Credit Allocation under Economic Stimulus: Evidence from China

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Motivation

Allocation of resources across firms in China
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- 2000-2008: Boom years
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→ Scarce direct empirical evidence
Credit Growth During Stimulus

Figure: Capital Flows from Financial System to Real Economy

Source: People's Bank of China - Total Social Financing Dataset
This paper

Study effect of credit supply increase on firm-level outcomes and allocation of credit across firms
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- Firm-level data from Manufacturing Survey
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   - Firm-level exposure to credit supply (Bartik instrument)
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  - by period: pre-stimulus, stimulus
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     - by period: pre-stimulus, stimulus

3. Discussion
   - Discuss/test potential channels driving credit allocation dynamics
Preview of Results

- Average effects
  - Firms with larger increase in credit supply during stimulus
    → larger borrowing ($\approx 1$), investment (0.22), employment (0.32)
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  - Effect of credit supply on firm borrowing:
    - stimulus (2009-10): 38% larger for state-owned firms
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→ Reversal of previous reallocation process
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  - State-ownership connection (banks-firms)
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- **Channels**
  1. State-ownership connection (banks-firms)
  2. Implicit bail-out of SOEs
Literature

1. Macroeconomics

2. Misallocation and Growth
   - Dynamic: Song et al. (2011); Buera and Shin (2013); Gopinath et al (2016)

3. China Economy and Credit Boom
   - Local government debt: Huang, Pagano, and Panizza (2016); Bai, Hsieh, and Song (2016); Ambrose, Deng, and Wu (2015); Chen, He, and Liu (2016)

4. State-Owned Enterprises
   - Political view: Stigler (); Shleifer and Vishny (1998); Sapienza (2002)
Structure of the Talk

- Background and Stylized Facts
  - Identification
  - Empirical Results
- Discussion
Background

Structure of the Economic Stimulus Plan

Economic Stimulus

- Fiscal Plan
  - 4Tr CNY

- Credit Plan

Promote LGFV mostly financed with bank credit

Bank Credit Supply

- ↑ lending quotas
- ↓ required reserve ratio
- ↓ benchmark lending rates

Firms
- Agriculture
- Utilities
- Construction
- Manufacturing
- Services

Households

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Fiscal Plan
4 Tr CNY

Central Gov Exp
1.18 Tr CNY

Local Gov Exp
2.82 Tr CNY

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Source: Chen, He and Liu (2017)
Changes in Banking Regulation

- Reduction in Required Reserve Ratios (RRR = reserves/deposits)
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- Reduction in Required Reserve Ratios (RRR = reserves/deposits)

\[ \downarrow \text{RRR Large Banks: } 17.5 \rightarrow 15.5\% \]
\[ \downarrow \text{RRR Small Banks: } 17.5 \rightarrow 13.5\% \]

Notes: Shaded areas indicate stimulus years (2008:Q4 to 2010:Q4). Data on actual reserve ratios is from WIND and comes aggregated by bank category.
Data Description

1. CBRC loan-level database (2006-2013)
   - Source: China Banking Regulatory Commission
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   - Universe of loans to firms with annual outstanding balance $\geq 50m$ CNY
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   - Universe of loans to firms with annual outstanding balance $\geq$ 50m CNY
   - Variables: loan balance, maturity, repayment, bank and firm identifiers
## Banks in the CBRC Loan-level Dataset

<table>
<thead>
<tr>
<th>Bank Name</th>
<th>Bank Type</th>
<th>Lending Share in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICBC</td>
<td>State-Owned Commercial Bank</td>
<td>18.19%</td>
</tr>
<tr>
<td>China Development Bank</td>
<td>Policy Bank</td>
<td>16.38%</td>
</tr>
<tr>
<td>China Construction Bank</td>
<td>State-Owned Commercial Bank</td>
<td>15.82%</td>
</tr>
<tr>
<td>Agricultural Bank</td>
<td>State-Owned Commercial Bank</td>
<td>13.03%</td>
</tr>
<tr>
<td>Bank of China</td>
<td>State-Owned Commercial Bank</td>
<td>10.44%</td>
</tr>
<tr>
<td>Communication Bank</td>
<td>State-Owned Commercial Bank</td>
<td>5.52%</td>
</tr>
<tr>
<td>Min Sheng Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>2.95%</td>
</tr>
<tr>
<td>Merchants Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>2.95%</td>
</tr>
<tr>
<td>China CITIC Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>2.72%</td>
</tr>
<tr>
<td>Pudong Development Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>2.62%</td>
</tr>
<tr>
<td>Export Import Bank</td>
<td>Policy Bank</td>
<td>2.08%</td>
</tr>
<tr>
<td>Ever Bright Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>2.05%</td>
</tr>
<tr>
<td>Industrial Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>1.68%</td>
</tr>
<tr>
<td>Hua Xia Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>1.45%</td>
</tr>
<tr>
<td>Guang Fa Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>0.81%</td>
</tr>
<tr>
<td>Ping An Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>0.81%</td>
</tr>
<tr>
<td>Bo Hai Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>0.18%</td>
</tr>
<tr>
<td>Ever Growing Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>0.16%</td>
</tr>
<tr>
<td>Zhe Shang Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>0.15%</td>
</tr>
</tbody>
</table>

