

# INFORMATION ASYMMETRY, FISCAL COMPETITION AND OPTIMAL INTERREGIONAL TRANSFER

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This paper explores the optimal intergovernmental transfer policy when there exists information asymmetry between one central government and multiple local governments. The central government allocates transfers based on observable local output, which is influenced by local private information, output shocks, and endogenous fiscal expenditures. Local governments also leverage their private information to engage in interregional competition. Theoretically, the optimal transfer policy functions simultaneously as interregional insurance, information rent, and Pigouvian taxation correcting fiscal competition. The information rent is further decomposed into behavioral elasticities and multipliers capturing how the deviation from the IC constraint influences social welfare. Using 2019 Chinese county-level fiscal data, we find that the optimal transfer payment exhibits an inverted U-shape with per capita GDP, emphasizing its roles in providing interregional insurance and incentivizing local expenditure efforts. Specifically, we quantify the effects of information asymmetry, local governors' competitive motivations, and economic fluctuations on the optimal transfer policy.

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## 1. INTRODUCTION

Information asymmetry between central and sub-national governments has long been a cornerstone of studies on fiscal decentralization. The seminal works of Tiebout (1956) and Oates (1972) favored a decentralized fiscal systems because local governments are presumed to possess superior knowledge than the central government about local characteristics, such as the preferences of regional residents on public goods provision. The information limitation induces the central government to provide a uniform level of public goods across regions. Recent studies argue that local private information is partially observable, since central governments can infer it through observable indicators (Gaubert et al., 2021, Berriel et al., 2024, Song and Xiong, 2023), which rationalizes the implementation of place-based fiscal policies by the central government. However, as these studies adopt entirely different frameworks, they fail to provide a unified theory to answer how the partial observability determines the optimal design of place-based policies<sup>1</sup>.

This article develops a unified framework to investigate the role of observable indicators – determined by both localities’ private information and various important factors – in affecting optimal design of place-based central fiscal policy. We discuss a partially decentralized fiscal system with interregional competition, where infinite local governments are heterogeneous in governance abilities unobservable to the central government. Local governments allocate local fiscal revenues to both local productive public goods and non-productive public goods<sup>2</sup>. The central government designs place-based intergovernmental transfer policies relying on the observable local output. We set the output is jointly influenced by local governance abilities, idiosyncratic output shocks, and productive public investments, all of which are factors separately discussed by previous literature. Besides,

<sup>1</sup>Separately, previous literature investigates factors affecting the observability including exogenous factors, such as disturbance terms such as aggregate shocks discussed in the literature on monetary unions (Farhi and Werning, 2017, Evers, 2012, Dmitriev and Hoddenbagh, 2019) or noise in signals (Berriel et al., 2024), and the endogenous fiscal behavior of local governments such as public expenditures (Lockwood, 1999, Song and Xiong, 2023, Boadway et al., 1999).

<sup>2</sup>This is a partially decentralized fiscal system because in this economy, local governments make their own spending decisions based on local tax revenues income, while the central government also reallocates fiscal resources funded by the central tax revenues.

due to unobservable local governance abilities, local governors have incentives to “window-dress” their fiscal performance by achieving higher GDP through public investment. Therefore, the interregional tournament arises, as illustrated in [Song and Xiong \(2023\)](#)<sup>3</sup>.

In our model, local output is a misleading indicator of local heterogeneities for transfer policymakers due to disturbances and endogenous incentives for local governments to manipulate output levels. Moreover, local governments’ incentives are multidimensional: (1) mitigating residents’ risk exposure to local economic shocks through ex-ante public investment as a form of imperfect self-insurance; (2) participating in interregional expenditure competition, which generates externality problem across regions ([Bordignon et al., 2003](#), [Revelli, 2005](#), [Foucault et al., 2008](#)); and (3) concealing both their private information (governance abilities) and their efforts (public investments), thereby generating adverse selection and moral hazard challenges. To address these issues, we analyze the optimal intergovernmental transfer in a Mirrleesian principal-agent framework, incorporating moral hazard, adverse selection, and the externalities induced by interregional competition.

The theoretical analysis reveals that the optimal marginal transfer is determined by the information rent resulting from moral hazard and adverse selection, risk attitude and self-insurance motivation of local governments, the central government’s targets, and other parameters related to the fiscal decentralization system. We further decompose the information rent using sufficient statistics into the behavioral elasticity term and welfare multiplier terms related to risks, trade-off of local public goods and externalities. The former reveals how factors including private information, output shocks, and interregional competition affect the optimal transfer by distorting local governments’ fiscal choices, leading them to deviate from truth-telling behavior. The latter ones reflect the direct welfare effects of increasing fiscal expending induced by these factors.

Next we numerically simulate optimal transfer based on county-level data from China. The optimal transfer follows an inverse U-shaped pattern. The ascending section of the transfer curve is designed to provide less developed regions with an incentive for public investment expansion, while the descending part highlights the transfers’ three roles in

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<sup>3</sup>As local governments have autonomy in making fiscal decisions, literature emphasizes the existence of fiscal competition among regions under such decentralized systems ([Bellofatto and Besfamille, 2018](#), [Janeba and Wilson, 2011](#)). Here we focus on expenditure competition among regions because local expenditures play a critical and direct role in determining observable local output.

risk sharing, promoting interregional equity, and as a Pigouvian tax to correct externalities. Compared to the current transfer policies in China, our optimal design advocates for increasing subsidies to regions with low to medium GDP per capita by reallocating fiscal funds from regions with higher GDP per capita. This approach effectively reduces disparities in per capita public services and mitigates local exposure to macroeconomic risks.

Based on the theoretical and numerical analysis, this article elucidates the impacts of following three factors in shaping the optimal place-based fiscal policy. The first is the local private information. As shown in our numerical simulations, the presence of information asymmetry can reverse the sign of optimal marginal transfers from negative to positive, in order to prevent low-output regions from reducing their expenditure efforts. This suggests that a completely redistributive transfer schedule, which decreases with per capita GDP—especially in low-output regions—is inefficient, as it can hardly settle the information friction problem in fiscal decentralization.

Second, local output shocks impact the dual roles of transfers: providing interregional insurance and addressing moral hazard through information rents. A greater uncertainty weakens local governments' ability to manage the risks via public investment, which necessitates a more redistributive marginal transfer curve, highlighting the role of transfers as interregional insurance. It also incurs stronger incentives of local governments to increase investment spending, thereby enhancing their self-insurance capacities. Hence the optimal transfer scheme should also prevent local governments' aggressive investment spending behavior. Numerically, we see an increase in transfers to low-output regions but a decline in transfers to medium- and high-output regions when the volatility of shocks increases. Additionally, from the decomposition of the information rent, we further reveal that output shocks not only incentivize local governments to deviate from incentive-compatible fiscal behavior, as indicated by behavioral elasticities, but also affect the extent to which this behavioral change impacts social welfare.

At last, we discuss the externality effects of fiscal competition. Our theoretical analysis demonstrates that interregional tournaments impact the optimal transfer design by influencing the information rent, necessitating transfers to function as a form of Pigouvian taxation. We calibrate the distribution parameters of governance abilities and the weights of local governors' career concerns. Both parameter distributions are being estimated for the first time using county-level data in China. The optimal marginal transfer decreases with lev-

els of career concern because the central government prioritizes interregional redistribution over correcting fiscal behavioral distortions in this context.

Our first contribution is applying the Mirrleesian principal-agent model to the transfer design problem, so that we can address the efficiency loss induced by information asymmetry between central and local governments. Unlike a few studies that employed this framework in topics related to fiscal decentralization (Lockwood, 1999, Persson and Tabellini, 1996, Bordignon et al., 2001), we present a more analytical optimal transfer rule with a clearer decomposition of the roles of various factors in determining the transfer and the information rent.

Second, beyond the literature emphasizing the risk-sharing challenges while neglecting the information structures (Farhi and Werning, 2017, Evers, 2012), we simultaneously discuss the three key elements shaping optimal transfers which are related to risks: local residents' risk-aversion, aligning with the inverse elasticity rule outlined in Chetty and Finkelstein (2012), the self-insurance capabilities of local governments via public spending and the information rent. We further decomposes the information rent into welfare multiplier terms which capture risk-insurance and fiscal pressure considerations, and behavioral elasticities, which represent incentive effects. To our knowledge, this is the first study to decompose information rent in this manner, separating the incentive mechanisms of risks.

The final contribution is that we incorporate interregional tournament into a principal-agent model and numerically verify the importance of considering externalities when designing place-based fiscal policies. While certain studies within the field of fiscal federalism have explored electoral mechanisms (Besley and Case, 1995, Besley and Coate, 2003) and yardstick competition (Bordignon et al., 2003, Revelli, 2005, Foucault et al., 2008), the impact of political promotion or electoral processes on the formulation of optimal transfer designs has not been adequately addressed<sup>4</sup>. We demonstrate the role of transfers as a form of Pigouvian taxation to correct externalities by decomposing the information rent term. Additionally, we calibrate the distribution of the parameter connected to interregional competition and numerically exhibit the efficiency loss of such competition.

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<sup>4</sup>Although Song and Xiong (2023) also introduces the career concern model to study Chinese local governmental competition, he did not to discuss the optimal interregional fiscal policies to mitigate this problem, which is the central to our paper.

The remainder of the paper is organized as follows: In section 2 we introduce the setup of the principal-agent model. Section 3 gives the theoretical results of optimal transfer policy and its economic insights. Section 4 conducts the numerical simulation of optimal transfer design. Section 5 concludes.

*Related Literature.* This paper is closely connected to three branches of literature. First, our work is related to the studies of optimal place-based fiscal policies. We outline two main branches of literature connected to the place-based policies: fiscal unions (Farhi and Werning, 2017) and fiscal federalism (Oates, 1972, Berriel et al., 2024). The former one emphasizes the influence of uncertainties on fiscal policy design and the latter one focuses on information asymmetry<sup>5</sup>. Besides, Gaubert et al. (2021) develops a two-region model featuring heterogeneous workers sorting among regions, which focuses on worker behavior under place-blind income taxation and place-based lump-sum transfer policies, leading to a simplification of local public spending. To conclude, none of these studies develops a unified framework to incorporate both information asymmetry and uncertainties. Our work studies the optimal place-based policies in a general equilibrium model, encompassing information asymmetry, regional macroeconomic shocks, and local governments' multiple dimensions of incentives. Moreover, we numerically solve the optimal place-based policies, offering practical guidance for policy reform.

Second, this paper enriches the discussion of interregional fiscal competition. A number of studies explore the tax competition for mobile firms or residents (Janeba and Wilson, 2011, Janeba and Todtenhaupt, 2018, Bellofatto and Besfamille, 2018, 2021), while a few studies emphasize the importance of yardstick competition, where electorates with incomplete information evaluate municipal governors based on information externalities (Bordignon et al., 2003, Ferraresi, 2019). Song and Xiong (2023) establishes a career concern model to characterize the governors' yardstick tournament in China. However, all of these studies fail to discuss how to design fiscal place-based policies under the context of expenditure competition. Our work sheds light on the roles of interregional yardstick competition via the local expenditure choice in a decentralized fiscal system. This framework can simultaneously discuss the information asymmetry and interregional competition issues.

