

The Nexus of Monetary Policy and Shadow Banking in China¹

Kaiji Chen^a, Jue Ren^b, and Tao Zha^c

^a Emory University

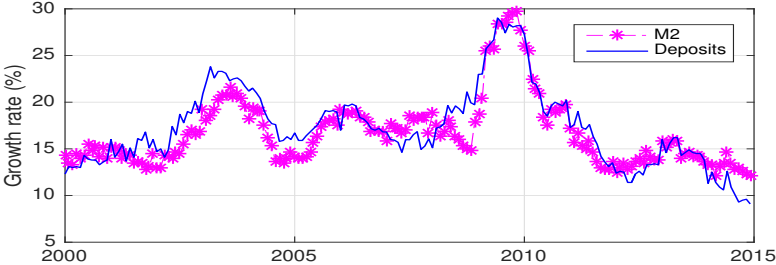
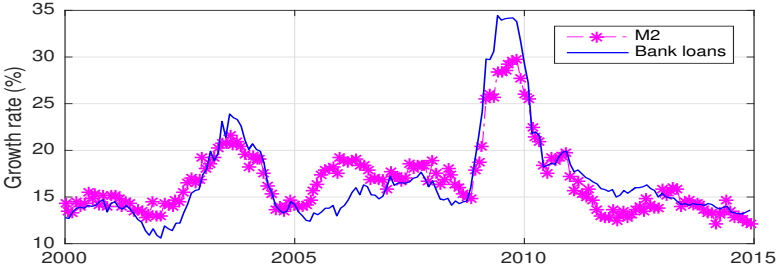
^bTexas Christian University

^cFRB Atlanta, Emory University, and NBER

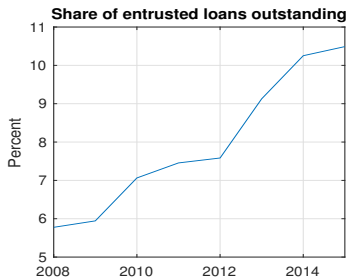
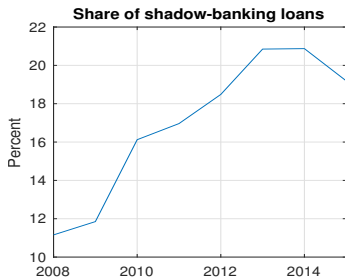
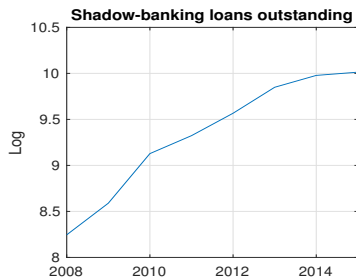
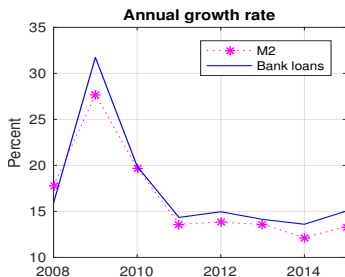
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Monetary policy and the banking system



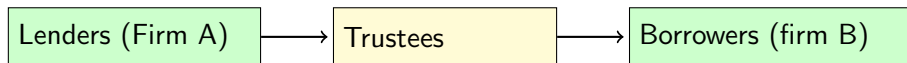
Monetary policy and shadow banking



Off-balance-sheet shadow banking in China

- Shadow banking have three components:
 - ▶ Trust loans
 - ▶ Bank acceptances
 - ▶ Entrusted loans
- Entrusted loans cover financing activities between *nonfinancial* companies.
 - ▶ A role of the banking system: banks or nonbank financial intermediaries act as trustees or middlemen to facilitate the financing activities.
 - ▶ The share of outstanding entrusted lending in total outstanding shadow banking lending was always high with 47% in 2009 and 49% in 2015.
 - ▶ A unique feature of China's shadow banking and thus is a focus of our analysis.

Entrusted lending by law



The balance sheet for the banking system

- Shadow banking products showed up on banks' balance sheets in the form of ARI:

Assets	Liabilities
Cash	Deposits
Bank loans	
Account-receivable investment (ARI)	Equity

- ARIX is ARI excluding central bank bills.