*Source: CBRC, Bankscope. All banks are currently publicly traded except: Guang Fa Bank, Ever Growing Bank, Bohai Bank and the two policy banks.*
Credit Growth across Sectors

**Figure:** Change in Bank Lending to Firms - by Sector, Quarterly Data

Notes: Source: China Banking Regulatory Commission. To produce this graph we first sum across firms the monetary value of their outstanding loan balance at the end of each quarter. Then we take a quarter to quarter difference of the sum.
Credit Growth across Regions

Figure: Change in Bank Lending to Firms during Stimulus - by City/Prefecture-city

Notes: For each city $c$, we plot $\Delta L_c = \left( \frac{1}{2} \sum_{t=09}^{T=10} L_{ct} - \frac{1}{2} \sum_{t=07}^{T=08} L_{ct} \right) / \left( \frac{1}{2} \sum_{t=07}^{T=08} L_{ct} \right)$. 

- Source: China’s National Bureau of Statistics
- Manufacturing firms with revenues: $\geq 5m$ CNY (20m after 2010)
- Variables: employment, investment, assets, value added, book value of $K$
- Share of government ownership (following Hsieh and Song, 2015)

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- Manufacturing firms with revenues: ≥ 5m CNY (20m after 2010)
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- Share of government ownership (following Hsieh and Song, 2015)

1. + 2. Matched sample:

- 67% of Manufacturing Firms with credit relationship with top-19 bank
- Lending to manufacturing represents 22% total bank lending (2006-2013)
# Summary Statistics

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Mean</th>
<th>Median</th>
<th>St.Dev.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: CBRC loan-level data:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$loan_{ibt}$ (million RMB)</td>
<td>163</td>
<td>63</td>
<td>452</td>
<td>177,087</td>
</tr>
<tr>
<td>stimulus years</td>
<td>179</td>
<td>68</td>
<td>474</td>
<td>39,005</td>
</tr>
<tr>
<td>stimulus years, firm-level</td>
<td>554</td>
<td>156</td>
<td>1791</td>
<td>11,067</td>
</tr>
<tr>
<td>$\Delta \log loan_{ibt}$</td>
<td>0.039</td>
<td>0.000</td>
<td>0.433</td>
<td>177,087</td>
</tr>
<tr>
<td>stimulus years</td>
<td>0.033</td>
<td>0.000</td>
<td>0.461</td>
<td>39,005</td>
</tr>
<tr>
<td>stimulus years, firm-level ($\Delta \log loan_{it}$)</td>
<td>0.094</td>
<td>0.048</td>
<td>0.442</td>
<td>11,067</td>
</tr>
<tr>
<td><strong>Panel B: Annual Survey of Industrial firms:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number of employees</td>
<td>2,144</td>
<td>702</td>
<td>7,405</td>
<td>11,067</td>
</tr>
<tr>
<td>fixed assets (million RMB)</td>
<td>731</td>
<td>121</td>
<td>3,699</td>
<td>11,067</td>
</tr>
<tr>
<td>sales (million RMB)</td>
<td>1,621</td>
<td>421</td>
<td>6,255</td>
<td>11,067</td>
</tr>
<tr>
<td>$StateShare$</td>
<td>0.113</td>
<td>0.000</td>
<td>0.290</td>
<td>11,067</td>
</tr>
<tr>
<td>age (year)</td>
<td>15</td>
<td>11</td>
<td>14</td>
<td>11,067</td>
</tr>
<tr>
<td>exporter dummy</td>
<td>0.449</td>
<td>0.000</td>
<td>0.497</td>
<td>11,067</td>
</tr>
<tr>
<td>public</td>
<td>0.052</td>
<td>0.000</td>
<td>0.222</td>
<td>11,067</td>
</tr>
<tr>
<td>$\Delta \log$ employment</td>
<td>0.027</td>
<td>0.045</td>
<td>0.598</td>
<td>11,067</td>
</tr>
<tr>
<td>$\Delta \log$ fixed assets</td>
<td>-0.272</td>
<td>-0.073</td>
<td>0.669</td>
<td>11,067</td>
</tr>
<tr>
<td><strong>Panel C: independent variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta \log L_{b-cj,t}$</td>
<td>0.131</td>
<td>0.118</td>
<td>0.113</td>
<td>177,087</td>
</tr>
<tr>
<td>stimulus years</td>
<td>0.231</td>
<td>0.187</td>
<td>0.127</td>
<td>39,005</td>
</tr>
<tr>
<td>$\Delta L_{icj,t}$</td>
<td>0.219</td>
<td>0.198</td>
<td>0.115</td>
<td>11,067</td>
</tr>
</tbody>
</table>
Structure of the Talk