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<sup>5</sup>Early studies like Persson and Tabellini (1996), Lockwood (1999), Boadway et al. (1999), Gaubert et al. (2021) shed light on the asymmetric information problem when designing transfer policies, they fail to give numerical analysis, or simplify the setup of local governments' behavior.

The last branch of related literature is the principal-agent model addressing adverse selection and moral hazard. Early explorations on the optimal contract problem under both adverse selection and moral hazard can be found in [Laffont and Tirole \(1986\)](#) and [Gottlieb and Moreira \(2014\)](#). [Castro-Pires et al. \(2024\)](#) raise a disentangling method to solve the optimal contract under a more general setting. While their contract is based on an agent's performance and ability, our work assumes central transfer only depends on local output, which is consistent with the practice in reality. A setup similar to our work also appears in the context of optimal income taxation, such as [Boadway and Sato \(2015\)](#), [Kapička and Neira \(2019\)](#). This paper differs from previous works by developing a comprehensive framework that incorporates interregional competition with canonical local heterogeneities and disturbances. Additionally, it is noteworthy that we disentangle the information rent term using sufficient statistics, allowing us to highlight the influence of various factors shaping the optimal policy – an approach not undertaken by prior literature ([Low and Maldoom, 2004](#), [Chetty and Finkelstein, 2012](#), [Boadway and Sato, 2015](#)).

## 2. MODEL ENVIRONMENT

We build a model featuring information asymmetry between two tiers of government—the central government and regional governments, as discussed in [Song and Xiong \(2023\)](#) – to study the optimal design of interregional transfer policies. Given the tax-sharing rate between the central and local governments, along with the transfer rule, local governments first decide on the amount of productive fiscal expenditures. Subsequently, local governments encounter idiosyncratic output shocks. Once the shocks are realized, transfers are distributed according to the predetermined rule, while non-productive fiscal expenditures are determined ex-post. Besides, there exist interregional tournaments, which will be discussed in Section 2.3.

The baseline model assumes the existence of one central government and two types of regional governments to illustrate the optimal transfer rules. The two types of regional governments are denoted by  $i \in \{H, L\}$ . Each region contains a representative firm hiring labor and capital, and a representative labor-supplier. For simplicity, assume that both firms and labor-suppliers are immobile, while there are a mass of mobile capital owners.

2.1. *Firms*

The output of the representative firm in the region  $i$  is determined by the local productivity  $A_i$ , capital  $K_i$ , labor  $L_i$  and local government's investment (productive) spending  $G_i$ . The production function is

$$Y_i = A_i K_i^\alpha L_i^{1-\alpha} G_i^g, \quad (1)$$

where  $\alpha \in (0, 1)$  is the output share of capital.  $g \in (0, 1)$  is the elasticity of output to local investment spending. When  $g = 1 - \alpha$ , a local government's investment spending is "labor-augmenting", e.g., infrastructure like subways reducing commuting costs and thus improving the efficiency of supplying labor. [Song and Xiong \(2023\)](#) and [Barro and Sala-i Martin \(2004\)](#) used this form when  $g = 1 - \alpha$  because given a fixed labor supply in each region, the production is constant return to scale with  $K_i$  and  $G_i$ . In this way, they could discuss the balance growth path of the economy. The productivity  $A_i$  consists of both the regional governor's ability  $a_i$  and an idiosyncratic productivity shock  $\varepsilon_i$ . Both  $a_i$  and  $\varepsilon_i$  are unobservable to the central government. We adopt the following form of  $A_i$ :

$$\log A_i = \Lambda(a_i) + \varepsilon_i. \quad (2)$$

Function  $\Lambda(a_i)$  is increasing in  $a_i$ . Output shock  $\varepsilon_i \in \Omega_F$  captures the economic risk in regional development, where  $\Omega_F$  is a Borel set and  $\mathcal{F}$  is the corresponding Borel  $\sigma$ -algebra. The shocks may reflect the fluctuation of the macro economy, the occurrence of regional-specific natural disasters, etc. Use  $F^E(\varepsilon)$  to denote the cumulative distribution function of output shock building on  $\mathcal{F}$ . We assume  $F^E(\varepsilon)$  is differentiable and its PDF function is denoted as  $f^E(\varepsilon)$ . For simplicity, assume that the distributions of  $a$  and  $\varepsilon$  are independent to each other.

Both the regional governor's ability  $a$  and the realization of output shock  $\varepsilon_i$  are private information to local governor  $i$ , while the exogenous distributions of  $a$  and  $\varepsilon$  are common knowledge to all governments. There are two typical kinds of regional governments with ability  $a_H$  and  $a_L$ , with  $a_H > a_L > 0$ . The central government knows the distribution probability  $\pi_H$  and  $\pi_L = 1 - \pi_H$  of these two types of ability, but cannot observe the ability level of any governor.



A representative firm hires capital  $K_i$  and labor  $L_i$  to maximize the following profit:

$$\max_{\{K_i, L_i\}} A_i K_i^\alpha L_i^{1-\alpha} G_i^g - \Phi_i L_i - R K_i. \quad (3)$$

Assume all local producers can rent capital from the global capital market at an exogenously given gross return rate  $R$ . Since we assume labor is immobile, the wage rate between the two regions can differ. We use  $\Phi_i$  to denote the wage rate in region  $i$ . To abstract the effect of labor supply elasticity from the model, following [Song and Xiong \(2023\)](#), without loss of generality, we normalize the labor supply in all regions to one.

By solving the optimization problem of representative firms, we can express the production function as:

$$Y_i = \left(\frac{\alpha}{R}\right)^{\alpha/(1-\alpha)} A_i^{1/(1-\alpha)} G_i^{g/(1-\alpha)} \quad (4)$$

Equation (4) shows the size of investment spending  $G_i$  positively correlates with local output. This is consistent with the facts that governmental spending is essential to economic growth and poverty reduction, especially in developing countries. For instance, [Binswanger et al. \(1993\)](#) find infrastructure spending promoted long-run output in India. [Liu and Hu \(2010\)](#) further point out transportation infrastructure and information infrastructure have significant spillover effects on China's economic growth.

## 2.2. Households

Both labor suppliers and capital owners investing in the same region are local consumers, collectively referred to as “local residents” in our paper. As capital owners are mobile across regions, we make the innocuous assumption that each capital suppliers holds one unit of capital, and after she receives the capital gross return  $R$ , she will consume at the location.

Hence the total private goods consumption of consumers in the region  $i$  is the sum of both after-tax labor income and after-tax capital income. Without loss of generality, assume the labor supply  $L_i$  is inelastic.

Local consumers enjoy the consumption of both private and public goods. Denote by  $C_i$  the private good consumption of the consumers in the region  $i$ .  $S_i$  represents non-productive but utility-enhancing fiscal expenditure provided in the region  $i$ , as classified by [Barro](#)

(1990). The private goods consumption satisfies:

$$C_i = (1 - \tau^l) \Phi_i L_i + (1 - \tau^k) R K_i, \quad (5)$$

in which  $\tau^l$  and  $\tau^k$  correspond to the linear labor income tax rate and linear capital income tax rate. It is easy to show that under the Cobb-Douglas production function as in (4),  $C_i$  is a linear proportion to regional output  $Y_i$ .

$$C_i = \left[ (1 - \tau^l) (1 - \alpha) + (1 - \tau^k) \alpha \right] Y_i \quad (6)$$

Equation (6) indicates a local government has a trade-off over  $G_i$  and  $S_i$ . Regional investment spending  $G_i$  promotes output and indirectly enhances the consumer's welfare, while regional public goods expenditure  $S_i$  directly improves the consumer's welfare. Due to constraints of local fiscal budgets, local governments must balance the provision of these two distinct public goods.

### 2.3. The Local Government: Budget and Career Concern

In this part, we first present the timeline of local and central governments' decision. Next, based on the timeline, we illustrate interregional fiscal competition (or tournaments) based on the career concern model proposed by [Holmstrom \(1982\)](#). Finally, we introduce the optimization problems of local governments.

Figure 1 illustrates the timeline of interregional tournaments in our model. In this one-period model, the local government obtains ability  $a_i$  and chooses the amount of productive investment spending  $G_i$  at the beginning of the period. Then an output shock  $\varepsilon_i$  is realized and  $Y_i$  is determined at the end of the period. It is notable that the local government chooses  $G_i$  before the realization of output shocks. This is consistent with the reality because  $G_i$  primarily involves projects with long investment cycles, such as infrastructure construction, which requires time to yield outcomes.

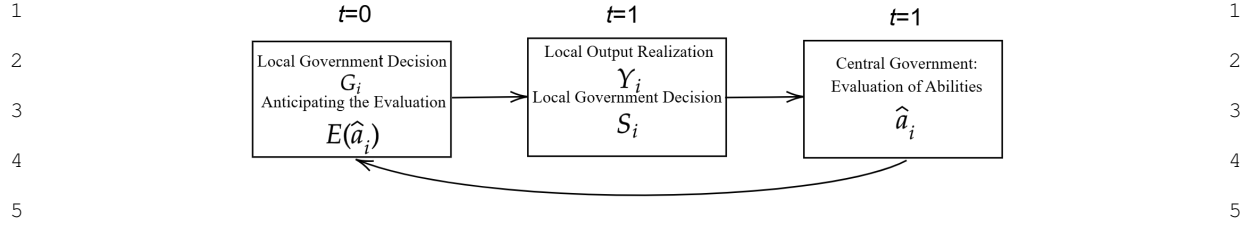


FIGURE 1.—The timeline of a local government's decisions and central government's evaluation

As soon as the shock is realized, the central government observes the ex-post output of local governments  $Y_i$ . The local government collects tax revenues and receives central transfer  $T_i$ . Then the amount of public service  $S_i$  is determined to ensure a balanced fiscal budget. To capture fiscal decentralization in the model, we denote by  $\xi^l$  and  $\xi^k$  a local government's retention rate of labor and capital income tax revenue. The fiscal transfer  $T_i$  to region  $i$  depends on the region's output  $Y_i$ . Hence the budget constraint is

$$G_i + S_i = T(Y_i) + \xi^l \tau^l \Phi_i L_i + \xi^k \tau^k R K_i. \quad (7)$$

Based on (4), the above budget constraint can be transformed into:

$$S_i = T(Y_i) + \Omega Y_i - G_i \quad (8)$$

in which  $\Omega \equiv \xi^l \tau^l (1 - \alpha) + \xi^k \tau^k \alpha$  denotes the share of output retained in local governments. From (8), we can define function  $S(y, a_i)$ , because the right-hand side of (8) is contingent on both the ex-post output  $Y$  and the pre-determined variable  $G(a)$ .