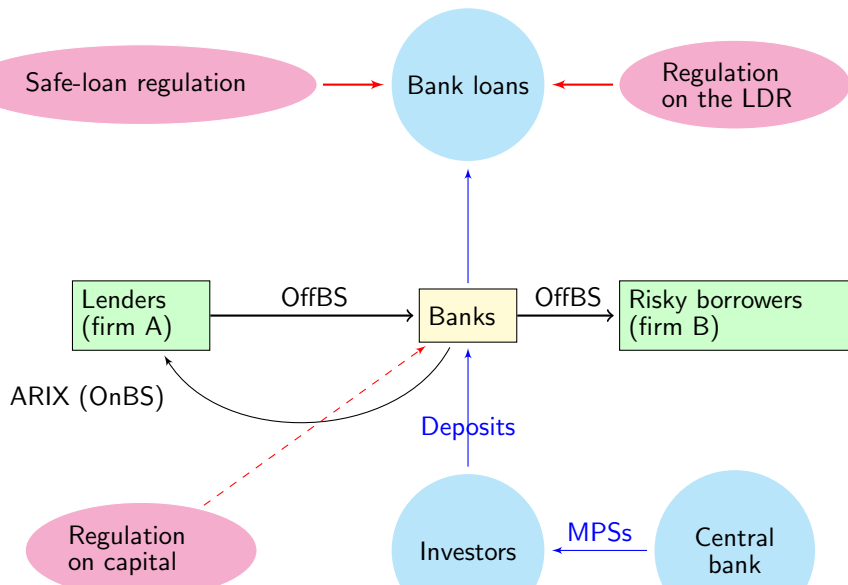
This paper: assessing effects of China's contractionary monetary policy on its shadow banking activities

- Identify monetary policy rule and monetary policy shocks;
- Construct two bank-level micro datasets (off-balance-sheet and balance-sheet);
- Estimate the impacts of contractionary monetary policy on banks' shadow banking activities off balance sheet as well as on the balance sheet.
- Quantify the effects of monetary policy on bank loans and ARIX in the banking system.

Main findings

- In response to monetary policy tightening, nonstate banks increased shadow banking activities and brought shadow bankings products onto their balance sheets, while state banks did not.
- Contractionary monetary policy in China, although exerting an expected effect on bank loans, **stimulated shadow loan** during 2009-2015.
- As a result, the effectiveness of monetary policy on **the total credit** in the banking system was severely hampered.

Nexus between monetary policy, the banking system, and shadow banking



Monetary policy rule for China

$$g_{m,t} = \gamma_0 + \gamma_m g_{m,t-1} + \gamma_\pi (\pi_{t-1} - \pi^*) + \gamma_{x,t} (g_{x,t-1} - g_{x,t-1}^*) + \sigma_{m,t} \varepsilon_{m,t},$$

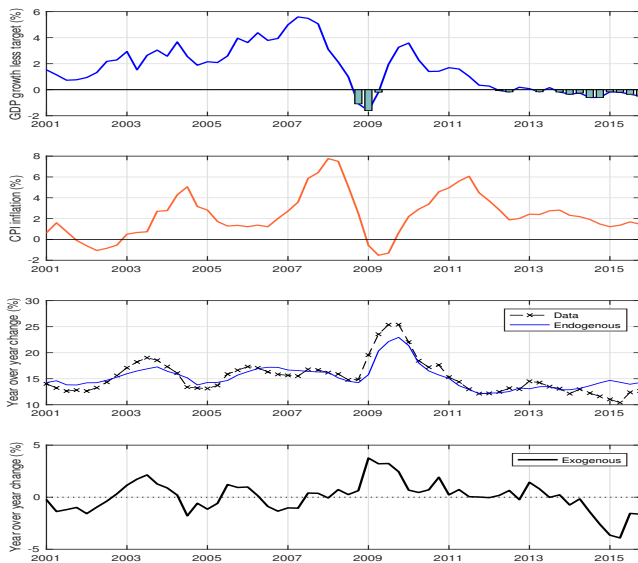
where $\varepsilon_{m,t}$ is a serially independent random shock that has a standard normal distribution,

$$\gamma_{x,t} = \begin{cases} \gamma_{x,a} & \text{if } g_{x,t-1} - g_{x,t-1}^* \geq 0 \\ \gamma_{x,b} & \text{if } g_{x,t-1} - g_{x,t-1}^* < 0 \end{cases},$$

and

$$\sigma_{m,t} = \begin{cases} \sigma_{m,a} & \text{if } g_{x,t-1} - g_{x,t-1}^* \geq 0 \\ \sigma_{m,b} & \text{if } g_{x,t-1} - g_{x,t-1}^* < 0 \end{cases}.$$