- Background and Stylized Facts
- Identification
- Empirical Results
- Discussion
Identification

- Empirical questions:
  - Effect of bank credit supply on firm borrowing, investment and size
  - Allocation across firms with different ownership, initial productivity

- Main challenge:
  - Isolate changes in firm borrowing that are solely driven by credit supply forces and not by changes in demand/investment opportunities
Empirics
Identification Strategy

- Measure of **firm exposure** to credit supply changes exploits:
  - Heterogeneous increases in lending across banks
  - Pre-existing bank-firm relationships
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Identification Strategy

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  - Pre-existing bank-firm relationships

- **Firm** $i$ exposure [as in Chodorow-Reich (QJE, 2014)]

\[
\Delta L_{icjt} = \sum_{b \in O_i} \omega_{bi,t=0} \times \Delta Loans_{b-cj,t} \tag{1}
\]

- $\omega_{bi,t=0} = \text{initial share of borrowing of firm } i \text{ from bank } b$
- $\Delta Loans_{b-cj,t} = \text{change in total loan balance of bank } b$
  \rightarrow \text{excluding any lending to sector } j \text{ and city } c \text{ where firm } i \text{ operates}
Discussion

Identification Assumptions:

A1) Bank-firm relationships persistent over time
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A2) Cross-sectional variation in bank lending during stimulus:
   - reflects supply forces
     e.g. exposure to changes in bank regulation
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   - or observable firm characteristics
     e.g. sector, export, location, size, age
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   - reflects supply forces  
     e.g. exposure to changes in bank regulation
   - or observable firm characteristics  
     e.g. sector, export, location, size, age
   - but ⊥ unobservable firm characteristics affecting their credit demand
Diagnostics of Identification Assumptions

1. (A1) Estimate probability of new loan from pre-existing lender

2. (A2) Estimate loan-level equation with firm $\times$ year FE (Khwaja and Mian 2009)

$$\Delta \log loan_{ibcj} = \alpha + \alpha_{it} + \beta \Delta \log L_{b-cj,t} + \varepsilon_{ibcj}$$

where: $i$ firm, $b$ bank, $c$ city, $j$ sector, $t$ year
### (A1) Persistence of Bank-Firm Relationship

<table>
<thead>
<tr>
<th>outcome:</th>
<th>( I(\text{New loan of firm } i \text{ from bank } b)_t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I(\text{Lending relationship firm } i\text{-bank } b)_{t-1} )</td>
<td>0.949</td>
</tr>
<tr>
<td></td>
<td>([0.001]^{***})</td>
</tr>
<tr>
<td>Year, Bank, Industry, City fe</td>
<td>y</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.807</td>
</tr>
<tr>
<td>Observations</td>
<td>882,580</td>
</tr>
</tbody>
</table>

**Notes:** The outcome variable is a dummy equal to 1 if firm \( i \) takes a new loan from bank \( b \) at time \( t \). Each observation in the dataset is a potential bank-firm relationship, i.e. for each firm and year, there is an observation for each potential lender. The independent variable is a dummy equal to 1 if firm \( i \) had a pre-existing credit relationship with bank \( b \) at time \( t \) — 1. Standard errors clustered by firm. Significance levels: \(* * * p < 0.01\), \(* * p < 0.05\), \( * p < 0.1\).

