Interest-Rate Liberalization and Capital Misallocations

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China’s interest rates have been tightly regulated

Recent liberalization: lending rates (2013); deposit rates (2015)
Standard theory: Financial liberalization improves productivity

- Financial frictions lead to misallocation and depressed productivity (e.g., Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Buera, et al. 2011; Midrigan and Xu, 2014; Moll, 2014)

- Alleviating financial frictions improves capital allocation and productivity
With multiple distortions, consequences of financial liberalization less clear

- China’s SOEs have distorted incentives
  - SOEs (broadly defined) help provide public goods: need to maintain employment, not just maximizing profit (Bai, et al, 2006)
  - Government subsidizes inefficient SOEs to keep them alive: soft budget constraints (Lin, et al, 1998; Lin and Tan, 1999)
  - SOEs also have superior access to credit (Brandt and Zhu, 2000)

- Financial liberalization may exacerbate SOE over-investment, partly undoing the benefits of liberalization

- Studying full consequences of financial liberalization requires GE framework with multiple distortions
Interest-rate liberalization incurs tradeoff in GE model

- Analytical results: two-sector model with firm heterogeneity and credit constraints
  1. Interest-rate liberalization improves within-sector capital allocation
  2. but exacerbates misallocation across sectors (SOE over-investment)
  3. Overall effects on TFP and welfare ambiguous

- Calibrated quantitative model:
  ▶ Interest-rate liberalization can reduce productivity and welfare
  ▶ SOE reforms can alleviate/eliminate welfare loss from financial liberalization

- Implications for sequencing of reforms: SOE reforms should precede financial liberalization
A static model

- Two types of firms: state-owned enterprises (SOEs) with measure $\mu$ and private-owned enterprises (POEs) with measure $1 - \mu$; Each firm endowed with $h$ units of capital

- SOE firm uses 1 unit of capital to produces $z^s \varepsilon$ units output, with TFP $z^s$ and idiosyncratic productivity $\varepsilon \sim F(\varepsilon)$

- POE firm uses 1 unit of capital to produces $z^p \varepsilon$ units output, where TFP $z^p > z^s$

- Interest rate wedge: $r^l = r^d + \phi$
  - Base model: $\phi$ controlled by gov't, $r^l$ and $r^d$ endogenous
  - Isomorphic setup: $r^d$ controlled by gov't, $r^l$ and $\phi$ endogenous
POE’s problem

- POE firm with productivity $\varepsilon$ maximizes profit

$$\max_{\{k^p(\varepsilon), l^p(\varepsilon), s^p(\varepsilon)\}} z^p \varepsilon k^p (\varepsilon) - \left( r^d + \phi \right) l^p (\varepsilon) + r^d s^p (\varepsilon),$$

- Flow-of-funds constraint

$$k^p (\varepsilon) = h + l^p (\varepsilon) - s^p (\varepsilon),$$

- Borrowing constraint

$$l^p (\varepsilon) \leq \theta^p h,$$

- Constraint on savings

$$0 \leq s^p (\varepsilon) \leq h.$$
SOE’s problem

- SOE firm’s objective function
  \[ \tau z^{s} \varepsilon k^{s}(\varepsilon) - \left( r^{d} + \phi \right) l^{s}(\varepsilon) + r^{d} s^{s}(\varepsilon), \]

- \( \tau > 1 \): distorted SOE incentive
  - Parsimony for soft budget constraints: gov’t subsidies, monopoly rents, or fixed costs
  - SOE’s private MPK exceeds social MPK \( \Rightarrow \) incentive to expand scale

- Flow-of-funds constraints
  \[ k^{s}(\varepsilon) = h + l^{s}(\varepsilon) - s^{s}(\varepsilon) \]

- Borrowing constraint
  \[ l^{s}(\varepsilon) \leq \theta^{s} h \]

- Constraint on savings
  \[ 0 \leq s^{s}(\varepsilon) \leq h \]

- SOEs have easier access to credit: \( \theta^{p} < \theta^{s} \)
Aggregation and market clearing