Endogenous and exogenous components of monetary policy



► Estimation Results

Impact of monetary policy on shadow banking activities

- We run the unbalanced regression

$$\log \mathcal{L}_{bt} = \alpha + \alpha_g g_{t-1} + \beta_{ns} g_{t-1} \mathbb{J}(\text{NSB}_b) + \beta_{sb} g_{t-1} \mathbb{J}(\text{SB}_b) + \text{Control}_{bt} + u_{bt}.$$

Table: Estimated results for the panel regression on total entrusted lending

Dependent Variable: Log of total entrusted lending	(1)	(2)	(3)
	Trustee Sample	Bank Sample	Bank Sample
$g_{t-1} : \alpha_g$	13.12* (7.51)	16.50 (10.14)	253.6*** (85.76)
$g_{t-1} \mathcal{I}(\text{NSB}_b) : \beta_{nsb}$	-23.77*** (7.70)	-30.46*** (9.838)	-55.30*** (13.49)
$g_{t-1} \mathcal{I}(\text{SB}_b) : \beta_{sb}$	4.306 (10.72)		
$g_{t-1} * \text{Liquidity ratio}$			0.51 (0.90)
$g_{t-1} * \text{Return on assets}$			90.47*** (30.22)
$g_{t-1} * \text{Log of total assets}$			-18.87*** (6.35)
$g_{t-1} * \text{Capital}$			-4.17 (2.59)
$g_{t-1} * \text{NPL}$			9.62 (14.77)
$g_{t-1} * \text{LDR}$			-0.37 (0.590)
<i>Impact of money growth on nonstate bank</i>	-10.65*** (4.39)	-14.00*** (5.73)	-17.97†
<i>Impact of money growth on state bank</i>	17.42* (9.29)	16.50 (10.14)	37.33
Observations	583	342	342
Bank Characteristics single term controls	NO	NO	Yes
GDP, CPI controls	Yes	Yes	Yes

Table: Estimated results for the unbalanced panel regression on ARIX

	(1)	(2)	(3)	(4)
	Bank Sample	Bank Sample	Bank Sample	Bank Sample
Dependent Variable: Log of ARIX				
$g_{t-1} : \alpha_g$	26.56** (12.55)	23.57* (13.01)	245.9 (189.8)	341.1 (215.3)
$g_{t-1} \mathcal{I}(\text{NSB}_b) : \beta_{nsb}$	-64.26*** (15.45)	-69.30*** (15.48)	-108.6*** (32.83)	-113.8*** (32.59)
$g_{t-1} * \text{Liquidity ratio}$			1.006 (1.15)	0.992 (1.35)
$g_{t-1} * \text{Return on assets}$			196.2** (93.56)	190.7** (87.09)
$g_{t-1} * \text{Log of total assets}$			-24.26 (16.60)	-27.34 (18.40)
$g_{t-1} * \text{Capital}$			-13.29 (12.47)	-14.73 (12.89)
$g_{t-1} * \text{NPL}$			-18.74 (24.62)	-29.19 (21.09)
$g_{t-1} * \text{LDR}$			0.731 (1.37)	0.448 (1.29)
<i>Impact of money growth on nonstate bank</i>	-37.69*** (9.85)	-45.73*** (8.89)	-42.33†	-43.68†
<i>Impact of money growth on state bank</i>	26.56** (12.55)	23.57* (13.01)	66.27	70.12
Observations	410	373	373	373
Bank Characteristics single term controls	No	No	Yes	Yes
GDP, CPI controls	Yes	Yes	Yes	Yes

Takeaway

- Nonstate banks are not only passive facilitator in shadow banking activities, but also **active participants** in bringing these shadow banking products onto their balance sheets.