- 95% probability new loan from bank with pre-existing relationship
(A2) Bank Lending and Borrowers’ Characteristics

\[ \Delta \log \text{loan}_{ibt} = \alpha + \alpha_{it} + \beta \Delta \log L_{b-i,t} + \varepsilon_{ibt} \]

<table>
<thead>
<tr>
<th></th>
<th>all firms</th>
<th>multi-lender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>( \Delta \log \text{Loan}_{b-i,t} )</td>
<td>0.173</td>
<td>0.174</td>
</tr>
<tr>
<td></td>
<td>[0.045]**</td>
<td>[0.045]**</td>
</tr>
<tr>
<td>Year fe</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Industry fe</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>City fe</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Firm characteristics</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Firm ( \times ) Year fe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.012</td>
<td>0.012</td>
</tr>
<tr>
<td>Observations</td>
<td>177,087</td>
<td>177,087</td>
</tr>
</tbody>
</table>

Notes: The unit of observation is a loan. Standard errors clustered at the main lender level. Significance levels: ***, ** p < 0.01, ** p < 0.05, * p < 0.1.

- Similar point estimates when using within-firm variation
Structure of the Talk

- Background and Stylized Facts
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- **Empirical Results**
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Effect of Credit Supply on Firm Borrowing

Average effects

\[ \Delta \log y_{icjt} = \alpha_c + \alpha_j + \alpha_t + \beta \Delta \tilde{L}_{icjt} + \gamma X_{i,t-1} + \varepsilon_{icjt} \]

- \( i \) firm, \( j \) sector, \( c \) city, \( t \) year.
- \( \Delta \tilde{L}_{it} \): firm-level exposure to credit supply increases

\[ \Delta \tilde{L}_{icjt} = \sum_{b \in O_i} \omega_{bi,t=0} \times \Delta \log Loans_{b-cj,t} \]

- \( X_{i,t-1} \): firm characteristics: size, export status, age, publicly traded status
### Average Effects

<table>
<thead>
<tr>
<th>outcome:</th>
<th>$\Delta \log \text{loan}_{it}$ (1)</th>
<th>$\Delta \log K_{it}$ (2)</th>
<th>$\Delta \log L_{it}$ (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \tilde{L}_{ijt}$</td>
<td>1.005 [0.088]**</td>
<td>0.218 [0.107]**</td>
<td>0.318 [0.100]**</td>
</tr>
<tr>
<td>Year FE</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Industry FE</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>City FE</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Firm characteristics</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.094</td>
<td>0.438</td>
<td>0.232</td>
</tr>
<tr>
<td>Observations</td>
<td>11,067</td>
<td>11,067</td>
<td>11,067</td>
</tr>
</tbody>
</table>

**Notes:** Standard errors clustered at city level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

- 1 percent increase in credit supply from pre-existing lenders:
  - $\approx$ 1 percent increase in firm borrowing
  - 0.22 percent increase in fixed capital
  - 0.32 percent increase in employment
\[ \Delta \log y_{icjt} = \alpha_c + \alpha_j + \alpha_t + \beta_1 \Delta \tilde{L}_{icjt} \times C_{i,t=0} + \beta_2 \Delta \tilde{L}_{icjt} + \beta_3 C_{i,t=0} \]

\[ + \gamma X_{i,t-1} + \varepsilon_{ijct} \]

- \( i \) firms, \( j \) sector, \( c \) city, \( t \) year.
- \( \Delta \tilde{L}_{icjt} \): firm-level exposure to credit supply increases
- \( C_{i,t=0} \):
  - \textit{StateShare} share of government ownership
  - \( \log APK = \log \frac{VA}{K} \)
State Ownership and Average Product of Capital

- unconditional (left) and conditional on city and industry (right)
<table>
<thead>
<tr>
<th>Model</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \log \text{loan}_{it}$</td>
<td>0.367</td>
<td>0.119</td>
<td>***</td>
</tr>
<tr>
<td>$\Delta \log \text{APK}_{i,t=0}$</td>
<td>0.972</td>
<td>0.086</td>
<td>***</td>
</tr>
<tr>
<td>$\log \text{APK}_{i,t=0}$</td>
<td>-0.080</td>
<td>0.027</td>
<td>***</td>
</tr>
</tbody>
</table>

All columns include Year, Industry and City fixed effects as well as firm characteristics. Standard errors clustered at city level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 20 / 31
### Outcome: \( \Delta \log loan_{it} \)

<table>
<thead>
<tr>
<th>Sample: All Firms</th>
<th>( \log APK_{i,t=0} = \text{low} )</th>
<th>( \log APK_{i,t=0} = \text{high} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta L_{ict} \times \text{StateShare}_{i,t=0} )</td>
<td>0.367 [0.119]**</td>
<td>0.354 [0.132]**</td>
</tr>
<tr>
<td>( \Delta L_{ict} )</td>
<td>0.972 [0.086]**</td>
<td>0.872 [0.106]**</td>
</tr>
<tr>
<td>( \text{StateShare}_{i,t=0} )</td>
<td>-0.080 [0.027]**</td>
<td>-0.051 [0.033]</td>
</tr>
</tbody>
</table>

