State versus Market: China's Hybrid Economy

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China's Market Reforms

- China didn't adopt the shock therapy and instead took gradualist reforms to incorporate many free-market features in the past 40 years
  - Deng Xiaoping: "crossing river by touching the stones"

- Reforms without a blueprint
  - Lau, Qian & Roland (2000, JPE) "Economic Reforms without Losers": a dual-track approach to avoid massive unemployment and social unrest
  - Song, Storesletten & Zilibotti (2011, AER) "Growing Like China": A transition economy

Urban Employment

Urban Employment in China by Registration Type (Million)
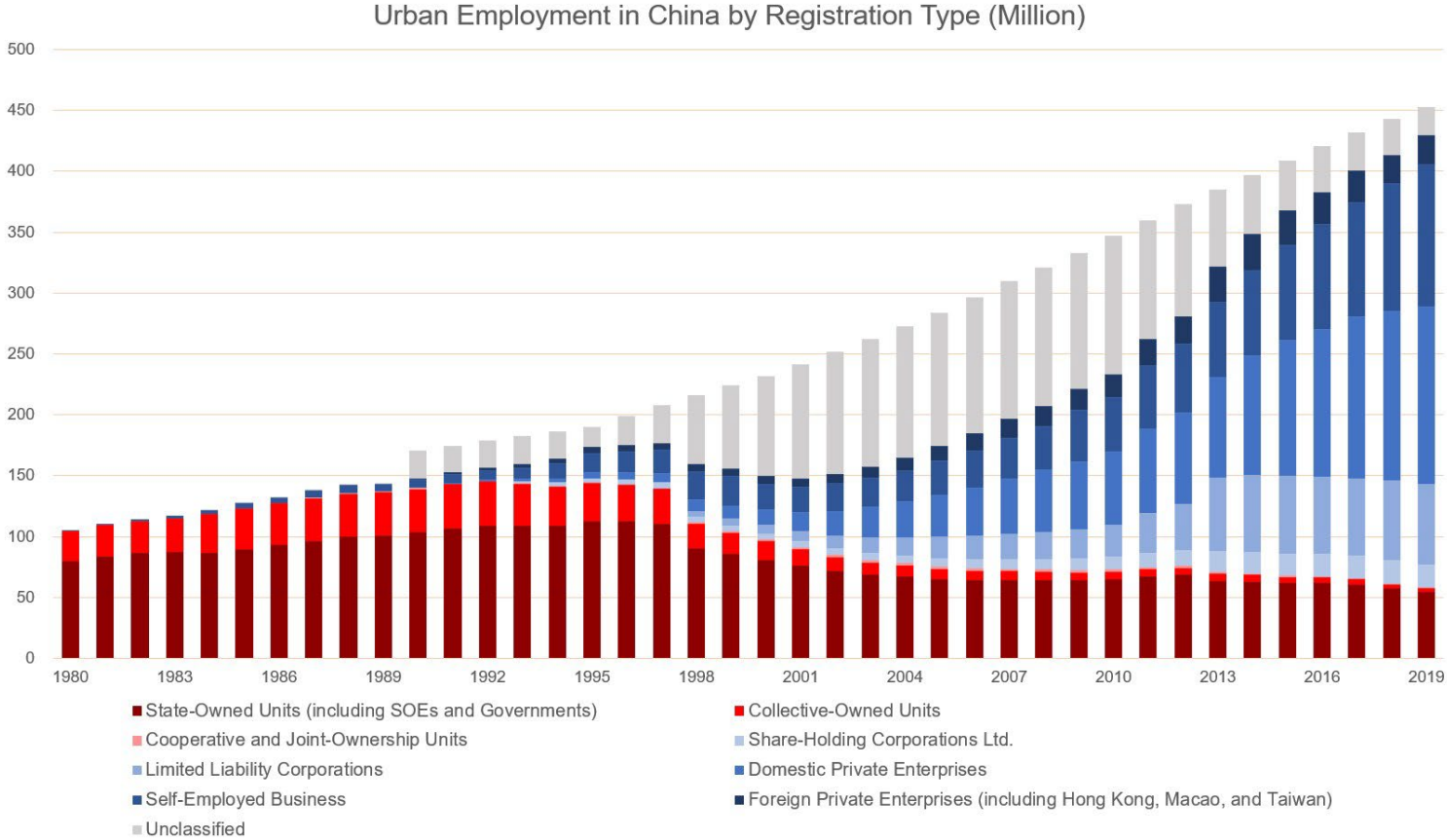
Source: PRC National Bureau of Statistics, Annual Data

China's Hybrid Economy

- Economic planning and market forces are two complementary aspects of the Chinese economy

- Central government still uses economic planning to set overall direction and goals for the economy
    - sets priority of economic development, guide resource allocation, regulate markets, and ensure stability
    - a top-down approach to direct and motivate local governments and SOEs
    - Incentives, regulations and administrative orders to guide private firms