▶ Further Evidence

Intuition for nonstate banks' to conduct regulatory arbitrage

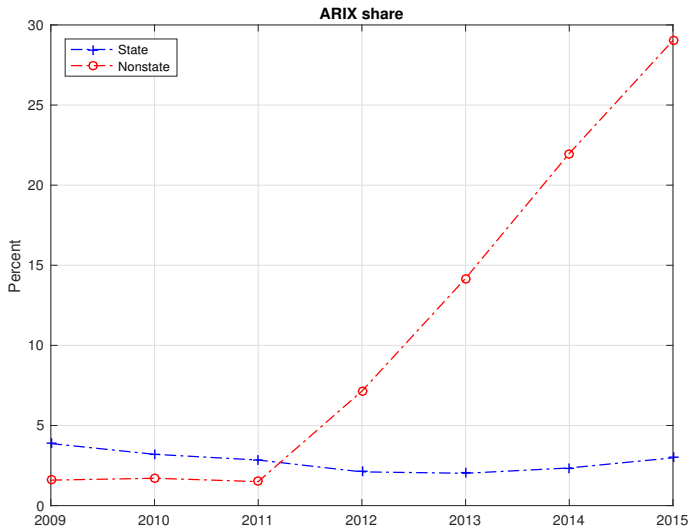
- The fundamental asset-pricing equation:

Return on ARIX – Default risk premium =

Return on bank loans – Expected regulation costs.

- Monetary policy tightening increases the risk of deposit withdrawal and thus Expected regulation costs under the LDR regulation.

ARIX share in state and non-state banks



Micro data. “ARIX share” is the ratio of ARIX holdings to the sum of ARIX holdings and bank loans on the balance sheets of the 16 publicly listed commercial banks. Based on the bank asset data from these individual banks, the data are further grouped into those from state banks and from nonstate banks. Data sources: PBC and WIND.

Effectiveness of monetary policy: panel SVAR

- Extend the Romer and Romer (2004) methodology to a dynamic panel model. The dynamic quarterly panel model is of simultaneous-equation form as

$$A_0^b \begin{bmatrix} \Delta B_{bt} \\ \Delta \mathcal{A}_{bt} \end{bmatrix} = c^b + \sum_{k=1}^{\ell} A_k^b \begin{bmatrix} \Delta B_{bt-k} \\ \Delta \mathcal{A}_{bt-k} \end{bmatrix} + \begin{bmatrix} \sum_{k=0}^{\ell} c_k^b \varepsilon_{m,t-k} \\ 0 \end{bmatrix} + \eta_{bt},$$

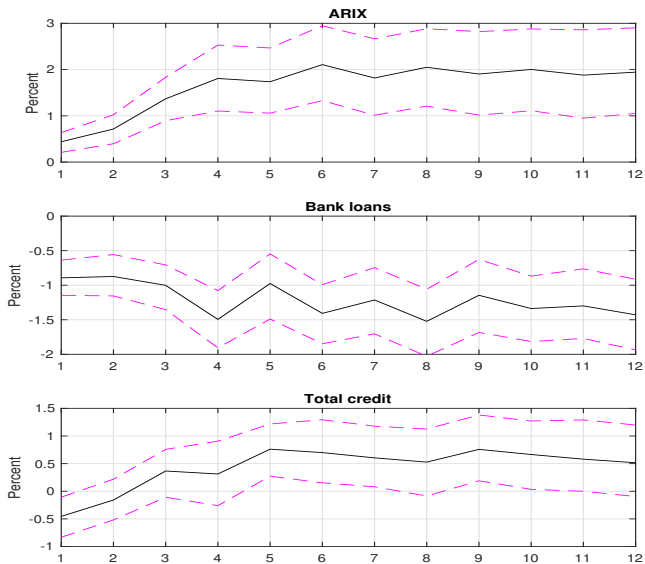
where the subscript b represents an individual bank, B_{bt} represents bank loans made by bank b at time t , and \mathcal{A}_{bt} represents ARIX accumulated by bank b at time t .