R-squared | 0.095 | 0.139 | 0.107
Observations | 11,067 | 5,531 | 5,510

### Sample: \( \text{StateShare}_{i,t=0} = 0 \)

<table>
<thead>
<tr>
<th>Sample: All Firms</th>
<th>( \text{StateShare}_{i,t=0} = 0 )</th>
<th>( \text{StateShare}_{i,t=0} &gt; 0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta L_{ict} \times \log APK_{i,t=0} )</td>
<td>0.972 0.872 1.043</td>
<td>[0.086]** [0.106]** [0.123]**</td>
</tr>
<tr>
<td>( \Delta L_{ict} )</td>
<td>-0.080 -0.051 -0.097</td>
<td>[0.027]** [0.033] [0.056]*</td>
</tr>
<tr>
<td>( \log APK_{i,t=0} )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R-squared | 0.095 | 0.139 | 0.107
Observations | 11,067 | 5,531 | 5,510

All columns include Year, Industry and City fixed effects as well as firm characteristics. Standard errors clustered at city level. *** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.1 \).
<table>
<thead>
<tr>
<th>outcome:</th>
<th>$\Delta \log \text{loan}_{it}$</th>
<th>log $\text{APK}_{i,t=0}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample:</td>
<td>all firms</td>
<td>= low</td>
</tr>
<tr>
<td>$\Delta \widetilde{L}<em>{icjt} \times \text{StateShare}</em>{i,t=0}$</td>
<td>0.367 [0.119][***]</td>
<td>0.354 [0.132][***]</td>
</tr>
<tr>
<td>$\Delta \widetilde{L}_{icjt}$</td>
<td>0.972 [0.086][***]</td>
<td>0.872 [0.106][***]</td>
</tr>
<tr>
<td>$\text{StateShare}_{i,t=0}$</td>
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<td>-0.051 [0.033]</td>
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<td>0.139</td>
</tr>
<tr>
<td>Observations</td>
<td>11,067</td>
<td>5,531</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
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<th>$\Delta \log loan_{it}$</th>
<th>$\Delta \log APK_{i,t=0}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample:</td>
<td>all firms</td>
<td>all firms</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta L_{icjt} \times StateShare_{i,t=0}$</td>
<td>0.367</td>
<td>0.354</td>
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<tr>
<td></td>
<td>[0.119]**</td>
<td>[0.132]**</td>
</tr>
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<td>$\Delta L_{icjt}$</td>
<td>0.972</td>
<td>0.872</td>
</tr>
<tr>
<td></td>
<td>[0.086]**</td>
<td>[0.106]**</td>
</tr>
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<td>StateShare$_{i,t=0}$</td>
<td>-0.080</td>
<td>-0.051</td>
</tr>
<tr>
<td></td>
<td>[0.027]**</td>
<td>[0.033]</td>
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<td>R-squared</td>
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<td>0.139</td>
</tr>
<tr>
<td>Observations</td>
<td>11,067</td>
<td>5,531</td>
</tr>
</tbody>
</table>

sample: all firms

| $\Delta L_{icjt} \times \log APK_{i,t=0}$ | -0.060 | -0.058 | 0.040 |
|          | [0.027]**                 | [0.029]**                 |
| $\Delta L_{icjt}$                           | 0.984 | 0.960 | 1.204 |
|          | [0.090]**                 | [0.094]**                 |
| $\log APK_{i,t=0}$                         | 0.047 | 0.052 | 0.002 |
|          | [0.008]**                 | [0.008]**                 |
| R-squared | 0.099                    | 0.101                    |
| Observations | 11,067               | 9,251                    |

All columns include Year, Industry and City fixed effects as well as firm characteristics. Standard errors clustered at city level. *** p < 0.01, ** p < 0.05, * p < 0.1.
Discussion

- Effect of credit supply increase on firm borrowing during stimulus
  - 38% larger for fully state-owned than for fully private firms
    → Result holds both within low and high capital productivity firms
  - 8% larger for firms with 1 st.dev. lower initial $APK$
    → between (private to SOEs) and within effect (among private firms)

- Robustness
  - Exclude input-suppliers to construction and utilities
### Allocation Dynamics: All Years