- The market economy
    - better incentives for individuals and firms
    - important market signals for state planning: CPI, PMI, housing prices, commodity prices, financial prices, volume of transactions
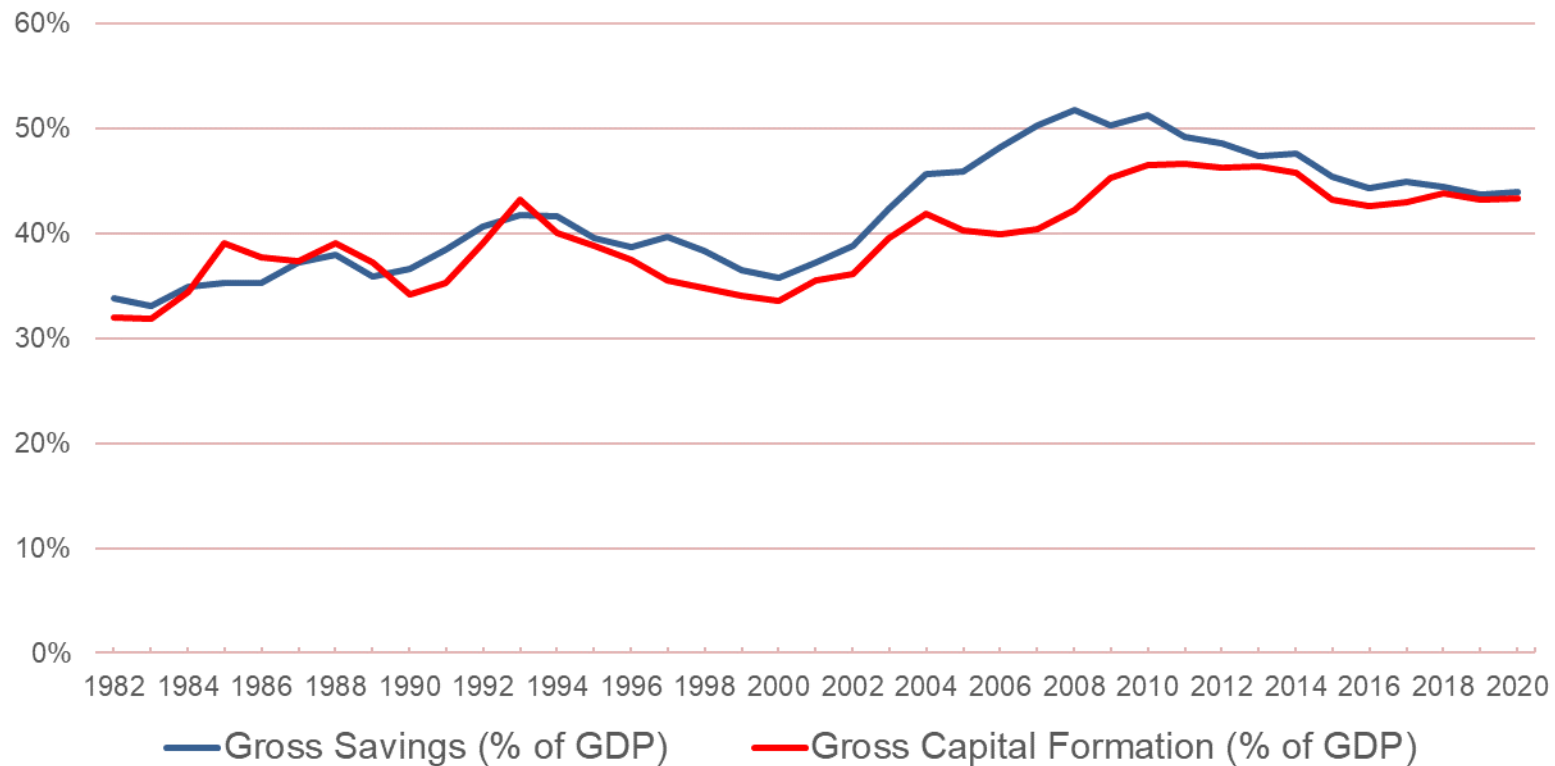   - vital performance measure for local governments
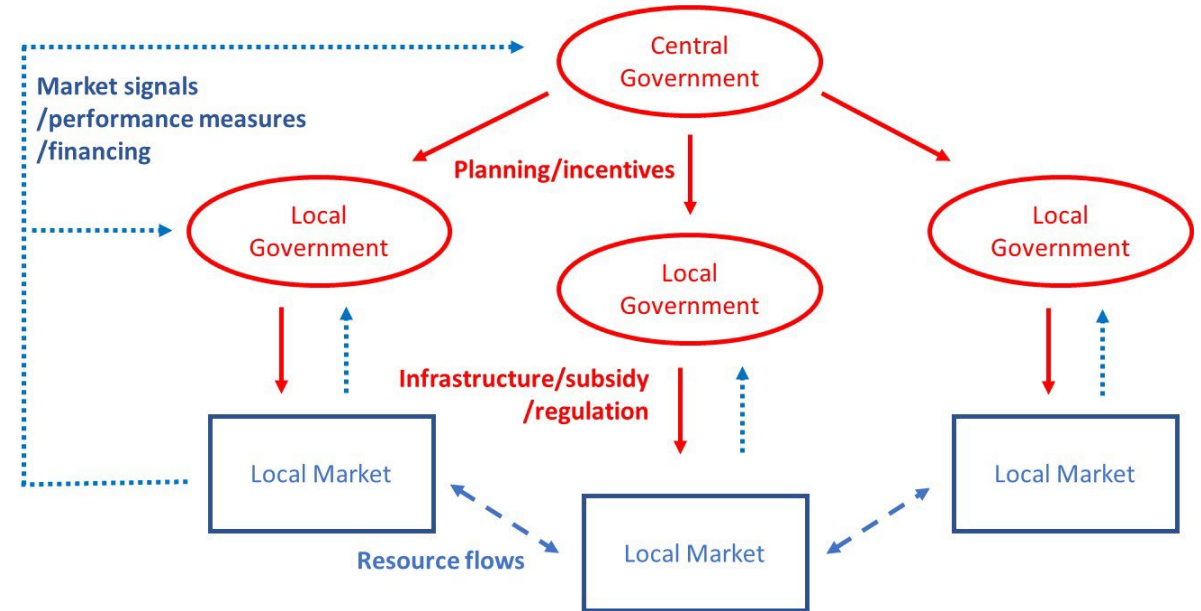
- State vs market
    - A two-way feedback system: top-down and bottom-up
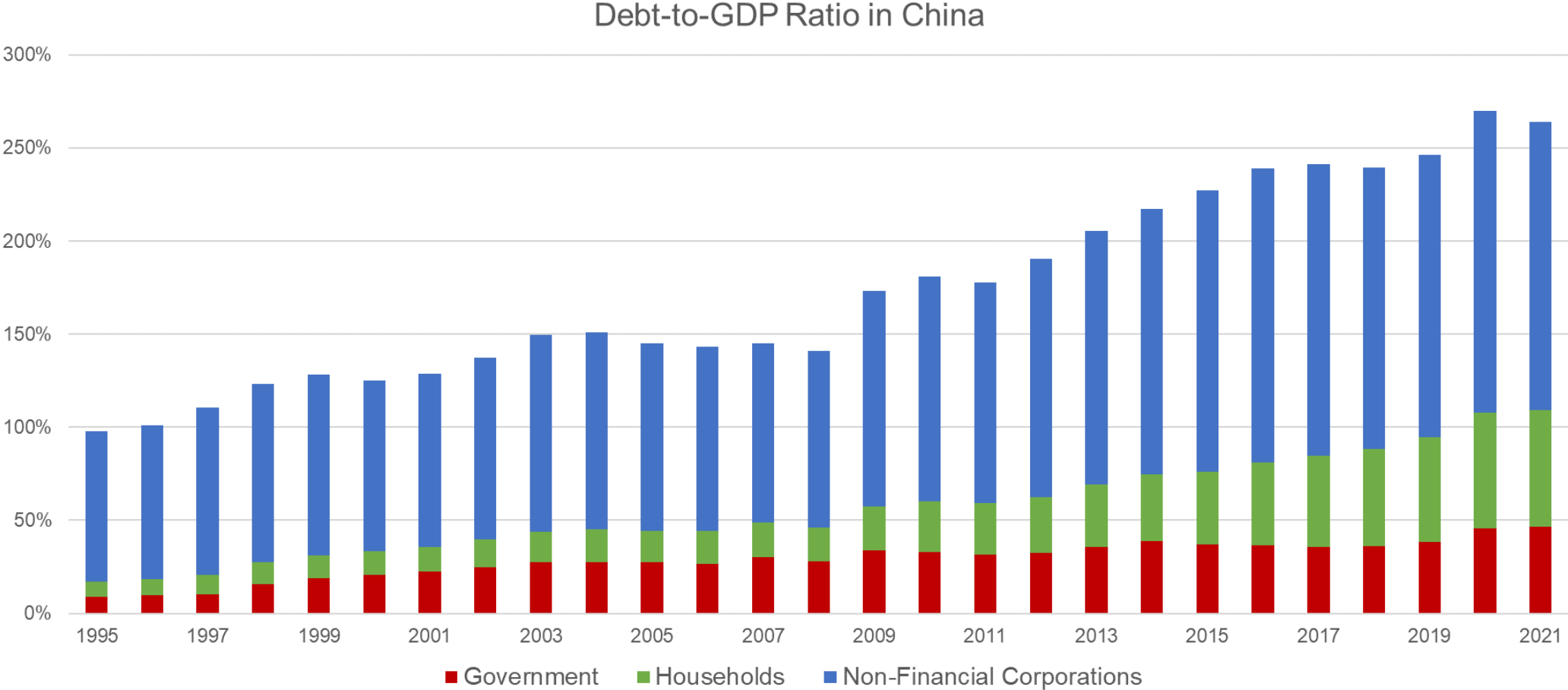   - May complement or exacerbate each other

