Information Discovery in a Hybrid Economy*

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Abstract

We analyze how state interventions impact information discovery in China's hybrid economy. In our model, a local government makes public investment decisions based on a combination of its policy agenda and a market signal about economic fundamentals. Private firms, limited in their capacity to process information, must choose between focusing on the fundamental and the government's policy agenda. We find that a moderate governmental response to its agenda leads firms to prioritize information about the fundamental, which enhances market-based information discovery that benefits both government and firm decision-making. In contrast, an intense government response may divert firms' attention exclusively towards deciphering the government's agenda. The crux of this dynamic lies in the dual accountability of the local governor, who must balance the central authority's performance evaluation against the need to uphold household welfare. These dual roles shape the governor's policy choices, ultimately influencing the efficacy of the market's information discovery.

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The state versus the market debate has been a long-standing fixture in economics. In the 20th century, this debate manifested itself as a contest between central planning and free markets. Central planning, as exemplified by the economic model of the former Soviet Union, promised economic efficiency through a central planner that maximized social welfare rather than the interests of specific individuals or groups. However, as argued by von Mises (1922) and Hayek (1945), a key flaw of central planning is the lack of necessary information for the planner to make the most efficient decisions for the entire economy. The contest between central planning and free markets was ultimately settled by the collapse of the Soviet Union. Yet, the discourse between state and market has taken on a new form in recent decades, partially motivated by the expansive experiments undertaken through China's economic reforms.

In response to significant economic difficulties, China refrained from following the "shock therapy" strategy of Russia and other Eastern European nations during the early 1990s, which aimed for an abrupt shift from a centrally planned to a market-based economy. Instead, China chose a more gradual strategy for economic reform, carefully integrating aspects of free markets into its pre-existing planned economy. Although many anticipated that China would eventually transform into a Western-style free-market economy, recent developments have made it clear that the Chinese economy will maintain a hybrid structure for the foreseeable future. As it stands, private firms now account for over 70% of the economy. However, the government still exerts considerable influence over the economy through its ownership of state-owned enterprises (SOEs). Despite significant consolidation, SOEs occupy key sectors of the economy, including banking, energy, transportation, and telecommunication. Moreover, the government maintains influence through a wide range of policy measures, including industrial policy, substantial infrastructure projects, and fiscal stimulus initiatives.

China's hybrid economy raises fundamental questions about how state interventions might interact with market forces. An optimistic view is this hybrid structure might combine the best of central planning and free markets. Market forces would allow private firms and individuals to profit from their private information, providing a valuable channel for information discovery to inform the state planner. Concurrently, the state planner could utilize state firms and other policy measures to intervene in the economy, providing public goods and mitigating market externalities. Is this outcome feasible? If so, under what conditions? This paper develops a model to examine these important fundamental issues.

In our model, we consider a closed, hybrid economy where a local government's investment in infrastructure serves as a public good, enhancing the productivity of private firms. This economy comprises a continuum of private firms, each making capital investment decisions aimed at maximizing value for its owners. Both the government and the firms face an unobservable economic fundamental that affects the productivity of all firms. The government's infrastructure investment choices, in turn, are guided by a policy agenda that remains hidden from the firms. This policy agenda is shaped by both the economic fundamental and the local governor's ability to execute the central authority's policy objectives. Although the government is aware of its policy agenda, it cannot distinctly identify its two determinants – the economic fundamental and the governor's implementation capability. As a result, the government may gain from the private firms' discovery of information about the fundamental.

Each firm allocates its limited information processing capacity to gather information about the fundamental and/or the government's policy agenda. The equilibrium capital price is publicly observable and, by matching firms' aggregate total demand with the supply of capital, aggregates the private information gathered by firms into a noisy public signal. This signal informs the investment decisions of both the government and firms. To analyze how this information discovery role of capital markets interacts with state interventions in this hybrid economy, we derive a tractable log-linear equilibrium.

Since the government's infrastructure investment complements the fundamental in driving firms' profits, the government's policy agenda becomes a relevant factor in firms' investment decisions. This relevance is determined by the elasticity of the government's response to its policy agenda. As a result, the government's response to its policy agenda may divert firms' attention away from acquiring information about the economic fundamental.

When the government's investment response to its policy agenda is moderate, firms focus on acquiring information about the fundamental. By aggregating firms' information, the capital price consequently informs both the government and the firms' investment decisions. This outcome supports the notion that a hybrid economy can effectively integrate the advantages of central planning with those of free markets.

However, when the government's aggressively responds to its policy agenda, firms may choose to focus solely on acquiring information solely about the government's policy agenda, rather than about the fundamental. This shift the economy into a government-centric equilibrium, where market-based information aggregation fails to reflect the economic fundamental, leaving both the government and firms uninformed about these critical factors. Additionally, this scenario may induce excessive output volatility, stemming from the high correlation between the investment decisions of firms and the government. The emergence of a government-centric equilibrium raises concerns about the state becoming excessively influential, thereby undermining the market's essential role in information discovery and negatively impacting the efficacy of policy-making and investment decisions.

A critical question then arises: what factors influence the government's response to its policy agenda? To address this, we consider a pivotal aspect of the hybrid economy – the local government governor's dual accountability. On one hand, the governor is evaluated by the central authority, with this evaluation having significant implications for her career trajectory. On the other hand, she must also safeguard the welfare of local households. Faced with these dual responsibilities, the governor may be inclined towards a strong policy response to demonstrate her effectiveness in implementing central policies, potentially leading to a government-centric equilibrium. However, a more measured response would better serve social welfare, allowing market-based information to guide the investment decisions of both the government and firms, thereby reducing the risks for risk-averse households.

To analyze this tension, we define the governor's optimal policy as one that maximizes her career incentive while being constrained by the necessity to maintain social welfare above a certain threshold – a public outcry constraint. Our findings reveal that the stringency of this constraint, determined by the minimum acceptable welfare level for households, moderates the governor's policy response. This serves to prevent excessively aggressive actions that could unduly prioritize her career advancement over the well-being of local households.

Our analysis sheds light on how frictions within the state system, particularly the career incentives of local governors, can significantly impact the market's role in information discovery. This contribution adds a new dimension to the extensive body of literature that examines dispersed information in economic settings influenced by government interventions, a field explored by scholars such as Angeletos and Pavan (2004, 2007), Bond and Goldstein (2015), Cong, Grenadier, and Hu (2017), and Brunnermeier, Sockin, and Xiong (2017, 2022). While our core premise—that government intervention distorts private agents' information acquisition incentives—resonates with the findings of Bond and Goldstein (2015) and Brunnermeier, Sockin, and Xiong (2022), our proposed mechanism is distinct and links it to agency issues within China's hybrid economy.

In Bond and Goldstein (2015), government bailouts during a financial crisis diminish market participants' motivation to assess its severity, complicating government decision-making for bailouts. Conversely, in our model, an assertive government response to its policy agenda doesn't diminish firms' motivation to analyze economic fundamentals. Instead, it prioritizes the profitability of understanding the government's policy agenda. Brunnermeier, Sockin, and Xiong (2022) discuss how government interventions in asset markets, aimed at countering noise trading, may inadvertently shift focus away from fundamental asset information because of the interplay between current information acquisition and future government actions. Our model, in a simpler static framework, illustrates this crowding-out effect and, crucially, connects it to real effects on firm investment. More importantly, our approach highlights the role of agency frictions within the state system in driving these effects.

Our research is also related to studies that focus on the role of the government as an informed policy-maker, as seen in works by Hellwig (2005), Angeletos and Pavan (2006), Amador and Weil (2012), Angeletos, Iovino, and La'O (2016), and Melosi (2017). These papers investigate how governments provide public signals to economic agents through either direct disclosure or indirect signaling, and explore the consequences of such information provision as a coordination tool among economic agents. For instance, Angeletos and Pavan (2006) demonstrate that the welfare impact of public signaling depends on whether it leads to over- or under-coordination in the absence of informational frictions, while Amador and Weil (2012) argue that public disclosures can crowd out private information, rendering prices less informative.

Our approach, however, diverges from these models. Unlike settings where a government openly announces its policy agenda, our model involves implicit coordination. Firms anticipate the government's level of aggressiveness in implementing its policy agenda. This, in turn, influences their private information acquisition because of the complementarity between public and private investment. Furthermore, our model contrasts with others in which the government's response to its private information is typically more restrained when its signal is noisy. In our model, agency frictions within the government may drive the local governor to adopt a more assertive stance on the policy agenda, thereby fostering a government-centric equilibrium.

Our research also contributes to the expanding body of literature that examines the impact of China's bureaucratic system on its economic growth. This area has been explored by Qian and Roland (1998), Lau, Qian, and Roland (2000), and Maskin, Qian, and Xu (2000), who delve into the mechanism design of China's economic reforms, ranging from the dual-track reform strategy to the tournament-based evaluation of local officials. Li and Zhou (2005) provide empirical evidence of local officials' career incentives driving regional development. Song and Xiong (2023) analyze how local officials' career incentives may lead to short-termist behaviors, such as over-leveraging. Song, Storesletten, and Zilibotti (2011) focus on the transitional dynamics of China's hybrid economy, particularly emphasizing the role of the financial system in disproportionately supporting the less efficient state sector over the private sector. Li, Liu, and Wang (2015) examine the concentration of state ownership in key sectors as a manifestation of state capitalism. Additionally, Chen and Zha (2023) and Chen et al. (2023) assess the impacts of China's financial policies across various sectors.

However, our model distinguishes itself from these studies by highlighting a unique and crucial aspect: how agency frictions within the state system can skew the market's capability for information discovery, subsequently affecting economic activity. This novel perspective adds a significant dimension to the understanding of China's economic development and the complex interplay between its bureaucratic mechanisms and market dynamics.

1 The Model

We analyze a closed, hybrid economy with the government and private firms both taking investment decisions. There are three dates $t \in \{0, 1, 2\}$. A continuum of private firms individually choose information acquisition strategy at data 0, purchase capital from capital providers at date 1, and subsequently produce output at date 2. Concurrently, the government chooses its infrastructure investment policy at date 0 and makes its infrastructure investment at date 1. We interpret this economy as a region in a large country and the governor of the region as the decision maker for the regional government.

We assume that the output of an individual firm at date 2 is determined by the following production function:

$$Y_i = F G^{\alpha_G} K_i^{\alpha_K}, \tag{1}$$

where K_i is the firm's capital, G is the infrastructure invested by the government, and F is the productivity common to all firms in the economy. We assume that $\alpha_G \in (0, 1)$ and $\alpha_K = 1 - \alpha_G$. As the government's infrastructure investment G boosts the firm's output, the government's infrastructure investment and the firm's private investment are complementary.

The economic fundamental F is unobservable to either the government or the firms. Their prior belief of the fundamental is $f \equiv \log F \backsim \mathcal{N}\left(\bar{f}, \tau_f^{-1}\right)$. They have to make investment decisions based on the information available to them.

The decision-making process for infrastructure investment G is a critical responsibility of the regional governor. The governor is tasked with balancing the economic interests of local residents, represented by the economic fundamental f, and the non-economic agenda set by the upper-level government, which determines the governor's career trajectory. In recent decades, with the Chinese central government prioritizing GDP growth, regional governors find themselves in a competitive environment, striving to exceed the economic growth levels justified by the fundamental.

For simplicity, we assume that at date 1, the governor works with the various branches in the regional government to deliver a policy agenda π_g:

$$\pi_g = f + \theta. \tag{2}$$

This agenda integrates the economic fundamental f and an additional component $\theta \backsim \mathcal{N}\left(0, \tau_\theta^{-1}\right)$, which represents the governor's capability to persuade and coordinate her associates to achieve economic outcomes surpassing the fundamental. It is important to note that although the governor issues this agenda, she does not observe its individual components.

Furthermore, at date 0, the governor selects an investment policy for G. This policy, as we discuss in the sequel, adheres to a linear rule relative to the announced agenda π_g and the capital price, which is determined by the capital market at date 2 and contains useful information about the economic fundamental.

At date 0, each firm decides the amount of private information to acquire about the economic fundamental f and/or the government's policy agenda π_g. This decision is crucial in our model. At date 1, the investment made by the firm K_i reflects the acquired information, thereby enabling the capital price q to aggregate the firms' private information. This mechanism allows both firms and the government to extract useful information about the fundamental, creating an important feedback loop between the market and both private and public investment. The efficiency of this feedback mechanism is contingent on the firms' information acquisition strategy that is, in turn, influenced by the government's public investment strategy. The aim of our model is to delve into this intricate, interconnected relationship.

1.1 Firms

There is a continuum of households in the economy, with each household (i) owning a corresponding firm (i). Because of the direct connection between household i and firm i, we often use these terms interchangeably.

At date 2, household i receives firm i's profit as a dividend:

$$\Pi_i = e^f G^{\alpha_G} K_i^{\alpha_K} - qK_i, \tag{3}$$

where qK_i is the cost of buying capital from capital providers. The household has constant relative risk aversion (CRRA) preferences regarding its consumption,

$$u(C_i) = \frac{C_i^{1-\gamma}}{1-\gamma}, \text{ for } \gamma \in [0, 1/\alpha_K),$$

where its consumption is given by

$$C_i = \Pi_i + \tau_i. \tag{4}$$

We assume that households together own capital providers in the economy. As a result, the revenue of capital providers is eventually transferred back to the households. For simplicity, we assume each household receives back the cost of capital paid by the firm it owns. As a result, household i's consumption is

$$C_i = e^f G^{\alpha_G} K_i^{\alpha_K}. \tag{5}$$

The household holds undiversified risk in the firm. As such, at date 1, its valuation of the firm's profit is given by $\mathbb{E}[\Lambda_i \Pi_i | \mathcal{I}_i]$, where $\Lambda_i = \lambda_i \frac{u'(C_i)}{\mathbb{E}[u'(C_i)]}$ is the household's stochastic discount factor for some constant λ_i and $u'(C_i)$ is its marginal utility of consumption. At date 1, the firm chooses its investment K_i to maximize

$$\max_{K_i} \mathbb{E}[\Lambda_i \Pi_i | \mathcal{I}_i] = \max_{K_i} \mathbb{E}\left[\Lambda_i \left(e^f G^{\alpha_G} K_i^{\alpha_K} - qK_i\right) | \mathcal{I}_i\right], \tag{6}$$

where $\mathcal{I}_i$ is the firm's information set.

At date 1, the firm observes a private signal about f:

$$s_i = f + \varepsilon_{si}, \tag{7}$$

where $\varepsilon_{si} \backsim N(0, \tau_s^{-1})$ is independent noise specific to firm i. In addition, it also receives a private signal about the government's policy agenda:

$$v_i = \pi_g + \varepsilon_{vi}, \tag{8}$$

where $\varepsilon_{vi} \backsim N(0, \tau_v^{-1})$ is independent noise specific to firm i.

Firms' total investment

$$K = \int K_i di \tag{9}$$

aggregates the firms' information about f and π_g and determines the capital price q. We assume that the capital price q is publicly observable, while total firm investment is not. Therefore, aggregate investment serves as a noisy channel for aggregating firms' private information in the economy. Consequently, firm i's information set is $\mathcal{I}_i = \{s_i, v_i, q\}$.[1]

[1] By analyzing a survey of executives of publicly listed firms in China, Goldstein, Liu and Yang (2022) show that stock prices have an important feedback effect on firm investment through an informational channel.

It is immediate from the firm's problem in (6) that firm i's optimal investment K_i is

$$K_i = \left(\frac{\alpha_K}{q} \frac{\mathbb{E}\left[\Lambda_i e^f G^{\alpha_G} | \mathcal{I}_i\right]}{\mathbb{E}\left[\Lambda_i | \mathcal{I}_i\right]} \right)^{\frac{1}{1-\alpha_K}} = \left(\frac{\alpha_K}{q} \frac{\mathbb{E}\left[\left(e^f G^{\alpha_G}\right)^{1-\gamma} \mid \mathcal{I}_i\right]}{\mathbb{E}\left[\left(e^f G^{\alpha_G}\right)^{-\gamma} \mid \mathcal{I}_i\right]} \right)^{\frac{1}{1-\alpha_K}}. \tag{10}$$

The firm's optimal choice of capital is similar to the case of a risk-neutral firm, after adjusting for the risk faced by the household that owns it.