- For $k = 0, \dots, \ell$

$$c^b, c_k^b, A_k^b = \begin{cases} c^{ns}, c_k^{ns}, A_k^{ns}, & \text{if bank } b \text{ is a nonstate bank} \\ c^{sb}, c_k^{sb}, A_k^{sb}, & \text{if bank } b \text{ is a state bank} \end{cases}.$$

- The asset pricing equilibrium condition in our theory indicates that indicates that B_{bt} and \mathcal{A}_{bt} must be simultaneously determined.

Impulse responses—panel SVAR



Conclusion

- The interaction between China's monetary policy and regulatory policies made its monetary policies ineffective in reducing total credit in the banking system.

Impact of monetary policy: on-balance-sheet activities

- The quarterly panel regression on ARIX:

$$\log \mathcal{A}_{bt} = \alpha + \alpha_g g_{t-1} + \beta_{ns} g_{t-1} J(\text{NSB}_b) + \text{Control}_{bt} + \varepsilon_{bt}.$$

Understanding China monetary policy

- Mechanically applying the standard Taylor interest rate rule.

$$R_t = \alpha_0 + \alpha_R R_{t-1} + \alpha_\pi (\pi_t - \pi^*) + \alpha_x (x_t - \bar{x}_t) + \varepsilon_{R,t},$$

- Estimated results with the HP filtered output \bar{x}_t :

Coefficient	1-day Repo			7-day Repo		
	Estimate	SE	p-value	Estimate	SE	p-value
α_R	0.706***	0.078	0.000	0.770***	0.063	0.000
α_π	0.007	0.103	0.948	0.144	0.098	0.144
α_x	0.139*	0.078	0.079	0.147*	0.076	0.057
Coefficient	1-day Chibor			7-day Chibor		
	Estimate	SE	p-value	Estimate	SE	p-value
α_R	0.707***	0.078	0.000	0.779***	0.063	0.000
α_π	-0.010	0.101	0.919	0.149	0.096	0.123
α_x	0.132*	0.076	0.085	0.117	0.074	0.119

Estimated monetary policy

Coefficient	Estimate	SE	p-value
γ_m	0.391***	0.101	0.000
γ_π	-0.397***	0.121	0.001
$\gamma_{x,a}$	0.183***	0.060	0.002
$\gamma_{x,b}$	-1.299***	0.499	0.009
$\sigma_{m,a}$	0.005***	0.001	0.000
$\sigma_{m,b}$	0.010***	0.002	0.000

◀ Back

State versus nonstate banks: usual suspects (%)

Description	Capital adequacy ratio	Excess reserve ratio	LDR
State banks	13.07	1.45	68.06
Nonstate banks	12.16	3.32	71.12
Overall	12.71	1.90	68.85
Std. Err.	4.49	0.46	7.05
P-value	0.85	0.00	0.959

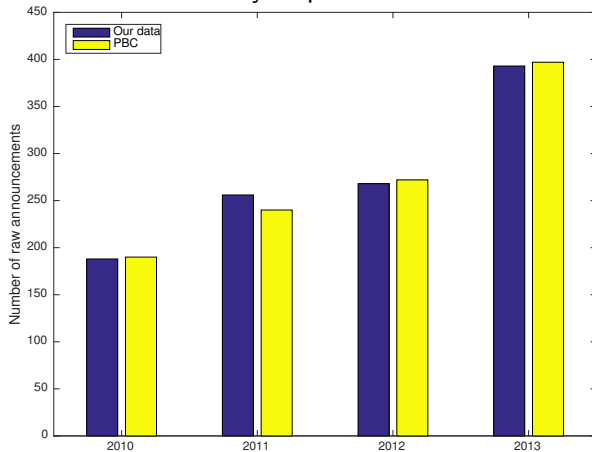
Note. Each reported ratio is weighted by bank assets for 2009-2015. The calculation is based on the balance-sheet information of all commercial banks reported by Bankscope and WIND. Capital adequacy ratios and loan-to-deposit ratios (LDRs) are downloaded directly from Bankscope and excess reserve ratios are manually collected from banks' annual reports, which are downloaded from WIND. The standard error (Std. Err.) for the difference between the ratio for state banks and the ratio for nonstate banks, along with the corresponding p-value (P-value), is reported in the last two rows of the table.

Data Cleaning

- Duplications in reporting transactions.
- Outstanding vs. newly originated loans.
- Reporting how the transaction of an entrusted loan was conducted (planned vs executed).
- Delays in announcing transactions.
- Announcement date vs. transaction date.

