substitution For IB Lending

	<i>NCD_holding_{i,t}</i>		<i>NCD_outstanding_{i,t}</i>	
	(1)	(2)	(3)	(4)
	OLS	2SLS	Full	Assets > 100 bn
<i>Δcb_borrow_{i,t}</i>	-0.062 (0.076)	-0.098 (0.082)	-0.076 (0.163)	-0.083 (0.177)
<i>Δcb_borrow_{i,t} × NSB_i</i>	0.294*** (0.100)	0.289** (0.112)	-0.053 (0.215)	0.131 (0.242)
<i>cb_borrow_{i,t-1}</i>	0.010 (0.015)	0.009 (0.015)	-0.134*** (0.033)	-0.130*** (0.031)
Deposit controls	Y	Y	Y	Y
Fundamental Controls	Y	Y	Y	Y
Bank-type FE & Year FE	Y	Y	Y	Y
Observations	124	124	124	124
R-squared	0.271	0.267	0.249	0.239
Instruments' F-statistics		100.98/84.83		100.98/84.83

- State banks' conservatism prevents full reallocation of funds when state banks lend

RRR Cuts

- Implication 2: more negative correlation between borrowing and deposits after RRR cuts

Implication 2

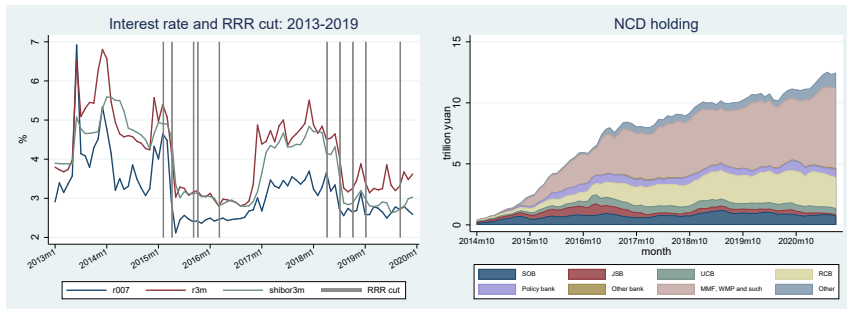
$$Y_{i,t} = \lambda_t + \beta_1 RRR_cut_t \times deposit_{i,t} + \beta_2 deposit_{i,t} + \beta_3 cb_borrow_{i,t} + \gamma X_{i,t} + u_{i,t}$$

RRR Cuts

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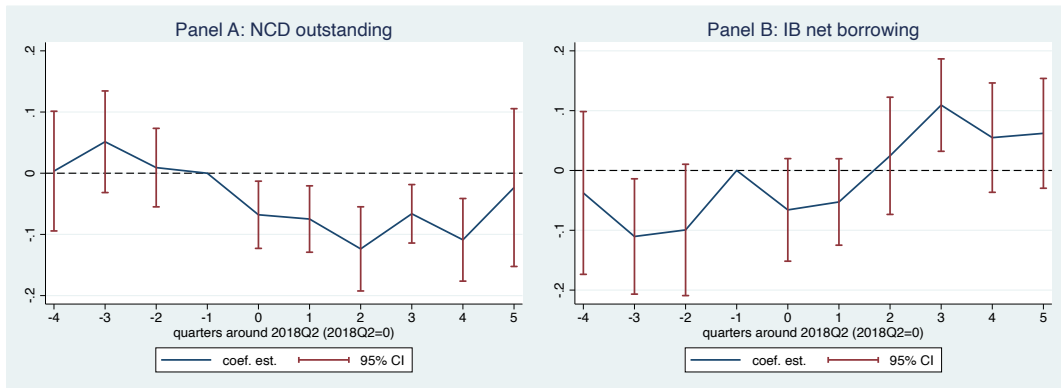
Implication 2

$$Y_{i,t} = \lambda_t + \beta_1 RRR_cut_t \times deposit_{i,t} + \beta_2 deposit_{i,t} + \beta_3 cb_borrow_{i,t} + \gamma X_{i,t} + u_{i,t}$$



- Focus on the second one
 - ▶ no strong pattern for the first one since NCD was not fully developed then

RRR Cuts: Time Trend



- The relationship between NCD outstanding and deposits
 - ▶ is stable before RRR cuts
 - ▶ becomes significantly more negative afterwards.