Since the central government cannot observe  $a_i$ , it forms the expectation of local government abilities, denoted as  $\hat{a}_i$ , based on the output level. Define  $h(a | Y_i)$  as the conditional density function of a local governor's ability when output  $Y_i$  is observed, and  $\mathbb{G} = \{\mathcal{G} : a \rightarrow G(a)\}$  as the collection of functions, where  $\mathcal{G} \in \mathbb{G}$ . The central government cannot observe abilities or public investment levels  $G$ . This assumption can be explained by the fact that, although the central government can monitor total public expenditures within specific regions, the practical isolation of productive investments from diverse expenditure items presents significant challenges. This difficulty arises because expenditure programs aimed at promoting local economies frequently intersect with various budget categories.

Local governments may also manipulate or window-dress their fiscal reports, further compounding the challenges of distinguishing productive spending. Nonetheless, policymakers can infer the relationship between abilities and public spending,  $\mathcal{G}$ , by solving the optimization problem faced by local governments. We can express  $\hat{a}_i$  as:

$$\hat{a}_i = \hat{a}(Y_i, \mathcal{G}) = E_a[a | Y_i, \mathcal{G}] = a_H h(a_H | Y_i) + a_L h(a_L | Y_i). \quad (9)$$

$\hat{a}_i$  represents the central government's evaluation of local governance abilities. As discussed in [Song and Xiong \(2023\)](#), the evaluation of local governors' abilities formed by the central government determines the probability of their promotion in the future. Thus the local government, motivated by their political promotion prospects, would care about the expectation of  $\hat{a}_i$  before they make expending choice of  $G$ . We denote such expectation by  $E(\hat{a}_i)$ . Denoting by  $F(y | a, G(a))$  the conditional distribution function of output given investment spending  $G(a)$  and ability type  $a$ , we have

$$E(\hat{a}_i) = \int_{\underline{y}(a_i)}^{\bar{y}(a_i)} \hat{a}_i F_y(y | a, G(a)) dy. \quad (10)$$

In equation (10),  $\bar{y}$  and  $\underline{y}$  correspond to the upper and lower bounds of output. Following [Boadway and Sato \(2015\)](#), we assume that both  $\bar{y}$  and  $\underline{y}$  are functions of  $a_i$ , and  $\bar{y}$  increases with  $a_i$ .

$E(\hat{a}_i)$  enters local governors' utility functions to capture their concerns of promotion. Additionally, a local government is concerned with the local consumption of both private and public goods. We use function  $u(C_i, S_i)$  to capture such welfare concern. Assume that  $u_c > 0$ ,  $u_s > 0$ ,  $u_{ss} \leq 0$ . Therefore, the ex-ante utility of a local government is

$$U_i = E[u(C_i, S_i)] + \chi_i E(\hat{a}_i), \quad (11)$$

where  $\chi_i$  is the weight assigned to the governor  $i$ 's career concerns.

A comprehensive understanding of the competitive motivations of local governors can be achieved by integrating equations (9), (11), and (10). Since local governors are concerned with the central government's assessment, the only way to improve the perceived ability

level,  $\hat{a}_i$ , is by increasing productive public spending. It is notable that  $\hat{a}_i$  is determined by the relative position of the output of region  $i$  in comparison to the outputs of other regions within the nation, where the expenditure competition arises. There are externalities associated with expenditure competition: an increase in public spending in one region not only enhances the likelihood of promotion in that region but also undermines the utility of other regions by reducing their relative standing in the competition. Given the strategies of the other regions, each region may have the incentive to increase its own productive public spending<sup>6</sup>.

A type- $i$  local government's optimization problem is:

$$\begin{aligned} \max_{\{G_i\}} \quad & E[u(C_i, S_i)] + \chi_i E(\hat{a}_i) \\ \text{s.t.} \quad & (4), (6), (8), (9) \text{ hold.} \end{aligned} \tag{12}$$

The first-order optimization condition of  $G_i$  is:

$$\int_y -u_s(C, S) F_y(y | a, G) dy + \int_y u(C, S) F_{yG}(y | a, G) dy + \chi \int_y \hat{a} F_{yG}(y | a, G) dy = 0. \tag{13}$$

Here we omit script  $i$  for simplicity.  $F_{yG}(y | a, G)$  is the partial derivative of  $F_y(y | a, G)$  on  $G$ . Equation (13) reveals multidimensional incentives of local governments' fiscal choice. If local government  $i$  spends more on productive public goods, this action will, on one hand, tighten the budget constraint and directly influence the ex-post provision of non-productive public goods, thereby influencing the marginal cost of increasing  $G_i$ . On the other hand, the marginal increase in  $G_i$  will alter the distribution of future output and consumption. This generates marginal benefits in two directions. First, it could help hedge against economic uncertainties by thickening the right tail of the distribution of  $Y_i$ . Second, a larger investment in production would improve the probability of being promoted in the tournament. The economic uncertainties and tournament mechanism create additional incentives for local governors in the trade-off between various types of public goods spending.

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<sup>6</sup>However, it cannot be concluded that every region will increase spending compared to a scenario without competition. Local governments must consider the trade-off between providing non-productive services and the productive goods. The fiscal transfer rule will also influence the choice.

## 2.4. Central Government

Equation (13) characterizes the expenditure choice of local governments given the transfer schedule announced by the central government at the beginning of the period<sup>7</sup>. Next, we explore the design of optimal transfer rule using the primal approach, where the central government optimizes social welfare by directly allocating resources. The optimal transfer rule should accommodate three main objectives: (1) to promote interregional equity as a form of fiscal insurance; (2) to mitigate the efficiency losses caused by fiscal competition; and (3) to address both moral hazard and adverse selection through mechanism design.

Firstly, a benevolent central government designs a fiscal transfer system, funded by tax revenues shared by localities, to maximize the following social welfare  $W$ :

$$W = \sum_i \beta_i \left( \int_y u(C_i, S_i) F_y(y | a_i, G_i) dy \right) \pi_i \quad (14)$$

where  $\beta_i$  is the social welfare weight associated with local government  $i$ . Besides, since the welfare function (14) is concave with respect to non-productive public services  $\{S_i\}$ , the central government is also risk-averse and seeks to provide interregional insurance for local governments via the design of transfers.

Besides, the central government does not encourage the tournaments and therefore the concern about tournaments does not enter into the social welfare function. This setup, analogous to optimal taxation models where agents' utility follows a hyperbolic function, positions the transfer rule as a form of Pigouvian tax aimed at correcting distortions in local fiscal behavior.

The last consideration of the central government is about information asymmetry. To deal with adverse selection and moral hazard issues, the central government offers a menu of contracts that consists of a pair of functions  $\{T(y), G(a)\}$ <sup>8</sup>. Denote by  $V(a_i, G(a_i))$  the utility of a local governor honestly reporting his ability  $a_i$  and spending  $G(a_i)$ , which can

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<sup>7</sup>We assume that the central government has the full commitment capabilities in order to focus on the mechanisms induced by interregional competition and information asymmetry.

<sup>8</sup>It is notable that the transfer schedule is solely based on output  $Y$ . We choose this setup because it aligns with practices observed in many countries.

be expressed as

$$\begin{aligned}
 V(a_i, G(a_i)) = & \int_y u(C(y), T(y) + \Omega y - G(a_i)) F_y(y | a, G(a_i)) dy \\
 & + \chi_i \int_y \hat{a}_i F_y(y | a, G(a_i)) dy,
 \end{aligned} \tag{15}$$

where we substitute  $S$  using (8). The central government should ensure incentive compatibility (IC) condition holding as:

$$V(a_i, G(a_i)) \geq V(a_i, G(a_j)), \quad \forall i, j \in \{H, L\} \tag{16}$$

When there are only two types of governors in the benchmark model, the equivalent IC condition equals exactly equation (13)<sup>9</sup>. The local economic uncertainties play important roles in such a principal-agent model. If we remove  $\varepsilon$  from the model, the IC condition degenerates to a scenario where there is no moral hazard problem. Consequently, the transfer rule only needs to address adverse selection. Besides, the provision of interregional fiscal insurance against risks is abstracted from the transfer design. Moreover, if there is no uncertainty of local output, the optimal contract condition should ensure that  $Y_i$  is monotonically related to  $a_i$ . In this case, the central government can accurately infer a region's true relative standing, completely eliminating the room for interregional competition. Therefore, the introduction of  $\varepsilon$  enriches the economic insights underlying the mechanism design by incorporating risk aversion and competition incentives. We will quantitatively examine the incentives and the associated information rents in Section 3.2.

Central transfers are only a portion of the central government's expenditures, which are funded by tax revenues collected nationwide. The central government also has its own consumption denoted by  $Z$ . As we focus on the expenditure structure of local governments, we assume the central government's consumption  $Z$  is a fixed share of fiscal income. We denote by  $z$  the ratio of central fiscal income to central government's consumption and also assume  $Z$  affects neither residents' utility nor local productivity. Therefore, the central

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<sup>9</sup>Condition (16) requires that function  $\tilde{V}(a_j) \equiv V(a_i, G(a_i)) - V(a_i, G(a_j))$  has minimum value at  $a_j = a_i$ . The first-order condition is just the necessary condition of choosing  $G$  to maximize  $V(a, G)$ .

government's budget constraint is

$$Z + \int_y T(y) f^Y(y) dy = \int_y \left( (1 - \xi^l) \tau^l \Phi(y) + (1 - \xi^k) \tau^k RK(y) \right) f^Y(y) dy. \quad (17)$$

Equation (17) can be further rewritten as:

$$\sum_i G(a_i) \pi_i + \sum_i \int_y S(y, a_i) F_y(y | a_i, G(a_i)) dy \pi_i = \int_y \Gamma y f^Y(y) dy, \quad (18)$$

where we define total retention rate of fiscal revenues at local governments  $\Gamma$  as

$$\Gamma \equiv (1 - \alpha) \left[ (1 - z) (1 - \xi^l) + \xi^l \right] \tau^l + \alpha \left[ (1 - z) (1 - \xi^k) + \xi^k \right] \tau^k. \quad (19)$$

Moreover, the central government also faces the resource constraint:

$$\int_y y f^Y(y) dy = \int_y C(y) f^Y(y) dy + \sum_i \int_y S(y, a_i) F_y(y | a_i, G(a_i)) dy \pi_i + \sum_i G(a_i) \pi_i + Z \quad (20)$$

Therefore, the central government's optimization problem is as follows:

$$\max_{\{G(a_i), C(y), S(y, a_i)\}} \sum_i \beta_i \left( \int_y u(C(y), S(y, a_i)) F_y(y | a_i, G(a_i)) dy \right) \pi_i$$

s.t. (13), (18), (20) hold.

### 3. THEORETICAL RESULTS

To better understand the essential insights in designing optimal interregional fiscal policies, we provide the expression of the optimal transfer rule as a function of output but announced before output shocks take place. Through the determinants of the optimal transfer formula and the decomposition of information rent term in the formula, we can evaluate the effects of multiple concerns on optimal transfer design, including fiscal equity, interregional insurance and distortion resulted from information asymmetry and tournaments.