Data verification

Number of raw announcements we collect versus number published by the PBC's Financial Stability Reports. Data source: WIND.



Number of announcements (2009-2015)

- By lenders and borrowers:

Description	NLA	NBA	NLABA	Total
Number of observations	1152	228	1	1379

- By types of trustees and types of loans:

Description	NBTs	State banks	Nonstate banks	Total
Non-affiliated loans	5	11	255	376
Affiliated loans	304	256	443	1003
Total	309	372	698	1379

- Proportions (%) by types of trustees, frequency, and volume.

Description	NBTs	State banks	Nonstate banks	Total
Number of transactions	22.41	26.98	50.62	100
Loan volume	28.73	24.03	47.24	100

Bank attributes

Descriptive statistics of individual bank characteristics from 2009 to 2015

Attribute/variable	Obs	Mean	Std. Dev.	Min	Median	Max
LDR	396	69.49	7.11	47.43	71.70	85.16
Size	396	14.86	1.20	11.42	14.84	16.84
Capital	396	6.05	1.25	3.18	5.99	12.34
Liquidity	396	27.01	7.13	12.21	25.44	48.10
ROA	396	1.06	0.19	0.42	1.06	1.58
NPL	396	1.08	0.56	0.38	0.96	4.32

Note. All variables except Size (log value of total assets) are expressed in percent.

Further evidence

Correlation between new entrusted loans (\mathcal{L}) channeled by banks and changes in ARIX or the share of ARIX in 2009-2015

Description	State banks	p-value	Nonstate banks	p-value
$\text{Corr}(\Delta\text{ARIX}, \mathcal{L})$	0.224	0.197	0.621***	0.000
$\text{Corr}\left(\frac{\text{ARIX}}{\text{ARIX}+\text{B}}, \mathcal{L}\right)$	-0.179	0.304	0.458***	0.001

Note. The symbol “B” stands for bank loans. [◀ Back](#)

Effectiveness of monetary policy: theoretical framework

- The economy is populated by a continuum of banks whose identity is indexed by $j \in [0, 1]$.
- All banks are infinitely-lived and are subject to idiosyncratic withdrawal shocks to deposits with a fraction ω_t of deposits withdrawn in the economy.
- Denote the deposits of bank j at the beginning of period t by $D_t(j)$.
- The deposits of bank j *after* the realization of an idiosyncratic withdrawal shock to deposits, therefore, is $D_t(j)(1 - \omega_t)$.
- We follow Bianchi and Bigio (2014) in modeling the shock process of ω_t .
 - ▶ The idiosyncratic shock ω_t is uniformly distributed with the support of $[\mu(\varepsilon_{m,t}), 1]$.

Monetary policy shocks and deposit withdrawal

- Denote exogenous money growth by $\varepsilon_{m,t} = \Delta \log M_t^{\text{exog}}$, where M_t^{exog} represents exogenous money supply.
- Changes in $\varepsilon_{m,t}$ affect bank deposits directly through open market operations.
- Direct effect on deposits:

$$\begin{aligned}\varepsilon_{m,t} &= \log \int_0^1 \int_{\mu(\varepsilon_{m,t})}^1 D_t(j) (1 - \omega_t) f(\omega_t) d\omega_t dj - \log \int_0^1 D_t(j) dj \\ &\simeq -(1 + \mu(\varepsilon_{m,t}))/2,\end{aligned}$$

- which leads to

$$\mu(\varepsilon_{m,t}) \simeq -(2\varepsilon_{m,t} + 1).$$

Open Market Sales

- Stage 0

- ▶ The central bank performs open market sales by selling central bank bills (CBB_0) to the primary dealer, while debiting primary dealer an amount equal to CBB_0 .
- ▶ The bank observes the open market operations initiated by the central bank and anticipates a higher risk of deposit withdrawal from the primary dealer.
- ▶ The bank then decides on dividend payout (DIV_0) and a portfolio allocation among three assets: bank loans (B_0), risky assets (I_{r_0}), and cash (C_0).

- Stage 1

- ▶ Primary dealers withdraw deposit from their banks to payoff its loan to the central bank.