Open Issues

- How to characterize the relationship between state and market in China?
  - Balancing the government's visible hand and the market's invisible hand is a recurring theme in China's economic reforms
  - Xi's characterization: "enabling government and efficient markets" (有为政府、有效市场)
    - 2022 CCP Constitution: "发挥市场在资源配置中的 基础性 决定性作用，更好发挥政府作用，建立完善的宏观调控体系。"

- Long-standing concerns about central planning
  - Mises (1922) and Hayek (1945): Central planners cannot command all the knowledge initially dispersed among many different individuals
  - The lack of incentives

- Can the hybrid economy address the information and incentive challenges?

Investment-Driven Economy
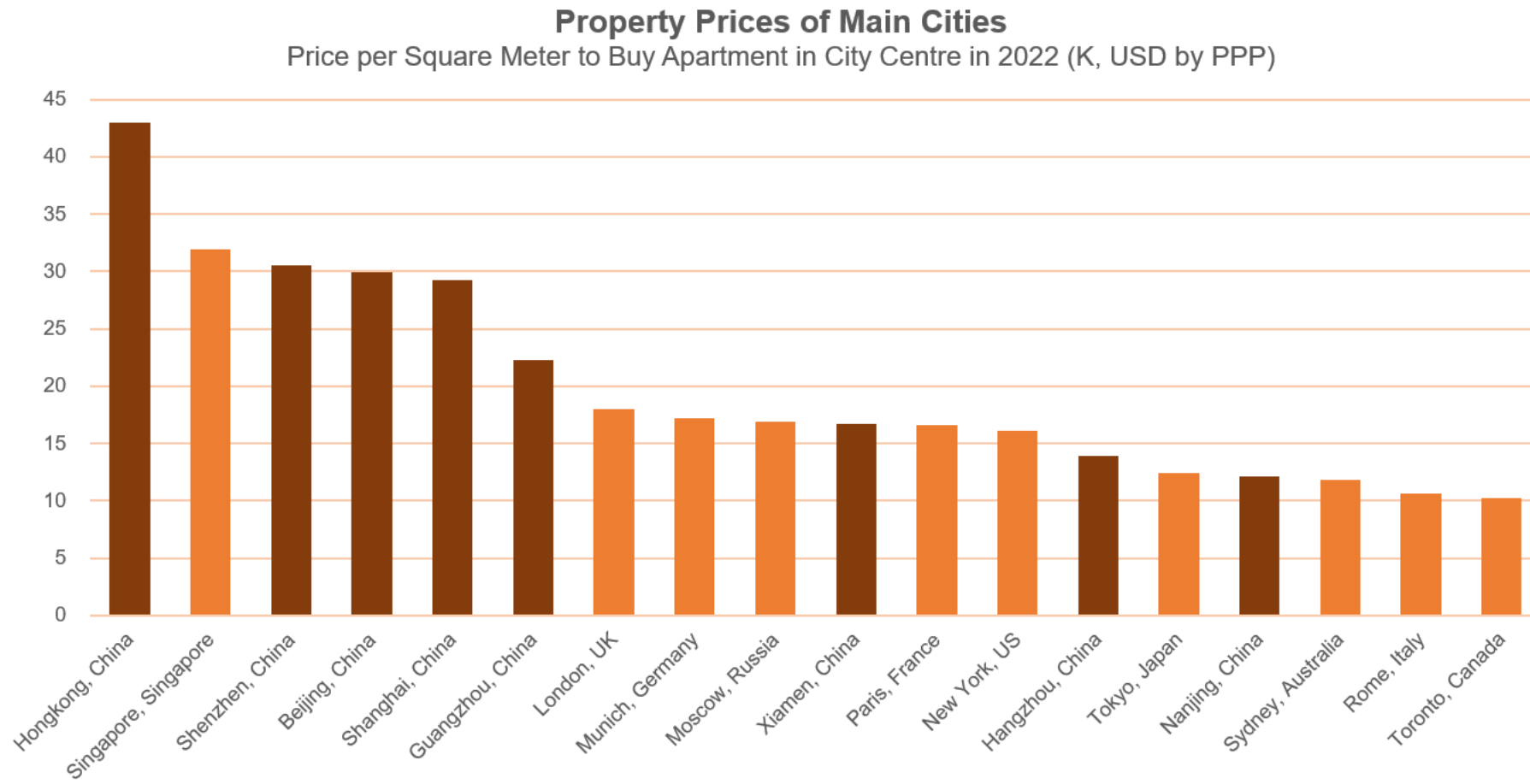

- Chen and Zha (2023)

High Leverage

Debt-to-GDP Ratio in China

Bubbly Real Estate

Property Prices of Main Cities
Price per Square Meter to Buy Apartment in City Centre in 2022 (K, USD by PPP)

Source: Numbeo; OECD Data

Outline

- A brief overview of China's market reforms and hybrid economy

- A simple G-K framework to incorporate state and market

- Information discovery in the G-K framework
  - Brunnermeier, Sockin & Xiong (2022, RES) "China's Model of Managing the Financial System"
  - Sockin & Xiong (2023) "State vs Market: Information Discovery in a Hybrid Economy"

- Incentives, investment and leverage in the Mandarin system
  - Song & Xiong (2023) "The Mandarin Model of Growth"

- Real estate
  - Xiong (2023) "Derisking Real Estate in China's Hybrid Economy"

# A Simple Framework

$$Y = A\, G^{\alpha_G}\, K^{\alpha_K}$$

- G is infrastructure developed by the government
  - Particularly relevant for developing economies, which tend to lack infrastructure
  - Difficult for private firms to provide due to its public good nature
  - The government can recover the cost through taxation
  - Can also be broadly interpreted as both physical and soft infrastructure

- K is capital investment by private firms

- G and K are complementary
  - Free markets are more efficient in information discovery and incentive provision, but subject to externalities
  - The state system can internalize externalities but is subject to information and incentive issues