At date 0, firm i chooses the precision of its private signals, s_i and v_i. Following the rational inattention literature (e.g., Sims (2003)), we assume that the firm faces an information acquisition constraint in reducing the Shannon Entropy of f and π_g through the noisy signals s_i and v_i. Because firms have access to all public information (i.e., the capital price q) at date 1, the reduction in entropy is from the public information set $\mathcal{I}_P = \{q\}$ to its private information set $\mathcal{I}_i = \sigma\left(\{q, s_i, v_i\}\right)$. We conjecture that the posteriors with respect to public information $\mathcal{I}_P$ and firm i's private information $\mathcal{I}_i$ will be Gaussian:

$$\begin{bmatrix} f \\ \pi_g \end{bmatrix} | \mathcal{I}_P \backsim \mathcal{N}\left(\begin{bmatrix} \hat{f} \\ \hat{\pi}_g \end{bmatrix}, \Sigma_P \right) \tag{11}$$

and

$$\begin{bmatrix} f \\ \pi_g \end{bmatrix} | \mathcal{I}_i \backsim \mathcal{N}\left(\begin{bmatrix} \hat{f}_i \\ \hat{\pi}_{gi} \end{bmatrix}, \Sigma_i \right). \tag{12}$$

Then, the entropy reduction from observing private signals with precisions τ_s and τ_v, $I\left(\tau_s, \tau_v\right)$, is

$$I\left(\tau_s, \tau_v\right) = \frac{1}{2} \log \left|\Sigma_P\right| - \frac{1}{2} \log \left|\Sigma_i\right|. \tag{13}$$

At date 0, the firm chooses the precision of its signals to maximize the household's expected utility from consumption:

$$U_i = \sup_{\tau_s, \tau_v} \mathbb{E}\left[\frac{C_i^{1-\gamma}}{1-\gamma}\right] \tag{14}$$

subject to the entropy constraint

$$I\left(\tau_s, \tau_v\right) \leq \frac{\kappa}{2}, \tag{15}$$

where $\kappa/2$ is the firm's total information-processing capacity.

1.2 Capital Suppliers

There is a continuum of capital suppliers. Each supplier (j) produces capital k_j at a convex effort cost $\frac{1}{1+1/\psi} \varepsilon^{\varphi_j} k_j^{1+1/\psi}$ for $\psi < 1$, where φ_j is supplier j's operating cost that is observable only to itself. We assume

$$\varphi_j = \varphi + \varepsilon_{\varphi j}, \tag{16}$$

where $\varphi \backsim N\left(0, \tau_{\varphi}^{-1}\right)$ is the common operating cost, and $\varepsilon_{\varphi j} \backsim N\left(0, \tau_{\varphi\epsilon}^{-1}\right)$ is the idiosyncratic cost to supplier j that satisfies the Strong Law of Large Numbers across suppliers. Supplier j chooses k_j to maximize its profit at date 1:

$$\sup_{k_j} qk_j - \frac{1}{1+1/\psi} e^{\varphi_j} k_j^{1+1/\psi}, \tag{17}$$

subject to her information set $\mathcal{I}_j = \{q, \varphi_j\}$. Because both φ_j and the capital price q are observable to supplier j, it follows that the optimal choice of k_j is

$$k_j = \left(qe^{-\varphi_j}\right)^{\psi}. \tag{18}$$

Aggregating across capital suppliers, the total capital supplied is

$$K_S = \int k_j dj = q^{\psi} e^{-\psi\varphi + \frac{1}{2}\psi^2 \tau_{\varphi\epsilon}^{-1}}. \tag{19}$$

The capital suppliers are ultimately owned by households. For simplicity, we assume that the government collects the revenue of each capital supplier, i.e., $\tau_j^S = qk_j$, and transfers it to the corresponding household. As a result, capital suppliers incur a disutility from supplying capital to the economy, which the government will internalize when maximizing welfare.

1.3 Government

At date 1, the government chooses its infrastructure investment G alongside firms at date 1 based on its information set, which includes the government agenda π_g in equation (2) and the capital price q. In what follows, we restrict the government's infrastructure choice to a log-linear function of π_g and $\log q$:

$$\log G = b_\pi \pi_g + b_q \log q + b_0. \tag{20}$$

The weight b_π, which is set at date 0 before π_g is realized at date 1, reflects how strongly the governor relies on her own political capability to expand public investment. This is similar to the Ramsey approach in the optimal taxation literature that examines how particular policies impact the economy. For now, we take the government's infrastructure policy $\{b_\pi, b_q, b_0\}$ as given. We will discuss the government's objective and consequently its optimal infrastructure policy in Sections 3 and 4.

1.4 Equilibrium Definition

We analyze a Ramsey Noisy Rational Expectations Equilibrium. A Ramsey Noisy Rational Expectations Equilibrium is a list of policy functions $\{K_i, k_j\}$ and price q such that:

- Firm Optimization: taking as given G and the investment policies of other firms, K_i solves firm i's optimization problem in (6).
- Capital Supplier Optimization: taking as given the capital price q, supplier j's choice of k_j solves its problem in (17).
- Market-clearing: the market for capital clears with

$$K = K_S, \tag{21}$$

and the market for output clears with

$$C_i = Y_i, \tag{22}$$

- Consistency: firms and capital suppliers update their beliefs according to Bayes' Law given their information sets, respectively.

2 Market Equilibrium

In this section, we analyze the market equilibrium among firms and capital suppliers by taking the government's policy as given. In particular, we establish a necessary and sufficient condition for the existence of a government-centric equilibrium, in which all firms focus exclusively on learning about the government's policy agenda. We examine the government's optimal policy based on its objective in Sections 3 and 4.

We begin our characterization by analyzing the optimal investment of an individual firm. As derived in equation (10), firm i's optimal investment decision is determined by its expectation of $\left(e^f G^{\alpha_G}\right)^{1-\gamma}$, which, given the government's infrastructure investment policy in (20), is ultimately driven by the firm's expectation of a log-linear expression of f and π_g. Since the firm's information set $\mathcal{I}_i$ contains the public information set $\mathcal{I}_P$ and the two private signals s_i and v_i, it is direct to derive the firm's optimal investment in the following log-linear function:

$$\log K_i = a_f \hat{f} + a_\pi \hat{\pi}_g + a_s s_i + a_v v_i + a_q \log q + a_0, \tag{23}$$

where $\hat{f} = E\left[f|\mathcal{I}_P\right]$ and $\hat{\pi}_g = E\left[\pi_g|\mathcal{I}_P\right]$ are the expectations of f and π_g conditional on the public information. The first two terms $a_f \hat{f} + a_\pi \hat{\pi}_g$ represent the contribution from the public information, the next two terms $a_s s_i + a_v v_i$ represent the contribution from the firm's private information, and the fifth term $a_q \log q$ includes the effect of the capital price in not only driving the firm's capital cost but also affecting the government's expectation and infrastructure investment.

Aggregating across firms yields total firm investment $K = \int K_i di$. It is straightforward to see that total firm investment K also takes a log-linear form:

$$\log K = A_s f + A_v \pi_g + A_q \log q + A_f \hat{f} + A_\pi \hat{\pi}_g + A_0. \tag{24}$$

Aggregating across symmetric firms and imposing the Strong Law of Large Numbers lead to

$$A_s = a_s, A_v = a_v, A_q = a_q, A_f = a_f, A_\pi = a_\pi, A_0 = a_0 + \frac{1}{2}\left(a_s^2 \tau_s^{-1} + a_v^2 \tau_v^{-1}\right).$$

Even though, the coefficients of the total firm investment A_s, A_v, A_q, $A_{f,}$ and A_π are the same as the corresponding coefficients of individual firm investment, it is important to bear in mind that these are equilibrium relationships. We still need to differentiate the coefficients of the aggregate investment from those of individual firm investment, particularly when determining a firm's optimal information acquisition policy, which takes total investment as given.

Imposing market-clearing with equation (19) , the price of capital satisfies

$$\log q = \frac{1}{\psi - A_q}\left(A_s f + A_v \pi_g + A_f \hat{f} + A_\pi \hat{\pi}_g + A_0 + \psi \varphi + \frac{1}{2}\left(A_s^2 \tau_s^{-1} + A_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right)\right). \tag{25}$$

We can then summarize the information content of $\log q$ by the following linear statistic:

$$\begin{aligned} z_q &= \frac{1}{A_s}\left((\psi - A_q)\log q - A_f \hat{f} - A_\pi \hat{\pi}_g - A_0 - \frac{1}{2}\left(A_s^2 \tau_s^{-1} + A_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right)\right) \\ &= f + \frac{A_v}{A_s}\pi_g + \frac{\psi}{A_s}\varphi. \end{aligned} \tag{26}$$

After observing this linear public signal, all firms and the government can update their priors about f and π_g based on the public information z_q. By Bayes' Rule, this posterior is normally distributed as conjectured:

$$\begin{bmatrix} f \\ \pi_g \end{bmatrix} | \mathcal{I}_P \backsim \mathcal{N}\left(\begin{bmatrix} \hat{f} \\ \hat{\pi}_g \end{bmatrix}, \begin{bmatrix} \hat{\tau}_f^{-1} & \hat{\tau}_{f\pi}^{-1} \\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1} \end{bmatrix}\right), \tag{27}$$

where the conditional means are given in equation (A.2) and precisions are given in equation (A.3). Firm i then updates its beliefs again using its private signals, s_i and v_i, to arrive at its private beliefs about f and π_g.

We then have the following proposition that characterizes the optimal investment and information acquisition choices of firms.

Proposition 1. *At date* 1*, firm i's optimal investment choice is*

$$\begin{aligned} \log K_i &= \frac{1}{1-\alpha_K}\hat{f} + \frac{\alpha_G b_\pi}{1-\alpha_K}\hat{\pi}_g + a_s\left(s_i - \hat{f}\right) + a_v\left(v_i - \hat{\pi}_g\right) + \frac{\alpha_G b_q - 1}{1-\alpha_K}\log q \\ &\quad + \frac{\log \alpha_K + \alpha_G b_0}{1-\alpha_K} + \frac{1-2\gamma}{2}\left(a_s \tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right), \end{aligned} \tag{28}$$

where a_s and a_v are given by equations (A.10) *and* (A.11)*, and* $\log q$ *is given by equation* (25).

At date 0*, each firm's information acquisition choices of τ_s and τ_v are determined by*

$$\begin{aligned} \{\tau_s, \tau_v\} &= \arg min_{\tau_v,\tau_s} \, Var\left[f + \alpha_G b_\pi \pi_g \middle| \, \mathcal{I}_i\right], \\ \textit{such that} \quad & \log\left|\frac{\hat{\tau}_f + \tau_s}{\hat{\tau}_f}\frac{\hat{\tau}_\pi + \tau_v}{\hat{\tau}_\pi} - \frac{\tau_s}{\hat{\tau}_{f\pi}}\frac{\tau_v}{\hat{\tau}_{f\pi}}\right| \leq \kappa, \end{aligned} \tag{29}$$

taking as given $\hat{\tau}_f^{-1}$, $\hat{\tau}_\pi^{-1}$, and $\hat{\tau}_{f\pi}^{-1}$. The optimal choices are

$$\tau_s = \min\left\{ \begin{array}{c} \max\left\{\sqrt{\left(\tau_f + \left(\frac{a_s}{\psi}\right)^2\tau_\varphi\right)^2 - \tau_f^2 + \frac{\tau_f\hat{\tau}_\pi - (1-e^\kappa)\left(\frac{a_v}{\psi}\right)^2\tau_\varphi\tau_f}{(\alpha_G b_\pi)^2}} - \left(\tau_f + \left(\frac{a_s}{\psi}\right)^2\tau_\varphi\right), 0\right\}, \\ (e^\kappa - 1)\,\hat{\tau}_f \end{array}\right\}, \tag{30}$$

$$\tau_v = \min\left\{\max\left\{(\alpha_G b_\pi)^2\tau_s + \frac{(\alpha_G b_\pi)^2\,\hat{\tau}_f - \hat{\tau}_\pi}{1 - \frac{\hat{\tau}_f}{\hat{\tau}_{f\pi}}\frac{\hat{\tau}_\pi}{\hat{\tau}_{f\pi}}}, 0\right\}, (e^\kappa - 1)\,\hat{\tau}_\pi\right\}. \tag{31}$$

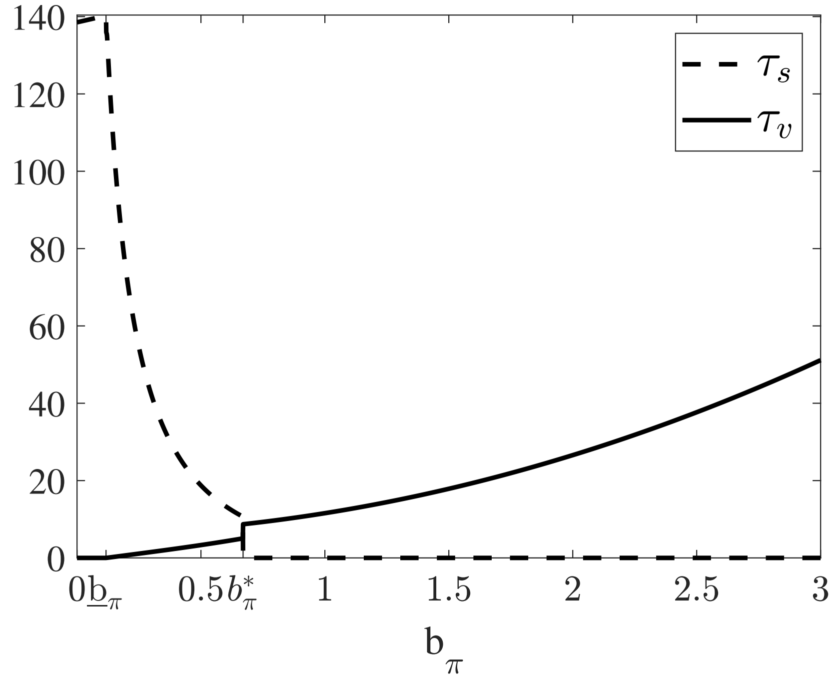
The firm's choice of τ_s is (weakly) decreasing in $\hat{\tau}_f$ and $\alpha_G b_\pi$, while τ_v is (weakly) decreasing in $\hat{\tau}_\pi$ and increasing in $\alpha_G b_\pi$.

Proposition 1 confirms that firms follow a log-linear policy. Firms differ in their investments because of dispersion in their two private signals, s_i and v_i, with $a_s s_i + a_v v_i$ as a sufficient statistic for the idiosyncratic component of firm capital investment. A firm's information acquisition decision minimizes the conditional variance of its household's utility subject to the rational inattention constraint. This is equivalent to minimizing the conditional variance of the sum of the economic fundamental f and the impact of the government's policy agenda, $\alpha_G b_\pi \pi_g$.

We can now state the main result of this section. We establish a necessary and sufficient condition for a government-centric equilibrium to exist, in which all firms acquire private information only about the government's policy agenda. We have the following proposition.