RRR Cuts: Estimation

Table: The responses to the 2nd wave of RRR cuts

	<i>NCD_outstanding_{i,t}</i>			<i>IB_netborrow_{i,t}</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	3+1	3+2	3+3	3+1	3+2	3+3
<i>RRR_cut_t × deposit_{i,t}</i>	-0.090*** (0.025)	-0.093*** (0.025)	-0.110*** (0.027)	-0.006 (0.039)	-0.001 (0.033)	0.025 (0.035)
<i>deposit_{i,t}</i>	-0.364*** (0.041)	-0.362*** (0.040)	-0.362*** (0.039)	-0.471*** (0.058)	-0.473*** (0.058)	-0.475*** (0.057)
<i>cb_borrow_{i,t}</i>	-0.904*** (0.171)	-0.877*** (0.160)	-0.855*** (0.151)	-0.386 (0.260)	-0.413* (0.242)	-0.415* (0.223)
Fundamental Controls	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Observations	562	702	843	562	702	843
R-squared	0.457	0.469	0.480	0.496	0.501	0.498

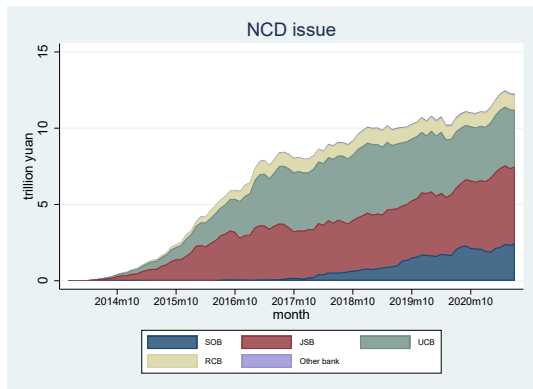
- After RRR cuts, banks with more deposits reduce NCD outstanding more.

robustness

Lending to the Real Economy

Identification

- Use the diff btw Scenario 1 and Scenario 2 to identify the impacts
- State banks began to issue NCDs in 2018.
 - ▶ Interpretation: a shift from Scenario 1 to Scenario 2
 - ▶ A potential force: a boom in MMFs dampened state banks' deposit growth



Banks' Utilization of Funds

- Implication 3: Banks' utilization of funds Implication 3

$$\Delta xreserve_{i,t} = \alpha_i + \lambda_t + \beta_1 \Delta assest_{i,t} + \beta_2 \Delta asset_{i,t} \times NSB_i + \gamma X_{i,t} + u_{i,t}.$$

	Excess reserves			Excess reserves in two quarters		
	(4) Full	(5) Before 2018	(6) Since 2018	(7) Full	(8) Before 2018	(9) Since 2018
$\Delta assest_{i,t}$	0.262*** (0.033)	0.279*** (0.026)	0.163** (0.076)	0.179*** (0.046)	0.232*** (0.048)	0.059* (0.030)
$\Delta asset_{i,t} \times NSB_i$	-0.226*** (0.033)	-0.255*** (0.026)	-0.107 (0.075)	-0.164*** (0.046)	-0.221*** (0.048)	-0.039 (0.029)
Fundamental Controls	Y	Y	Y	Y	Y	Y
Bank FE & Quarter FE	Y	Y	Y	Y	Y	Y
Observations	2,488	1,100	1,388	2,332	1,015	1,317
R-squared	0.179	0.189	0.226	0.146	0.134	0.194

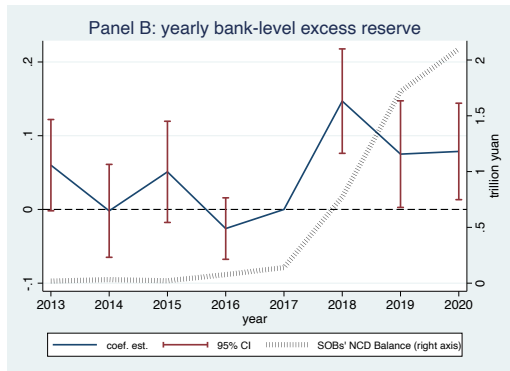
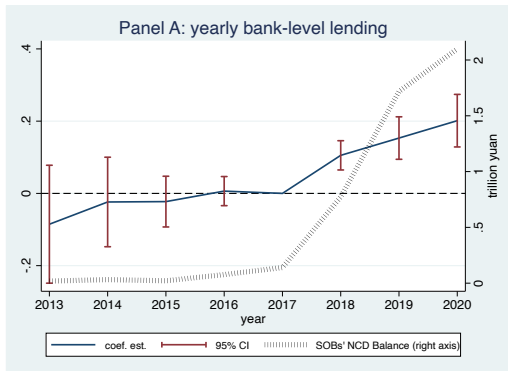
- Non-state banks have a significantly lower tendency to allocate resources to excess reserves than state banks.
- The difference dwindles and becomes insignificant since 2018.