### 3.1. Optimal Ex-post transfer

Proposition (1) shows the optimal marginal ex-post transfer rule:

PROPOSITION 1: Define the likelihood ratio  $\eta(a, y)$  as:

$$\eta(a, y) = \frac{F_{yG}(y | a, G(a))}{F_y(y | a, G(a))} = \frac{\partial \ln F_y(y | a, G(a))}{\partial G(a)}. \quad (21)$$

when the utility function  $u(C, S)$  is additive with respect to the private consumption  $C$  and non-productive public spending  $S$ , and the utility function of  $S$  takes the form of CARA, the optimal marginal transfer can be expressed as:

$$T'(y) = \sum_i \frac{1}{r_i} \frac{\mu_i \eta_y(a_i, y) \pi_i}{\beta_i + \mu_i [\eta(a_i, y) + r_i]} - \Omega, \quad i = H, L; \quad (22)$$

$$\Omega \equiv \xi^l \tau^l (1 - \alpha) + \xi^k \tau^k \alpha$$

where  $\mu_i$  is the co-state variable for the IC constraint.  $r_i$  is the risk-aversion coefficient of a local government over public goods.  $\eta$  reflects the elasticity of the PDF of  $y$  to the local productive public spending. Referring to [Milgrom \(1981\)](#), we assume  $\eta_y > 0$ .

The proof is contained in the online appendix A. The equation (22) reflects the key elements determining the design of the optimal marginal transfer: the risk-aversion attitude of local governments, the likelihood ratio, the information rent, the equity preference of the central planner, and the statutory local retention rate determined by the tax-sharing system. The following analysis gives more details of the above four key elements.

**Risk-aversion attitude.** First, due to the absence of complete insurance tools for local governments against regional economic shocks, the transfer system should serve as an interregional insurance. Hence, the risk-aversion attitudes of local governments determine the distribution of transfers. When the utility function with  $S$  is in the form of CARA, controlling  $\mu_i$  and likelihood ratio  $\eta_i$ , we can easily verify that  $T'(y)$  negatively correlates with the risk-aversion coefficient  $r_i$ <sup>10</sup>.

<sup>10</sup>Although in the optimal transfer, it is actually impossible to change  $r_i$  while controlling the optimal  $\mu_i$  and  $\eta_i$ , as [Varian \(1980\)](#) explains, this method can be viewed as a first-order approximation of the marginal change. We can reach a similar conclusion to his work discussing the effect on the marginal tax rate.

The reciprocal of the coefficient of absolute risk aversion,  $1/r_i$ , corresponds to the insurance effect in the optimal marginal income tax, as discussed in [Boadway and Sato \(2015\)](#). They argue that individuals exhibiting greater risk aversion are subject to higher marginal tax rates. Considering that central transfers can be viewed as the opposite to income taxes, our findings that agents' risk attitudes is negatively related to marginal transfers align with the intuition of optimal income taxation.

As discussed in the literature, interregional transfers play a crucial role in mitigating regional risks. [Asdrubali et al. \(1996\)](#) show 13% of GDP shocks are smoothed by federal transfers. [Tochkov \(2007\)](#) finds that the transfer policy in China offers inadequate insurance for low-income regions. This deficiency highlights the necessity for transfer payment policies to address these gaps.

**Likelihood Ratio.** The second element is the likelihood ratio  $\eta$  and its derivative  $\eta_y$ . They shapes the central government's efficiency concern and social insurance concern separately.  $\eta$  reflects the difficulty of local governments to change the expected future output via public investment. From definition (21),  $\eta$  can also be interpreted as the elasticity of distribution with respect to local public investment  $G_i$ .

In (22),  $\eta$  negatively correlates with  $T'(y)$ . According to the efficiency principle of optimal social insurance in [Baily \(1978\)](#), the marginal benefit of a smoother output path realized by  $T'$  should equates the marginal efficiency cost, measured by the behavioral response in public investment. As marginal efficiency cost is smaller for regions with high  $\eta$ ,  $T'$  for these regions should be lower, indicating that transfer policy can be more redistributive. The reason why high  $\eta$  corresponds to a low marginal efficiency cost is as follows: a higher value of  $\eta$  implies that  $G(a)$  has a greater impact on the probability of achieving output  $y$ . When  $T'$  increases, local governments are incentivized to increase their investment spending, leading to a larger distortion compared to the case of lump-sum transfers. As a result,  $T'$  should not be set too high in order to avoid efficiency losses caused by the overspending of  $G$ . Similarly, in the optimal replacement formula in [Chetty and Finkelstein \(2012\)](#), the responsiveness of the distribution of output to unobservable effort appears at the denominator in (22), which coincides with the inverse elasticity rules from the literature on optimal commodity taxation.

$\eta_y$  represents the marginal change in self-insurance capabilities resulting from a marginal increase in output  $y$ . We set  $\eta_y > 0$ , which is the monotone likelihood ratio property as in

Milgrom (1981). This property means that a high observed value of  $y$  likely indicates high public investment  $G(a)$ . When  $\mu_i > 0$ , A higher  $\eta_y$  implies that it is easier to change the PDF of large values of  $y$  via public spending, compared to the interval with relatively lower values of  $y$ . Thus a higher  $\eta_y$  indicates local governments possess greater **self-insurance abilities**, as they are more capable of increasing the probability of achieving higher output levels through the utilization of local productive public spending. As a result, the central government offers a less redistributive transfer policy, or equivalently, a larger marginal transfer  $T'$ .

**Information rent.** What distinguishes our work from the existing literature is the interplay of various determinants of information rent  $\mu$ . The level of information rent reflects the cost of keeping the local government revealing their true types. Similar to the interpretation of information rent in Mirrlees taxation, when the information rent is positive (negative), optimal transfer aims to restrain under-reporting (over-reporting) of ability. Compared to literature with moral hazard and adverse selection,  $\mu$  captures a broader set of incentives, including the trade-off between different types of public spending and the impact of interregional competition. By decomposing the information rent, we can demonstrate how it influences local government behavior and helps mitigate efficiency losses arising from asymmetric information and competition. The detailed discussion is in Section 3.2.

**Equity preference and the tax-sharing system.** At last, the social preference of the central government  $\beta_i$  and the retention rate of the final output at the sub-national level of governments  $\Omega$  will influence the optimal transfer policy. Under the Cobb-Douglas production function, the ratio  $\Omega$  is exogenous and constant, determined by the proportion of tax revenues retained at the local level (so-called retention rate), tax rates, and the capital share in the production function. A high  $\Omega$  leads to a low marginal transfer level since the tax revenue partially substitutes transfers. The marginal transfer on output depends only on  $\Omega$  when the central government can observe the abilities of local governors.<sup>11</sup>

### 3.2. Decomposition of Multiple Incentives in Information Rent

The information rent  $\mu$  encompasses multiple types of incentives of local governments induced by uncertainty, interregional tournaments, and fiscal pressure under decentraliza-

<sup>11</sup>We discuss the optimal transfer under full information in the online appendix D.3.

tion. These factors are prominently discussed in the context of fiscal federalism and fiscal union research. Therefore, through a detailed analysis of  $\mu$ , we can thoroughly examine how these factors should be aligned with or adjusted through the design of transfers, offering a clear decomposition of the incentives involved.

To simplify the analysis, assume only regions with higher ability care about interregional competition. This means  $\chi_H > 0$ , and  $\chi_L = 0$ . Denote by  $\mu_H$  the information rent for a high-ability region, and denote by  $\mu_L$  the rent for a low-ability region. Proposition 2 provides clear decomposition of optimal information rents for both types of regions:

PROPOSITION 2: *When  $\chi_L = 0$ , optimal information rents can be decomposed as:*

$$\begin{aligned} \mu_i = & - \underbrace{\beta_i \text{cov}_y(u_i, \eta_i)}_{\text{Risk-based Social Welfare Multiplier}} \times \underbrace{\tilde{\varepsilon}_i}_{\text{Behavioral Elasticity}} \\ & + \underbrace{\beta_i E_y(u_{s,i}) (1 + \mathcal{T}'(G_i) - E_y(G_i \eta_i))}_{\text{Budget-based Social Welfare Multiplier}} \times \tilde{\varepsilon}_i \\ & - \underbrace{\chi_j \mu_j \pi_j a_i \Psi}_{\text{Correction of Interregional Tournaments}} \times \tilde{\varepsilon}_i; \quad i \neq j. \end{aligned} \quad (23)$$

$\tilde{\varepsilon}_i$  denotes the total elasticity of productive public spending connected to incentive compatibility for two types of regions.<sup>12</sup>  $\mathcal{T}'(G_i) \equiv \frac{d \int_y (T(y) + \Omega y) F_y(y|a_i, G_i) dy}{dG_i}$  is the expectation of the marginal change of ex-post fiscal revenues induced by the change of productive public spending.  $\Psi$  is a term related to the externality caused by the high-ability governments' competitive incentives on the low-ability regions.

Proposition 2 shows optimal information rents for both types of regions are shaped by two groups of items. First is the behavioral term  $\tilde{\varepsilon}_i$ . It reflects, when local governments receive a marginal change in transfers, to what extent their behavior  $G$  will change and thus they deviate from the original IC constraints. Second is a collection of all the remaining terms in (23). They capture how the deviation from the original IC constraint influences social welfare. Finally, to prevent such deviation and ensure that local governments reveal

<sup>12</sup>We will show its definition and discuss it in Section 3.2.2.

their true private information, the central government should compensate local governments with a price of  $\mu_i$  (information rent).

Since  $\chi_H > 0, \chi_L = 0$ ,  $\mu_H$  differs from  $\mu_L$  only by the removal of the last line of equation (23), we will first discuss the information rent in the low-ability region based on (23). Following that, we will briefly compare  $\mu_H$  to  $\mu_L$ .

### 3.2.1. Information Rent of Low-ability Regions

According to (23), the information rent for a low-ability region is determined by four factors. Despite the behavioral term  $\tilde{\varepsilon}_L$ , the other three terms are all the direct effects on social welfare as a result of the change in the tightness of IC constraint.

**Risk-based Social Welfare Multiplier.** First, the behavioral changes of local governments influence social welfare by altering the output distribution, as reflected in the first term on the right-hand side of (23). Since the central government is concerned about the utility of local governments, a marginal deviation from the IC constraint will require the marginal change in the productive public spending (the behavioral effect), which will further impact the output distribution (the risk-based social welfare multiplier). Given that  $\eta_L$  represents the elasticity of the conditional distribution of  $y_L$  to the public spending in type-L region, the covariance  $cov_y(u_L, \eta_L)$  reflects how a marginal increase in transfers to this region can alter the expected final output to hedge against uncertainties. A higher covariance indicates that the ability to change the distribution is more likely to increase the final welfare. This implies that the regional government can more readily ensure both the consumption of non-productive public goods and private consumption after receiving interregional insurance from the central government<sup>13</sup>. As a result, with a significantly large risk-adjusted welfare effect, the transfer policy does not need to provide excessive subsidies to low-ability regions, which means  $\mu_L$  should be low when  $cov_y(u_L, \eta_L)$  is high.