Figure 1: Share of Infrastructure Capital

Panel B: City
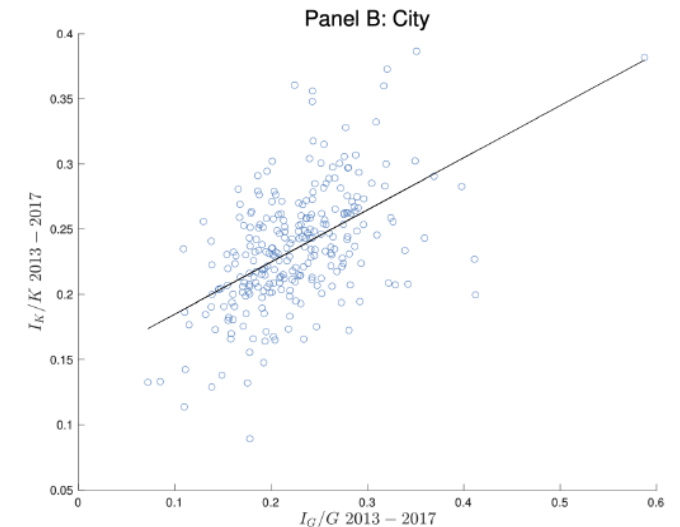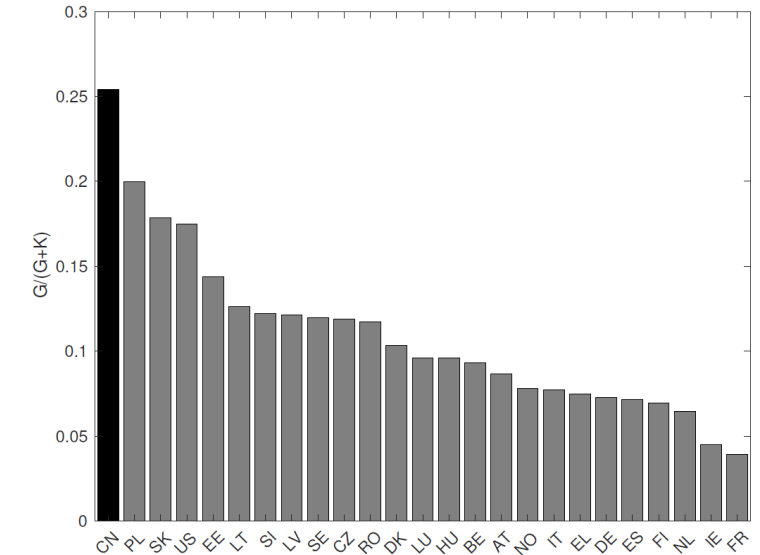
"State vs Market: Information Discovery in a Hybrid Economy" Sockin & Xiong (2023)

- Can a hybrid economy overcome the information challenge faced by central planning, as highlighted by Mises (1922) and Hayek (1945)?

- Information among dispersed private firms can be aggregated through their investment decisions in the private sector
  - Feedback to other private firms
  - Feedback to policy makers and state firms
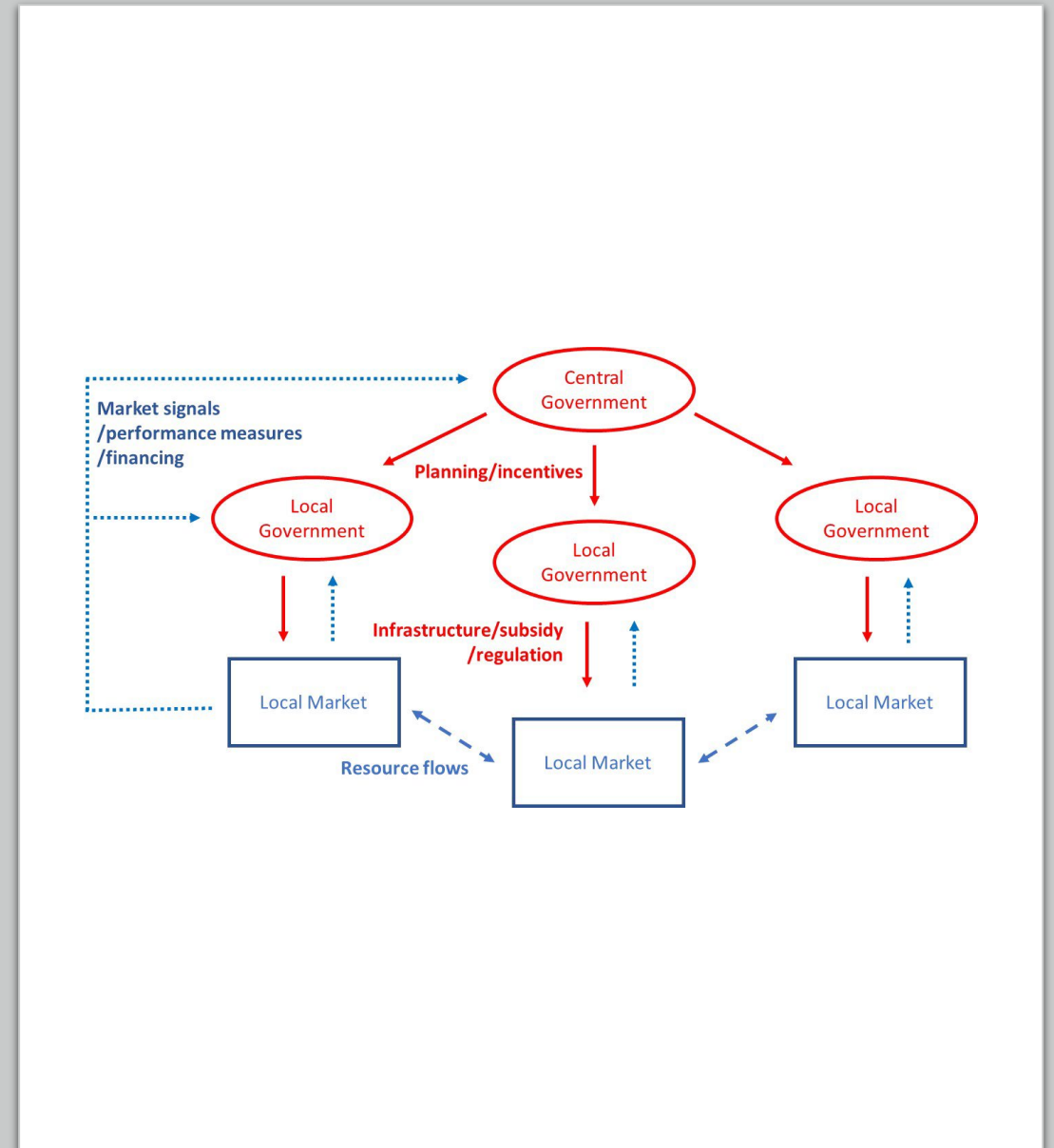
Model Setting

- Three dates $t \in \{0, 1, 2\}$
- Three types of economic actors
  - government
  - private firms
  - capital suppliers

- Date 0:
  - Government chooses an infrastructure investment policy
  - Each firm chooses what information to acquire, fundamental and/or noise
- Date 1:
  - Government chooses infrastructure G
  - Each firm chooses how much capital K_i
- Date 2:
  - Firms produce and households consume output

Firms

- A continuum of firms each owned by a risk-averse household

- At date 2, each firm's output:

$$Y_i = e^f \, G^{\alpha_G} \, K_i^{\alpha_K}, \qquad \alpha_G = 1 - \alpha_K$$

- At date 1, each firm chooses K_i based on I_i:

$$\max_{K_i} E[Y_i - qK_i + \tau_i | I_i]$$

  - I_i is the firm's information set
  - $\tau_i = qK_i$ is a transfer from government