Proposition 2. *There exists a government-centric equilibrium in which firms acquire private signals only about the government's policy agenda, π_g, if and only if $b_\pi \in (-\infty, -\tilde{b}_\pi^*] \cup [b_\pi^*, \infty)$, where $\tilde{b}_\pi^*$ and b_π^* exist if $\tau_f \geq \tau_\varphi e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2$, are decreasing in α_G, τ_f, and ψ, increasing in τ_θ, κ, and τ_φ, and solve (A.38) with equality. In contrast, there exists a fundamental-centric equilibrium in which firms acquire private signals only about the fundamental, f, if and only if $b_\pi \in [-\underline{\tilde{b}}_\pi, \underline{b}_\pi]$, where $\underline{\tilde{b}}_\pi, \underline{b}_\pi > 0$ are decreasing in α_G, τ_f, κ, and τ_φ, increasing in τ_θ and ψ, and solve (A.43) with equality. For a given b_π, there exists at most one extreme (i.e., fundamental- or government-centric) equilibrium.*

Figure 1: Firm information acquisition policies τ_s and τ_v for different values of b_π for $\tau_f = 20$, $\tau_\theta = 1$, $\tau_\phi = 1$, $\kappa = 2$, $\alpha_K = 0.33$, $\psi = 1$.



Proposition 2 outlines the potential equilibria based on the government's response elasticity to the governor's political agenda, b_π. If $|b_\pi|$ is adequately low (i.e., lower than $\tilde{\underline{b}}_\pi$ and $\underline{b}_\pi$), a fundamental-centric equilibrium exists. If $|b_\pi|$ is sufficiently high (i.e., greater than $\tilde{\underline{b}}_\pi$ or $\underline{b}_\pi$), a government-centric equilibrium arises. There may also be a mixed equilibrium where firms acquire signals about both the fundamental and the government political agenda.[2]

For a government-centric equilibrium to exist, ex-ante uncertainty about the government's policy agenda (as measured by τ_θ^{-1}) must be sufficiently high relative to that about the fundamental (as measured by τ_f^{-1}). This is because a high $|b_\pi|$ implies the government's policy agenda, π_g, has a large impact on the economy, but the government's policy agenda also contains information about the fundamental f. It must be the case that the government acts on the policy agenda aggressively even though it is extremely uninformative about f.

We note two additional points about the effects of b_π. First, it is monotonic. The more the government invests in infrastructure based on its policy agenda (i.e., larger b_π), the more likely it is to distract the firms. This is because the policy agenda becomes a more significant part of

[2] For generality of our model, we allow b_π to take negative values. As we will introduce in Section 4, an important benchmark of the government's policy objective is to maximize social welfare. Under such an objective, it is possible for the government to choose a negative b_π when households are sufficiently risk averse. This is because a negative b_π can serve as a hedge against the investment risks faced by firms.

firms' output. Second, the thresholds of the government-centric equilibrium region, $\tilde{b}^*_\pi$ and b^*_π , are decreasing in τ_f, the prior's precision about the fundamental f. As such, the less uncertainty there is about f, the more likely there is a government-centric equilibrium.

Figure 1 depicts firms' information acquisition strategies for various levels of b_π.[3] If b_π is less than $\underline{b}_\pi$, firms allocate all their attention to acquiring information about the fundamental, consistent with a fundamental-centric equilibrium. As b_π rises above $\underline{b}_\pi$, a mixed equilibrium arises. Firms start to shift more attention toward acquiring private information about the government's policy agenda, π_g, and less about the economic fundamental, f. When b_π exceeds b^*_π, the equilibrium transitions to a government-centric one, where firms learn solely about the government's policy agenda. There is no upper bound to the scale of the government's intervention for a government-centric equilibrium to exist because the government acts on its policy agenda π_g and not the fundamental directly. Consequently, given π_g, firms do not need to know about f.

Until now, we have taken the government's investment policy as given to highlight the impact of government policy on firms' information acquisition decisions. When firms direct all their limited attention to acquiring information about the government's policy agenda, the capital price does not provide any useful information to the government to guide its investment policy. As a result, the market does not facilitate any information discovery for the government. Given this inefficiency, it is reasonable to argue the government should regulate its choice of b_π to prevent the onset of a government-centric equilibrium. In the next section, we will explore how the government determines its investment policy.

3 The Governor's Career Incentives

It is important to note that the government in practice is not a social planner, but rather a large organization that operates under a full range of agency issues. In the context of China, the government is a large hierarchical system wherein local governments manage local economic development. These local officials are not elected by local citizens, but are appointed by the central authority and subject to regular performance evaluations.[4] These performance evaluations ultimately determine the promotion and demotion of local officials, giving rise to career concerns that are distinct from those faced by politicians who are elected by their constituents. There are extensive studies of this agency problem between central and local governments and the career

[3]For illustration, when multiple equilibria exist, we select the extreme equilibrium.

[4]This is a notable departure from the literature on political business cycles (e.g., Besley and Case (2003)), where changes in political parties because of elections lead to shortsightedness and volatility in government policies.

incentives of local officials, e.g., Maskin, Qian and Xu (2000), Li and Zhou (2005), Xu (2011), Yu, Zhou and Zhu (2016), and Song and Xiong (2023). As a result of agency issues, the local government may have a different objective than maximizing social welfare.

Suppose the central authority oversees multiple regions and benefits from the infrastructure investments of their local governments, G, because they help to accomplish the central authority's non-economic goals, such as boosting employment and maintaining social stability. Because provinces are ex ante identical with independent fundamentals, what distinguishes the governor of one region from another is her personal capacity θ that enables her to implement various government agenda. Thus, the central authority prefers to promote a governor with a high value of θ, but faces an inference problem because not only is it difficult to observe the local government's policy agenda π_g, it is also difficult to separate the governor's capability θ from the local economic fundamental f in π_g. We assume that the governor's capability θ is unknown to herself and the central authority at date 0, and both have the same prior belief about θ as households and firms: $\theta \sim \mathcal{N}\left(0, \tau_\theta^{-1}\right)$.

Although the central authority does not observe the governor's capability θ or infrastructure investment decision G, it observes the local economy's log total consumption $\log C$ (which is equal to log output) and log capital price $\log q$. Based on its observation of $\log C$ and $\log q$, it can construct two de-trended linear sufficient statistics:[5]

$$\begin{aligned} z_C &= \frac{1}{\alpha_G b_\pi}\left(\log C_s - \mathbb{E}\left[\log C\right] - \frac{\alpha_G b_q - \alpha_K}{1-\alpha_K}\log q - \frac{\alpha_K}{1-\alpha_K}\sigma_z z_Q\right) \\ &= \theta + \left(1 + \frac{1}{\alpha_G b_\pi}\right)\left(f - \bar{f}\right) - \frac{\alpha_K \psi}{\alpha_G b_\pi}\varphi, \end{aligned} \tag{32}$$

$$\begin{aligned} z_Q &= \frac{1 - a_G b_q + \psi\left(1-\alpha_K\right)}{\sigma_z}\left(\log q - \mathbb{E}\left[\log q\right]\right) \\ &= a_v\theta + \left(a_s + a_v\right)\left(f - \bar{f}\right) + \psi\varphi. \end{aligned} \tag{33}$$

Note that z_Q is equivalent to $z_q$used before but with π_g expressed as a linear combination of f and θ. These two statistics z_C and z_Q capture all relevant information contained in $\log C$ and $\log q$.

The following proposition characterizes the central authority's posterior beliefs about θ, which takes into account the governor's infrastructure policy.

Proposition 3. *The central government's posterior of θ after observing $\log C$ and $\log q$ is Gaussian:*

[5] Because both signals would be flat with respect to π_g when $b_\pi = 0$, the governor will never choose $b_\pi = 0$ in equilibrium.

$\theta | z_C, z_Q \sim \mathcal{N}\left(\hat{\theta}, \hat{\tau}_\theta^{-1}\right)$, *where*

$$\hat{\theta} = \tau_\theta^{-1} \begin{pmatrix} a_v \\ 1 \end{pmatrix}' \Sigma^{-1} \begin{pmatrix} z_Q \\ z_C \end{pmatrix}, \tag{34}$$

$$\hat{\tau}_\theta = \tau_\theta + \frac{\left(\alpha_G b_\pi a_s - a_v\right)^2 \frac{\tau_\varphi}{\psi^2} + \left(\alpha_G b_\pi + \alpha_K a_v\right)^2 \tau_f}{\left(1 + \alpha_G b_\pi + \alpha_K \left(a_s + a_v\right)\right)^2}. \tag{35}$$

The central authority's posterior beliefs about the governor's political capability θ is Gaussian and fully summarized by the first (i.e., $\hat{\theta}$) and second (i.e., $\hat{\tau}_\theta$) moments. The central authority ranks the governor according to her $\hat{\theta}$. Because there is uncertainty in this estimate, it is also desirable to reward the governor for lowering this uncertainty, which we measure as the reduction in the entropy of the central authority's belief after observing the public signals z_Q and z_C: $\frac{1}{2}\log\left(\frac{\hat{\tau}_\theta}{\tau_\theta}\right)$. The central authority fully internalizes that the governor can influence the information acquisition decisions of households and firms.

For simplicity, we assume that the central authority assigns a reward function $R\left(\hat{\theta}, \hat{\tau}_\theta\right)$ to the governor of the following form:

$$R\left(\hat{\theta}, \hat{\tau}_\theta\right) = \hat{\theta} + \frac{1}{2}\log\left(\frac{\hat{\tau}_\theta}{\tau_\theta}\right).$$

We can thus summarize the governor's problem at time 0 in choosing her investment policy $\left\{b_0, b_\pi, b_q\right\}$ as

$$V = \sup_{\left\{b_0, b_\pi, b_q\right\}} \mathbb{E}\left[R\left(\hat{\theta}, \hat{\tau}_\theta\right)\right] = \sup_{\left\{b_\pi\right\}} \frac{1}{2}\log\left(\frac{\hat{\tau}_\theta}{\tau_\theta}\right). \tag{36}$$

As the central authority fully internalizes the governor's policy choice, it is futile for the governor to use the policy choice to influence the ex ante expected evaluation outcome $\hat{\theta}$. Nevertheless, the governor can directly affect the uncertainty about the governor's capability $\hat{\tau}_\theta$ through her choice of b_π. It is immediate that the optimal choice of b_π maximizes the conditional precision of the central government's belief:

$$b_\pi = \arg\sup_{b'_\pi} \hat{\tau}_\theta.$$

Given the goal to maximize $\hat{\tau}_\theta$, it is intuitive that the governor would prefer choosing a larger b_π even within a fundamental-centric equilibrium. This is because even taking the firms' information choices as given, a higher b_π makes both of z_Q and z_C load more on the government agenda π_g, thus serving as more informative signals for the governor's capability. However, the governor's choice of b_π within a fundamental-centric equilibrium is bounded by $\underline{b}_\pi$. If the governor chooses b_π above $\underline{b}_\pi$, the market equilibrium would switch to either a mixed equilibrium or a government-centric one.

According to Proposition 2, under the condition $\tau_f \geq \tau_\varphi e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2$, a government-centric equilibrium is possible. In a government-centric equilibrium, firms all focus on acquiring information about the government agenda π_g, making z_Q and z_C even more informative about π_g and consequently θ. Taken together, it should be clear that to maximize $\hat{\tau}_\theta$, the governor's incentive is to choose the largest b_π and induce a government-centric equilibrium. Proposition 4 formally proves this statement.

Proposition 4. *Under the condition* $\tau_f \geq \tau_\varphi e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2$*, the governor optimally chooses* b_π *as large as possible, which, in turn, induces a government-centric equilibrium, to maximize the precision of the central government's posterior beliefs,* $\hat{\tau}_\theta$*.*

The governor's career concern problem in our context introduces a new aspect about the local government's investment policy, specifically in relation to the governor's career incentives. The governor is motivated to leverage her infrastructure investment policy as a tool to manage the variance (or the second moment) in the central authority's assessment of her political capability. This unique incentive structure tends to foster more assertive government intervention, potentially skewing the information acquisitions of market participants. This approach presents a departure from the career incentive effects traditionally highlighted in the existing literature, which often center on first-moment (mean) effects. For instance, Maskin, Qian and Xu (2000) examine how performance evaluation under different organizational forms may affect managers' effort choices. Li and Zhou (2005) provide empirical evidence for the incentive effects of economic tournaments on local officials to enhance local GDP in China. Fang, Li, and Wu (2022) explore the negative implications of such tournaments on local protectionism. Song and Xiong (2023) discuss the short-termist behaviors driven by career incentives among local officials in China.

In our analysis so far, the governor is not concerned about the welfare of households. In the next section, we further expand the model to allow the governor's policy choice to account for both household welfare and the governor's own career incentives.

4 Social Welfare

As a benchmark, we first characterize the government's optimal policy if it maximizes social welfare. We define the social welfare of households (who ultimately own firms) and capital suppliers as

$$W=\mathbb{E}\left[\int_0^1 C_i^{1-\gamma}di\right]^{\frac{1}{1-\gamma}}-\mathbb{E}\left[\frac{qK}{1+1/\psi}\right]-R_G\mathbb{E}\left[G\right], \tag{37}$$

which is the certainty-equivalent consumption of households' aggregate utility from consumption less the effort costs of capital suppliers in producing capital and the social cost of government infrastructure, which we assume is $R_G\mathbb{E}\left[G\right]$.[6] Given all three terms are log-linear in the market equilibrium, we can substitute terms in equation (37) with equation (B.9) to express the government's optimal program as

$$\bar{W}=\sup_{\left\{b_0,b_\pi,b_q\right\}}\left(e^{-\frac{\gamma}{2}Var[\log C_i]}-\frac{\psi\alpha_K}{1+\psi}e^{-\gamma Var\left[f+\alpha_G b_\pi\pi_g|\,\mathcal{I}_i\right]}\right)\mathbb{E}\left[C_i\right]-R_G\mathbb{E}\left[G\right], \tag{38}$$

where C_i is the consumption of a representative household. Appendix B provides the expressions for C_i and other variables in the market equilibrium.

Proposition 5 characterizes this optimal program. In particular, we establish using a log-linear approximation that if the government maximizes social welfare, then its optimal policy will not induce a government-centric equilibrium if the households are sufficiently risk averse. In solving this investment policy choice at $t=0$, the government recognizes its information set at time 1 is $\mathcal{I}_G=\sigma\left(\left\{\pi_g,q\right\}\right)$, as is reflected in equation (20).

Proposition 5. *The government's optimal infrastructure choice to maximize social welfare is as follows:*

1. Its optimal choice of b_0 satisfies

$$e^{\mathbb{E}[\log C_i]+\frac{1}{2}Var[\log C_i]}\left(e^{-\frac{\gamma}{2}Var[\log C_i]}-\frac{\psi\alpha_K}{1+\psi}e^{-\gamma Var\left[f+\alpha_G b_\pi\pi_g|\,\mathcal{I}_i\right]}\right)=\frac{1+\psi\left(1-\alpha_K\right)}{\left(1+\psi\right)\alpha_G}R_G e^{\mathbb{E}[\log G]+\frac{1}{2}Var[\log G]}, \tag{39}$$

and is given explicitly by equation (A.59);

2. Its optimal choices of b_π and b_q satisfy the first-order necessary conditions:

$$\left(\frac{\psi\alpha_K}{1+\psi}+2\gamma\left(A-1\right)\right)\partial_{b_\pi}Var\left[f+\alpha_G b_\pi\pi_g|\,\mathcal{I}_i\right]+\left(\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi}-\gamma A\right)\partial_{b_\pi}Var\left[\log C_i\right]=$$
$$+\alpha_G\partial_{b_\pi}Var\left[\log G\right]+\frac{\alpha_K}{1+\psi}\partial_{b_\pi}\left(a_v^2\tau_v^{-1}\right), \tag{40}$$

and

$$\left(\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi}-\gamma A\right)\partial_{b_q}Var\left[\log C_i\right]=\alpha_G\partial_{b_q}Var\left[\log G\right]. \tag{41}$$

respectively, where $A=\frac{\alpha_G\mathbb{E}[C]}{R_G\mathbb{E}[G]}e^{-\frac{\gamma}{2}Var[\log C_i]}\geq\frac{1+\psi(1-\alpha_K)}{1+\psi}$;

[6]From equations (18), (19), and (21), we recognize $\int e^{\varphi_j}k_j^{1+1/\psi}dj=qK$.