T-account analysis

Stage 0 (before ω_t is realized)

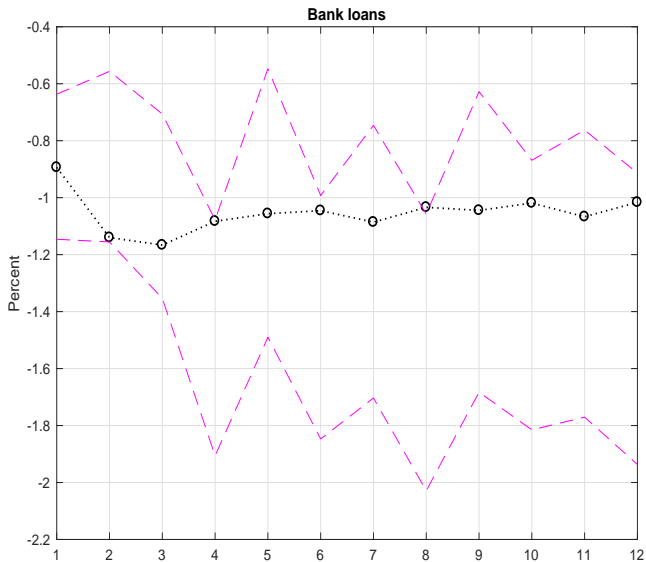
central bank		Primary Dealer	
DPD_0 ↗	CBB_0 ↗ C_0	CBB_0 ↗ D_0	DPD_0 ↗
Bank			
B_0 ↘	D_0		
I_0^r ↗			
C_0		$(\mathcal{E} - DIV_0)$ ↘	↗

T-account analysis (cont.)

Stage 1 (after ω_t is realized)

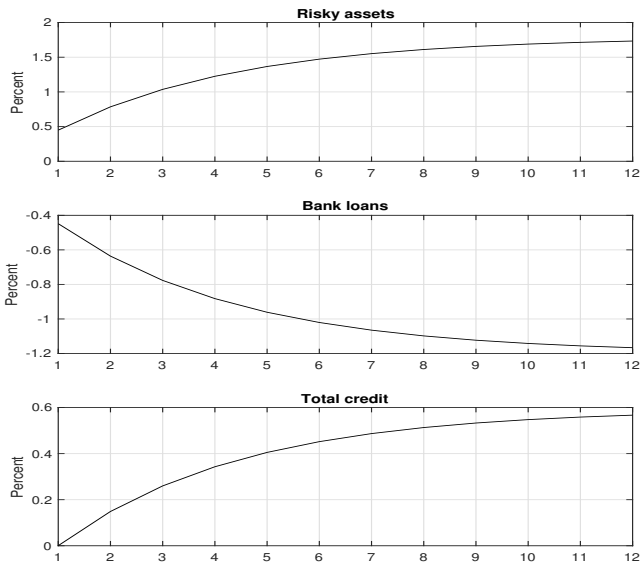
central bank		Primary Dealers	
$DPD_1 = 0$	$CBB_1 = CBB_0$	$CBB_1 = CBB_0$	$DPD_1 = 0$
$C_1 \searrow$		$D_1 \searrow$	
Bank			
$B_1 = B_0$		$D_1 \searrow$	
$I_1^r = I_0^r$			
$C_1 \searrow$		$\mathcal{E} - DIV_0$	

Policy Implications—counterfactual panel SVAR



Bank loans equal total credit in this case

Impulse responses—theory



Dynamic responses to a one-standard-deviation fall of exogenous money growth in the theoretical model.

Linkage to Recent Regulatory Policy Reforms

- A recent series of regulatory policy changes in China bear the same spirit as our counterfactual experiments.
 - ▶ Since the beginning of 2016, the PBC has established the so-called macro prudential assessment (MPA) system to coordinate its conduct of monetary policy.
 - ▶ A salient feature of MPA is the requirement that the “broad credit” growth rate should not deviate from the targeted growth rate of M2 by more than 22%.
 - ▶ In October 2016, the PBC further incorporated those assets financed by wealth management products into the measure of broad credit.
 - ▶ Also, the growth rate of entrusted loan should not deviate from the targeted growth rate of M2 by more than 22%.