A few papers discuss the risk-sharing function of interregional transfers in a fiscal union, such as Farhi and Werning (2017), Lockwood (1999), Dashkeev and Turnovsky (2018), Dai et al. (2022). Our work explores the role of interregional transfers as a form of insurance against regional economic shocks, where local governments can conduct incomplete

<sup>13</sup>The correlation between  $u$  and  $\eta$  is not necessarily positive. The expansion of  $G$  not only increases expected output but also directly affects the budget for non-productive public spending. Therefore, the relationship between  $G$  and utility  $u$ , which depends on both  $S$  and  $C$ , is complex.

self-insurance through productive public investment. The unobservable economic uncertainties for policymakers also induce moral hazard problem in this model. As a result, the central government should pay different information rents to two types of regions. Some studies discussing fiscal insurance against economic uncertainties also stress the impact of information rents (Boadway and Sato, 2015, Dyrda and Pedroni, 2022, Heathcote and Tsujiyama, 2021, Castro-Pires et al., 2024). Most of them focus on taxation and individual income shocks. However, we hardly find any decomposition of an information rent showing how uncertainty shapes the information rent. By contrast, we decompose the information rent term and highlight  $\mu$  negatively correlates with the risk-based welfare adjustment term, provided that the behavioral elasticity is positive.

Such decomposition of  $\mu$  helps to separate the behavioral influence of moral hazard from the social welfare influence of pure insurance against risks in the information rent<sup>14</sup>. The correction of behavioral distortions induced by moral hazard and adverse selection is reflected in the behavioral elasticity term  $\tilde{\varepsilon}_L$ , and by multiplying the elasticity with the social welfare marginal effects such as  $cov_y(u_L, \eta_L)$  we can obtain the welfare cost  $\mu$  addressing moral hazard and adverse selection. This means that we confine the impact of moral hazard on optimal transfer design into the elasticity terms. We will decompose the elasticity term  $\tilde{\varepsilon}_L$  in the next subsection.

**Budget-based social welfare multiplier.** Changes in  $G$  affect fiscal pressure, which in turn influences public service provision and social welfare, ultimately impacting the optimal information rent. The budget-based social welfare multiplier reflects the effect of relaxing the budget constraint under a decentralized fiscal system. The item  $1 + \mathcal{T}'(G_L) - E_y(G_L \eta_L)$  is the marginal change in the expectation of non-productive public spending resulting from the marginal change in the productive public expenditure.

A change in central transfers can marginally increase local productive public spending. If this significantly enhances the provision of non-productive public goods, as reflected by a high expectation of local residents' marginal utility  $E_y(u_{s,L})$ , local governments will have a stronger incentive to deviate from their original public spending levels in order to expand

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<sup>14</sup>However, moral hazard and adverse selection are not separated in this expression, as the effects of these two issues may not be orthogonal.

public service provision<sup>15</sup>. Therefore, this welfare multiplier is positively linked to the information rent, implying that the central government should provide greater compensation to these regions.

The budget-based social welfare multiplier encapsulates the trade-off between public investment and non-public goods consumption. Early fiscal federalism literature provides prescriptive studies on the composition of governmental public spending (Oates, 1972). However, the discussion about the trade-off between productive public investment and non-productive public services is scarce. Keen and Marchand (1997) argue that interregional competition for mobile capital leads to under-provision of public goods for immobile consumers and over-provision of public productive investment. This finding supports the argument in our work that competition causes efficiency losses by driving excessive spending on  $G$ , but they fail to discuss this problem under the fiscal decentralization context. This paper offers a theoretical analysis of the optimal composition of local public spending under a decentralized fiscal system. The trade-off between productive and non-productive spending is influenced not only by the tax competition incentives explored in Keen and Marchand (1997), but also by risk-aversion motivations and the asymmetric information structure.

**Correction of interregional tournaments.** Finally, apart from the endogenous choice of the low-ability governments, the fiscal behavior of the high-ability governments will also generate the fiscal externality on the low-ability regions due to interregional tournaments. The term  $\Psi$  summarize the externality caused by high-ability governments' competitive incentives on low-ability regions. Denote by  $\psi(a_i, G_i, y)$  the proportion of regions with ability  $a_i$  among all regions with output  $y$ , and  $\psi_G(a_i, G_i, y)$  the partial derivative of function  $\psi(a_i, G_i, y)$  on  $G_i$ . The expression is  $\psi(a_i, G_i, y) = \frac{F_y(y|a_i, G(a_i))\pi_i}{\sum_j F_y(y|a_j, G(a_j))\pi_j}$ . Then we have

$$\Psi \equiv E_y \left[ \frac{\psi_G(a_L, G_L, y)}{\pi_L} \frac{\psi_G(a_H, G_H, y)}{\pi_H} \right], \quad (24)$$

In the career concern model, the central government evaluates local governance abilities through the observation of  $y$ . Hence  $\psi$  reflects the pooling status of heterogeneous regions after the realization of shocks and how the central government updates its evaluation through the level of  $y$ . Since public investment from both two types of regions can affect

<sup>15</sup>Recalling that  $u_s$  is negatively connected with  $S$ , a high  $E_y(u_{s,L})$  indicates a low level of  $S_L$ .



the composition of regions realizing output level  $y$ ,  $\psi_G$  reflects how the public spending of different regions jointly influences the evaluation process of the central government. It is noteworthy that even if low-ability regions do not care about the promotion, the IC condition prevents them from imitating a high-ability region's behavior. Hence the information rent for low-ability regions should account for the incentives of tournament of the high-ability regions. The third term  $\chi_H \mu_H \pi_H a_L \Psi$  thus represents the correction of the externalities caused by the competitive incentive of the high-ability region.

Externalities in the design of fiscal policies have received significant attention in the literature. The most frequently discussed type of externality is the classic spillover effect of public goods, as noted by [Kaplow \(2012\)](#), [Jacobs and de Mooij \(2015\)](#), [Berriel et al. \(2024\)](#). Another category of externality includes fiscal externality, such as the migration induced by fiscal policies, often referred to as “voting with their feet”. This kind of externality is well-explored in spatial public economics research, for instance, in the works of [Lehmann et al. \(2014\)](#), [Fajgelbaum and Gaubert \(2020\)](#), [Gaubert et al. \(2021\)](#). Additionally, another branch of literature discusses fiscal externalities within the context of political economics. These studies primarily belong to the theories of fiscal federalism ([Besley and Coate, 2003](#), [Janeba and Wilson, 2011](#)) and focus on the optimal level of decentralization instead of place-based policies. Equations (23) and (24) clearly demonstrate how externalities arising from interregional tournaments impact Mirrleesian mechanism design, thereby influencing place-based fiscal transfer policies and allowing them to function as Pigouvian taxes. This distinction sets our work apart from previous literature and introduces a novel challenge into the studies of fiscal decentralization.

### 3.2.2. Behavioral Elasticity: Sufficient Statistic Approach

Next we turn to explain the behavioral elasticities in detail. The elasticity  $\tilde{\varepsilon}_i$  summarizes all channels where transfers affect productive public spending through the first-order (or equivalently, IC) condition of a type-L local government, which is the behavioral effect of the information rent. The elasticity can be decomposed as follows:

$$\tilde{\varepsilon}_i = \underbrace{\left[ \varepsilon_i^s \frac{E_y(u_{s,i})}{G_i} (1 + \mathcal{T}'(G_i) - E_y(G_i \eta_i)) \right]}_{\text{Price Channel}} \underbrace{\left[ -\varepsilon_i^\eta \frac{E_y(u_i \eta_i)}{G_i} \right]}_{\text{Distribution Channel}} \underbrace{\left[ \overbrace{+\chi_i \Xi(a_i, G_i)}^{=0 \text{ when } i=L} \right]}_{\text{Tournament Channel}}^{-1} \quad (25)$$



The first term,  $\varepsilon_i^s \equiv -\frac{\partial E_y(u_{s,i})}{\partial G_i} \frac{G_i}{E_y(u_{s,i})}$ , is the elasticity of the marginal utility  $u_s$  to the productive public spending.  $1 + \mathcal{T}'(G_i) - E_y(G_i \eta_i)$  is the change of expected public good consumption induced by a marginal change in  $G_i$ . Since  $u_s$  represents the relative price between  $S$  and  $G$ , the price channel reflects how the shadow price of non-productive public goods is affected by the change of public investment, representing the trade-off on the composition of public spending in the first-order condition of a type- $i$  local government.

The second term  $\varepsilon_i^\eta \equiv -\frac{\partial E_y(u_i \eta_i)}{\partial G_i} \frac{G_i}{E_y(u_i \eta_i)}$  is the elasticity of the covariance between the likelihood ratio and utility to the non-productive public goods<sup>16</sup>. As the likelihood ratio  $\eta_i$  represents local governments' abilities of self-insurance, this elasticity reflects how changes in  $G_i$  influence the self-insurance incentive through the expansion of public investment. The distribution channel corresponds to the marginal change in the second term of the first order condition of a type- $i$  local government (13). It indicates that the deviation from the efficient public investment levels induced by a variation in transfer funds will also result in the changes in local self insurance abilities.

Finally, the third term reflects the interregional competition channel influencing the behavior of local governments. Since low-ability regions do not engage in the tournament, this part is equal to zero.  $\Xi(a_j, G_j)$  is defined by

$$\Xi(a_j, G_j) \equiv \chi_j \int_y \hat{a}(y) F_{yGG}(y | a_j, G_j) dy - \chi_j \int_y a_j \frac{F_{yG}^2(y | a_j, G_j)}{f^Y(y)} \pi_j dy, \quad j \in \{H, L\}.$$

It is exactly the derivative of the third term connected to the competitive incentive in (13), representing the marginal change in the career concern term in the first order condition of local governments induced by the marginal increase in  $G_i$ .

These three terms in the bracket of (25) together capture the direct social welfare impact of a marginal change in  $G_i$ . They respectively correspond to the incentives of a type-L local government, as illustrated in the first-order condition (13): the incentives to substitute nonproductive public goods with productive one, the risk-insurance incentives, and the competitive incentives. The inverse of their sum can be interpreted as an elasticity of the productive public spending  $G_i$  with respect to the overall results of policy changes. Specif-

<sup>16</sup>Since  $cov_y(u_i \eta_i) \equiv E_y(u_i \eta_i) - E_y(u_i) E_y(\eta_i)$  and  $E_y(\eta_i) = \int_y F_{yG}(y | a, G(a)) dy$ , we have  $cov_y(u_i \eta_i) = E_y(u_i \eta_i)$ .

ically, given the level of marginal deviation from the first-order condition, the elasticity  $\tilde{\varepsilon}_i$  indicates how much the spending  $G_i$  should adjust to achieve such deviation.