3. In a log-linear approximation of social welfare around $\gamma = 0$ (where $A \equiv 1$), $\partial_\gamma b_\pi \propto -Var[\log C]$ and there exists a γ^* such that if $\gamma \geq \gamma^*$, the government's optimal policy will not induce a government-centric equilibrium.

The government chooses its constant level of log government infrastructure b_0 to ensure the net welfare from consumption and capital supplier effort is proportional to the cost of government expenditures. In contrast, it chooses its optimal levels of b_π and b_q to balance the costs and benefits of (conditional) log consumption and government expenditure volatility. Because log consumption volatility is increasing in $|b_\pi|$ in a government-centric equilibrium, the government will choose a smaller scale when households are more risk-averse (i.e., higher γ). For sufficiently high γ, the government will choose a sufficiently small scale to avoid a government-centric equilibrium, and instead will choose either a fundamental-centric or mixed equilibrium.[7]

In practice, the governor needs to balance the central authority's performance evaluation with the welfare of local households. If the local governor's objective is to maximize her performance evaluation as outlined in equation (36), she must also ensure that the welfare of local households, denoted by W from equation (37), does not drop below a certain reservation level, $\underline{W}$. This precaution is necessary to prevent a public outcry that could lead the central authority to remove her from her position.

This consideration leads to the following modified optimization problem for the governor:

$$\mathcal{V} = \sup_{\{b_0, b_\pi, b_q\}} \frac{1}{2} \log\left(\frac{\hat{\tau}_\theta}{\tau_\theta}\right), \tag{42}$$

$$s.t.: \log W \geq \log \underline{W}. \tag{43}$$

The governor's choice of b_π now must take into account how increasing the elasticity of government policy to the government policy agenda b_π also impacts social welfare. Because the choices of b_0 and b_q do not affect the governor's evaluation, it is immediate that she sets them to maximize social welfare according to Proposition 5. Consequently, her career incentive distorts only her choice of b_π.

In what follows, suppose that households are sufficiently risk-averse (i.e., γ sufficiently large) that under the welfare-maximizing policy, the government does not induce a government-centric equilibrium based on Proposition 5. We then have the following proposition.

[7] Although we resort to linear approximation for proving this property, numerical analyses suggest this approximation is quite reasonable. The variable A is typically close to unity in the fully nonlinear model if τ_f and τ_φ are modestly large.

Proposition 6. *The governor's optimal choice of b_π is declining in $\underline{W}$, and achieves its value that maximizes social welfare if $\underline{W}$ is set at $\bar{W}$.*

Proposition 6 shows that the public outcry constraint serves as a mechanism to regulate the governor against adopting aggressive policies (such as a high b_π) that prioritize her own career advancement over the welfare of the local economy. The higher the minimum acceptable level of local household welfare $\underline{W}$, the more effective is the public outcry constraint. As $\underline{W}$ approaches the maximum possible level of social welfare $\bar{W}$, the governor is increasingly compelled to choose a b_π value that aligns with the maximization of social welfare.

A key prediction of our model is consequently that there should be variation in economic efficiency across different regions based on the relative prioritization of household welfare versus the career advancement of governors. Regions that place greater emphasis on household welfare, rather than solely focusing on the career progression of their governors, are more likely to foster an environment where the market can effectively fulfill its role in information discovery. As a result, in these regions, firms will exhibit higher productivity and capital allocation among them will be more efficient. Additionally, infrastructure investments made by local governments in these areas should be more effective in enhancing firm productivity and more responsive to local economic fundamentals.

5 Conclusion and Discussions

This paper explores the complex interplay between state intervention and market dynamics in a hybrid economy. We find that when governmental interventions are judiciously moderated, the market effectively focuses on uncovering information about economic fundamentals, thereby enhancing decision-making processes at both the government and firm levels. This supports the notion that a hybrid economy can adeptly merge the strengths of central planning, particularly in public good provision, with the efficiency of market-based information discovery processes.

However, our model also highlights a boundary for state intervention. Beyond this point, market dynamics shift to a government-centric equilibrium wherein market participants prioritize information related to the government's policy agenda over economic fundamentals. Such an outcome undermines the market's role in information discovery, ironically intensifying the shortcomings of both central planning and market systems.

The prevalence of either scenario hinges on the internal agency frictions within the state system, particularly the dual accountability of local governors. Balancing central authority evaluations, which significantly impact their career prospects, with the responsibility to bolster local household welfare, local governors face a strategic choice. A strong policy response may exhibit their capability in policy implementation, risking a shift towards a government-centric equilibrium. In contrast, a more tempered approach prioritizes local welfare and leverages market information discovery for informed governmental and firm investments, beneficial to risk-averse households. Our analysis demonstrates that these dual responsibilities significantly influence local governors' policy decisions, consequently affecting the market's ability to perform its information discovery.

Our analysis holds particular relevance for understanding the current challenges confronting the Chinese economy. Critics have raised a significant concern that centralized political power may hinder the free flow of information in the state system, particularly information that is deemed unfavorable, to top leadership, as suggested by the "yes-man" theory of Prendergast (1993). Our analysis underscores a different, and potentially more serious, distortion whereby frictions in the state system may obstruct the market forces that facilitate information discovery in the market system.

After four decades of significant economic reforms, the Chinese economy has entered a new phase. To sustain its high growth, China can no longer depend solely on labor-intensive manufacturing and export-driven industries. Instead, it needs to foster innovations in both the technology and service sectors. As China approaches the technological frontier, it faces increased uncertainty and the need to make challenging choices among various technologies and products. In this context, the market's role in identifying the most promising technologies and products will be crucial. It's increasingly evident that bureaucrats alone cannot effectively navigate these complex decisions, highlighting the growing importance of market-driven information discovery in shaping China's economic future.

Our model underscores the need for controlling internal agency frictions within the state system to enhance market-based information discovery. As articulated by Xu (2011) and Qian (2017), China operates a vast governmental structure where the central government collaborates with regional governments at various levels: province, city, county, and township. These regional governments are pivotal in China's economic development, executing over 70% of fiscal spending and spearheading the development of industries, economic institutions, and infrastructure regionally. Our model demonstrates that top officials in these regional governments face dual responsibilities: adhering to the central authority's performance evaluations and fostering local economic growth to improve household welfare. The potential disconnect between these responsibilities can lead to significant distortions in market dynamics.

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Appendix A: Proof of Propositions

Proof of Proposition 1

Step 1: Solve for Firm i's Beliefs

We begin with the beliefs conditional on $\mathcal{I}_P$: $\begin{bmatrix} f \\ \pi_g \end{bmatrix} | \mathcal{I}_P \backsim \mathcal{N}\left(\begin{bmatrix} \hat{f} \\ \hat{\pi}_g \end{bmatrix}, \begin{bmatrix} \hat{\tau}_f^{-1} & \hat{\tau}_{f\pi}^{-1} \\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1} \end{bmatrix} \right)$. Define the Kalman Gain H as

$$H = \frac{A_s}{(A_s + A_v)^2 \tau_f^{-1} + A_s^2 \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1}} \begin{bmatrix} (A_s + A_v)\, \tau_f^{-1} \\ (A_s + A_v)\, \tau_f^{-1} + A_v \tau_\theta^{-1} \end{bmatrix}, \tag{A.1}$$

Then, the conditional expectation is given by

$$\begin{bmatrix} \hat{f} \\ \hat{\pi}_g \end{bmatrix} = \begin{bmatrix} \bar{f} \\ \bar{f} \end{bmatrix} + \frac{\begin{bmatrix} (A_s + A_v)\, \tau_f^{-1} \\ (A_s + A_v)\, \tau_f^{-1} + A_v \tau_\theta^{-1} \end{bmatrix} \left(A_s z_q - (A_s + A_v)\, \bar{f} \right)}{(A_s + A_v)^2 \tau_f^{-1} + A_v^2 \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1}}, \tag{A.2}$$

and the conditional variance by

$$\begin{aligned} \begin{bmatrix} \hat{\tau}_f^{-1} & \hat{\tau}_{f\pi}^{-1} \\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1} \end{bmatrix} &= \begin{bmatrix} \tau_f^{-1} & \tau_f^{-1} \\ \tau_f^{-1} & \tau_f^{-1} + \tau_\theta^{-1} \end{bmatrix} - H \begin{bmatrix} (A_s + A_v)\, \tau_f^{-1} \\ (A_s + A_v)\, \tau_f^{-1} + A_v \tau_\theta^{-1} \end{bmatrix}' \\ &= \frac{\psi^2 \tau_\varphi^{-1} \tau_f^{-1} \iota_2 \iota_2' + \begin{bmatrix} A_v^2 \tau_f^{-1} \tau_\theta^{-1} & -A_s A_v \tau_f^{-1} \tau_\theta^{-1} \\ -A_s A_v \tau_f^{-1} \tau_\theta^{-1} & A_s^2 \tau_f^{-1} \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1} \tau_\theta^{-1} \end{bmatrix}}{(A_s + A_v)^2 \tau_f^{-1} + A_v^2 \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1}} \end{aligned} \tag{A.3}$$

Because firms are Bayesian, we can update from the public beliefs to the private beliefs of firm i. Conditional on observing its private signals s_i and v_i, the posterior beliefs of firm i are also jointly normally distributed $\begin{bmatrix} f \\ \pi_g \end{bmatrix} | \mathcal{I}_i \backsim \mathcal{N}\left(\begin{bmatrix} \hat{f}_i \\ \hat{s}_{Gi} \end{bmatrix}, \begin{bmatrix} \hat{\tau}_{f,i}^{-1} & \hat{\tau}_{fG,i}^{-1} \\ \hat{\tau}_{fG,i}^{-1} & \hat{\tau}_{G,i}^{-1} \end{bmatrix} \right)$. Define the Kalman Gain H_i as

$$\begin{aligned} H_i &= \begin{bmatrix} \hat{\tau}_f^{-1} & \hat{\tau}_{f\pi}^{-1} \\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1} \end{bmatrix} \begin{bmatrix} \hat{\tau}_f^{-1} + \tau_s^{-1} & \hat{\tau}_{f\pi}^{-1} \\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1} + \tau_v^{-1} \end{bmatrix}^{-1} \\ &= \frac{\begin{bmatrix} \hat{\tau}_f^{-1} \left(\hat{\tau}_\pi^{-1} + \tau_v^{-1} \right) - \hat{\tau}_{f\pi}^{-1} \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_{f\pi}^{-1} \tau_s^{-1} \\ \hat{\tau}_{f\pi}^{-1} \tau_v^{-1} & \hat{\tau}_\pi^{-1} \left(\hat{\tau}_f^{-1} + \tau_s^{-1} \right) - \hat{\tau}_{f\pi}^{-1} \hat{\tau}_{f\pi}^{-1} \end{bmatrix}}{\left(\hat{\tau}_\pi^{-1} + \tau_v^{-1} \right) \left(\hat{\tau}_f^{-1} + \tau_s^{-1} \right) - \hat{\tau}_{f\pi}^{-1} \hat{\tau}_{f\pi}^{-1}}. \end{aligned}$$

Then, the conditional expectation of beliefs of firm i are given by

$$\left[\begin{array}{c}\hat{f}_i\\ \hat{\pi}_{gi}\end{array}\right]=\frac{\left[\begin{array}{cc}\tau_s^{-1}\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right) & -\hat{\tau}_{f\pi}^{-1}\tau_s^{-1}\\ -\hat{\tau}_{f\pi}^{-1}\tau_v^{-1} & \tau_v^{-1}\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)\end{array}\right]}{\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}\left[\begin{array}{c}\hat{f}\\ \hat{\pi}_g\end{array}\right]+H_i\left[\begin{array}{c}s_i\\ v_i\end{array}\right], \tag{A.4}$$

and the conditional variance by

$$\begin{aligned}\left[\begin{array}{cc}\hat{\tau}_{f,i}^{-1} & \hat{\tau}_{f\pi,i}^{-1}\\ \hat{\tau}_{f\pi,i}^{-1} & \hat{\tau}_{\pi,i}^{-1}\end{array}\right] &= \left[\begin{array}{cc}\hat{\tau}_f^{-1} & \hat{\tau}_{f\pi}^{-1}\\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1}\end{array}\right]-H_i\left[\begin{array}{cc}\hat{\tau}_f^{-1} & \hat{\tau}_{f\pi}^{-1}\\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1}\end{array}\right]'\\ &= \frac{\left[\begin{array}{cc}\tau_s^{-1}\hat{\tau}_f^{-1}\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)-\tau_s^{-1}\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1} & \tau_s^{-1}\tau_v^{-1}\hat{\tau}_{f\pi}^{-1}\\ \tau_s^{-1}\tau_v^{-1}\hat{\tau}_{f\pi}^{-1} & \tau_v^{-1}\hat{\tau}_\pi^{-1}\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\tau_v^{-1}\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}\end{array}\right]}{\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}\end{aligned} \tag{A.5}$$

Step 2: Solve for Firm i's Optimal Investment Policy

By substituting the government's policy function (20) into equation (10) and substituting our learning expressions, we have

$$\begin{aligned}\log K_i &= \frac{1}{1-\alpha_K}\log\mathbb{E}\left[\frac{e^{(1-\gamma)f+(1-\gamma)\alpha_G b_\pi\pi_g+(1-\gamma)a_G b_q\log q}}{\mathbb{E}\left[e^{-\gamma f-\gamma\alpha_G b_\pi\pi_g-\gamma a_G b_q\log q}\mid\mathcal{I}_i\right]}\mid\mathcal{I}_i\right]+\frac{\log\alpha_K+\alpha_G b_0-\log q}{1-\alpha_K},\\ &= \frac{1}{1-\alpha_K}\frac{\tau_s^{-1}\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)-\alpha_G b_\pi\hat{\tau}_{f\pi}^{-1}\tau_v^{-1}}{\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}\hat{f}\\ &\quad+\frac{1}{1-\alpha_K}\frac{\alpha_G b_\pi\tau_v^{-1}\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\tau_s^{-1}}{\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}\hat{\pi}_g\\ &\quad+\frac{\alpha_G b_q-1}{1-\alpha_K}\log q+\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}\\ &\quad+\frac{1}{1-\alpha_K}\frac{\hat{\tau}_f^{-1}\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}+\alpha_G b_\pi\hat{\tau}_{f\pi}^{-1}\tau_v^{-1}}{\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}s_i\\ &\quad+\frac{1}{1-\alpha_K}\frac{\hat{\tau}_{f\pi}^{-1}\tau_s^{-1}+\alpha_G b_\pi\left(\hat{\tau}_\pi^{-1}\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}\right)}{\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)-\hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}v_i\\ &\quad+\frac{1-2\gamma}{2}\frac{\hat{\tau}_{f,i}^{-1}+\left(\alpha_G b_\pi\right)^2\hat{\tau}_{g,i}^{-1}+2\alpha_G b_\pi\hat{\tau}_{fG,i}^{-1}}{1-\alpha_K},\end{aligned} \tag{A.6}$$

Matching coefficients in equation (23) with (A.6), we find

$$\begin{aligned} a_q &= \frac{\alpha_G b_q - 1}{1-\alpha_K}, && \text{(A.7)} \\ a_f &= \frac{1}{1-\alpha_K} - a_s, && \text{(A.8)} \\ a_\pi &= \frac{\alpha_G b_\pi}{1-\alpha_K} - a_v, && \text{(A.9)} \\ a_s &= \frac{1}{1-\alpha_K} + \frac{1}{1-\alpha_K}\frac{\alpha_G b_\pi \hat{\tau}_{f\pi}^{-1}\tau_v^{-1} - \tau_s^{-1}\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right)}{\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right) - \hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}, && \text{(A.10)} \\ a_v &= \frac{\alpha_G b_\pi}{1-\alpha_K} + \frac{1}{1-\alpha_K}\frac{\hat{\tau}_{f\pi}^{-1}\tau_s^{-1} - \alpha_G b_\pi\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)\tau_v^{-1}}{\left(\hat{\tau}_f^{-1}+\tau_s^{-1}\right)\left(\hat{\tau}_\pi^{-1}+\tau_v^{-1}\right) - \hat{\tau}_{f\pi}^{-1}\hat{\tau}_{f\pi}^{-1}}, && \text{(A.11)} \\ a_0 &= \frac{1-2\gamma}{2}\frac{\hat{\tau}_{f,i}^{-1} + (\alpha_G b_\pi)^2\hat{\tau}_{g,i}^{-1} + 2\alpha_G b_\pi \hat{\tau}_{fG,i}^{-1}}{1-\alpha_K} \\ &\quad + \frac{\log \alpha_K + \alpha_G b_0}{1-\alpha_K} \\ &= \frac{1-2\gamma}{2}\left(a_s\tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right) + \frac{\log\alpha_K + \alpha_G b_0}{1-\alpha_K}. && \text{(A.12)} \end{aligned}$$

Thus, we obtain the expression for $\log K_i$ in equation (28). This confirms that if other firms and the government follow log-linear policies, it is optimal for firm i to follow a log-linear investment policy.