Banks' Asset Allocation

- Implication 4: the level of asset allocation Implication 4
- Yearly sample from 2016 to 2019

$$\log(Y_{i,t}) = \beta_1 (\text{after}_t \text{ or } \text{NCD_outstanding_SOB}_t) \times \text{NSB}_i + \alpha_i + \lambda_t + u_{i,t}$$

- ▶ $Y_{i,t} = \{\text{loan}_{i,t}, \text{rxreserve}_{i,t}\}$
- ▶ $\text{rxreserve} = \text{reserves}/\text{required reserves}$
- ▶ after_t : the post-2018 dummy
- ▶ $\text{NCD_outstanding_SOB}_t$: state banks' NCD outstanding



	$\log(\text{loan})_{i,t}$		$\log(\text{rxreserve})_{i,t}$	
	(1)	(2)	(3)	(4)
$\text{after}_t \times \text{NSB}_i$		0.125*** (0.028)	0.126*** (0.035)	
$\text{NCD_outstanding_SOB}_{i,t} \times \text{NSB}_i$			0.095*** (0.021)	0.063*** (0.024)
Bank FE & Year FE	Y	Y	Y	Y
Observations	2,225	2,225	2,214	2,214
R-squared	0.985	0.985	0.602	0.602

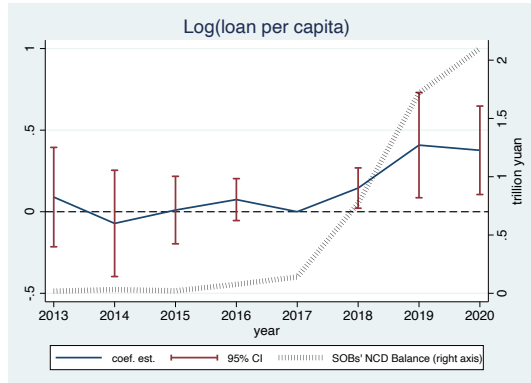
NSBs experienced higher growth in lending and xreserves than SBs since 2018.

City-Level Lending

- Further implication: cities with higher exposure to non-state banks have higher lending growth since 2018.
- Exposure to non-state banks: $fraction_{city} \triangleq (\#JSB + \#UCB) / (\#JSB + \#UCB + \#SOB)$
 - ▶ These banks are active in lending while RCB branches mainly take deposits.
- Yearly sample from 2016 to 2019,

$$\log(loan)_{city,t} = \beta_1 (after_t \text{ or } NCD_outstanding_SOB_t) \times fraction_{city} \\ + \beta_2 fraction_{city} + \alpha_{province} + \lambda_t + \gamma CX_{city,t} + u_{city,t}$$

- ▶ $fraction_{city}$ in 2012 or 2015
- ▶ City fundamental controls: $CX_{city,t} = \{\log(GDP_{city,t}), \log(population_{city,t}), primary_sector_{city,t}, secondary_sector_{city,t}\}$



	$fraction_{city}$ in 2012		$fraction_{city}$ in 2015	
	(1)	(2)	(3)	(4)
$after_t \times fraction_{city}$		0.230*** (0.104)	0.163*** (0.072)	
$NCD_outstanding_SOB_t \times fraction_{city}$			0.220** (0.104)	0.185** (0.065)
$fraction_{city}$	0.932*** (0.271)	0.897*** (0.281)	1.374*** (0.271)	1.327*** (0.281)
City fundamental controls	Y	Y	Y	Y
Province FE & Year FE	Y	Y	Y	Y
Observations	1,131	1,131	1,131	1,131
R-squared	0.939	0.939	0.942	0.942