Sufficient statistics are widely used in public finance research. Saez (2001) and Chetty (2009) introduced the method in the optimal taxation theory. Hendren (2016) and Hendren and Sprung-Keyser (2020) propose the policy elasticity in analyzing welfare effects of governmental policies. However, Kleven (2021) questions the feasibility of sufficient statistics under different scenarios. In our model,  $\tilde{\varepsilon}_L$  is a compound elasticity and is related to the comprehensive outcomes resulting from fiscal policy changes. Although this elasticity is difficult to estimate empirically,<sup>17</sup> it is still helpful to use sufficient statistics to offer clear economic insights understanding the optimal design of information rent in Proposition 2.

### 3.2.3. Information Rent of High-ability Regions

As  $\chi_L = 0$ , the information rents for the high-ability regions only have the first two terms in (23). However, the elasticity  $\tilde{\varepsilon}_H$  in (23) encompasses incentives arising from concerns about tournaments, as indicated in the last term in the bracket of (25).

Although there is no correction term of externalities in (23) when  $i = H$ , the central government still needs to address distortions in high-ability regions. First, we can find the competitive incentive is taken into consideration in the behavioral elasticity (25). Besides, by holding the correction term in (23), the spillover effects on the low-ability regions of competitive incentives from the high-ability regions is corrected by transfers. Finally, since the optimal transfer is the weighted sum of both  $\mu_L$  and  $\mu_H$ , the correction term  $\chi_H \mu_H \pi_H a_L \Psi$  will simultaneously influence the scale of transfers to all regions with the same output levels.

## 4. NUMERICAL ANALYSIS

In this section, we simulate optimal transfer and quantitatively illustrate the effects of information asymmetry, regional macroeconomic shocks, and interregional competition on the optimal policy. We adapted the baseline model into a continuum of ability types, so that the numerical results can be referred to in countries with varies local governments.

<sup>17</sup>There are mainly two difficulties in estimating  $\tilde{\varepsilon}_i$ : (1) it is difficult to extract the information rent from fiscal funds given to localities in reality; (2)  $\tilde{\varepsilon}_i$  represents the behavioral effects of  $\mu_i$  on the welfare, which can not be equivalently replaced by the behavioral effects of observable changes in  $G$  empirically estimated in reality.

China is selected as a case study for this analysis. Chinese central government established the interregional transfer system in 1995, after the comprehensive reform of tax collection and tax-sharing system in 1994. In the fiscal year of 2023, the most important component of interregional transfers, the general transfers, amounted to about 8.5 trillion CNY, accounting for about 72.5% of total local fiscal revenues according to the official National Government Final Account published by the Chinese Ministry of Finance. Moreover, China faces multiple challenges highlighted in this paper, making it an ideal subject for exploring the reform of transfer policies. By utilizing fiscal data from Chinese county-level governments in 2019, we can approximate the current transfer schedule  $T(y)$ , calibrate the distribution of ability  $a$  and the welfare weight on career concern  $\chi$ , and simulate the optimal transfer schedule. We also present how regional economic fluctuation and career concern shape the design of place-based fiscal policies.<sup>18</sup>

#### 4.1. Data and Parameters

Table I collects the main parameters used in numerical analysis. Some parameters are directly imposed based on readily available information. We adopt the following utility function of a local governor:

$$u(C, S) = \ln C - A \frac{1}{r} e^{-rS}, \quad (26)$$

The utility function of  $S$  takes the form of CARA so that we can apply the expression of optimal marginal transfer in equation (22) to simulation.<sup>19</sup> Where  $A$  measures the resident's relative preference for public goods consumption  $S$  compared to private goods consumption  $C$ . We set  $A = 0.02$  in our baseline model. For the degree of absolute risk aversion, we set  $r = 6$  following Jackwerth (2000). In the production function estimation in Collard-Wexler and De Loecker (2016), the capital coefficient is half of the labor coefficient in China. Therefore, in the production function (4), we set  $\alpha = 0.3$ . Following Song and Xiong

<sup>18</sup>In the online appendix B, we simulate the influence of retention rate and social welfare weight on optimal transfer.

<sup>19</sup>This assumption on function form is not restrictive. Yan et al. (2024) prove that as long as the agent's utility function is in the form of expected utility, then the agent's utility function is the constant absolute risk aversion (CARA) utility function.

(2023), we set  $g = 1 - \alpha$ . The annual return rate of one-year treasury bonds is around 3% in 2019, so we adopt  $R = 1.03$ . According to China's current tax sharing rules and tax rate, we set  $\xi^k = 0.5$ ,  $\xi^l = 0.4$ ,  $\tau^k = 0.17$ , and  $\tau^l = 0.25$ .<sup>20</sup> Based on the execution of the central government's fiscal budget during 2019 to 2022, the ratio of transfers to the central government's consumption expenditure as 2/3. Therefore, the share of the central government's consumption to fiscal income,  $z$ , is 40%. For governments' preferences, assume that the central government adopts a utilitarian social welfare function, i.e.  $\beta(a) = 1$ .

We select the remaining parameters to fit Chinese county-level fiscal and economic data. The data on transfers and local government expenditures were manually collected from the final financial accounts of local governments in 2019. We collected variables including amounts of transfers, local government's fiscal expenditures, regional output, and other local economic characteristics data of China in 2019 for numerical simulation. Since the labor supply of each region is normalized to 1 in the model, we measure the level of regional output by per capita GDP. 1385 observations were obtained after removing the invalid observations with missing values of some key variables. To avoid the interference of outliers on the results, the local GDP and productive expenditure were further truncated at the level of 5%, and finally we obtain 1119 valid observations.

We first calibrate the current transfer function  $T(y)$  in China. We adopt the following functional form, similar to the form of the income taxation formula discussed in Heathcote et al. (2017):

$$T(y) = y - \phi_1 y^{1-\phi_2} + y_0, \quad (27)$$

where  $\phi_1$  and  $\phi_2$  measures the size and progressivity of central transfer.  $y_0$  is the lump-sum subsidies to local governments. We fit the observed data on  $y$  and  $T(y)$  by the nonlinear least square method and get  $\phi_1 = 1.07$ ,  $\phi_2 = 0.02$ ,  $y_0 = 0.66$ . This function well fits the relationship between transfers received by local governments and local output in reality. To

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<sup>20</sup>The top four taxes in China are value-added tax, corporate income tax, excise tax (on 15 kinds of goods) and individual income tax. Since our model does not incorporate intermediate goods, the value-added tax in China can be viewed as the consumption tax. Denote by  $\tau^I$  and  $\tau^C$  the average individual income tax rate and the average value-added tax rate. We get  $C(1 + \tau^C) = (1 - \tau^I)\Phi L + RK$ . This indicates that labor income tax rate in our model satisfies  $1 - \tau^l = \frac{1 - \tau^I}{1 + \tau^C} \approx 1 - \tau^I - \tau^C$  and  $1 - \tau^k = \frac{1}{1 + \tau^C} \approx 1 - \tau^C$ . As firms in our model have no profit, we do not consider corporate tax.

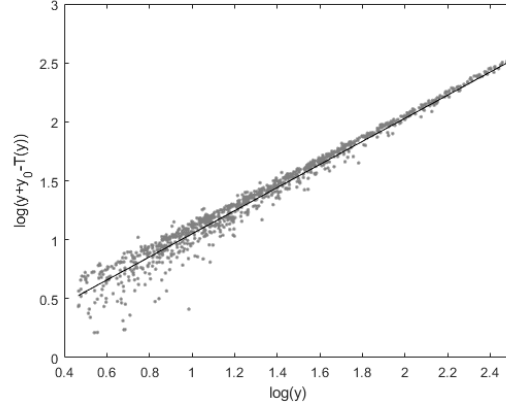


FIGURE 2.—The fitness of central transfer function

see this, transform the equation (27) into:

$$\log(y + y_0 - T(y)) = \log \phi_1 + (1 - \phi_2) \log y. \quad (28)$$

Figure 2 presents an obvious linear correlation between  $\log(y)$  and  $\log(y + y_0 - T(y))$  in the data (the scattered points) and fitted result (the solid line). The  $R^2$  under the OLS regression (28) is 0.972. Therefore, the function form in (27) well captures the relationship between central transfer and local output.

As we divide public expenditure into productive expenditure and non-productive expenditure according to its different purposes in the model following Barro (1990), we need to clarify the fiscal expenditure categories in the data. In China, the fiscal expenditure is classified into more detailed groups. Based on whether an expenditure can improve output directly in a short period, We select 8 kinds of general public budget expenditure and sum them up as the proxy of non-productive expenditures<sup>21</sup>.

The local governors' abilities and the relative welfare weights on career concerns are unobservable and require calibration. To capture how abilities determine productivity, we set  $\Gamma(a) = a^{0.5}$ . This means the marginal influence of  $a$  on  $\log(A)$  is decreasing, while the marginal influence of the output shock  $\varepsilon$  is constant. Assume that abilities and

<sup>21</sup>The 8 kinds of general public budget expenditure include general public service expenditure, national defense expenditure, public security expenditure, education expenditure, culture, sports, tourism and media expenditure, health expenditure, urban and rural community expenditure, and housing security expenditure.

TABLE I  
THE PARAMETER VALUES USED IN BASELINE SIMULATION

Variables	Notations	Values	Source
Share of capital income	$\alpha$	0.30	Collard-Wexler and De Loecker (2016)
Retention rate of labor income tax	$\xi^l$	40%	to match the corporate income tax sharing ratio
Retention rate of capital income tax	$\xi^k$	50%	to match the value-added income tax sharing ratio
Labor income tax rate	$\tau^l$	25%	the statutory corporate income tax rate
Capital income tax rate	$\tau^k$	17%	the statutory value-added tax rate
Share of central government consumption	$z$	40%	to match the share of national defense in the central government's expenditure
Absolute risk aversion coefficient	$r$	6	Jackwerth (2000)
Gross return of capital	$R$	1.03	the annual return rate of one-year treasury bonds
Mean of abilities	$\mu_a$	2.4988	to match the distribution of $G$ and $y$ in data
Variance of abilities	$\sigma_a^2$	0.4415	to match the distribution of $G$ and $y$ in data
Mean of output shocks	$\mu_\varepsilon$	0.1960	to match the distribution of $G$ and $y$ in data
Variance of output shocks	$\sigma_\varepsilon^2$	0.0661	to match the distribution of $G$ and $y$ in data

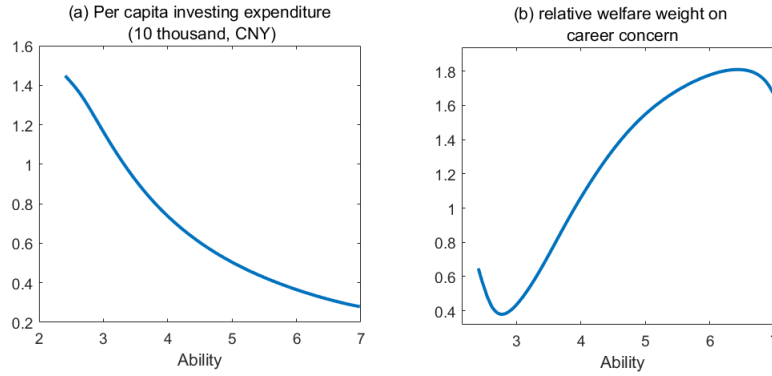


FIGURE 3.—The calibration of  $\chi$  and  $a$

output shocks are normally distributed and independent of each other:  $a \sim N(\mu_a, \sigma_a)$ ;  $\varepsilon \sim N(\mu_\varepsilon, \sigma_\varepsilon)$ <sup>22</sup>. We calibrate  $\chi$  according to the relationship between transfer, productive public spending, and local GDP in China.