- Capital market clearing condition

\[ \mu \int k^s(\varepsilon) \, dF(\varepsilon) + (1 - \mu) \int k^p(\varepsilon) \, dF(\varepsilon) = h. \]

- Aggregate output

\[ Y = \mu \int z^s \varepsilon k^s(\varepsilon) \, dF(\varepsilon) + (1 - \mu) \int z^p \varepsilon k^p(\varepsilon) \, dF(\varepsilon). \]
Capital allocations

There exist two cutoff productivity levels $\varepsilon_j$ and $\bar{\varepsilon}_j$ for each sector $j \in \{s, p\}$ such that

$$s^j(\varepsilon) = \begin{cases} h & \text{if } \varepsilon < \varepsilon^j \\
0 & \text{if } \varepsilon^j \leq \varepsilon \end{cases}$$

$$p^j(\varepsilon) = \begin{cases} 0 & \text{if } \varepsilon < \bar{\varepsilon}_j \\
\theta_j h & \text{if } \bar{\varepsilon}_j \leq \varepsilon \end{cases}$$

$$k^j(\varepsilon) = \begin{cases} 0 & \text{if } \varepsilon < \varepsilon^j \\
h & \text{if } \varepsilon^j \leq \varepsilon < \bar{\varepsilon}_j \\
(1 + \theta^j) h & \text{if } \bar{\varepsilon}_j \leq \varepsilon \end{cases}$$

The cutoff productivity levels are given by

$$\varepsilon^j = \frac{r}{z^j \tau^j}, \quad \bar{\varepsilon}_j = \frac{r + \phi}{z^j \tau^j}$$
Macro effects of interest rate liberalization

- Liberalization (lower $\phi$) $\Rightarrow$ capital flows from POE to SOE

\[
\frac{\partial K^s}{\partial \phi} < 0, \quad \frac{\partial K^p}{\partial \phi} > 0.
\]

- Liberalization raises TFP for POE, but not necessarily for SOE
  - Higher deposit rate → low productivity firms become savers, boosting within-sector TFP
  - But across-sector capital reallocation exacerbates SOE over-investment, offsetting TFP gains

- Net effects on aggregate TFP ambiguous
A dynamic model

- Generalize static model to incorporate (1) endogenous capital accumulation; (2) decreasing returns
- Firm in sector $j \in \{s, p\}$ has DRS production function

$$y^j_t = \left[ \left( z^j \varepsilon^j_t k^j_t \right)^\alpha \left( n^j_t \right)^{1-\alpha} \right]^\eta$$

where $\varepsilon^j_t$ denotes idiosyncratic productivity.
- Flow-of-funds constraint

$$k^j_t = l^j_t + h^j_t - s^j_t$$

where $h^j_t$ is net worth carried over from $t - 1$
- Borrowing constraint

$$0 \leq l^j_t \leq \theta^j h^j_t$$
- Constraint on savings

$$0 \leq s^j_t \leq h^j_t$$
Firm’s decision problem

- Firm in sector $j \in \{s, p\}$ maximizes value function

$$V^j_t \left( h^j_t, \varepsilon^j_t \right) = d^j_t(h^j_t, \varepsilon^j_t) + \beta \frac{\Lambda_{t+1}}{\Lambda_t} \int V^j_{t+1} \left( h^j_{t+1}, \varepsilon^j_{t+1} \right) dF^j \left( \varepsilon^j_{t+1} \right)$$

- Flow dividend $d^j_t$ is given by

$$d^j_t(h^j_t, \varepsilon^j_t) \equiv \tau^j_t R_t \left( z^j_t \varepsilon^j_t k^j_t \right)^{\tilde{\alpha}} + (1 - \delta) k^j_t - (1 + r_{lt}) l^j_t + (1 + r_{dt}) s^j_t - h^j_{t+1}$$

where $R_t \equiv (1 - \gamma) \left( \frac{\gamma}{W_t} \right)^{\frac{\gamma}{1-\gamma}}$ is the pre-subsidy return on capital
The representative household

- Utility function
  \[
  \sum_{t=0}^{\infty} \beta^t \log C_t
  \]