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Sample</th>
<th>Δ log loan_{it}</th>
<th>All firms</th>
<th>log APK_{i,t=0} = low</th>
<th>= high</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta \tilde{L}<em>{ict} \times StateShare</em>{i,t=0} \times I(stimulus) )</td>
<td></td>
<td></td>
<td></td>
<td>0.874</td>
<td>[0.240]***</td>
</tr>
<tr>
<td>( \Delta \tilde{L}<em>{ict} \times StateShare</em>{i,t=0} \times I(post-stimulus) )</td>
<td></td>
<td></td>
<td></td>
<td>0.664</td>
<td>[0.291]**</td>
</tr>
<tr>
<td>( \Delta \tilde{L}<em>{ict} \times StateShare</em>{i,t=0} )</td>
<td></td>
<td></td>
<td></td>
<td>-0.493</td>
<td>[0.209]**</td>
</tr>
</tbody>
</table>

R-squared 0.065  
Observations 46,568

**Notes:** All regressions include main effects of the triple interaction; year, industry and city fixed effects; firm characteristics. Standard errors clustered at city level. *** p < 0.01, ** p < 0.05, * p < 0.1.

- Effect of credit supply increase on firm borrowing:  
  - pre-stimulus: 49% larger for private firms than SOEs  
  - Reversal starting from 2009, extends in post-stimulus period
### Allocation Dynamics: All Years

<table>
<thead>
<tr>
<th>outcome:</th>
<th>( \Delta \log \frac{\text{loan}<em>{it}}{\text{APK}</em>{i,t=0}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample:</td>
<td>all firms</td>
</tr>
<tr>
<td></td>
<td>( = \text{low} )</td>
</tr>
</tbody>
</table>

| \( \Delta L_{icjt} \times \text{StateShare}_{i,t=0} \times I(\text{stimulus}) \) | 0.874 | 0.650 | 1.152 |
| \( \Delta L_{icjt} \times \text{StateShare}_{i,t=0} \times I(\text{post-stimulus}) \) | 0.664 | 0.438 | 1.244 |
| \( \Delta L_{icjt} \times \text{StateShare}_{i,t=0} \) | -0.493 | -0.246 | -0.859 |

R-squared: 0.065, 0.076, 0.062
Observations: 46,568, 23,280, 23,279

**Notes:** All regressions include main effects of the triple interaction; year, industry and city fixed effects; firm characteristics. Standard errors clustered at city level. *** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.1 \).

- **Effect of credit supply increase on firm borrowing:**
  - pre-stimulus: 49% larger for private firms than SOEs
  - Reversal starting from 2009, extends in post-stimulus period
  - effect holds when conditioning on capital productivity
### Allocation Dynamics: All Years

<table>
<thead>
<tr>
<th>Outcome:</th>
<th>( \Delta \log \text{loan}_{it} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>( \text{all firms} )</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\Delta \tilde{L}_{icjt} \times \log APK_{i,t=0} \times I(\text{stimulus}) & \quad -0.149 \\
\Delta \tilde{L}_{icjt} \times \log APK_{i,t=0} \times I(\text{post – stimulus}) & \quad -0.054 \\
\Delta \tilde{L}_{icjt} \times \log APK_{i,t=0} & \quad 0.093
\end{align*}
\]

- R-squared: 0.069
- Observations: 46,568

**Notes:** All regressions include main effects of the triple interaction; year, industry and city fixed effects; firm characteristics. Standard errors clustered at city level. *** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.1 \).

- **Effect of credit supply increase on firm borrowing:**
  - Pre-stimulus: larger for *high* capital productivity firms
  - Reversal starting from 2009
## Allocation Dynamics: All Years

<table>
<thead>
<tr>
<th>outcome:</th>
<th>$\Delta \log \text{loan}_{it}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample:</td>
<td>all firms</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>all firms</th>
<th>$\text{StateShare}_{i,t=0}= 0$</th>
<th>$\text{StateShare}_{i,t=0} &gt; 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta L_{icjt} \times \log APK_{i,t=0} \times I(stimulus)$</td>
<td>-0.149</td>
<td>-0.162</td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.048]***</td>
<td>[0.057]***</td>
<td>[0.143]</td>
<td></td>
</tr>
<tr>
<td>$\Delta L_{icjt} \times \log APK_{i,t=0} \times I(post – stimulus)$</td>
<td>-0.054</td>
<td>-0.055</td>
<td>0.203</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.061]</td>
<td>[0.069]</td>
<td>[0.177]</td>
<td></td>
</tr>
<tr>
<td>$\Delta L_{icjt} \times \log APK_{i,t=0}$</td>
<td>0.093</td>
<td>0.107</td>
<td>-0.013</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.044]**</td>
<td>[0.053]**</td>
<td>[0.119]</td>
<td></td>
</tr>
</tbody>
</table>