- At date 0, each chooses its information acquisition strategy

Government

- Date 1:
  - Government receives private signal s_g:

$$s_g = f + \epsilon_g, \qquad \epsilon_g \sim N(0, \tau_g^{-1})$$

  - Government's information set $I_G = \{s_g, \log q\}$

  - A log-linear infrastructure policy:

$$\log G = b_s s_g + b_q \log q + b_0$$

    - We assume that the government cannot credibly announce s_g to the public

- Date 0:
  - The government announces its policy $\{b_s, b_q, b_0\}$

Firm Information

- At date 1, the public information $I_P = \{\log q\}$; Gaussian prior: $\begin{bmatrix} f \\ \epsilon_g \end{bmatrix} | I_P \sim N\left(\begin{bmatrix} \hat{f} \\ \hat{\epsilon}_g \end{bmatrix}, \Sigma_P \right)$

  - Firms cannot observe $\log G$, but can observe $\log q$
  - Realistic delay in macro reporting, capital market better at information discovery

- Each firm may acquire two private signals

  - Fundamental signal:
  $$s_i = f + \epsilon_{si}, \ \epsilon_{si} \sim N(0, \tau_s^{-1})$$

  - Signal about government information:
  $$v_i = s_g + \epsilon_{vi}, \qquad \epsilon_{vi} \sim N(0, \tau_v^{-1})$$

- Gaussian posterior based on firm I_i: $\begin{bmatrix} f \\ \epsilon_g \end{bmatrix} | I_i \sim N\left(\begin{bmatrix} \hat{f}_i \\ \hat{\epsilon}_{gi} \end{bmatrix}, \Sigma_P \right)$

Firm Information Acquisition

- At date 0, each firm chooses τ_s and τ_v to maximize its household's expected utility:

$$U_i = \max_{\tau_s, \tau_v} E\left[\frac{C_i^{1-\gamma}}{1-\gamma}\right]$$

subject to a rational inattention constraint (a la Sims 2003):

$$I(\tau_s, \tau_v) = \frac{1}{2}\log|\Sigma_P| - \frac{1}{2}\log|\Sigma_i| \leq \frac{\kappa}{2}$$

Capital Suppliers

- A continuum of capital suppliers supply capital at date 1 at price q

  - Supplier j chooses k_j subject to an effort cost:

$$\max_{k_j} \quad qk_j - \frac{1}{1+1/\psi} e^{\varphi_j} k_j^{1+1/\psi}$$

  with

$$\varphi_j = \varphi + \epsilon_{\varphi j}, \qquad \varphi \sim N\left(0, \tau_\varphi^{-1}\right), \qquad \epsilon_{\varphi j} \sim N\left(0, \tau_{\varphi\epsilon}^{-1}\right)$$

  - Optimal supply: $k_j = (qe^{-\varphi_j})^\psi$

- Aggregate capital supply:

$$K_S = \int k_j dj = q^\psi e^{-\psi\varphi + \frac{1}{2}\psi^2 \tau_{\varphi\epsilon}^{-1}}$$

Market Equilibrium

- Firms take government policy $\{b_s, b_q, b_0\}$ as given

- At date 1:
  - Each firm invests:
  $$\log K_i = \frac{1+\alpha_G}{\alpha_G} b_s \hat{f} + b_s \, \hat{\epsilon}_g + a_s(s_i - \hat{f}) + a_v(v_i - \hat{\epsilon}_g) + \frac{\alpha_G b_q - 1}{\alpha_G} \log q + a_0$$
  - Market clearing of capital:
  $$\log q = \frac{1}{\psi - A_q}\left(A_s f + A_v \epsilon_g + A_f \, \hat{f} + A_g \, \hat{\epsilon}_g + A_0 + \psi \varphi - \frac{1}{2}\psi^2 \tau_{\varphi\epsilon}^{-1}\right)$$
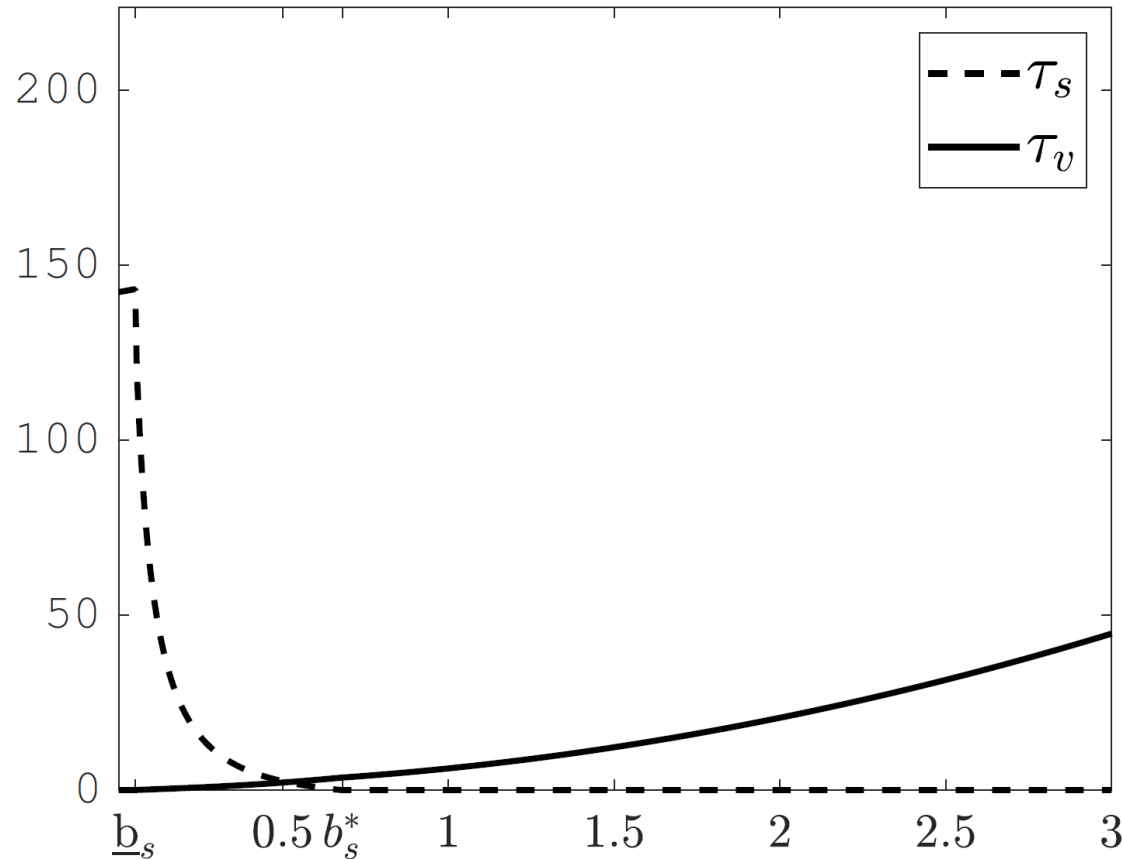
- At date 0:

  - Each firm solves
  $$\min_{\tau_s, \tau_v} Var\left[f + \alpha_G b_s s_g | I_i\right]$$

  subject to $I(\tau_s, \tau_v) \leq \kappa/2$

Market Equilibrium

- Fundamental-centric equilibrium if $b_s \leq \underline{b}_s$
  - $\underline{b}_s$ is decreasing in $\alpha_G, \tau_f, \kappa, \tau_\varphi$, and increasing in τ_g, ψ

- Government-centric equilibrium if $b_s > b_s^*$
  - No fundamental information discovery by the market
  - b_s^* is decreasing in α_G, τ_f, ψ, and increasing in $\tau_g, \kappa, \tau_\varphi$

Government Policy

- Would the government choose a sufficiently high b_s to lead to government-centric equilibrium?

