Information Discovery in a Hybrid Economy

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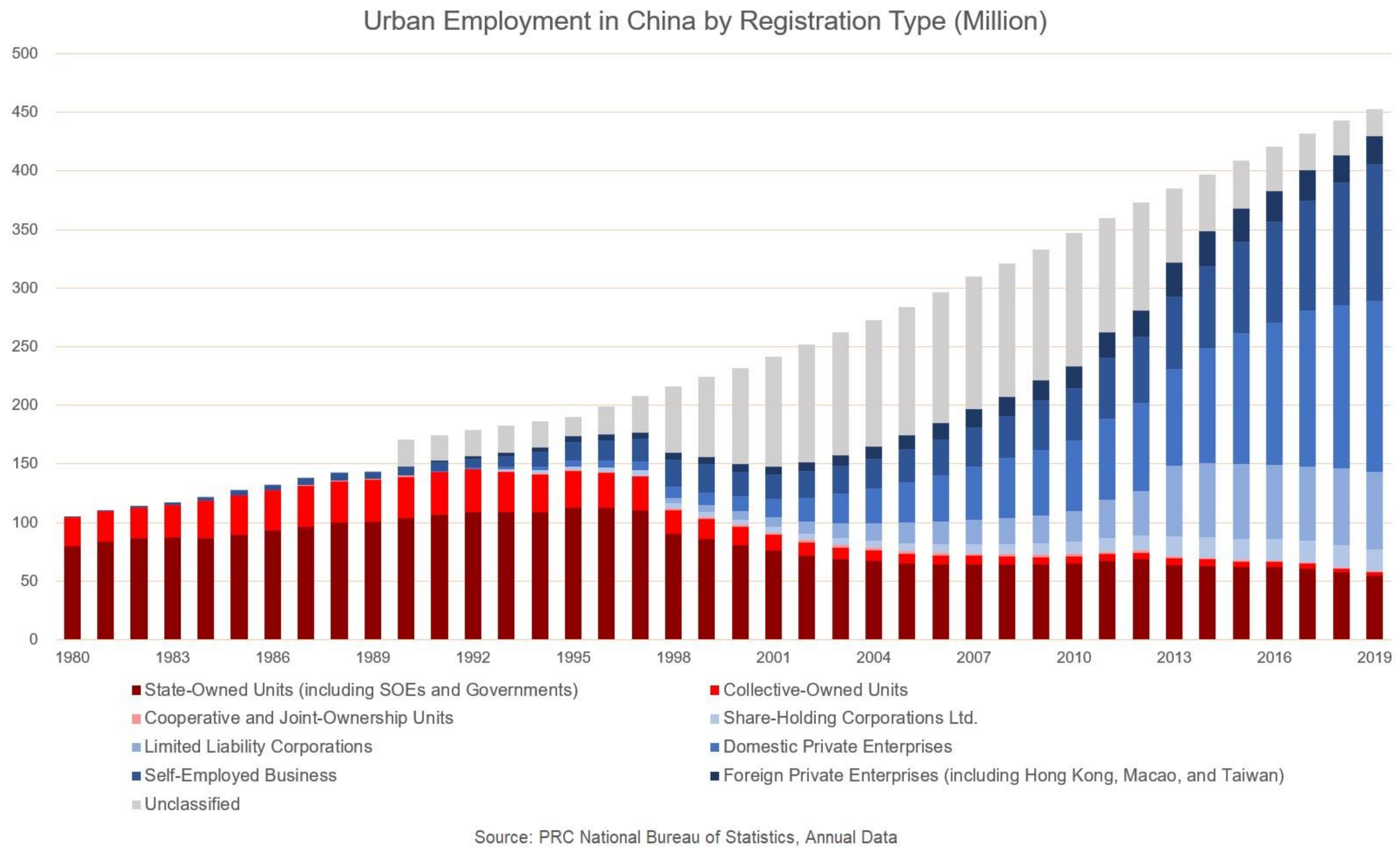
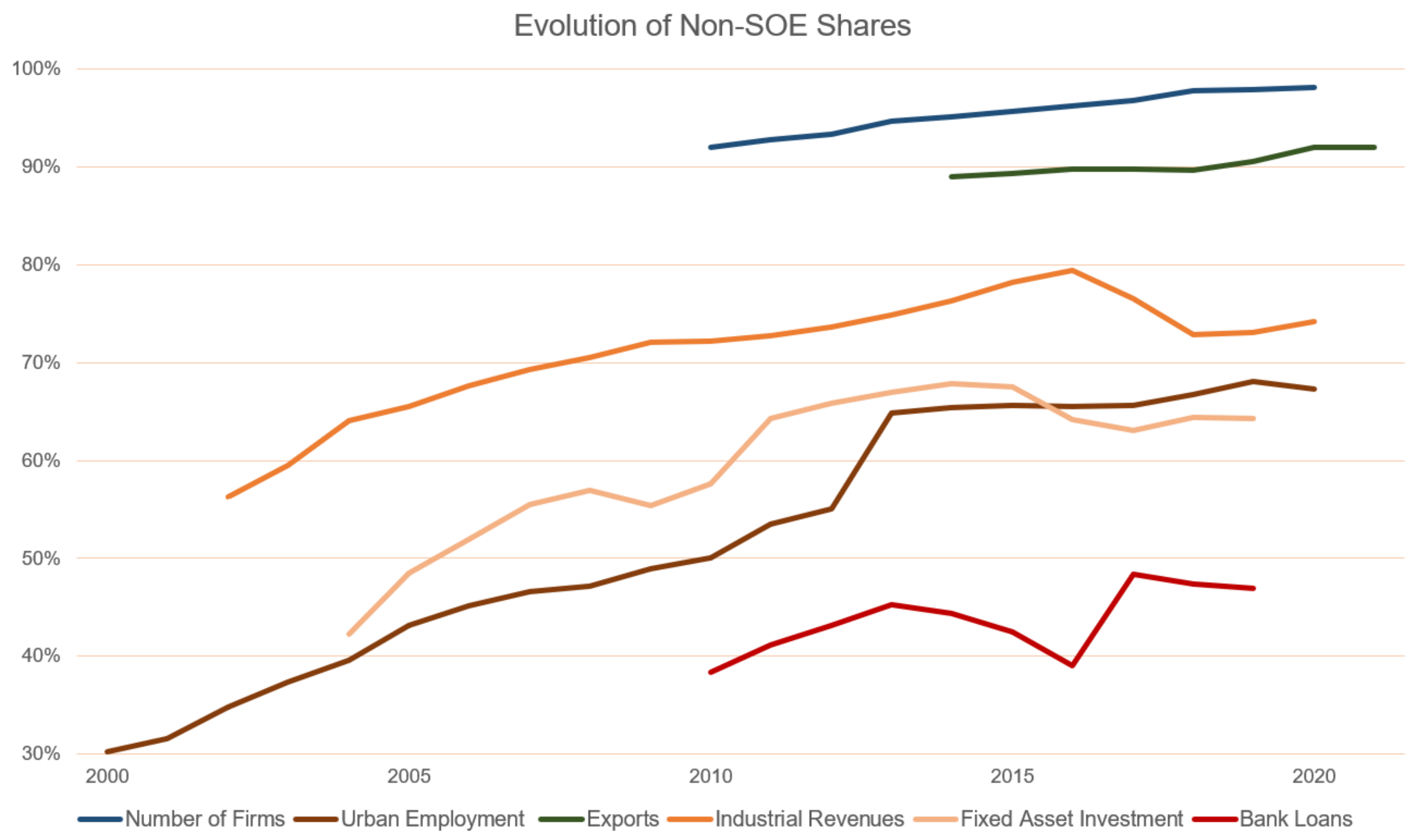
State vs Market