Step 3: Solve for the Price of Capital

By substituting equations (A.7), (A.8), (A.9) and (A.12) into equation (25), we have

$$\begin{aligned} \log q &= \frac{1-\alpha_K}{1-a_G b_q + \psi(1-\alpha_K)}\left(\frac{1}{1-\alpha_K}\hat{f} + \frac{\alpha_G b_\pi}{1-\alpha_K}\hat{\pi}_g + A_s\left(f-\hat{f}\right) + A_v\left(\pi_g - \hat{\pi}_g\right) + \psi\varphi\right) \\ &\quad + \frac{1-\alpha_K}{1-a_G b_q + \psi(1-\alpha_K)}\left(A_0 + \frac{1}{2}\left(A_s^2\tau_s^{-1} + A_v^2\tau_v^{-1} - \psi^2\tau_{\varphi\epsilon}^{-1}\right)\right), && \text{(A.13)} \end{aligned}$$

where, in equilibrium, $A_s = a_s$, $A_v = a_v$, and $A_0 = a_0$.

Step 4: Solve for Firm i's Optimal Information Acquisition Decision

Recall that the household maximizes (14). Substituting with equation (10) into (14), the household's optimal information acquisition policy solves the time 0 problem

$$\begin{aligned} U_i &= \sup_{\tau_v,\tau_s}\frac{1}{1-\gamma}\mathbb{E}\left[\left(e^f G^{\alpha_G}K_i^{\alpha_K}\right)^{1-\gamma}\right] && \text{(A.14)} \\ s.t. &: \quad I(\tau_s,\tau_v) \le \frac{\kappa}{2}. \end{aligned}$$

Define

$$h = f + \alpha_G b_\pi \pi_g.$$

Then, recognizing for a constant a and log-normal random variable h

$$\mathbb{E}\left[e^{ah} \middle| \mathcal{I}_i\right] = e^{a\mathbb{E}[h|\,\mathcal{I}_i]+\frac{a^2}{2}Var[h|\,\mathcal{I}_i]}, \tag{A.15}$$

the objective in equation (A.14) reduces to

$$\begin{aligned} U_i &= \frac{e^{(1-\gamma)\alpha_K\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}}}{1-\gamma}\mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\alpha_G b_q-\alpha_K\right)\log q}e^{(1-\gamma)h}\left(\frac{\mathbb{E}\left[e^{(1-\gamma)h}\middle|\,\mathcal{I}_i\right]}{\mathbb{E}\left[e^{-\gamma h}\middle|\,\mathcal{I}_i\right]}\right)^{\frac{(1-\gamma)\alpha_K}{1-\alpha_K}}\right] \\ &= \frac{e^{(1-\gamma)\alpha_K\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}}}{1-\gamma}\mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\alpha_G b_q-\alpha_K\right)\log q}e^{(1-\gamma)h}e^{\frac{(1-\gamma)\alpha_K}{1-\alpha_K}\left(\mathbb{E}[h|\,\mathcal{I}_i]+\frac{1-2\gamma}{2}Var[h|\,\mathcal{I}_i]\right)}\right]. \end{aligned} \tag{A.16}$$

Applying the Law of Iterated Expectations by conditioning first on firm i's information set $\mathcal{I}_i$, and invoking equation (A.15), equation (A.16) simplifies to

$$\begin{aligned} U_i &= \frac{e^{(1-\gamma)\alpha_K\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}}}{1-\gamma}\mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\alpha_G b_q-\alpha_K\right)\log q}e^{\frac{(1-\gamma)\alpha_K}{1-\alpha_K}\left(\mathbb{E}[h|\,\mathcal{I}_i]+\frac{1-2\gamma}{2}Var[h|\,\mathcal{I}_i]\right)}\mathbb{E}\left[e^{(1-\gamma)h}\middle|\,\mathcal{I}_i\right]\right] \\ &= \frac{e^{(1-\gamma)\alpha_K\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}}}{1-\gamma}\mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\alpha_G b_q-\alpha_K\right)\log q}e^{\frac{1-\gamma}{1-\alpha_K}\mathbb{E}[h|\,\mathcal{I}_i]+\frac{1}{2}\frac{1-\gamma}{1-\alpha_K}(1-\gamma-\gamma\alpha_K))Var[h|\,\mathcal{I}_i]}\right] \\ &= \frac{e^{(1-\gamma)\alpha_K\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}}}{1-\gamma}\mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\alpha_G b_q-\alpha_K\right)\log q+\frac{1-\gamma}{1-\alpha_K}\mathbb{E}[h|\,\mathcal{I}_P]+\frac{1}{2}\left(\frac{1-\gamma}{1-\alpha_K}\right)^2 Var[\mathbb{E}[h|\,\mathcal{I}_i]|\,\mathcal{I}_P]+\frac{1}{2}\frac{1-\gamma}{1-\alpha_K}(1-\gamma-\gamma\alpha_K))\frac{Var[h|\,\mathcal{I}_i]}{1-\alpha_K}}\right]. \end{aligned} \tag{A.17}$$

We recognize that

$$\begin{aligned} \mathbb{E}\left[h|\,\mathcal{I}_P\right] &= \hat{f} + \alpha_G b_\pi \hat{\pi}_g, \\ Var\left[\mathbb{E}\left[h|\,\mathcal{I}_i\right]|\,\mathcal{I}_P\right] &= Var\left[h|\,\mathcal{I}_P\right] - \mathbb{E}\left[Var\left[h|\,\mathcal{I}_i\right]|\,\mathcal{I}_P\right] = Var\left[h|\,\mathcal{I}_P\right] - Var\left[h|\,\mathcal{I}_i\right], \\ Var\left[h|\,\mathcal{I}_P\right] &= \hat{\tau}_f^{-1} + \left(\alpha_G b_\pi\right)^2\hat{\tau}_\pi^{-1} + 2\alpha_G b_\pi \hat{\tau}_{f\pi}^{-1} \end{aligned}$$

and consequently equation (A.17) can be expressed as

$$\begin{aligned} U_i = {} & \frac{e^{-\frac{1-\gamma}{2(1-\alpha_K)}\frac{1-\gamma\alpha_K}{1-\alpha_K}\alpha_K Var[h|\,\mathcal{I}_i]}}{1-\gamma}\mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\hat{f}+\alpha_G b_\pi\hat{\pi}_g+\left(\alpha_G b_q-\alpha_K\right)\log q\right)}\right] \\ & \times e^{\frac{1}{2}\left(\frac{1-\gamma}{1-\alpha_K}\right)^2 Var[h|\,\mathcal{I}_P]+(1-\gamma)\alpha_K\frac{\log\alpha_K+\alpha_G b_0}{1-\alpha_K}}. \end{aligned} \tag{A.18}$$

It is clear from (A.18) that $Var\left[h|\,\mathcal{I}_i\right]$ is the only term in U_i that varies with τ_s and τ_v.

Let $\tilde{\theta}_i$ be the Lagrange multiplier on the information acquisition constraint. Simplifying equation (A.18), we arrive at the Lagrangian

$$U_i = \sup_{\tau_v,\tau_s} \frac{\Xi}{1-\gamma} e^{-\frac{1-\gamma}{2(1-\alpha_K)}\frac{1-\gamma\alpha_K}{1-\alpha_K}\alpha_K Var[h|\,\mathcal{I}_i]} - \frac{\tilde{\theta}_i}{2}\left(I\left(\tau_s,\tau_v\right)-\kappa\right), \tag{A.19}$$

where $\Xi \geq 0$ given by

$$\begin{aligned}\Xi &= \mathbb{E}\left[e^{\frac{1-\gamma}{1-\alpha_K}\left(\hat{f}+\alpha_G b_\pi \hat{\pi}_g+\left(\alpha_G b_q-\alpha_K\right)\log q\right)}\right] \\ &\quad \times e^{\frac{(1-\gamma)^2}{2(1-\alpha_K)^2}\left(\hat{\tau}_f^{-1}+(\alpha_G b_\pi)^2\hat{\tau}_\pi^{-1}+2\alpha_G b_\pi \hat{\tau}_{f\pi}^{-1}\right)+(1-\gamma)\frac{\alpha_K}{1-\alpha_K}(\log\alpha_K+\alpha_G b_0)}.\end{aligned} \tag{A.20}$$

Because the firm behaves competitively, it takes Ξ, $\hat{\tau}_f^{-1}$, $\hat{\tau}_\theta^{-1}$, and $\hat{\tau}_{f\theta}^{-1}$ as given.

If we define

$$\theta_i = \frac{2}{1-\gamma\alpha_K}\frac{1-\alpha_K}{\alpha_K} e^{-\frac{1-\gamma}{2(1-\alpha_K)}\frac{1-\gamma\alpha_K}{1-\alpha_K}\alpha_K Var[h|\,\mathcal{I}_i]}\Xi^{-1}\tilde{\theta}_i,$$

to be the normalized Lagrange multiplier, we can write the first-order necessary conditions of the Lagrangian for τ_s and τ_v as

$$\tau_s \;:\; -\frac{\partial Var\left[h|\,\mathcal{I}_i\right]}{\partial\tau_s} - \theta_i\frac{\partial I\left(\tau_s,\tau_v\right)}{\partial\tau_s} \leq 0 \;\left(= \text{binds if } \tau_s > 0\right), \tag{A.21}$$

$$\tau_v \;:\; -\frac{\partial Var\left[h|\,\mathcal{I}_i\right]}{\partial\tau_v} - \theta_i\frac{\partial I\left(\tau_s,\tau_v\right)}{\partial\tau_v} \leq 0 \;\left(= \text{binds if } \tau_v > 0\right), \tag{A.22}$$

If $\gamma < \frac{1}{\alpha_K}$ and $\tilde{\theta}_i \geq 0$, then $\theta_i > 0$.

Notice, however, that these first-order necessary conditions are equivalent to the simpler information acquisition program

$$\begin{aligned} u_i &= \sup_{\tau_v,\tau_s} -Var\left[h|\,\mathcal{I}_i\right], \\ s.t. &: \; I\left(\tau_s,\tau_v\right) \leq \kappa/2, \end{aligned} \tag{A.23}$$

because $h = f + \alpha_G b_\pi \pi_g$ by definition, taking as given $\hat{\tau}_f^{-1}$, $\hat{\tau}_\pi^{-1}$, and $\hat{\tau}_{f\pi}^{-1}$.

To take the first-order conditions more formally, we recognize substituting equation (A.5) into equations (A.10) and (A.11) that

$$a_s = \frac{\hat{\tau}_{f,i}^{-1} + a_G b_\pi \hat{\tau}_{fG,i}^{-1}}{1-\alpha_K}\tau_s, \tag{A.24}$$

$$a_v = \frac{\hat{\tau}_{fG,i}^{-1} + a_G b_\pi \hat{\tau}_{G,i}^{-1}}{1-\alpha_K}\tau_v, \tag{A.25}$$

so that

$$\frac{Var\left[h|\,\mathcal{I}_i\right]}{1-\alpha_K} = a_s\tau_s^{-1} + a_G b_\pi a_v \tau_v^{-1}. \tag{A.26}$$

Finally, we recognize the entropy reduction from the firm's information acquisition $I(\tau_s, \tau_v)$ can be expressed as

$$I(\tau_s, \tau_v) = \frac{1}{2}\log|\Sigma_P| - \frac{1}{2}\log|\Sigma_P - H_i\Sigma_P'| = -\frac{1}{2}\log\left| I_2 - \Sigma_P \begin{bmatrix} \hat{\tau}_f^{-1} + \tau_s^{-1} & \hat{\tau}_{f\pi}^{-1} \\ \hat{\tau}_{f\pi}^{-1} & \hat{\tau}_\pi^{-1} + \tau_v^{-1} \end{bmatrix}^{-1} \right|,$$

where I_2 is the 2×2 identity matrix. With some manipulation, this reduces to

$$I(\tau_s, \tau_v) = \frac{1}{2}\log\left| \frac{\hat{\tau}_f + \tau_s}{\hat{\tau}_f} \frac{\hat{\tau}_\pi + \tau_v}{\hat{\tau}_\pi} - \frac{\tau_s}{\hat{\tau}_{f\pi}} \frac{\tau_v}{\hat{\tau}_{f\pi}} \right|.$$

Substituting this expression for $I(\tau_s, \tau_v)$ yields that in the statement in the proposition. Notice that the capacity constraint will bind in equilibrium, which implies

$$\frac{\hat{\tau}_f + \tau_s}{\hat{\tau}_f} \frac{\hat{\tau}_\pi + \tau_v}{\hat{\tau}_\pi} - \frac{\tau_s}{\hat{\tau}_{f\pi}} \frac{\tau_v}{\hat{\tau}_{f\pi}} = e^\kappa. \tag{A.27}$$

Substituting with equation (A.27), we can express $\frac{\partial Var[h|\ \mathcal{I}_i]}{\partial \tau_s}$ and $\frac{\partial Var[h|\ \mathcal{I}_i]}{\partial \tau_v}$ as

$$\begin{aligned} -\frac{\partial Var[h|\ \mathcal{I}_i]}{\partial \tau_s} &= (a_G b_\pi)^2 e^{-\kappa} \tau_v^{-1} \hat{\tau}_f^{-1} \\ &\quad + \frac{\tau_s^{-1}\left(e^\kappa - 1 - \frac{\tau_v}{\hat{\tau}_\pi}\right) + 2\alpha_G b_\pi \hat{\tau}_{f\pi}^{-1} - (\alpha_G b_\pi)^2 \tau_v^{-1}\left(1 + \frac{\tau_s}{\hat{\tau}_f}\right)}{e^{2\kappa}} \tau_s^{-1}\left(e^\kappa - 1 - \frac{\tau_v}{\hat{\tau}_\pi}\right), \end{aligned}$$

and

$$-\frac{\partial Var[h|\ \mathcal{I}_i]}{\partial \tau_v} = e^{-\kappa}\tau_s^{-1}\hat{\tau}_\pi^{-1} + \frac{-\tau_s^{-1}\left(1 + \frac{\tau_v}{\hat{\tau}_g}\right) + 2\alpha_G b_\pi \hat{\tau}_{f\pi}^{-1} + (\alpha_G b_\pi)^2 \tau_v^{-1}\left(e^\kappa - 1 - \frac{\tau_s}{\hat{\tau}_f}\right)}{e^{2\kappa}} \tau_v^{-1}\left(e^\kappa - 1 - \frac{\tau_s}{\hat{\tau}_f}\right),$$

from which follows from the first-order conditions for τ_s and τ_v that we can identify τ_s and τ_v from equation (A.27) and

$$\frac{(a_G b_\pi)^2 \tau_v^{-1}}{e^\kappa - 1 - \frac{\tau_v}{\hat{\tau}_\pi}} = \frac{\tau_s^{-1}}{e^\kappa - 1 - \frac{\tau_s}{\hat{\tau}_f}}. \tag{A.28}$$

Notice the left-hand side of equation (A.28) that the left-hand side is monotonically decreasing in τ_v while the right-hand side is monotonically decreasing in τ_s. Consequently, as $a_G b_\pi$ increases, τ_v increases while τ_s (weakly) decreases. Similarly, τ_s is decreasing in $\hat{\tau}_f$ while τ_v is decreasing in $\hat{\tau}_\pi$.