Subgraph (a) of figure 3 illustrates the relationship between regional calibrated abilities  $a$  and levels of investment public spending. Under the current transfer function, per capita investment public spending and local governors' abilities are negatively correlated. This is because compared with regions with low abilities, local governments with high abilities do

<sup>22</sup>It is noteworthy that with the normal distributions of  $a$  and  $\varepsilon$ , the TFP  $A$  should be subject to a right-skewed distribution.

not require too much productive public spending to achieve an expected output. In reality, regions in China that are supposed to have more advanced governance abilities always spend more on non-productive public goods, or so-called basic public services, including local education, medical expenditures and social securities undertaken by local governments. These regions include the so-called ‘tier-1 cities’ like Beijing, Shanghai, Shenzhen, etc.

Subgraph (b) displays the relationship between  $\chi$  and  $a$ . With the improvement of ability, local government’s utility weights on career concern show an upward trend, but for areas at the two ends of the distribution,  $\chi$  gradually decreases with  $a$ . Compared with high-ability counterparts, it is difficult for low-ability governors to win over inter-regional competitions. Therefore, they lack the interest in valuing the central government’s expected evaluation of ability. This possibly explains the upward trend of  $\chi(a)$ . The downward sloping  $\chi(a)$  curve among extremely high-ability governors may result from a lack of strong opponents or a low pressure in promotion competition. For extremely low-ability governors, they have strong motivations to be “lifted out of poverty”, an indicator of outstanding poverty governance performance. Hence we see higher  $\chi(a)$  with lower  $a$  among these regions.

#### 4.2. Optimal transfer

Under the parameters in Table I, we combine the fixed-point algorithm as in [Mankiw et al. \(2009\)](#) with the way to solve the integral equation in [Sachs et al. \(2020\)](#) to solve the optimal transfer. Panel (b) of Figure 4 shows that, in terms of scale, the optimal per capita transfer is higher than the current per capita transfer in low GDP regions and lower than the current transfer level in high GDP regions. To illustrate this result, recall that the central government might deduce a low-ability governor behind a low regional output. Hence the regional transfer should be high enough to ensure the stable provision of public goods in these areas under economic uncertainty. However, the formula-based transfer scheme in China hardly considers regional economic fluctuation. Compared with the optimal transfer, the current transfer to low-output regions should increase. Our results coincide with [Tochkov \(2007\)](#), who pointed out that rich provinces in China were better insured against province-specific revenue shocks than poor provinces during the 1952–2001 period.

The optimal transfer function takes an inverted U-shaped pattern. The optimal marginal transfer in panel (a) turns from positive to negative as output increases. The explanation for

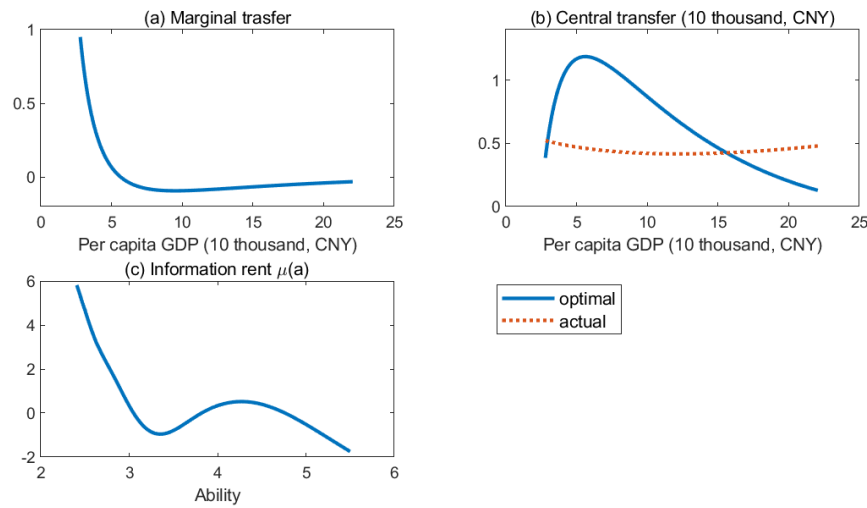


FIGURE 4.—Optimal per capita central transfer

the ascending phase of the optimal transfer rule (below 55 thousand CNY in the figure) is that, in the face of uncertainty, regions with such low per output are more likely to provide insufficient productive public spending. One reason is the low returns on public investment in these regions. Another consideration is that a high level of productive spending ( $G$ ) may increase their risk exposure, as it directly reduces resources available for non-productive public services. Therefore, the central government sets transfers increasing with outputs so that these governments are encouraged to enlarge productive public spending. In this way, both the central government's tax revenues and local output can be stimulated.

For local governments with a higher per capita GDP (over 55 thousand CNY in the figure), the optimal transfer curve turns to decline. This is because local governments with higher per capita GDP tend to have higher abilities, and these regions have strong self-development motivations. Even without transfers, they can spontaneously invest in infrastructures, thus increasing the probability of achieving higher output. A higher output not only helps in obtaining a better evaluation from the central government but also indirectly improves the level of public service. This means that the central government can reduce the gap in public services by reducing transfers to high-income regions. Additionally, low transfers to regions with high output levels can be seen as a correction mechanism for interregional competition. A higher output would result in fewer transfer funds, serving as a penalty for focusing too heavily on economic performance.



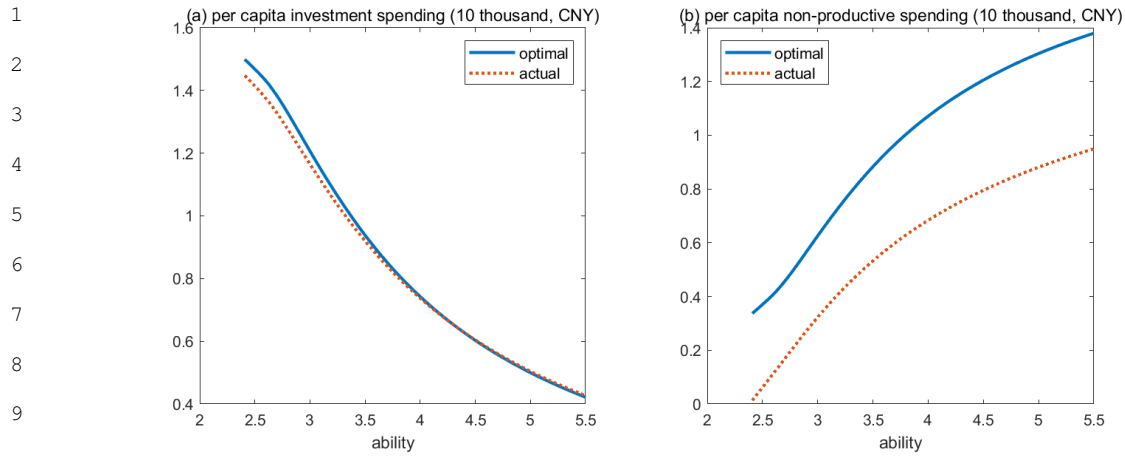


FIGURE 5.—The distribution of optimal and current local governments' expenditures

Note: The coefficients of variation for  $G$  are 0.39 and 0.4 separately under the optimal and actual transfer. The coefficients of variation for the conditional expectation of  $S$  are 0.33 and 1.51 separately under the optimal and actual transfer.

We also draw the information rent curve  $\mu(a)$  in panel (c) to inspect what drives the shape of optimal marginal transfer. The information rent primarily shows a descending trend as abilities increase, similar to the optimal marginal transfer curve with per capita GDP, but is slightly different by following a U-shaped pattern in the middle of the range. Therefore, for regions with low to medium output levels, the shape of the information rent is align with the optimal marginal transfer.

To see the behavioral impact of optimal transfer rule on the provision of local public goods, Figure 5 compares fiscal expenditure structure of local governments under current and optimal transfer. We can find that the low-ability regions spend more on productive public spending under the optimal transfer rule, verifying the stimulation effect of the increasing transfer schedule. Non-productive public goods in all regions increase obviously, resulting from the effective insurance against uncertainties provided by optimal transfers. The optimal transfer also serves effectively as interregional insurance. To show how optimal transfer reduces the fluctuation of regional fiscal expenditures, we compare the changes in coefficient of variance (CV) of two kinds of fiscal expenditure after the implementation of the optimal transfer schedule in China. The CV of per capita local investment public spending slightly decreases as the ability increases in panel (a), while the CV of public service expenditure per capita decreases sharply from 1.51 to 0.33. Figure 6 displays the

influence of adopting optimal transfer on fluctuations of regional output. The vertical axis denotes the standard deviation of future output given the ability type of a local governor. Obviously, the optimal transfer effectively reduces the fluctuation of local output.

Adopting an optional transfer can also improve efficiency. The scale of total fiscal transfer will be increased by 13.44%, corresponding to a considerate improvement in production efficiency and therefore total tax revenue.

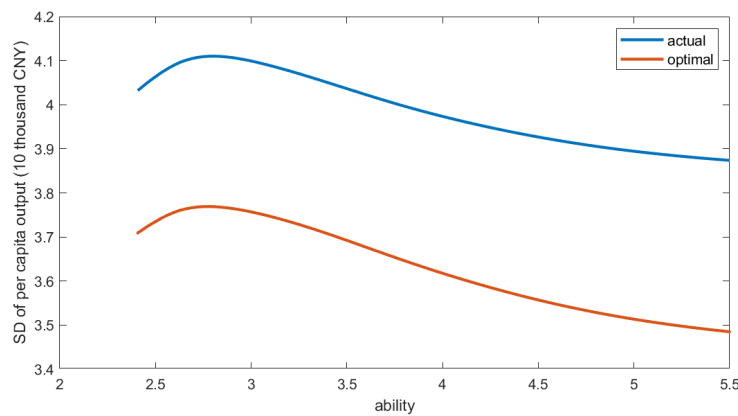


FIGURE 6.—Output fluctuation under current and optimal central transfer

### 4.3. Influences of Information Asymmetry

As discussed at the beginning of this paper, we argue that the information asymmetry is essential to the optimal transfer design. To see how introduction of information friction quantitatively changes the design of optimal transfer, we compare the results of full information with incomplete information in Figure 7. In the case of full information, the central government can observe both the ability and the investment expenditure of each local government. Therefore, the optimal transfer is a function of both output and ability. There is no competition induced by career concern since the central government can directly observe governance abilities<sup>23</sup>. Panel (a) of Figure 7 shows that the incorporation of information friction significantly reduces central transfer at all output levels. As the budget for transfers is constrained by the nationwide tax revenues related to total economic output, the decrease

<sup>23</sup>The derivation of optimal transfer under full information can be found in the online appendix D.3.

in transfers across all regions highlights considerable output decline and efficiency losses induced by information frictions.