Firm-level Lending

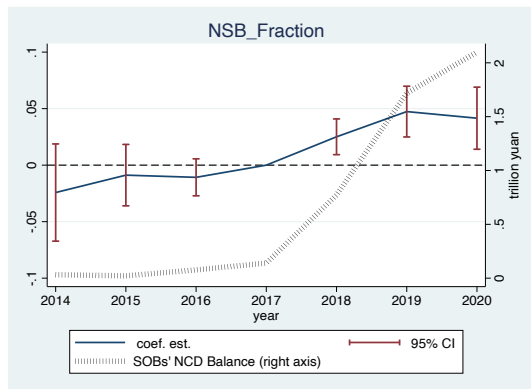
- Further implication: firms receive higher fractions of lending from non-state banks since 2018.
- Firms listed in National Equities Exchange and Quotations (NEEQ) are required to disclose borrowing
- Focus on firms with sizable loans from both state banks and non-state banks
- Loan composition:

$$NSB_Fraction_{i,t} \triangleq \frac{\text{ADB of loans from NSBs}}{\text{ADB of loans from NSBs and SOBs}}$$

▶ ADB: average daily balance

- Yearly or quarterly sample from 2016 to 2019

$$NSB_Fraction_{i,t} = \alpha_i + \beta_1 after_t + u_{i,t}.$$



	(1)	(2)	(3)	(4)	(5)	(6)
	Full	Full	Non-SOE	Non-SOE	SOE	SOE
$after_t$	0.043*** (0.009)		0.040*** (0.010)		0.055 (0.034)	
$NCD_outstanding_SOB_t$		0.035*** (0.007)		0.034*** (0.008)		0.044 (0.029)
Firm FE	Y	Y	Y	Y	Y	Y
Observations	2,213	2,213	1,966	1,966	197	197
R-squared	0.785	0.785	0.789	0.790	0.740	0.741

Concluding Remarks

- A model about Chinese banking system
 - ▶ Monetary policy transmission relies on systematic reallocation of funds.
 - ▶ State banks' conservatism impedes reallocation.
- Empirical findings suggest
 - ▶ State banks are conservative in lending.
 - ▶ NCDs play a dominant role in the reallocation.
 - ▶ The reallocation mechanism matters for credit
- Policy implications
 - ▶ Design monetary policy instruments to avoid funding imbalance
 - ▶ Facilitate financial liberalization to improve reallocation

Appendix

Parameterized Equilibrium

- Parameterization:
 - ▶ Liquidity value: $\gamma(x) = \gamma x (\bar{x} - \frac{1}{2}x)$, $\gamma\bar{x}$ ensures positive excess reserves in equil;
 - ▶ The expected payoff of investment: $R_k k - \eta(k) = R_k - \frac{1}{2}\eta k^2$;
 - ▶ State banks' aversion: $\delta_k(k) = \frac{1}{2}\delta_k k^2$, $\delta_f(f) = \frac{1}{2}\delta_f f^2$.

Proposition 1

Given the interbank rate R_{IB} ,

- for non-state banks,

$$k_i = \frac{R_k - R_{IB}}{\eta},$$
$$x_i = \bar{x} - \frac{R_{IB} - 1}{\gamma},$$

$$b_i - l_i = k_i + x_i - (1 - \rho)d_i - m_i;$$

- for state banks,

$$k_s = \frac{R_k - R_{IB}}{\eta + \delta_k} + \frac{\delta_f}{\eta + \delta_k} l_s \cdot \mathbf{1}\{l_s > 0\},$$
$$x_s = \bar{x} - \frac{R_{IB} - 1}{\gamma} + \frac{\delta_f}{\gamma} l_s \cdot \mathbf{1}\{l_s > 0\},$$

$$b_s - l_s = k_s + x_s - (1 - \rho)d_s - m_s.$$

- Notation: $(D_s, M_s) = (N_s d_s, N_s m_s)$, $(D_{ns}, M_{ns}) = \left(\sum_{i=1}^{N_{ns}} d_i, \sum_{i=1}^{N_{ns}} m_i \right)$.