- What is the objective of the government?
  - Local officials maximize the performance measure set by the central government, rather than aggregate welfare of local households
    - GDP and social welfare are highly correlated, albeit not perfectly

The Agency Problem

- Local GDP as the performance measure:
$$Y = \int e^f G^{\alpha_G} K_i^{\alpha_K} di$$

- Households' welfare:
$$W = E\left[\int C_i^{1-\gamma} di\right]^{\frac{1}{1-\gamma}} - E\left[\frac{qK}{1 + \frac{1}{\psi}}\right] - R_G E[G^2]$$
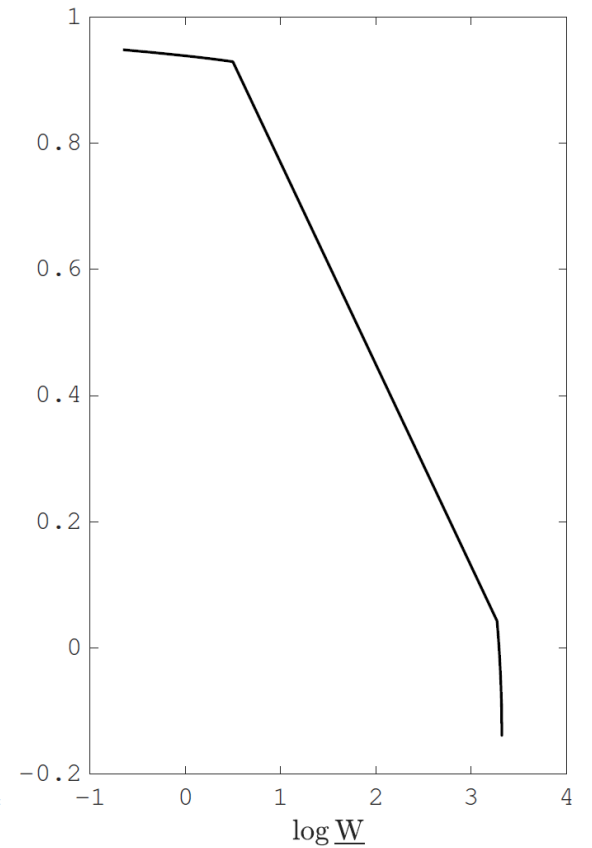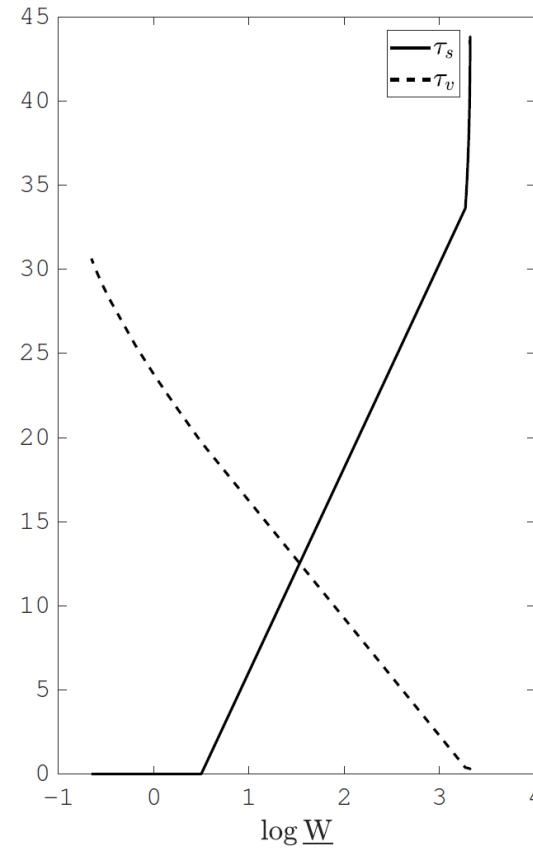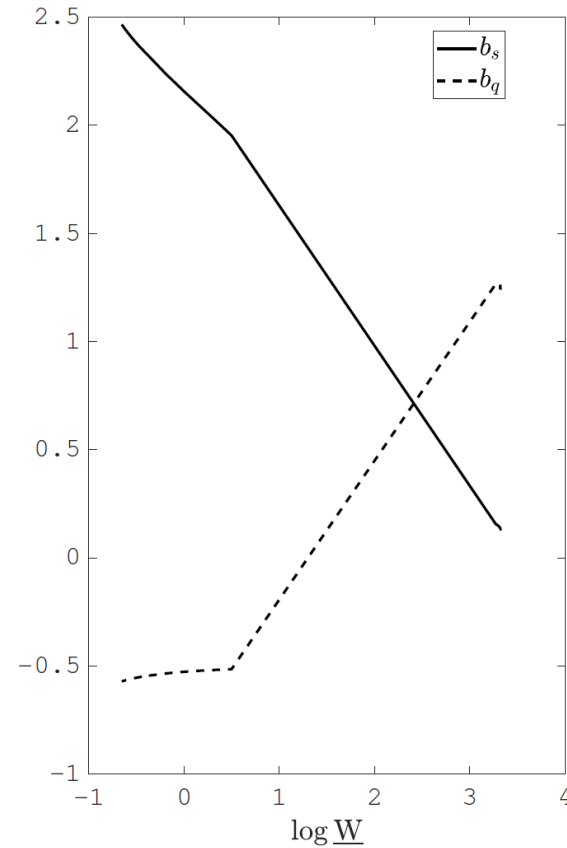
- The local government's problem at date 0:
$$V = \max_{b_s, b_q, b_0} \log E[Y]$$

with a public outcry constraint: $\log W \geq \log \underline{W}$.