- Long-standing debate in economics
  - First and Second Welfare Theorems...
  - Planner economy as a benchmark for policy…
- Contest between central planning & free markets in 20th century
  - central planner can marshal resources to maximize social welfare
  - …but lacks necessary information, e.g., von Mises (1922), Hayek (1945)
  - debate concluded by collapse of Soviet Union
- However, this debate has taken on a new form, in part motivated by China's hybrid economy

Urban Employment



Shares of Non-State Firms in Secondary Industries

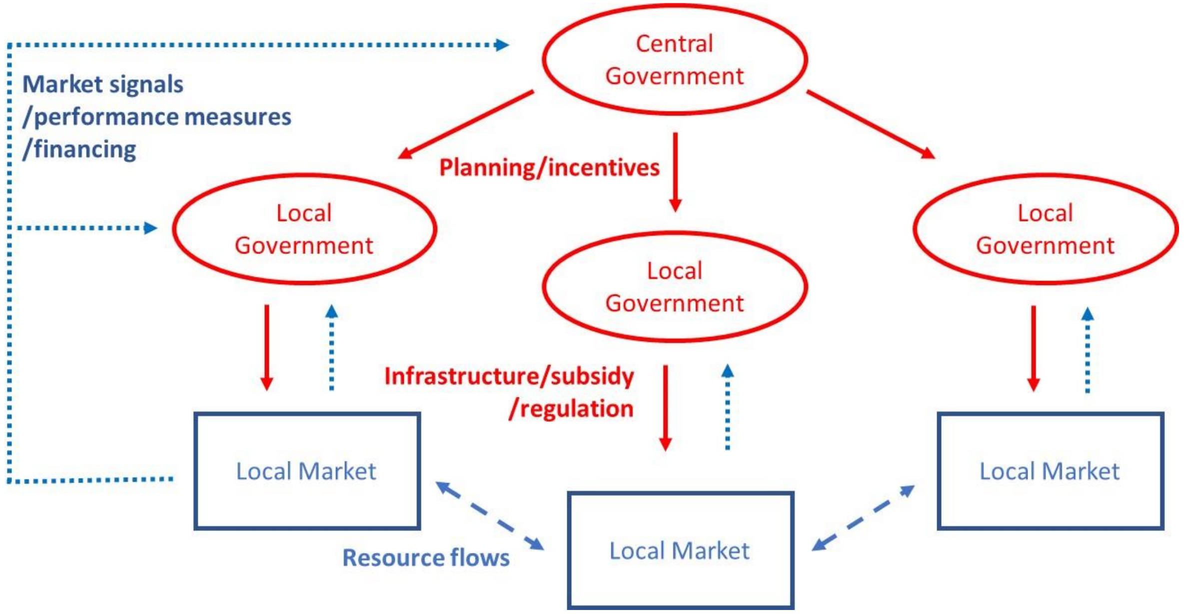


China's Hybrid Economy

- 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 relation between state and market in hybrid economy?
  - Balancing the government’s visible hand and the market’s invisible hand is a recurring theme in China’s economic reforms
  - Xi: “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。”

- Central to understanding investment-driven economy, high debt level, bubbly real estate

- An optimistic view of hybrid economy:
  - Firms and individuals, by profiting from the market, provide information discovery
  - The government, by using information from the market, provides public goods and mitigates externalities

- **Key Questions:** Is this outcome feasible? If so, under what conditions?

Key Insights

- Information discovery by market informs government and firms when policy intervention is within a certain boundary

- Intervention can distract market's incentives to acquire private information
  - Government-centric equilibrium: firms acquire information only about government agenda, not about the fundamental
  - Occurs when local government acts sufficiently aggressively on its agenda

- Agency issues may cause local government to actively choose a government-centric equilibrium
  - Market may exacerbate rather than mitigate issues of command economy when the state is sufficiently dominant

Related Literature

- China's Bureaucracy and Growth
  - Qian and Roland (1998), Lau, Qian and Roland (2000)
  - Maskin, Qian and Xu (2000), Li and Zhou (2005), Song and Xiong (2023)
  - Zhou (2018)

- Dispersed Information with Government Intervention:
  - Bond and Goldstein (2015)
  - Brunnermeier, Sockin, and Xiong (2022)
  - Angeletos and Pavan (2004, 2009), Cong, Grenadier, and Hu (2017)