Manipulating equations (A.28) (A.27), we can solve for τ_s and τ_v explicitly according to

$$\tau_v = \min\left\{ \max\left\{ (\alpha_G b_\pi)^2 \tau_s + \frac{(\alpha_G b_\pi)^2 \hat{\tau}_f - \hat{\tau}_\pi}{1 - \frac{\hat{\tau}_f}{\hat{\tau}_{f\pi}} \frac{\hat{\tau}_\pi}{\hat{\tau}_{f\pi}}}, 0 \right\}, (e^\kappa - 1)\,\hat{\tau}_g \right\}, \tag{A.29}$$

and

$$\tau_s = \min \left\{ \begin{array}{c} \max \left\{ \sqrt{\left(\tau_f + \left(\frac{a_s}{\psi} \right)^2 \tau_\varphi \right)^2 - \tau_f^2 + \frac{\tau_f \hat{\tau}_\pi - (1-e^\kappa) \left(\frac{a_v}{\psi} \right)^2 \tau_\varphi \tau_f}{(\alpha_G b_\pi)^2}} - \left(\tau_f + \left(\frac{a_s}{\psi} \right)^2 \tau_\varphi \right), 0 \right\}, \\ \\ \left(e^\kappa - 1 \right) \hat{\tau}_f \end{array} \right\}. \tag{A.30}$$

Substituting with equation (A.27), from equations (A.10) and (A.11), a_s and a_v become

$$a_s = \frac{1 - e^{-\kappa}}{1 - \alpha_K} + e^{-\kappa} \frac{\alpha_G b_\pi \tau_s \hat{\tau}_{f\pi}^{-1} - \tau_v \hat{\tau}_\pi^{-1}}{1 - \alpha_K},$$
$$a_v = \alpha_G b_\pi \frac{1 - e^{-\kappa}}{1 - \alpha_K} + e^{-\kappa} \frac{\tau_v \hat{\tau}_{f\pi}^{-1} - \alpha_G b_\pi \tau_s \hat{\tau}_f^{-1}}{1 - \alpha_K}.$$

Proof of Proposition 2

Step 1: Existence of a Government-centric Equilibrium

Suppose the equilibrium is a government-centric equilibrium in which all households choose to learn only about the government political agenda (i.e., $\tau_v > 0$ and $\tau_s = 0$). In this case, the entropy constraint (15), substituting with equation (13), reduces to

$$I(\tau_s, \tau_v) = \frac{1}{2} \log \frac{\hat{\tau}_\pi + \tau_v}{\hat{\tau}_\pi} \leq \kappa/2. \tag{A.31}$$

By the entropy constraint (A.31)

$$\tau_v = \left(e^\kappa - 1 \right) \hat{\tau}_\pi, \tag{A.32}$$

where $\hat{\tau}_\pi$ depends on τ_v. From equations (A.24) and (A.25), substituting with (A.32), a_s and a_v reduce to

$$a_s = 0, \tag{A.33}$$
$$a_v = \alpha_G b_\pi \frac{1 - e^{-\kappa}}{1 - \alpha_K} + e^{-\kappa} \frac{\hat{\tau}_{f\pi}^{-1} \tau_v}{1 - \alpha_K} = \left(\frac{\tau_\theta}{\tau_\theta + \tau_f} + \alpha_G b_\pi \right) \frac{1 - e^{-\kappa}}{1 - \alpha_K}. \tag{A.34}$$

Further, from equation (A.3)

$$\hat{\tau}_f^{-1} = \frac{A_v^2 \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1}}{A_v^2 \left(\tau_f^{-1} + \tau_\theta^{-1} \right) + \psi^2 \tau_\varphi^{-1}} \tau_f^{-1}, \tag{A.35}$$

and

$$\hat{\tau}_\pi^{-1} = \frac{\psi^2 \tau_\varphi^{-1} \left(\tau_f^{-1} + \tau_\theta^{-1}\right)}{A_v^2 \left(\tau_f^{-1} + \tau_\theta^{-1}\right) + \psi^2 \tau_\varphi^{-1}}. \tag{A.36}$$

In equilibrium, $A_v = a_v$ from equation (A.34), and from equations (A.32) and (A.36) $\hat{\tau}_g$ satisfies

$$\hat{\tau}_\pi = \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1} + \left(\frac{\tau_\theta}{\tau_\theta + \tau_f} + \alpha_G b_\pi\right)^2 \left(\frac{1}{\psi}\frac{1 - e^{-\kappa}}{1 - \alpha_K}\right)^2 \tau_\varphi. \tag{A.37}$$

from which we can recover τ_v from equation (A.32).

For the equilibrium to be a government-centric equilibrium $\tau_s = 0$, which requires in the optimal choice of τ_s from equation (A.30) that the first argument in the max be less than or equal to 0, or

$$\tau_f \left(\alpha_G b_\pi\right)^2 - e^\kappa \left(\frac{\tau_\theta}{\tau_\theta + \tau_f} + \alpha_G b_\pi\right)^2 \left(\frac{1}{\psi}\frac{1 - e^{-\kappa}}{1 - \alpha_K}\right)^2 \tau_\varphi \geq \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1}, \tag{A.38}$$

from which follows either

$$\begin{aligned}\alpha_G b_\pi \quad \leq \quad & \frac{\frac{\tau_\theta}{\tau_\theta+\tau_f} e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}{\tau_f - e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi} \\ & - \sqrt{\left(\frac{\frac{\tau_\theta}{\tau_\theta+\tau_f} e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}{\tau_f - e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}\right)^2 + \frac{\left(\frac{\tau_\theta}{\tau_\theta+\tau_f}\right)^2 e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi + \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1}}{\tau_f - e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}}\end{aligned}$$

which would imply a government-centric equilibrium exists if $\alpha_G b_\pi \leq -\alpha_G \tilde{b}_s^* < -\frac{\tau_\theta}{\tau_\theta+\tau_f}$, or

$$\begin{aligned}\alpha_G b_\pi \quad \geq \quad & \frac{\frac{\tau_\theta}{\tau_\theta+\tau_f} e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}{\tau_f - e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi} \\ & + \sqrt{\left(\frac{\frac{\tau_\theta}{\tau_\theta+\tau_f} e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}{\tau_f - e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}\right)^2 + \frac{\left(\frac{\tau_\theta}{\tau_\theta+\tau_f}\right)^2 e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi + \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1}}{\tau_f - e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi}}\end{aligned} \tag{A.39}$$

from which follows a government-centric equilibrium exists if $\alpha_G b_\pi \geq \alpha_G b_\pi \geq \sqrt{\frac{\tau_\theta}{\tau_\theta+\tau_f}} \geq \frac{\tau_\theta}{\tau_\theta+\tau_f}$ because $\frac{\tau_\theta}{\tau_\theta+\tau_f} \leq 1$. A necessary condition for solutions to exist is $\tau_f \geq \tau_\varphi e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2$; otherwise, both roots are imaginary.

It follows there exists critical values of b_π, $\tilde{b}_\pi^*$ and b_π^*, such that there exists a government-centric equilibrium if and only if $b_\pi \in (-\infty, -\tilde{b}_\pi^*] \cup [b_\pi^*, \infty)$, and there does not exist one otherwise. Because α_G and b_π enter the inequality together as $\alpha_G b_\pi$, it follows $\tilde{b}_\pi^*$ and b_π^* are decreasing in α_G. It is further immediate that they are decreasing in τ_f / τ_θ and increasing in $\frac{\tau_\varphi}{\psi^2}$ and κ.

Step 2: Existence of a Fundamental-centric Equilibrium

Suppose instead the equilibrium is a fundamental-centric equilibrium in which all households choose to learn only about the fundamental (i.e., $\tau_s > 0$ and $\tau_v = 0$). In this case, $\hat{\tau}_\pi^{-1} = \hat{\tau}_f^{-1} + \tau_\theta^{-1}$, $\hat{\tau}_{f\pi} = \hat{\tau}_f$ and by similar arguments to Step 1, $a_v = 0$,

$$\tau_s = (e^\kappa - 1)\,\hat{\tau}_f, \tag{A.40}$$

and we have

$$a_s = (1 + \alpha_G b_\pi)\,\frac{1 - e^{-\kappa}}{1 - \alpha_K}, \tag{A.41}$$

and

$$\hat{\tau}_f = \tau_f + (1 + \alpha_G b_\pi)^2 \left(\frac{1}{\psi}\frac{1 - e^{-\kappa}}{1 - \alpha_K}\right)^2 \tau_\varphi. \tag{A.42}$$

For the equilibrium to be a fundamental-centric equilibrium $\tau_v = 0$, which requires in the optimal choice of τ_v from equation (A.29) that the first argument in the max be less than or equal to 0, or

$$(\alpha_G b_\pi)^2 \left(1 + \frac{e^\kappa}{\tau_\theta}\left(\frac{\tau_\varphi}{\psi^2}a_s^2 + \tau_f\right)\right) \leq 1. \tag{A.43}$$

This can be expanded into the quartic polynomial

$$\begin{aligned}\frac{e^\kappa}{\tau_\theta}\tau_\varphi \left(\frac{1}{\psi}\frac{1 - e^{-\kappa}}{1 - \alpha_K}\right)^2 (\alpha_G b_\pi)^4 + 2\frac{e^\kappa}{\tau_\theta}\tau_\varphi \left(\frac{1}{\psi}\frac{1 - e^{-\kappa}}{1 - \alpha_K}\right)^2 (\alpha_G b_\pi)^3 \\ + \left(1 + \frac{e^\kappa}{\tau_\theta}\tau_\varphi \left(\frac{1}{\psi}\frac{1 - e^{-\kappa}}{1 - \alpha_K}\right)^2 + \frac{e^\kappa}{\tau_\theta}\tau_f\right)(\alpha_G b_\pi)^2 - 1 \quad \leq \quad 0,\end{aligned}$$

which has one positive and one negative root.

Notice a_v is monotonically increasing in $\alpha_G b_\pi$ from equation (A.41). When $b_\pi = 0$, the left-hand side reduces to 0, and consequently a fundamental-centric equilibrium exists. It is immediate that the left-hand side is monotonically increasing in $\alpha_G b_\pi$ for $b_\pi > 0$. Consequently, there exists a critical b_π, $\underline{b}_\pi$, such that a fundamental-centric equilibrium exists if $b_\pi \leq \underline{b}_\pi$, and does not exist otherwise. Similarly, there exists a second critical b_π, $-\tilde{\underline{b}}_\pi$,such that a fundamental equilibrium exists if $b_\pi \geq -\tilde{\underline{b}}_\pi$. Consequently, a fundamental-centric equilibrium exists if and only if $b_\pi \in [-\tilde{\underline{b}}_\pi, \underline{b}_\pi]$.

From equation (A.41), it is immediate that $\alpha_G \tilde{\underline{b}}_\pi, \alpha_G \underline{b}_\pi < \sqrt{\frac{\tau_\theta}{\tau_f + \tau_\theta}}$ because

$$\frac{\tau_\theta}{\tau_f + \tau_\theta}\left(1 + \frac{e^\kappa}{\tau_\theta}\left(\frac{\tau_\varphi}{\psi^2}a_s^2 + \tau_f\right)\right) = 1 + \frac{\left(e^\kappa \tau_f - 1\right)\tau_f}{\tau_f + \tau_\theta} + \frac{e^\kappa}{\tau_f + \tau_\theta}\frac{\tau_\varphi}{\psi^2}a_s^2 > 1.$$

Because α_G and b_π enter the inequality together as $\alpha_G b_\pi$, it follows $\underline{b}_\pi$ and $\tilde{\underline{b}}_\pi$ are decreasing in α_G. By the Implicit Function Theorem applied to equation (A.43) when it holds with equality, it is immediate the critical $\underline{b}_\pi$ and $\tilde{\underline{b}}_\pi$ are decreasing in τ_f/τ_θ, κ, and $\frac{\tau_\varphi}{\psi^2}$.

Step 3: Ranking the Cutoffs

Consider the critical $b_\pi > 0$, $\underline{b}_\pi$, that is the upper bound for a fundamental-centric equilibrium. From equation (A.43) when it holds with equality, we can bound this critical $\underline{b}_\pi$

$$\begin{aligned} 1 &= (\alpha_G \underline{b}_\pi)^2 \left(1 + \frac{e^\kappa}{\tau_\theta}\left((1+\alpha_G \underline{b}_\pi)^2 \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi + \tau_f\right)\right) \\ &> (\alpha_G \underline{b}_\pi)^2 \left(1 + \frac{e^\kappa}{\tau_\theta}\left(\left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi + \tau_f\right)\right), \end{aligned}$$

which implies

$$(\alpha_G \underline{b}_\pi)^2 < \frac{1}{1 + \frac{e^\kappa}{\tau_\theta}\left(\left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi + \tau_f\right)}. \tag{A.44}$$

It is then immediate from this bound (A.44) that

$$\begin{aligned} \tau_f (\alpha_G \underline{b}_\pi)^2 - e^\kappa \left(\frac{\tau_\theta}{\tau_\theta + \tau_f} + \alpha_G \underline{b}_\pi\right)^2 \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi &< \tau_f (\alpha_G \underline{b}_\pi)^2 \\ &< \frac{\tau_f \tau_\theta}{e^\kappa \tau_f + \tau_\theta + e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi} \end{aligned} \tag{A.45}$$

Note, however, because $\kappa \geq 0$ that

$$\frac{\tau_f \tau_\theta}{e^\kappa \tau_f + \tau_\theta + e^\kappa \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi} < \frac{\tau_f \tau_\theta}{\tau_f + \tau_\theta} = \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1}, \tag{A.46}$$

which consequently implies from inequality (A.45) that

$$\tau_f (\alpha_G \underline{b}_\pi)^2 - e^\kappa \left(\frac{\tau_\theta}{\tau_\theta + \tau_f} + \alpha_G \underline{b}_\pi\right)^2 \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi < \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1}. \tag{A.47}$$

Comparing (A.47) to (A.38), it is immediate that $\underline{b}_\pi$ does not satisfy the condition for the existence of a government-centric equilibrium. As such, $\underline{b}_\pi < b_\pi^*$.

Suppose now $b_\pi < 0$. By similar arguments, when equation (A.43) holds with equality, we can bound this critical $\underline{\tilde{b}}_\pi$

$$1 = \left(\alpha_G \underline{\tilde{b}}_\pi\right)^2 \left(1 + \frac{e^\kappa}{\tau_\theta}\left(\left(1 - \alpha_G \underline{\tilde{b}}_\pi\right)^2 \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi + \tau_f\right)\right) > \left(\alpha_G \underline{\tilde{b}}_\pi\right)^2 \left(1 + \frac{e^\kappa}{\tau_\theta}\tau_f\right),$$

which implies

$$\left(\alpha_G \underline{\tilde{b}}_\pi\right)^2 < \frac{\tau_\theta}{e^\kappa \tau_f + \tau_\theta}. \tag{A.48}$$

It is then immediate from this bound (A.48) that

$$\tau_f \left(\alpha_G \underline{\tilde{b}}_\pi\right)^2 - e^\kappa \left(\frac{\tau_\theta}{\tau_\theta + \tau_f} - \alpha_G \underline{\tilde{b}}_\pi\right)^2 \left(\frac{1}{\psi}\frac{1-e^{-\kappa}}{1-\alpha_K}\right)^2 \tau_\varphi < \tau_f \left(\alpha_G \underline{\tilde{b}}_\pi\right)^2 < \frac{\tau_f \tau_\theta}{e^\kappa \tau_f + \tau_\theta}. \tag{A.49}$$

It is then again immediate that

$$\frac{\tau_f \tau_\theta}{e^\kappa \tau_f + \tau_\theta} < \frac{\tau_f \tau_\theta}{\tau_f + \tau_\theta} = \left(\tau_\theta^{-1} + \tau_f^{-1}\right)^{-1},$$

and again $-\underline{\tilde{b}}_\pi$ is does not satisfy the condition (A.38) necessary for a government-centric equilibrium to exist. As such, $\underline{\tilde{b}}_\pi > \tilde{b}_\pi^*$.