Optimal Government Policy

- When the public outcry constraint is sufficiently lax, the government-centric equilibrium emerges

Summary

- State intervention and the market may complement each other when state intervention is restrained

- However, when the visible hand is too dominant, the invisible hand exacerbates rather than complements the visible hand

- A modest divergence in objective may be sufficient to motivate the government to choose to dominate the market

Incentives in the Mandarin System

- A politically centralized but fiscally decentralized system, e.g., Xu (2011), Maskin, Qian & Xu (2000), Li & Zhou (2005)
  - Local governors have autonomy in managing local fiscal budget and development
  - The central government evaluates local officials based on unified performance measures
  - A key channel for the state to exert controls of local officials and thus implement central government agenda

- The performance measure varies
  - Ideology and political loyalty before 1978
  - Economic development after 1978

- Market-based performance provides powerful incentives for economic development, yet the incentives may also induce short-termist behaviors, such as over-leverage
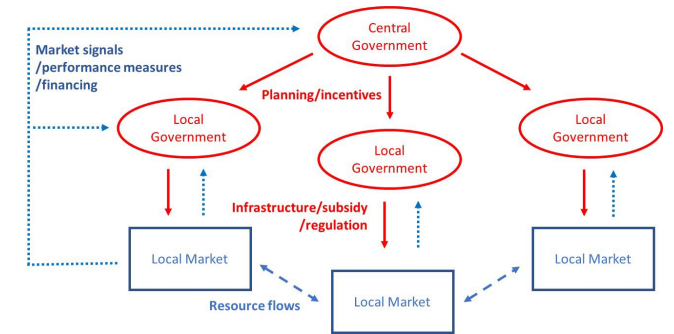
"The Mandarin Model of Growth"
Song & Xiong (2023)

- Consider an economy with infinitely many regions $i \in [0,1]$ and $t = 0, 1, 2, \ldots$

- In each region i, the representative firm's output is
$$Y_{it} = A_{it} G_{it}^{\alpha_G + \gamma} K_{it}^{\alpha_K}$$

- The economy is populated by two-period-lived OLG of households, with young households supplying labor to each region inelastically.

- Aggregate notation: $\bar{X}_t = \int X_{it} di$

Firms

- Each representative firm takes r_t as given and choose K_{it}:

$$\max_{K_{it}} (1-\tau)A_{it}G_{it}^{\alpha_G+\gamma}K_{it}^{\alpha_K} - (r_t + \delta_K)K_{it}$$

- $K_{it} = \left(\frac{(1-\tau)\alpha_K A_{it}}{r_t+\delta_K}\right)^{\frac{1}{1-\alpha_k}} G_{it}^{\frac{\alpha_G+\gamma}{1-\alpha_k}}$

- $Y_{it} = \left(\frac{(1-\tau)\alpha_K}{r_t+\delta_K}\right)^{\frac{\alpha_K}{1-\alpha_k}} A_{it}^{\frac{1}{1-\alpha_k}} G_{it}^{\frac{\alpha_G+\gamma}{1-\alpha_k}}$

- AG model if $\alpha_G + \gamma + \alpha_K = 1$

Households and Capital Market

- The young household maximizes

$$\max_{S_{t+1}} \log C_{t,t}^{H} + \beta \log C_{t,t+1}^{H}$$

subject to $\quad C_{t,t}^{H} + S_{t+1} = (1-\tau)(1-\alpha_K-\alpha_G)\,\bar{Y}_t$

$$C_{t,t+1}^{H} = (1+r_{t+1})S_{t+1}$$

- Household saving is given by

$$S_{t+1} = \frac{\beta}{1+\beta}(1-\tau)(1-\alpha_K)\bar{Y}_t \equiv s\bar{Y}_t$$

- Competitive national banks absorb all the household savings and provide capital to firms
  - The market clearing interest rate r_t: $\bar{K}_t = S_t$

Local Government

- A governor takes over the local government at the end of each period

- Choose C_{it}^G and G_{it+1} subject to

$$C_{it}^G + G_{it+1} = \tau Y_{it} + (1 - \delta_G)G_{it}$$

- The governor's ability a_{it} is unobservable and affects the local TFP:
$$A_{it} = e^{a_{it} + \epsilon_{it}}$$
  - $a_{it} \sim N(\bar{a}_i, \sigma_a^2)$
  - $\epsilon_{it} \sim N(0, \sigma_\epsilon^2)$

Career Incentives in the Mandarin System

- The central government uses the local output to evaluate performance:

$$\hat{a}_{it} = E[a_{it}|Y_{it}] \quad \text{where} \quad \textcolor{red}{Y_{it} = A_{it}G_{it}^{\alpha_G}K_{it}^{\alpha_K}}$$

and

The market provides the performance measure

$$\log Y_{it} = \frac{\alpha_G}{1 - \alpha_K}\log G_{it} + a_{it} + \epsilon_{it}$$

- G_{it} is not used because it is easily manipulable by the local government

- The signal jamming mechanism of Holmstrolm (1982):

$$\hat{a}_{it} \propto \kappa[(a_{it} - \bar{a}_{it}) + \epsilon_{it} + \alpha_K(\log G_{it} - \log G_{it}^*)] \quad \text{with} \quad \textcolor{red}{\kappa = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_\epsilon^2}}$$

Recursive Competitive Equilibrium

- Each region characterized by (G, A). The aggregate state is $\Gamma \equiv (\Phi, S)$, where Φ is the distribution of (G, A). Aggregation follows $\bar{X} = \int X d\Phi$.

- The capital market clearing condition and firm optimality condition imply

$$\bar{Y}(\Gamma) = S^{\alpha_K} \left(\int A_i^{\frac{1}{1-\alpha_k}} G_i^{\frac{\alpha_G + \gamma}{1-\alpha_k}} d\Phi \right)^{1-\alpha_K}$$

$$r(\Gamma) = \alpha_K (1 - \tau) \left(\frac{\int A_i^{\frac{1}{1-\alpha_k}} G_i^{\frac{\alpha_G + \gamma}{1-\alpha_k}} d\Phi}{S} \right)^{1-\alpha_K} - \delta_K$$

- Households and local governors perceive
$$\Gamma' = H(\Gamma)$$

Local Government Choices

- Local government solves

$$V^G(G, A; \Gamma) = \max_{C^G, G'} \log C^G + \textcolor{red}{\kappa \log G'} + \beta^G E[V^G(G', A'; \Gamma')]$$

  subject to $C^G + G' = \tau Y + (1 - \delta_G)G$ and $\Gamma' = H(\Gamma)$.

- Local governor's FOC:

$$\frac{1}{C^G} = \frac{\kappa}{G'} + \beta^G E\left[\frac{1}{C^{G'}}\left(\tau\frac{\partial Y'}{\partial G'} + 1 - \delta_G\right)\right]$$

- If $\delta_K = \delta_G = 1$, the governor chooses

  - $C^G = cY = \dfrac{1 - \beta^G\frac{\gamma + \alpha_G}{1 - \alpha_K}}{1 + \kappa}\tau Y$

  - $G' = gY = \left(\dfrac{\kappa + \beta^G\frac{\gamma + \alpha_G}{1 - \alpha_K}}{1 + \kappa}\right)\tau Y_{it-1}$

- The first best allocation: $g = \beta(\gamma + \alpha_G)$

Local Government Debt

- Suppose that the local governor can use debt D:
$$C^G + G' = \tau Y + (1 - \delta_G)G - (1 + r)D + D'$$

- The local leverage ratio $e = \dfrac{(1+r)D}{\tau Y}$

- Each region is now characterized by (G, D, A). The aggregate state is $\Gamma \equiv (\Phi, S)$, where Φ is the distribution of (G, D, A).