- Government as Informed Policymaker
  - Hellwig (2005), Angeletos and Pavan (2006), Amador and Weil (2012), Angeletos, Iovino, and La'O (2016), Melosi (2017)

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 agenda
- 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 to maximize *shareholder value* based on I_i:

$$\max_{\mathrm{K}_i} E[\Lambda_i(Y_i - qK_i + \tau_i) \,| I_i]$$

  - I_i is the firm's information set
  - Λ_i is stochastic discount factor of household
  - $\tau_i = qK_i$ is a transfer from government

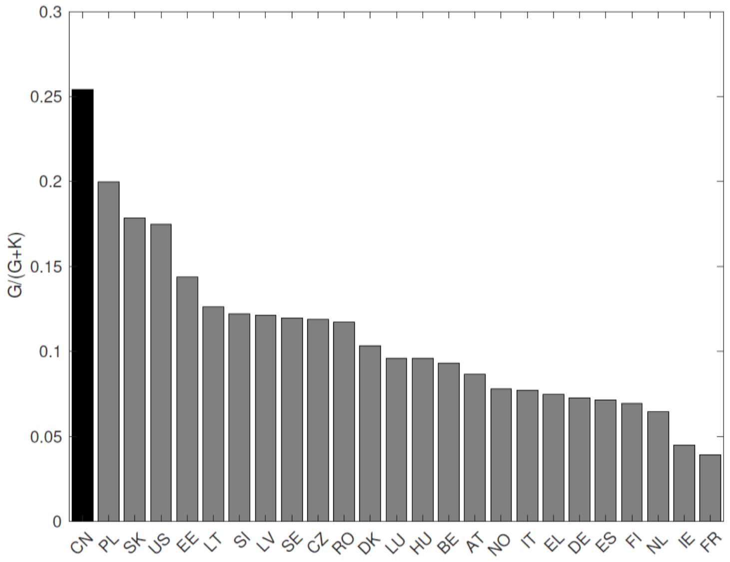
- At date 0, each chooses its information acquisition strategy

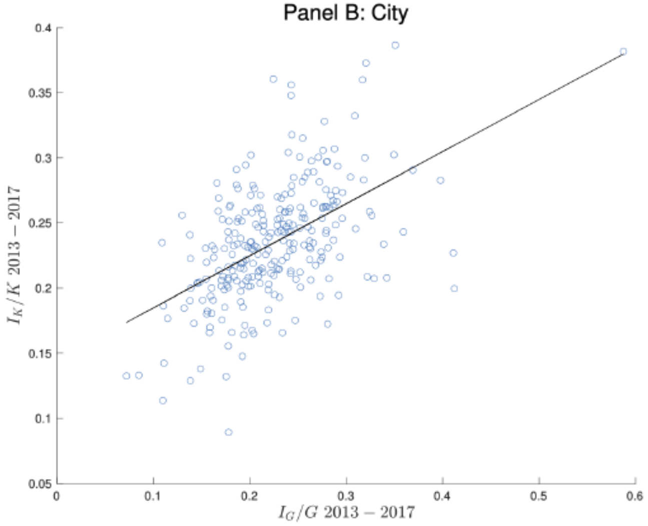
A Simple Framework

$$Y = e^{f} G^{\alpha_G} K^{\alpha_K}$$

- G is infrastructure developed by government
  - Particularly relevant for developing economies, which tend to lack infrastructure
  - Difficult for private firms to provide because of its public good nature
  - Government can recover the cost from households
  - Can broadly interpret as physical and soft infrastructure
- K is capital investment by private firms
- G and K are complementary, e.g., Song and Xiong (2023) “The Mandarin Model of Growth”
  - G crowds in K at city but may crowd out K at national level if government uses sufficient debt to finance G