We consequently have the cutoff ranking $-\tilde{b}_\pi^* < -\underline{\tilde{b}}_\pi < \underline{b}_\pi < b_\pi^*$. It then follows that for a given b_π, at most one pure equilibrium (i.e., fundamental- or government-centric) exists.

Proof of Proposition 3

In what follows, we first derive the posterior beliefs of the central government.

Given that the central government has a normal prior about θ, $\theta \sim \mathcal{N}\left(0, \tau_\theta^{-1}\right)$, and observes (conditionally) Gaussian signals z_C and z_Q, given by equations (32) and (33), respectively, its posterior is Gaussian $\theta | z_C, z_Q \sim \mathcal{N}\left(\hat{\theta}, \hat{\tau}_\theta^{-1}\right)$, where

$$\hat{\theta} = \tau_\theta^{-1} \begin{pmatrix} a_v \\ 1 \end{pmatrix}' \Sigma^{-1} \begin{pmatrix} z_Q \\ z_C \end{pmatrix} = \tau_\theta^{-1} \begin{pmatrix} a_v \\ 1 \end{pmatrix}' \Sigma^{-1} \begin{pmatrix} z_Q \\ z_C \end{pmatrix}, \tag{A.50}$$

$$\hat{\tau}_\theta^{-1} = \tau_\theta^{-1} - \tau_\theta^{-2} \begin{pmatrix} a_v \\ 1 \end{pmatrix}' \Sigma^{-1} \begin{pmatrix} a_v \\ 1 \end{pmatrix}, \tag{A.51}$$

and

$$\Sigma = \begin{bmatrix} (a_s + a_v)^2 \tau_f^{-1} + a_v^2 \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1} & a_v \tau_\theta^{-1} + (a_s + a_v)\left(1 + \frac{1}{\alpha_G b_\pi}\right)\tau_f^{-1} - \frac{\alpha_K \psi^2}{\alpha_G b_\pi}\tau_\varphi^{-1} \\ a_v \tau_\theta^{-1} + (a_s + a_v)\left(1 + \frac{1}{\alpha_G b_\pi}\right)\tau_f^{-1} - \frac{\alpha_K \psi^2}{\alpha_G b_\pi}\tau_\varphi^{-1} & \tau_\theta^{-1} + \left(1 + \frac{1}{\alpha_G b_\pi}\right)^2 \tau_f^{-1} + \left(\frac{\alpha_K \psi}{\alpha_G b_\pi}\right)^2 \tau_\varphi^{-1} \end{bmatrix}. \tag{A.52}$$

It is immediate from equation (A.52) that

$$\tau_\theta^{-2} \begin{pmatrix} a_v \\ 1 \end{pmatrix}' \Sigma^{-1} \begin{pmatrix} a_v \\ 1 \end{pmatrix} = \tau_\theta^{-2} \frac{\left(a_s - \frac{a_v}{\alpha_G b_\pi}\right)^2 \tau_f^{-1} + \left(1 + \frac{\alpha_K a_v}{\alpha_G b_\pi}\right)^2 \psi^2 \tau_\varphi^{-1}}{|\Sigma|}, \tag{A.53}$$

and

$$|\Sigma| = \tau_\theta^{-1}\left(a_s - \frac{a_v}{\alpha_G b_\pi}\right)^2 \tau_f^{-1} + \tau_\theta^{-1}\left(1 + \frac{\alpha_K a_v}{\alpha_G b_\pi}\right)^2 \psi^2 \tau_\varphi^{-1} + \psi^2 \tau_\varphi^{-1}\left(1 + \frac{1}{\alpha_G b_\pi} + \frac{\alpha_K}{\alpha_G b_\pi}(a_s + a_v)\right)^2 \tau_f^{-1}. \tag{A.54}$$

It then follows from equation (A.53) and (A.54) that

$$\hat{\tau}_\theta^{-1} = \frac{\psi^2 \tau_\varphi^{-1} \left(1 + \frac{1}{\alpha_G b_\pi} + \frac{\alpha_K}{\alpha_G b_\pi} \left(a_s + a_v\right)\right)^2 \tau_f^{-1}}{\tau_\theta^{-1} \left(a_s - \frac{a_v}{\alpha_G b_\pi}\right)^2 \tau_f^{-1} + \tau_\theta^{-1} \left(1 + \frac{\alpha_K a_v}{\alpha_G b_\pi}\right)^2 \psi^2 \tau_\varphi^{-1} + \psi^2 \tau_\varphi^{-1} \left(1 + \frac{1}{\alpha_G b_\pi} + \frac{\alpha_K}{\alpha_G b_\pi} \left(a_s + a_v\right)\right)^2 \tau_f^{-1}} \tau_\theta^{-1},$$

and therefore

$$\hat{\tau}_\theta = \tau_\theta + \frac{\left(\alpha_G b_\pi a_s - a_v\right)^2 \frac{\tau_\varphi}{\psi^2} + \left(\alpha_G b_\pi + \alpha_K a_v\right)^2 \tau_f}{\left(1 + \alpha_G b_\pi + \alpha_K \left(a_s + a_v\right)\right)^2}. \tag{A.55}$$

This completes our characterization of the central government's posterior beliefs.

Proof of Proposition 4

We follow the following steps: first to examine the governor's choice of b_π within a fundamental-centric equilibrium, then her choice within a government-centric equilibrium, and finally examine whether she prefers a fundamental- or government-centric equilibrium.

Step 1: Fundamental-centric Equilibrium

In a fundamental-centric, $\hat{\tau}_\theta$ from equation (A.55) based on Proposition 2 simplifies to

$$\hat{\tau}_\theta = \tau_\theta + \left(\alpha_G b_\pi\right)^2 \left(\frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}\right)^2 \frac{\tau_\varphi}{\psi^2} + \left(\frac{1 - \alpha_K}{1 - \alpha_K e^{-\kappa}}\right)^2 \left(\frac{\alpha_G b_\pi}{1 + \alpha_G b_\pi}\right)^2 \tau_f. \tag{A.56}$$

It is immediate that to maximize $\hat{\tau}_\theta$, the governor chooses $b_\pi > 0$ as large as possible. Thus, the optimal choice is $\underline{b}_\pi$, the maximum value of b_π that supports a fundamental-centric equilibrium.

Step 2: Government-centric Equilibrium

In a government-centric, $\hat{\tau}_\theta$ from equation (A.55) based on Proposition 2 simplifies to

$$\hat{\tau}_\theta = \tau_\theta + \left(\frac{\frac{\tau_\theta}{\tau_\theta + \tau_f} + \alpha_G b_\pi}{1 + \alpha_G b_\pi - \alpha_K \frac{\tau_f}{\tau_\theta + \tau_f} \frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}}\right)^2 \left(\frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}\right)^2 \frac{\tau_\varphi}{\psi^2} + \left(\frac{\alpha_G b_\pi + \alpha_K \frac{\tau_\theta}{\tau_\theta + \tau_f} \frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}}{1 + \alpha_G b_\pi - \alpha_K \frac{\tau_f}{\tau_\theta + \tau_f} \frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}}\right)^2 \tau_f. \tag{A.57}$$

It is immediate that to maximize $\hat{\tau}_\theta$, the governor chooses $b_\pi > 0$ as large as possible. Because a government-centric equilibrium exists if $b_\pi \geq b_\pi^*$, maximizing b_π is consistent with a government-centric equilibrium.

Step 3: Comparing Fundamental- and Government-centric Equilibria

Notice from comparing equations (A.56) and (A.57) that

$$\left(\frac{\alpha_G b_\pi + \alpha_K \frac{\tau_\theta}{\tau_\theta + \tau_f} \frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}}{1 + \alpha_G b_\pi - \alpha_K \frac{\tau_f}{\tau_\theta + \tau_f} \frac{1 - e^{-\kappa}}{1 - \alpha_K e^{-\kappa}}}\right)^2 \tau_f \geq \left(\frac{1 - \alpha_K}{1 - \alpha_K e^{-\kappa}}\right)^2 \left(\frac{\alpha_G b_\pi}{1 + \alpha_G b_\pi}\right)^2 \tau_f,$$

recognizing that $\frac{1-\alpha_K}{1-\alpha_K e^{-\kappa}} \leq 1$. Consequently, it is sufficient to focus only on the second terms in $\hat{\tau}_\theta$. Note that the governor would choose $b_\pi \to \infty$ in government-centric equilibrium, consequently causing the coefficient of the second term to $\left(\frac{1-e^{-\kappa}}{1-\alpha_K e^{-\kappa}}\right)^2 \frac{\tau_\varphi}{\psi^2}$. In the fundamental-centric equilibrium, the governor would choose $b_\pi = \underline{b}_\pi$, causing the second term to be $(\alpha_G \underline{b}_\pi)^2 \left(\frac{1-e^{-\kappa}}{1-\alpha_K e^{-\kappa}}\right)^2 \frac{\tau_\varphi}{\psi^2}$. From the proof of Proposition 2, $\alpha_G \underline{b}_\pi \leq \sqrt{\frac{\tau_\theta}{\tau_\theta+\tau_f}} < 1$ in a fundamental-centric equilibrium. Thus, $\hat{\tau}_\theta$ is higher in the government-centric equilibrium.

Consequently, the governor maximizes $\hat{\tau}_\theta$ by choosing a government-centric over a fundamental-centric equilibrium. It is immediate by continuity that such arguments also exclude a mixed equilibrium as being optimal.

Proof of Proposition 5

Step 1: Optimal Choice of b_0

With some manipulation of the social welfare objective (38), the first-order condition for the optimal choice of b_0 is

$$e^{\mathbb{E}[\log C_i]+\frac{1}{2}Var[\log C_i]}\left(e^{-\frac{\gamma}{2}Var[\log C_i]} - \frac{\psi\alpha_K}{1+\psi}e^{-\gamma Var\left[f+\alpha_G b_\pi \pi_g \mid \mathcal{I}_i\right]}\right) = \frac{1+\psi(1-\alpha_K)}{(1+\psi)\alpha_G}R_G e^{\mathbb{E}[\log G]+\frac{1}{2}Var[\log G]}. \tag{A.58}$$

from which we can derive b_0 explicitly. Let $\mathbb{E}\left[\widehat{\log C_i}\right]$ be $\mathbb{E}[\log C_i]$ from equation (B.7) without its b_0 term, and similarly for $\mathbb{E}\left[\widehat{\log qK}\right]$ and $\mathbb{E}\left[\widehat{\log G}\right]$. Then, the optimal b_0 is

$$\begin{aligned} b_0 \;=\; & \frac{1-a_G b_q+\psi(1-\alpha_K)}{1-\alpha_G}\left[\mathbb{E}\left[\widehat{\log C_i}\right] - \mathbb{E}\left[\widehat{\log G}\right] + \log\left(\frac{1+\psi}{1+\psi(1-\alpha_K)}\frac{\alpha_G}{R_G}\right).\right. \\ & \left. + \log\left(\frac{e^{-\frac{\gamma}{2}Var[\log C_i]} - \frac{\psi\alpha_K}{1+\psi}e^{-\gamma Var\left[f+\alpha_G b_\pi \pi_g \mid \mathcal{I}_i\right]}}{e^{\frac{1}{2}Var[\log G]-\frac{1}{2}Var[\log C]}}\right)\right] \end{aligned} \tag{A.59}$$

In what follows, we define

$$A = \frac{\alpha_G \mathbb{E}[C_i]}{R_G \mathbb{E}[G]} e^{-\frac{\gamma}{2}Var[\log C_i]}.$$

In the special case $\gamma = 0$ (i.e., households are risk-neutral), equation (A.59) implies $\alpha_G \mathbb{E}[C_i] = R_G \mathbb{E}[G]$ and $A = 1$. Otherwise, by definition from equation (A.58), we recognize

$$A \geq \frac{1+\psi(1-\alpha_K)}{1+\psi}. \tag{A.60}$$

Step 2: Optimal Choices of b_π and b_q

With respect to b_π and b_q, we can manipulate their first-order necessary conditions with equations (A.59), (B.4), and (B.7) to express them as

$$0 = 2\partial_{b_\pi}\mathbb{E}\left[\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi}\log C_i - \alpha_G \log G\right] + \left(\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi} - \gamma A\right)\partial_{b_\pi} Var\left[\log C_i\right], \quad \text{(A.61)}$$
$$-\alpha_G \partial_{b_\pi} Var\left[\log G\right] + 2\gamma B \partial_{b_\pi} Var\left[f + \alpha_G b_\pi \pi_g \middle| \mathcal{I}_i\right],$$

and

$$\left(\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi} - \gamma A\right)\partial_{b_q} Var\left[\log C_i\right] - \alpha_G \partial_{b_q} Var\left[\log G\right] = 0, \quad \text{(A.62)}$$

where

$$\mathbb{E}\left[\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi}\log C_i - \alpha_G \log G\right] = \bar{f} + \frac{\psi \alpha_K}{1+\psi}\left(\log \alpha_K + \frac{1-2\gamma}{2} Var\left[f + \alpha_G b_\pi \pi_g \middle| \mathcal{I}_i\right]\right)$$
$$- \frac{\alpha_K}{1+\psi}\frac{1}{2}\left(a_s^2 \tau_s^{-1} + a_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right), \quad \text{(A.63)}$$

and

$$B = A - \frac{1+\psi\left(1-\alpha_K\right)}{1+\psi} \geq 0, \quad \text{(A.64)}$$

because $A \geq \frac{1+\psi(1-\alpha_K)}{1+\psi}$.

Substituting with equations (A.63) and (A.64) into equation (A.61)

$$0 = \left(\frac{\psi \alpha_K}{1+\psi} + 2\gamma\left(A-1\right)\right)\partial_{b_\pi} Var\left[f + \alpha_G b_\pi \pi_g \middle| \mathcal{I}_i\right] - \frac{\alpha_K}{1+\psi}\partial_{b_\pi}\left(a_v^2 \tau_v^{-1}\right)$$
$$+ \left(\frac{1+\psi\left(1-\alpha_K\right)}{1+\psi} - \gamma A\right)\partial_{b_\pi} Var\left[\log C_i\right] - \alpha_G \partial_{b_\pi} Var\left[\log G\right]. \quad \text{(A.65)}$$

Step 3: Log-linear Approximating a Government-centric Equilibrium

Consider a log-linear approximation of the welfare objective around $\gamma = 0$ in which case $A = 1$. We focus on the first-order conditions for b_π and b_q. Let $X_s = 0$ be the left-hand side of equation (A.65) when $A = 1$. Because welfare will be twice continuously differentiable, notice equations (A.65) and (A.62) imply when $A = 1$

$$\partial_{b_q} X_s = 0, \quad \text{(A.66)}$$

and

$$\partial_\gamma X_s = -\partial_{b_\pi} Var\left[\log C\right]. \quad \text{(A.67)}$$

Let the left-hand side of equation (A.65) be X_q. Invoking the Implicit Function Theorem for b_π and b_q

$$\begin{bmatrix} \partial_\gamma b_\pi \\ \partial_\gamma b_q \end{bmatrix} = -\begin{bmatrix} \partial_{b_\pi} X_s & \partial_{b_q} X_s \\ \partial_{b_\pi} X_q & \partial_{b_q} X_q \end{bmatrix}^{-1} \begin{bmatrix} \partial_\gamma X_s \\ \partial_\gamma X_q \end{bmatrix}, \quad \text{(A.68)}$$

from which follows, because $\partial_{b_q} X_s = 0$, that

$$\partial_\gamma b_\pi = -\frac{\partial_\gamma X_s}{\partial_{b_\pi} X_s}, \tag{A.69}$$

where Δ is the determinant of the matrix in equation (A.68). If the government's problem has a unique local maximum, this matrix must be negative definite everywhere, and consequently its eigenvalues must all be negative. Because the eigenvalues of a triangular matrix are (proportional to) its diagonal entries, it follows that $\partial_{b_\pi} X_s < 0$. Consequently, this and equation (A.67) imply

$$\partial_\gamma b_\pi \propto -\partial_{b_\pi} Var\left[\log C_i\right].$$

We consequently focus on $Var\left[\log C_i\right]$ and make use of the following Lemma.