- Perceiving $\Gamma' = H(\Gamma)$, local government solves
$$V^G(G, D, A; \Gamma) = \max_{C^G, G', D'} \log C^G$$
$$+ \kappa(\omega \log G' + (1 - \omega) \log(1 - e')) + \beta^G E[V^G(G', A'; \Gamma')]$$

  - $(1 - \omega) \log(1 - e')$ represents liquidity risk created by debt
  - ω measures the weight given to economic tournament, $1 - \omega$ the weight to financial prudence

Optimal Conditions

- The FOCs for D' and G':

$$E\left[\frac{\kappa(1-\omega)}{1-e'}\frac{1+r'}{\tau Y'}|\Gamma\right] = \frac{1}{C^G} - \beta^G E\left[\frac{1+r'}{C^{G'}}|\Gamma\right]$$

and

$$\frac{1}{C^G} - E\left[\frac{\kappa(1-\omega)}{1-e'}\frac{(1+r')D'}{\tau\bar{Y}'^2}\frac{\partial Y'}{\partial G'}\right]$$
$$= \frac{\kappa\omega}{G'} + \beta^G E\left[\frac{1}{C^{G'}}\left(\tau\frac{\partial Y'}{\partial G'} + 1 - \delta_G\right)|\Gamma\right]$$

Capital Market Crowding Out

- The capital market clearing condition is now
$$\bar{K} + \bar{D} = S$$

- Aggregate output and equilibrium interest rate:

$$\bar{Y}(\Gamma) = (S - \bar{D})^{\alpha_K} \left(\int A_i^{\frac{1}{1-\alpha_k}} G_i^{\frac{\alpha_G + \gamma}{1-\alpha_k}} d\Phi \right)^{1-\alpha_K}$$

$$r(\Gamma) = \alpha_K (1 - \tau) \left(\frac{\int A_i^{\frac{1}{1-\alpha_k}} G_i^{\frac{\alpha_G + \gamma}{1-\alpha_k}} d\Phi}{S - \bar{D}} \right)^{1-\alpha_K} - \delta_K$$

Limiting Cases

- Assume $\delta_K = \delta_G = 1$ and $\sigma_a^2 \rightarrow 0$ and $\sigma_\epsilon^2 \rightarrow 0$ but $\sigma_a^2 / \sigma_\varepsilon^2$ remains unchanged
  - A is essentially constant and we can drop thus drop expectation but keep κ

- e_* and $\frac{1+r_*}{1+\chi_*}$ are always increasing in ω
  - The crowding out effect of ω: $K_*' = k_* Y_* \equiv \alpha_K (1-\tau) \frac{1+\chi_*}{1+r_*} Y_*$

- The steady state capital wedge

$$\Delta r_* = \frac{\dfrac{1+e_*}{1+\chi_*} g_*}{(1-\tau)(\gamma + \alpha_G)} - 1$$

  - $\Delta r_* > 0$ in the meritocratic regime (i.e., $\omega \rightarrow 1$), indicating over-investment in G

Summary

- Quantitative analysis of matching the model to
  - High G/(G+K) in China
  - Return to G and K
    - Investment wedge between G and K
  - Local government debt

- Linking government performance to economic growth provides local governments with powerful incentives to develop local economy

- Powerful incentives also lead to short-termist behaviors, the ultimate driver of the local government debt problem
  - Capital market feeds to the Mandarin system
  - Financial instability
  - Crowding-out effect on firms' capital investment

China's Hybrid Real Estate Model

Xiong (2023) "Derisking Real Estate in China's Hybrid Economy"

- How was China's urbanization funded?
  - Cannot rely on property taxes
  - Land sales as a novel funding model, as land ownership is similar to equity ownership in a city

- Local governments the real estate market complement each other
  - Local governments provide infrastructure and facilitate local businesses
  - The real estate market provides funding, market signals and performance measures for local governments
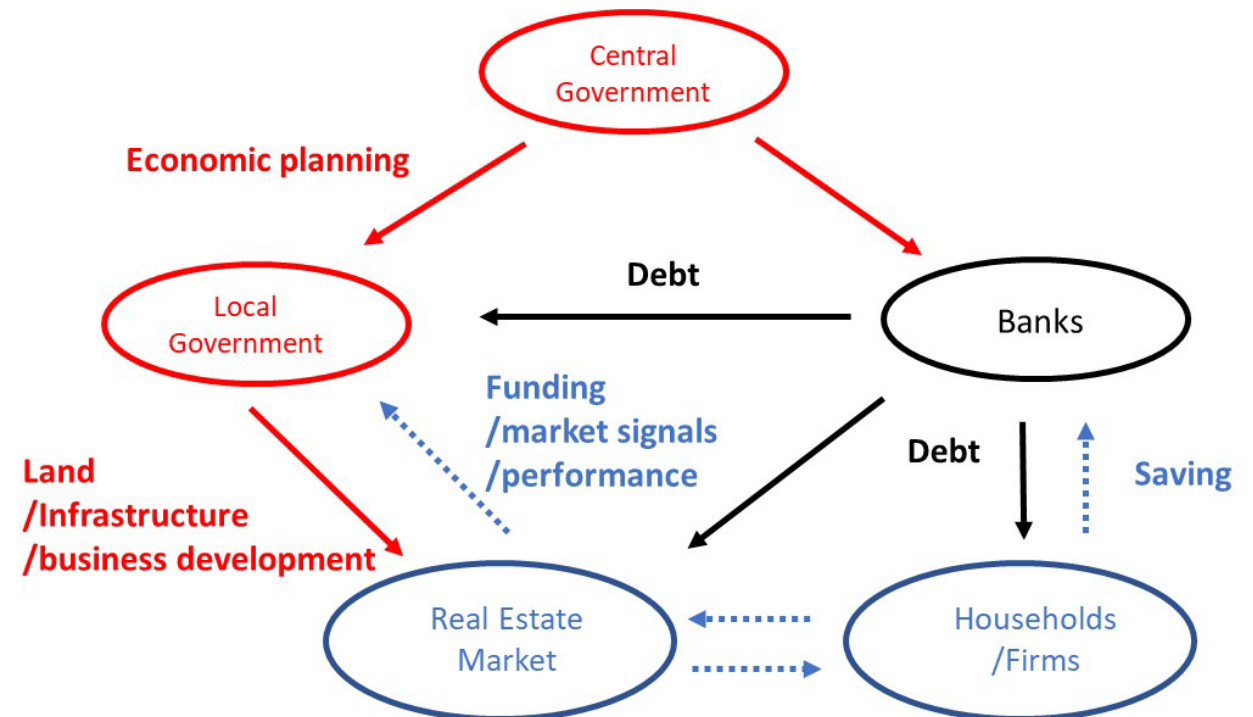
Excesses of the Hybrid Model

- The hybrid structure may lead to overinvestment and overleverage

  1. The financing channel: Local governments are responsible for implementing the central government policies with land sales being a primary source of funding

  2. The tournament channel: Short-term incentives may lead local governments to use debt financing, collateralized by land or future land sale revenue

  3. The government guarantee channel: The real estate sector is widely viewed as "too big to fail", which in turn induce even more overinvestment and overleverage in real estate by local governments, real estate firms, households, and other firms

Summary

- China's rapid growth is rooted to the complementarity between the state and the market
  - The market provides incentives and information to boost efficiency
  - State intervention to provide infrastructure and mitigate market externalities

- However, the market and the state may also exacerbate each other
  - Distortions in information discovery
  - Local government debt problem
  - Challenges in real estate
  - ….

Thank You!