Equilibrium and Parameterization

- Determine the interbank rate R_{IB} using the interbank market clearing, i.e.,

$$N_s (b_s - l_s) + \sum_{i=1}^{N_{ns}} (b_i - l_i) = W.$$

Proposition 2

Let R_{IB}^1 be the solution to the equation

$$\begin{aligned} N_s \left(\frac{R_k - R_{IB}^1}{\eta + \delta_k} + \bar{x} - \frac{R_{IB}^1 - 1}{\gamma} \right) + \left(1 + \frac{\delta_f}{\eta + \delta_k} + \frac{\delta_f}{\gamma} \right) N_{ns} \left(\frac{R_k - R_{IB}^1}{\eta} + \bar{x} - \frac{R_{IB}^1 - 1}{\gamma} \right) \\ = (1 - \rho) D_s + M_s + \left(1 + \frac{\delta_f}{\eta + \delta_k} + \frac{\delta_f}{\gamma} \right) [(1 - \rho) D_{ns} + M_{ns} + W] \end{aligned}$$

and R_{IB}^2 be the solution to the equation

$$N_s \left(\frac{R_k - R_{IB}^2}{\eta + \delta_k} + \bar{x} - \frac{R_{IB}^2 - 1}{\gamma} \right) + N_{ns} \left(\frac{R_k - R_{IB}^2}{\eta} + \bar{x} - \frac{R_{IB}^2 - 1}{\gamma} \right) = (1 - \rho) D_s + M_s + (1 - \rho) D_{ns} + M_{ns} + W.$$

- If $\frac{R_k - R_{IB}^2}{\eta + \delta_k} + \bar{x} - \frac{R_{IB}^2 - 1}{\gamma} < (1 - \rho) d_s + m_s$, the equilibrium interbank rate is $R_{IB}^* = R_{IB}^1$.
- If $\frac{R_k - R_{IB}^2}{\eta + \delta_k} + \bar{x} - \frac{R_{IB}^2 - 1}{\gamma} \geq (1 - \rho) d_s + m_s$, the equilibrium interbank rate is $R_{IB}^* = R_{IB}^2$.

Derivation for MLF Implication

- Holding deposits and RRR fixed

- ▶ State banks

$$\Delta b_S = - \left(\frac{1}{\eta + \delta_k} + \frac{1}{\gamma} \right) \Delta R_{IB} - \Delta m_s$$

- ▶ Non-state PDs

$$\Delta b_{nspd} = - \left(\frac{1}{\eta} + \frac{1}{\gamma} \right) \Delta R_{IB} - \Delta m_{nspd}$$

- ▶ Non-PDs

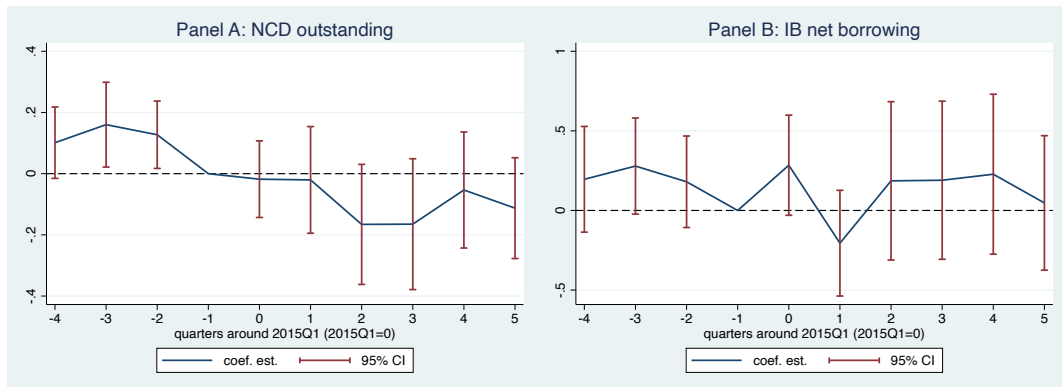
$$\Delta b_{npd} = - \left(\frac{1}{\eta} + \frac{1}{\gamma} \right) \Delta R_{IB} - \Delta m_{npd} = - \left(\frac{1}{\eta} + \frac{1}{\gamma} \right) \Delta R_{IB}$$

- Cross-sectional variation

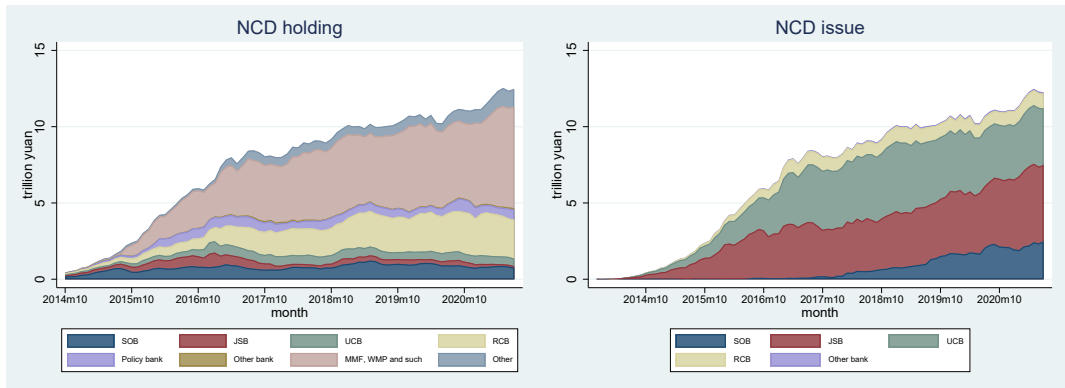
$$\frac{\Delta b_{nspd} - \Delta b_{npd}}{\Delta m_{nspd} - \Delta m_{npd}} = -1$$