R-squared | 0.069 | 0.070 | 0.120 |
Observations | 46,568 | 39,131 | 7,428 |

**Notes:** All regressions include main effects of the triple interaction; year, industry and city fixed effects; firm characteristics. Standard errors clustered at city level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

- Effect of credit supply increase on firm borrowing:
  - pre-stimulus: larger for *high* capital productivity firms
  - Reversal starting from 2009
  - capital productivity not a driver of credit allocation within SOEs
Structure of the Talk

- Background and Stylized Facts
- Identification
- Empirical Results
- Discussion
Discussion of Allocation Dynamics

Pre-stimulus years:
- Results consistent with capital reallocation from low to high-productivity firms in China during the 2000s (e.g. Song et al. AER 2011)
Discussion of Allocation Dynamics

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Stimulus years:
- what can explain reversal of previous reallocation process?
Discussion of Allocation Dynamics

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  - Results consistent with capital reallocation from low to high-productivity firms in China during the 2000s (e.g. Song et al. AER 2011)

- Stimulus years:
  - what can explain reversal of previous reallocation process?
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Discussion of Allocation Dynamics

- **Pre-stimulus years:**
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- **Stimulus years:**
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    - State-ownership connection between banks and firms
    - Implicit government bail-out of SOEs becoming more important during “recession”
State-ownership connection

Relies on two empirically testable arguments:
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1. State-Owned Banks might have a preferred relationship with SOEs
   - Plausible. Although scarce direct empirical evidence for China.
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   - Career incentives of top-management
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   - Direct government influence
   - Career incentives of top-management

→ “Mechanically” more of new credit directed to SOEs
State-ownership connection, cont.

First, re-construct ownership structure of 19 largest Chinese banks

<table>
<thead>
<tr>
<th>Bank Name</th>
<th>Bank Type</th>
<th>Gov. Ownership in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICBC</td>
<td>State-Owned Commercial Bank</td>
<td>75.10%</td>
</tr>
<tr>
<td>China Construction Bank</td>
<td>State-Owned Commercial Bank</td>
<td>58.56%</td>
</tr>
<tr>
<td>Agricultural Bank</td>
<td>State-Owned Commercial Bank</td>
<td>100.00%</td>
</tr>
<tr>
<td>Bank of China</td>
<td>State-Owned Commercial Bank</td>
<td>70.82%</td>
</tr>
<tr>
<td>China Development Bank</td>
<td>Policy Bank</td>
<td>100.00%</td>
</tr>
<tr>
<td>Communication Bank</td>
<td>State-Owned Commercial Bank</td>
<td>32.54%</td>
</tr>
<tr>
<td>Merchants Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>32.63%</td>
</tr>
<tr>
<td>Pudong Development Bank</td>
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<td>39.74%</td>
</tr>
<tr>
<td>China CITIC Bank</td>
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</tr>
<tr>
<td>Min Sheng Bank</td>
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<td>12.38%</td>
</tr>
<tr>
<td>Industrial Bank</td>
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<td>29.92%</td>
</tr>
<tr>
<td>Ever Bright Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>88.30%</td>
</tr>
<tr>
<td>Hua Xia Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>34.41%</td>
</tr>
<tr>
<td>Export Import Bank</td>
<td>Policy Bank</td>
<td>100.00%</td>
</tr>
<tr>
<td>Guang Fa Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>65.78%</td>
</tr>
<tr>
<td>Ping An Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>0.00%</td>
</tr>
<tr>
<td>Ever Growing Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>19.23%</td>
</tr>
<tr>
<td>Zhe Shang Bank</td>
<td>National Joint-Equity Commercial Bank</td>
<td>14.92%</td>
</tr>
<tr>
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Source: CBRC, Author’s calculations from Banks’ Annual Reports.
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<td>14.92%</td>
</tr>
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<td>National Joint-Equity Commercial Bank</td>
<td>62.01%</td>
</tr>
</tbody>
</table>

Source: CBRC, Author's calculations from Banks’ Annual Reports.
State-ownership connection, cont.