Lemma 7. *In a government-centric equilibrium, if $b_\pi < \hat{b}_\pi^*$, then $\partial_{b_\pi} Var\left[\log C_i\right] < 0$, while if $b_\pi > b_\pi^*$, then $\partial_{b_\pi} Var\left[\log C_i\right] > 0$.*

As a consequence of the lemma, if $b_\pi < \hat{b}_\pi^*$, then $\partial_\gamma b_\pi > 0$, while if $b_\pi > b_\pi^*$, then $\partial_\gamma b_\pi < 0$.

It is then immediate that if γ is sufficiently large, then the optimal choice of b_π is below b_π^* and above $\hat{b}_\pi^*$. As such, it follows that if γ is sufficiently large, then the government's optimal policy does not induce a government-centric equilibrium.

Proof of Lemma 7

In what follows, we focus on a government-centric equilibrium in which we can rewrite σ_z as

$$\sigma_z = \frac{1-\alpha_K}{1-e^{-\kappa}}\left(1 - \frac{e^{-\kappa}\psi^2\tau_\varphi^{-1}}{a_v^2\left(\tau_f^{-1}+\tau_\theta^{-1}\right)+\psi^2\tau_\varphi^{-1}}\right). \tag{A.70}$$

It is immediate σ_z is increasing in $|b_\pi|$ and $\sigma_z \in \left[1-\alpha_K, \frac{1-\alpha_K}{1-e^{-\kappa}}\right]$.

In addition, in a government-centric equilibrium, $\partial_{b_\pi} Var\left[\log C\right]$ is given by

$$\frac{\partial_{b_\pi} Var\left[\log C\right]}{2\alpha_G\left(\tau_f^{-1}+\tau_\theta^{-1}\right)} \tag{A.71}$$
$$= \left(\begin{array}{c}\left(1+\frac{a_G b_q+\psi\alpha_K}{1-\alpha_G b_q+\psi(1-\alpha_K)}\frac{a_v^2\left(\tau_f^{-1}+\tau_\theta^{-1}\right)+\left(\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}\sigma_z-\alpha_K\right)\frac{1-e^{-\kappa}}{1-\alpha_K}\psi^2\tau_\varphi^{-1}}{a_v^2\left(\tau_f^{-1}+\tau_\theta^{-1}\right)+\psi^2\tau_\varphi^{-1}}\right)^2 \\ +\frac{2e^{-\kappa}}{1-e^{-\kappa}}\left(\frac{\alpha_K\frac{1-e^{-\kappa}}{1-\alpha_K}\psi^2\tau_\varphi^{-1}}{\psi^2\tau_\varphi^{-1}+a_v^2\left(\tau_\theta^{-1}+\tau_f^{-1}\right)}\right)^2\end{array}\right)\frac{1-\alpha_K}{1-e^{-\kappa}}a_v$$
$$+\left(\frac{a_G b_q+\psi\alpha_K}{1-\alpha_G b_q+\psi\left(1-\alpha_K\right)}\right)^2\frac{2e^{\kappa}\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}-1-\left(\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}\frac{\psi^2\tau_\varphi^{-1}}{a_v^2\left(\tau_f^{-1}+\tau_\theta^{-1}\right)+\psi^2\tau_\varphi^{-1}}\right)^2}{a_v^2\left(\tau_f^{-1}+\tau_\theta^{-1}\right)+\psi^2\tau_\varphi^{-1}}\left(e^{-\kappa}\psi^2\tau_\varphi^{-1}\right)^2\frac{1-\alpha_K}{1-e^{-\kappa}}a_v.$$

Because $e^{\kappa} > \frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}$, we have

$$\begin{aligned}2e^{\kappa}\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}-1-\left(\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}\frac{\psi^2\tau_\varphi^{-1}}{a_v^2\left(\tau_f^{-1}+\tau_\theta^{-1}\right)+\psi^2\tau_\varphi^{-1}}\right)^2 &\geq 2e^{\kappa}\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}-1-e^{\kappa}\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K} \\ &\geq e^{\kappa}\frac{1-\alpha_K e^{-\kappa}}{1-\alpha_K}-1>0.\end{aligned}$$

It then follows that if $\alpha_G b_\pi \leq \alpha_G \hat{b}_\pi^* < -\frac{\tau_\theta}{\tau_f+\tau_\theta}$, and $a_v < 0$, then $\partial_{b_\pi} Var\left[\log C\right] < 0$, while if $\alpha_G b_\pi > \alpha_G b_\pi^* > \frac{\tau_\theta}{\tau_f+\tau_\theta}$ and $a_v > 0$, then $\partial_{b_\pi} Var\left[\log C\right] > 0$.

Proof of Proposition 6

We assume that households are sufficiently risk-averse such that, from Proposition 5, b_π is chosen small enough so as not to induce a government-centric equilibrium. Notice that the maximum posterior precision about the governor's ability $\bar{\tau}_\theta$ from Proposition 4 is achieved in a government-centric equilibrium as $b_\pi \to \infty$, and is given by

$$\bar{\tau}_\theta = \tau_f + \tau_\theta + \left(\frac{1-e^{-\kappa}}{1-\alpha_K e^{-\kappa}}\right)^2\frac{\tau_\varphi}{\psi^2}.$$

As a result, the maximum payoff to the governor from her evaluation is bounded from above by

$$\sup_{b_\pi}\frac{1}{2}\log\frac{\bar{\tau}_\theta}{\tau_\theta} = \frac{1}{2}\log\left(1+\frac{\tau_f}{\tau_\theta}+\frac{1}{\tau_\theta}\left(\frac{1-e^{-\kappa}}{1-\alpha_K e^{-\kappa}}\right)^2\frac{\tau_\varphi}{\psi^2}\right) < \infty.$$

Consequently, the maximum payoff the governor can gain from maximizing her evaluation from the central authority is bounded.

Define $\beta\left(\underline{W}\right) = \frac{\lambda(\underline{W})}{1+\lambda(\underline{W})}$, where $\lambda\left(\underline{W}\right)$ is the Lagrange multiplier on the public outcry constraint

(43) when the reservation welfare level is $\underline{W}$. We can rewrite the optimization problem of the governor (42) as

$$\hat{\mathcal{V}} = \sup_{\{b_0, b_s, b_q\}} (1 - \beta(\underline{W})) \frac{1}{2} \log\left(\frac{\hat{\tau}_\theta}{\tau_\theta}\right) + \beta(\underline{W}) \log W. \tag{A.72}$$

Because b_0 and b_q impact social welfare W but do not affect $\frac{1}{2}\log\left(\frac{\hat{\tau}_\theta}{\tau_\theta}\right)$, b_0 and b_q are chosen to maximize social welfare W, and are consequently given in Proposition 5. Further, because b_0 is chosen according to Proposition 5, social welfare W is always non-negative because we can substitute with b_0 to find

$$W = \frac{\alpha_K R_G}{(1+\psi)\,\alpha_G} \mathbb{E}[G] \geq 0.$$

Consequently, the log of social welfare $\log W$ is always well-defined.

We now consider two extreme cases. First, if $\underline{W} = \bar{W}$ (i.e., the maximum value of social welfare), then $\beta(\bar{W}) = 1$, and it is immediate that the governor must maximize social welfare. From Proposition 5, in this case b_π satisfies its optimal value from Proposition 5 and is chosen to be small enough so as to not induce a government-centric equilibrium.

Second, if $\underline{W}$ is sufficiently low (i.e., $\underline{W} = 0$), then $\beta(\underline{W}) \to 0$, and the governor instead maximizes her evaluation. From Proposition 4, in this case b_π is chosen to be arbitrarily large.

It then follows for $\bar{W}$ in an intermediate range that the governor must balance the two motives (social welfare and career advancement) when choosing b_π. Because the public outcry constraint (43) is tighter the higher is $\underline{W}$, $\lambda(\underline{W})$ and consequently $\beta(\underline{W})$ are both increasing in $\underline{W}$, causing the optimal choice of b_π to be decreasing in $\underline{W}$.

Appendix B: Additional Expressions

In this appendix, we provide explicit expressions for the first and second moments of log output, capital expenditure and government infrastructure.

Define

$$\sigma_z = \frac{(1+\alpha_G b_\pi)(a_s + a_v)\,\tau_f^{-1} + \alpha_G b_\pi a_v \tau_\theta^{-1} + (1-\alpha_K)\,\psi^2 \tau_\varphi^{-1}}{(a_s + a_v)^2\,\tau_f^{-1} + a_v^2 \tau_\theta^{-1} + \psi^2 \tau_\varphi^{-1}},$$

and

$$\epsilon_q = a_s z_q - (a_s + a_v)\,\bar{f},$$

to be the innovation to the log capital price $\log q$ relative to its mean. Then,

$$\hat{f} + \alpha_G b_\pi \hat{\pi}_g - (1-\alpha_K)\,a_s \hat{f} - (1-\alpha_K)\,a_v \hat{\pi}_g + (1-\alpha_K)\,a_s z_q = (1+\alpha_G b_\pi)\,\bar{f} + \sigma_z \epsilon_q.$$

Then, we can rewrite the price of capital from equation (A.13) as

$$\log q = \frac{1}{1 - a_G b_q + \psi\left(1-\alpha_K\right)} \left[\left(1+\alpha_G b_\pi\right)\bar{f} + \sigma_z \epsilon_q + \log \alpha_K + \alpha_G b_0 \right. \tag{B.1}$$
$$\left. + \frac{1-2\gamma}{2}\left(1-\alpha_K\right)\left(a_s \tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right) + \frac{1-\alpha_K}{2}\left(a_s^2 \tau_s^{-1} + a_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right)\right],$$

firm capital from equation (28) as

$$\log K_i = \frac{1}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} \left\{ \left(\alpha_G b_q - 1\right) \frac{1}{2}\left(a_s^2 \tau_s^{-1} + a_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right) \right.$$
$$\left. +\psi\left[\left(\left(1+\alpha_G b_\pi\right)\bar{f} + \sigma_z \epsilon_q\right) + \log \alpha_K + \alpha_G b_0 + \frac{1-2\gamma}{2}\left(1-\alpha_K\right)\left(a_s \tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right)\right]\right\}$$
$$-\psi\varphi + a_s \varepsilon_{si} + a_v \varepsilon_{vi}, \tag{B.2}$$

and government infrastructure as

$$\log G = \frac{1+\psi\left(1-\alpha_K\right)}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} b_0 + b_\pi \pi_g + \frac{b_q\left(\left(1+\alpha_G b_\pi\right)\bar{f} + \sigma_z \epsilon_q\right)}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)}.$$
$$+ b_q \frac{\log \alpha_K + \frac{1-2\gamma}{2}\left(1-\alpha_K\right)\left(a_s \tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right) + \frac{1-\alpha_K}{2}\left(a_s^2 \tau_s^{-1} + a_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right)}{1-\alpha_G b_q + \left(1-\alpha_K\right)} \tag{B.3}$$

These expressions imply

$$\mathbb{E}\left[\log G\right] = \frac{1+\psi\left(1-\alpha_K\right)}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} b_0 + b_\pi \bar{f} + \frac{b_q\left(1+\alpha_G b_\pi\right)}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} \bar{f}$$
$$+ b_q \frac{\log \alpha_K + \frac{1-2\gamma}{2}\left(1-\alpha_K\right)\left(a_s \tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right) + \frac{1-\alpha_K}{2}\left(a_s^2 \tau_s^{-1} + a_v^2 \tau_v^{-1} - \psi^2 \tau_{\varphi\epsilon}^{-1}\right)}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)}, \tag{B.4}$$

and

$$Var\left[\log G\right] = \left(b_\pi + \frac{b_q}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} \sigma_z\left(a_s + a_v\right)\right)^2 \tau_f^{-1} + \left(b_\pi + \frac{b_q}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} \sigma_z a_v\right)^2 \tau_\theta^{-1}$$
$$+ \left(\frac{b_q}{1-\alpha_G b_q + \psi\left(1-\alpha_K\right)} \sigma_z\right)^2 \psi^2 \tau_\varphi^{-1}. \tag{B.5}$$

Substituting these expressions into household consumption equation (5), which in aggregate is equal to output Y, we also have

$$\log C_i = (1+\alpha_K a_s)\left(f-\bar{f}\right) + (\alpha_G b_\pi + \alpha_K a_v)\left(\pi_g - \bar{f}\right) + \alpha_K\left(\frac{\sigma_z}{1-\alpha_K} - 1\right)\epsilon_q + \alpha_K a_s \varepsilon_{si} + \alpha_K a_v \varepsilon_{vi}$$
$$+ \frac{\alpha_G b_q - \alpha_K}{1-\alpha_K}\log q + \frac{1+\alpha_G b_\pi}{1-\alpha_K}\bar{f} + \frac{\alpha_K \log \alpha_K + \alpha_G b_0}{1-\alpha_K} + \frac{1-2\gamma}{2}\alpha_K\left(a_s \tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right), \tag{B.6}$$

from which follows

$$\mathbb{E}\left[\log C_i\right] = \frac{(1+\psi)\,\alpha_G b_0 + (1+\psi)\,(1+\alpha_G b_\pi)\,\bar{f} + \left(\alpha_G b_q - \alpha_K\right)\frac{1}{2}\left(a_s^2\tau_s^{-1} + a_v^2\tau_v^{-1} - \psi^2\tau_{\varphi\epsilon}^{-1}\right)}{1-\alpha_G b_q + \psi\,(1-\alpha_K)}$$
$$+ \frac{\alpha_K\psi + \alpha_G b_q}{1-\alpha_G b_q + \psi\,(1-\alpha_K)}\left(\log \alpha_K + \frac{1-2\gamma}{2}\,(1-\alpha_K)\left(a_s\tau_s^{-1} + \alpha_G b_\pi a_v \tau_v^{-1}\right)\right), \tag{B.7}$$

and

$$Var\left[\log C_i\right] = \left(1 + \alpha_G b_\pi + \frac{a_G b_q + \psi\alpha_K}{1-\alpha_G b_q + \psi\,(1-\alpha_K)}\sigma_z\,(a_s + a_v)\right)^2 \tau_f^{-1}$$
$$+ \left(\alpha_G b_\pi + \frac{a_G b_q + \psi\alpha_K}{1-\alpha_G b_q + \psi\,(1-\alpha_K)}\sigma_z a_v\right)^2 \tau_\theta^{-1}$$
$$+ \left(\frac{a_G b_q + \psi\alpha_K}{1-\alpha_G b_q + \psi\,(1-\alpha_K)}\sigma_z - \alpha_K\right)^2 \psi^2\tau_\varphi^{-1} + \alpha_K^2\left(a_s^2\tau_s^{-1} + a_v^2\tau_v^{-1}\right). \tag{B.8}$$

Notice the first-order condition for optimal capital is

$$qK_i = \alpha_K \mathbb{E}\left[C_i e^{-\gamma Var\left[f+\alpha_G b_\pi \pi_g \mid \mathcal{I}_i\right]}\right],$$

from which it is immediate by the Law of Iterated Expectations and the linearity of the integral operator

$$\mathbb{E}\left[qK\right] = \alpha_K \mathbb{E}\left[\int_0^1 C_i e^{-\gamma Var\left[f+\alpha_G b_\pi \pi_g \mid \mathcal{I}_i\right]} di\right] = \alpha_K \mathbb{E}\left[C_i\right] e^{-\gamma Var\left[f+\alpha_G b_\pi \pi_g \mid \mathcal{I}_i\right]}. \tag{B.9}$$