Figure 1: Share of Infrastructure Capital





Government

- Date 1:
  - Government has an agenda π_g related to both local fundamental and governor ability:

$$\pi_g = f + \theta, \qquad \varepsilon_g \sim N(0, \tau_\theta^{-1})$$

  - Government's information set $I_G = \{\pi_g, \log q\}$
  - A log-linear infrastructure policy:

$$\log G = b_\pi \pi_g + b_q \log q + b_0$$

    - We assume government cannot credibly communicate π_g to the public
- Date 0:
  - Government announces its policy $\{b_\pi, b_q, b_0\}$

Firm Information

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

$$s_i = f + \varepsilon_{si},\ \ \varepsilon_{si} \sim N(0, \tau_s^{-1})$$

  - Signal about government noise:

$$v_i = \pi_g + \varepsilon_{vi}, \qquad \varepsilon_{vi} \sim N(0, \tau_v^{-1})$$

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

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:

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

with

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

  - 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 $\{b_\pi, b_q, b_0\}$ as given
- At date 1:
  - Each firm invests:

$$\log K_i = \frac{1+\alpha_G}{\alpha_G} b_s \hat{f} + \hat{s}_\pi + a_s\left(s_i - \hat{f}\right) + a_v\left(v_i - \hat{\pi}_g\right) + \frac{\alpha_G b_q - 1}{\alpha_G} \log q + a_0$$

  - Market clearing of capital:

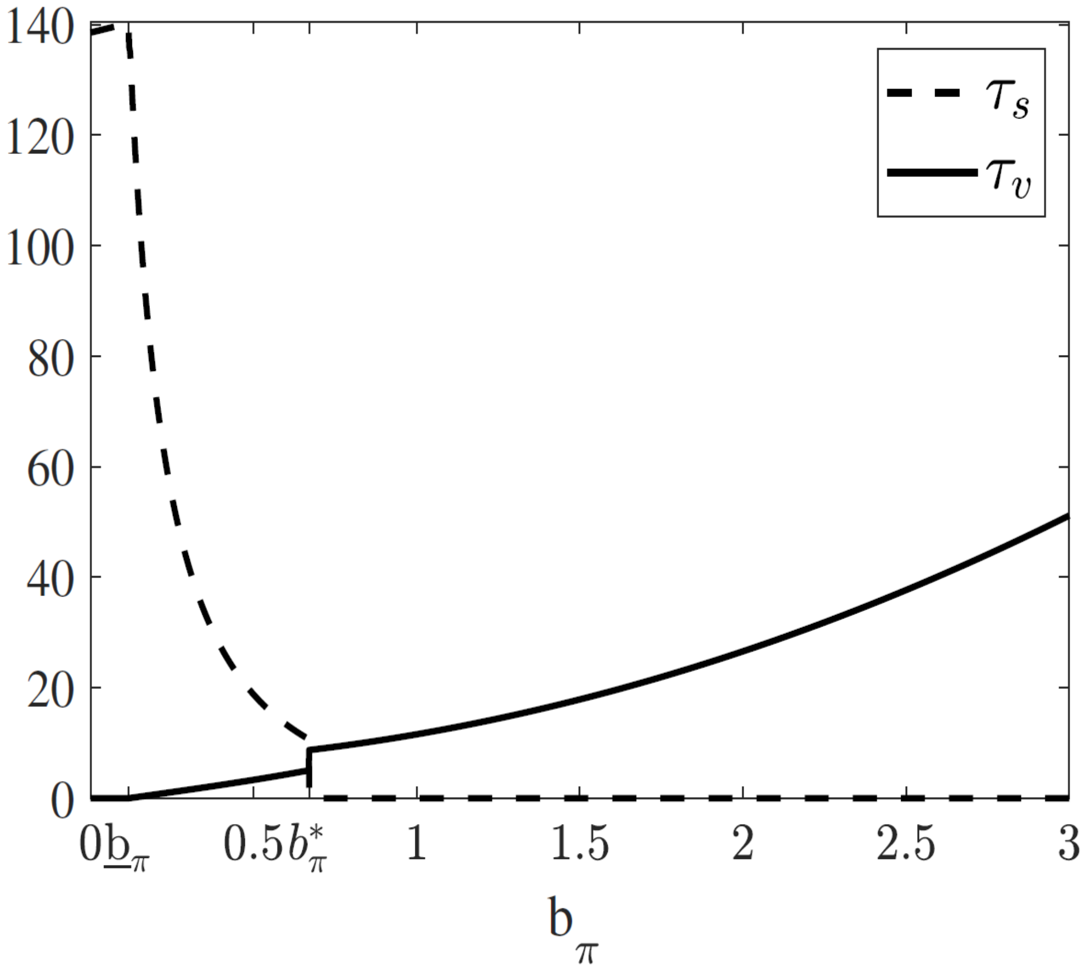
$$\log q = \frac{1}{\psi - A_q}\left(A_s f + A_v \pi_g + A_f \hat{f} + A_g \hat{\pi}_g + A_0 + \psi\varphi - \frac{1}{2}\psi^2 \tau_{\varphi\epsilon}^{-1}\right)$$