- Budget constraint
  \[
  C_t + \frac{B_{t+1}}{1 + r_{dt}} + \sum_{j=\{s,p\}} \int_{x_{i,t+1}} x_{i,t+1} \left( P_{it}^j - d_{it}^j \right) \, di \leq W_t N_t + B_t + \sum_{j=\{s,p\}} \int x_{it}^j P_{it}^j \, di - T_t
  \]

- Borrowing constraint
  \[
  \frac{B_{t+1}}{1 + r_{dt}} \geq 0
  \]

- Under interest rate controls, low deposit rate ⇒ \( B_{t+1} = 0 \)
Calibration

- Fixed parameters: $\beta = 0.96$, $\delta = 0.1$, $\alpha = 0.5$, $\eta = 0.85$, and $\phi = 0.032$
- Calibrate $\tau^j$, $\theta^j$, $Z^j$, and $\sigma^j$ using China’s Annual Survey of Industries, 1998-2007

Calibrated values: $\frac{\tau^s}{\tau^p} = 1.43$, $\frac{Z^p}{Z^s} = 1.92$, $\frac{\theta^s}{\theta^p} = 1.80$, $\frac{\sigma^p}{\sigma^s} = 1.23$
Transition dynamics following liberalization (set $\phi = 0$)

- Tradeoff b/n within-sector TFP gains and across-sector misallocation
- Short run drops in TFP and output; permanent increase in long run
Removing interest-rate wedge leads to modest welfare loss (0.28% consumption equivalent)
SOE reforms reduce or eliminate welfare losses from interest-rate liberalization
Empirical evidence for model’s reallocation mechanism

- Testable empirical implication: interest-rate liberalization can hurt productivity in the presence of distorted allocations

- Empirical specification:

\[
\Delta Y_{mt} = \beta_0 + \beta_1 \times D_{mt} + \beta_2 \times \Delta \phi_t + \beta_3 D_{mt} \times \Delta \phi_t + \beta_4 \times X_{mt} + \delta_m + \rho \Delta Y_{m,t-1} + \varepsilon_{mt}
\]

where \( \Delta Y_{mt} \) denotes labor productivity growth in industry \( m \)

- Distortion dummy:

\[
D_{mt} \equiv 1 \left( z_{mt}^{aut,x\%} \geq z_{mt}^{bott,x\%} \right), \quad x \in \{1, 2, 5\}
\]

where \( z_{mt}^{aut,x\%} \) and \( z_{mt}^{bott,x\%} \) denote TFP of bottom \( x\% \) of, respectively, financially autarkic firms and borrower firms in industry \( m \)

- Estimate empirical specification using firm-level data (NBS)
Response of labor productivity to changes in interest-rate wedge

<table>
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<th>$\Delta Y_{mt}$</th>
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<td>$\Delta \phi_t$</td>
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<td>$-0.753^{**}$</td>
<td>$-0.765^{**}$</td>
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<td>$(0.299)$</td>
<td>$(0.313)$</td>
<td>$(0.308)$</td>
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<td>$0.970^{**}$</td>
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<td>$D_{mt}$</td>
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- Reducing $\phi$ lowers productivity if industry has distorted allocation
- Without distorted allocation, reducing $\phi$ raises productivity
Other evidence for model’s reallocation mechanism

- Gao, Ru, Townsend, Yang (2017): Bank entry deregulation of 2009 → new entrant banks mostly lent to SOEs (less productive but safe); increased competition between new and incumbent banks raised loan quality and borrowing firms’ efficiency

- Chang, Liu, Spiegel, Zhang (2017): cutting required reserve ratio raises SOE loan shares, investment shares, and stock returns

- Cong, Gao, Ponticelli, Yang (2018): sharp credit expansion from fiscal stimulus reallocated capital to SOEs, despite their lower productivity
Conclusion

- Under multiple sources of distortions, complete interest-rate liberalization may not be desirable.
- Financial liberalization incurs tradeoff between within-sector productivity gains and across-sector misallocations (SOE over-investment).
- SOE reforms should precede financial liberalization.