Table: Top-10 Shareholders of China Everbright Bank Co., Ltd in 2008

<table>
<thead>
<tr>
<th>Rank</th>
<th>Shareholder</th>
<th>Shareholder type</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Central Huijin Investment Ltd.</td>
<td>Gov fund</td>
<td>70.88%</td>
</tr>
<tr>
<td>2</td>
<td>China Everbright Group</td>
<td>Gov fund</td>
<td>7.59%</td>
</tr>
<tr>
<td>3</td>
<td>China Everbright Limited</td>
<td>Gov fund</td>
<td>6.23%</td>
</tr>
<tr>
<td>4</td>
<td>Hongta Tobacco Group Company Limited</td>
<td>SOE</td>
<td>1.35%</td>
</tr>
<tr>
<td>5</td>
<td>Zhejiang Southeast Electric Power Company Limited</td>
<td>SOE</td>
<td>0.62%</td>
</tr>
<tr>
<td>6</td>
<td>Haixin Iron &amp; Steel Group Co., Ltd.</td>
<td>Private Corp.</td>
<td>0.59%</td>
</tr>
<tr>
<td>7</td>
<td>China Export &amp; Credit Insurance Corporation</td>
<td>SOE</td>
<td>0.53%</td>
</tr>
<tr>
<td>8</td>
<td>Qingdao Guoxin Industry Corporation</td>
<td>Local Gov Fund</td>
<td>0.39%</td>
</tr>
<tr>
<td>9</td>
<td>Shanxi International Electricity Group Company Limited</td>
<td>SOE</td>
<td>0.37%</td>
</tr>
<tr>
<td>10</td>
<td>Hongyun honghe Tobacco Group Company Limited</td>
<td>SOE</td>
<td>0.34%</td>
</tr>
</tbody>
</table>

Source: Annual Reports.

State-Ownership: Central Gov Funds + Local Gov Funds + SOEs
Do SOBs lend relatively more to SOEs than private firms?
Do SOBs respond more than private banks to credit stimulus?
Implicit bail-out of SOEs

- Government might bail out SOEs if close to financial distress
- Lenders favor SOEs *more* when probability of financial distress is higher

Anecdotal evidence:
- China Eastern (SOE) and East Star (Private) Airlines at risk of financial distress in 2009
- Government injected 7 billion CNY into China Eastern through SASAC
- East Star Airline liquidated in August 2009
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![Images of China Eastern and East Star Airlines]
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Ex-post Loan Performance

Panel A outcomes:

<table>
<thead>
<tr>
<th>Formula</th>
<th>( \Delta \log K_{it} )</th>
<th>( \Delta \log L_{it} )</th>
<th>( NPL_{it} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta \widetilde{L}<em>{icjt} \times \text{StateShare}</em>{i,t=0} \times I(stimulus) )</td>
<td>-0.282</td>
<td>0.760</td>
<td>-0.110</td>
</tr>
<tr>
<td></td>
<td>[0.256]</td>
<td>[0.310]**</td>
<td>[0.037]*****</td>
</tr>
<tr>
<td>( \Delta \widetilde{L}<em>{icjt} \times \text{StateShare}</em>{i,t=0} \times I(post - stimulus) )</td>
<td>-0.264</td>
<td>-0.130</td>
<td>-0.067</td>
</tr>
<tr>
<td></td>
<td>[0.267]</td>
<td>[0.379]</td>
<td>[0.034]*</td>
</tr>
<tr>
<td>( \Delta \widetilde{L}<em>{icjt} \times \text{StateShare}</em>{i,t=0} )</td>
<td>0.156</td>
<td>-0.031</td>
<td>0.086</td>
</tr>
<tr>
<td></td>
<td>[0.182]</td>
<td>[0.151]</td>
<td>[0.031]*****</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.383</td>
<td>0.044</td>
<td>0.070</td>
</tr>
<tr>
<td>Observations</td>
<td>46,568</td>
<td>46,568</td>
<td>42,974</td>
</tr>
</tbody>
</table>

**Notes:** \( NPL_{it} \): value-weighted share of loans originated in year \( t \) to firm \( i \) which are eventually non-performing (90 days or more delinquent). Standard errors are clustered at city level. Significance levels: *** \( p<0.01 \), ** \( p<0.05 \), * \( p<0.1 \).

- Effect of credit supply increase on ex-post non-performing loans:
  - pre-stimulus: loans to SOEs had larger probability of default
  - Gap closes from 2009
  - consistent with government intervention to prevent SOE financial distress
This paper uses loan-level and firm-level data from China to document:

- SOEs experienced larger bank credit growth than private firms
- Reversal of trend of reallocation observed during pre-stimulus years
- Within private firms, less productive (more connected?) ones experience larger credit growth

Discussion and empirical test of potential mechanisms:

- SOB did not respond more than private banks to stimulus policies
- Implicit bail out of SOEs might matter more in bad times

Informs debate on consequences of China stimulus plan.
- broader impact on the economy besides facilitating off-balance-sheet borrowing by local governments
Conclusions

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Thank you!
Appendix. SOEs and Private Firms: within industry and city

2007 (pre-stimulus)

Epanechnikov density

log(APK)

SOEs
Private Firms