- At date 0:
  - Each firm solves

$$\min_{\tau_s, \tau_v} Var\left[f + \alpha_G b_\pi \pi_g | I_i\right]$$

subject to $I(\tau_s, \tau_v) \leq \kappa/2,$ where optimal τ_s is decreasing in $\alpha_G b_\pi$ and $\hat{\tau}_f$, and τ_v is increasing in $\alpha_G b_\pi$ and decreasing in $\hat{\tau}_g$

Market Equilibrium



- Fundamental-centric equilibrium if $\underline{\hat{b}}_\pi \leq b_\pi \leq \underline{b}_\pi$
  - $\underline{b}_\pi$ is decreasing in $\alpha_G, \tau_f, \kappa, \tau_\varphi$, and increasing in τ_g, ψ
- Government-centric equilibrium if $b_\pi > b^*_\pi$ or $b_\pi < -\hat{b}^*_\pi$
  - No fundamental information discovery by the market
  - $b^*_\pi, \hat{b}^*_\pi$ are 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_π to induce a government-centric equilibrium?

- What is the objective of the government?
  - Local governor maximizes the performance measure set by the central government, rather than aggregate welfare of local households
  - Although local governors must internalize household welfare to avoid social unrest, they are motivated by career concerns

A Social Welfare Benchmark

- Suppose local governor aims only to maximize household welfare W

$$W = E\left[\int C_i^{1-\gamma} di\right]^{\frac{1}{1-\gamma}} - E\left[\frac{qK}{1+1/\psi}\right] - R_G E[G]$$

- If risk aversion γ sufficiently high (log-linear approximation), governor chooses b_π small enough to avoid government-centric equilibrium
  - b_π increases consumption volatility, which harms household welfare

The Agency Problem

- Central government wants to promote local governors more effective at advancing a political agenda (i.e., high θ)

- Central government does not observe θ directly but learns about it from observing consumption C and the capital price $\log q$
  - Rewards local governor based on θ (out of governor's control)
  - …but also how precise are public signals (within governor's control)

- The local governor's problem at date 0:

$$V = \max_{b_\pi, b_q, b_0} E[\theta] + \frac{1}{2} \log \frac{\hat{\tau}_\theta}{\tau_\theta}$$

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

The Agency Problem

- If public outcry constraint is sufficiently lax, local governor chooses b_π arbitrarily large to induce government-centric equilibrium
  - Intuition: when market learns only about her agenda π_g, then want market to amplify it to make capital prices and output more informative about θ

- If households sufficiently risk averse, local governor chooses a smaller b_π as $\underline{W}$ increases and constrains policy from shifting economy into a government-centric equilibrium

- Key empirical predictions:
  - Regions that place greater emphasis on welfare should exhibit higher productivity and more efficient capital allocation
  - Regions that place greater emphasis on evaluating local officials should exhibit investment and prices that diverge more from local fundamentals

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
  - career concerns of local officials exacerbate this issue
- Market's information discovery particularly relevant for innovation
  - Difficult for government to predict which technology is most promising
- May also be relevant for other economies when state interventions become more prevalent across the world
  - Key challenge for implementing industrial policies

Thank You!