$$\frac{\Delta b_s - \Delta b_{npd}}{\Delta m_s - \Delta m_{npd}} = \frac{\delta_k}{\eta (\eta + \delta_k)} \frac{\Delta R_{IB}}{\Delta m_S} - 1 < -1$$

RRR Cuts: the 1st Wave

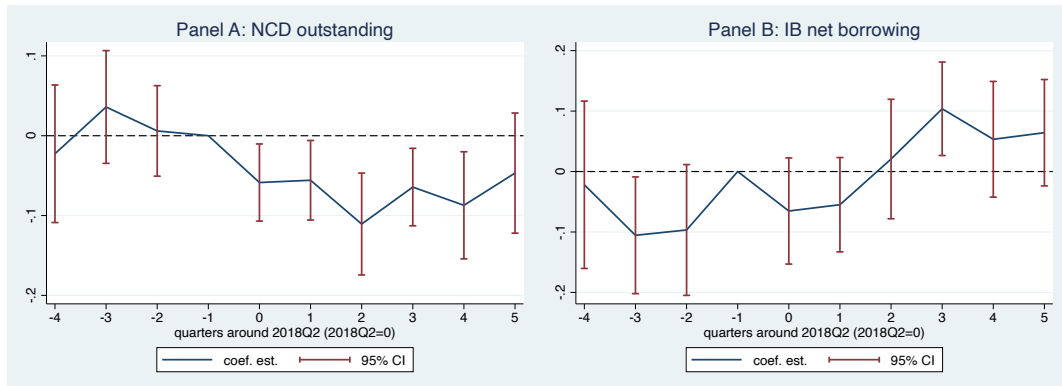


RRR Cuts: the 1st Wave



Robustness With Deposit Decile FE

- Robustness: divide banks into ten deciles based on their scaled deposits in 2018Q1 and add decile fixed effects



Robustness With Deposit Decile FE

Table: The responses to the 2nd wave of RRR cuts

	<i>NCD_outstanding_{i,t}</i>			<i>IB_netborrow_{i,t}</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	3+1	3+2	3+3	3+1	3+2	3+3
<i>RRR_cut_t × deposit_{i,t}</i>	-0.070*** (0.022)	-0.069*** (0.022)	-0.088*** (0.025)	-0.006 (0.040)	-0.004 (0.035)	0.020 (0.037)
<i>deposit_{i,t}</i>	-0.116* (0.064)	-0.146** (0.060)	-0.164*** (0.060)	-0.443*** (0.115)	-0.468*** (0.109)	-0.470*** (0.102)
<i>cb_borrow_{i,t}</i>	-0.925*** (0.165)	-0.879*** (0.157)	-0.846*** (0.150)	-0.336 (0.267)	-0.384 (0.253)	-0.392 (0.237)
Fundamental Controls	Y	Y	Y	Y	Y	Y
Deposit Decile FE	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
Observations	562	702	843	562	702	843
R-squared	0.541	0.544	0.549	0.505	0.510	0.510

back

Implications: The Aggregate Impact

- The aggregate impact of monetary policy, more normative than positive

Implication 5

- In Scenario 1, injecting liquidity to non-state banks results in a higher total investment than injecting liquidity to state banks, i.e.,

$$\frac{dTI}{d[(1-\rho)D_S + M_S]} < \frac{dTI}{d[(1-\rho)D_{NS} + M_{NS}]}.$$

- In Scenario 2, injecting liquidity to which bank does not matter, i.e.,

$$\frac{dTI}{d[(1-\rho)D_S + M_S]} = \frac{dTI}{d[(1-\rho)D_{NS} + M_{NS}]}.$$

MLF