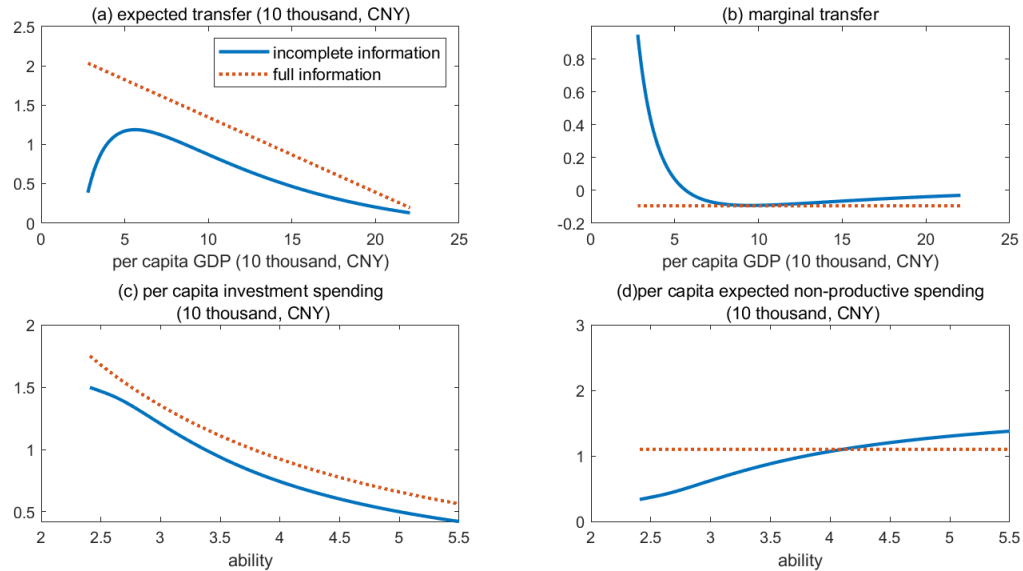


FIGURE 7.—A comparison of fiscal expenditure under different information structure

The shape of optimal transfer also changes. In panel (b), marginal transfer over local output under full information is negative. This is because the central government, knowing local governments' abilities, can assign a specific transfer schedule to each type of local government. After the realization of economic shocks, the central government can easily deduce the magnitude of the shocks from the observed output and provide accurate social insurance for each region. Thus, the negative marginal transfer in panel (b) represents such full insurance schedules.

In contrast, with information frictions, the sign of the optimal marginal transfer first becomes positive and then negative as output increases, leading to an inverse U-shaped pattern in the central transfer curve. This can be attributed to two reasons related to asymmetric information. First, due to the pooling of regions with different abilities, the full insurance is infeasible and transfers for low-output regions should serve as dual roles: insurance to regions with high levels of  $G$  but experiencing negative shocks, and incentivizing regions with high abilities but low levels of  $G$ . This complicates the sign of optimal marginal trans-

fer. Second, the information asymmetry also creates rooms for interregional competition for promotions. As the low-output regions have large scale of public spending, a large amount of transfers to these regions as in the first best case is no longer efficient since this may encourage radical public investment among these regions, resulting in significant negative externalities for other regions that are concerned about promotions. We will discuss the insurance and competition factors later in Section 4.4.

Recall that in panel (a) of Figure 5, a local government's investment spending  $G$  still negatively correlates with the local governor's ability  $a$  under optimal transfer. To explain this result, we compare the per capita investment in the baseline model with that under optimal transfer when the central government has full information in panel (c) of Figure 7. Even in the case of full information, optimal  $G(a)$  negatively correlates with the local governor's ability  $a$ . The central government can equalize public goods consumption across regions by specifying different transfers to regions with different output and abilities, as in panel (d) of Figure 7. However, unlike the public goods  $S(a, y)$ , which is fully insured through transfers, residents' consumption  $C(y)$  only depends on local output, which means it cannot be fully insured in tandem with  $S$ . As a result, optimal transfer under full information still requires low-ability regions to promote local output through high levels of investment spending. Such a mechanism still exists in our baseline simulation. By contrast, due to incomplete information, two new mechanisms are noteworthy in shaping  $G(a)$ . First, an optimal transfer schedule could only alleviate instead of eliminating inter-regional competition. Therefore, local governors with low abilities still have the incentive to gain a better evaluation by the central government, as in Song and Xiong (2023). Second, current transfer policies in China lack support for low-output regions. Thus low-ability governors make insufficient efforts to promote output due to the worry that a high level of  $G$  can expose them to large output fluctuations. Therefore, an upward-sloping transfer curve, the optimal one, can exactly provide insurance for regions with lower abilities to increase  $G$  and thus to enhance their output.

#### 4.4. Influences of Risks and Career Concerns

From Figure 7 we learn that introducing information asymmetry can reverse the sign of optimal marginal transfer in low-output regions. It can also greatly reduce the absolute

value of the optimal marginal transfer in the high-output regions. The frictions induced by asymmetric information in this paper are threefold: (1) a standard Mirrleesian private information (adverse selection) friction, as local governors' abilities are unobservable by the central government. (2) a moral hazard friction, where local productive public expenditures and economic shocks are unobservable by the central government. (3) an externality friction, where the central government has a corrective motive on the interregional competition behavior arising from local governments' career concerns. While the first friction has been emphasized in early studies like [Lockwood \(1999\)](#), the latter two were seldom examined in the literature on fiscal decentralization. In this part, we numerically present the impacts of parameters corresponding to the moral hazard friction and externality friction through comparative static analysis and emphasize the significance of various considerations in reforming transfer policies.

### 1. The impact of regional economic fluctuations

Regional economic fluctuations are the source of the moral hazard friction. As  $\sigma_\varepsilon^2$  measures the extent of risks, Figure 8 illustrates the optimal central transfer at various values of  $\sigma_\varepsilon^2$ . The three curves correspond to scenarios where  $\sigma_\varepsilon^2$  represents the realistic value (0.0661), a high-risk value (10% higher than the realistic value), and a low-risk value (10% lower than the realistic value).

Since increased  $\sigma_\varepsilon^2$  leads to greater fluctuations in local output, the transfer policy should take a more active role in hedging against economic shocks. Thus it is natural to observe that the optimal marginal transfer in panel (b) of Figure 8 decreases as the risk increases. Specifically, from panel (d) we observe that  $\eta_y$  in equation (22) gets smaller because a higher risk makes it harder for local governments to stabilize their output via self-insurance public spending. This produces a lower marginal transfer curve over local output.

Apart from the pure insurance consideration, the increase in risks also alters the incentives of local governments. The information rent curve  $\mu(a)$  becomes flatter, as displayed in panel (c). We observe a significant change at the left tail of the ability distribution, while changes in information rent across the rest of the distribution are trivial. As shown in Figure 5, low-ability regions allocate the largest scale of expenditures to productive investments, making them particularly vulnerable to increased economic risks. Additionally, the fiscal behavioral changes in these regions are likely to be more significant due to their high levels of public spending, which is exactly what the information rent aims to address. For

low-ability regions, such changes lead to lower marginal transfer in low-output ranges as the information rent dominates the shape of the marginal transfer among the low-ability interval. However, for high-ability regions, the shifts in information rents are insufficient to counterbalance the decline in  $\eta_y$ , so we still witness a decrease of marginal transfer in high-output regions in panel (b).

Moreover, regional economic fluctuations also impact regional competitions. To see this, we can find that the optimal transfers are higher in medium- and high-output areas in panel (a) of Figure 8 under lower economic fluctuations. Although transfers as rewards for high-output regions may intensify interregional economic competition and potentially crowd out non-productive fiscal expenditures in these regions, the resulting reduction in economic uncertainty may offset these effects. Consequently, these regions may still experience less exposure to the risk of insufficient provision of non-productive public goods, even if they expand their public expenditures  $G$ . For the central government, its focus shifts from insurance considerations to encouraging the expansion of public investment in the design of transfers. Consequently, there is less emphasis on inter-regional competition and risk-sharing when designing optimal transfers with lower economic uncertainty<sup>24</sup>.

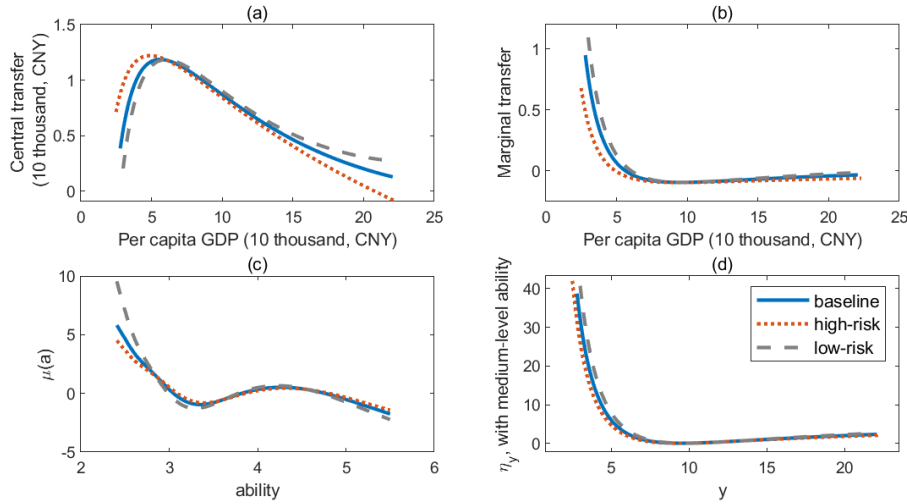


FIGURE 8.—Optimal transfer under different magnitude of risk

<sup>24</sup>Theoretically, we proved in Corollary A1 in the online appendix D.2 that when the local productivity shock  $\varepsilon$  approaches 0, interregional insurance and economic competition have minimal impact on information rents across all regions.

Overall, inter-regional competition necessitates that the optimal transfer may sacrifice some outputs to correct the distortions in local government expenditure caused by promotion incentives. This, in turn, affects total social welfare and overall output. Greater regional economic fluctuations require that the optimal transfer are supposed to achieve a higher degree of risk-sharing and address heightened concerns about regional competition.

## 2. The impact of career concerns

The promotion incentive for local governments introduced in this article distinguishes it from previous literature on fiscal decentralization and optimal taxation. Intuitively, magnifying  $\chi$  for all local governors has two impacts. First, it amplifies potential local governors' utility gains or losses from joining economic competitions and encourage higher investment spending. Second, high-ability governors face greater career concerns and thus experience more pronounced negative externalities from interregional competition, particularly stemming from the high public spending of low-ability regions. The two impacts complicate the changes of optimal transfer.

Figure 9 shows the optimal transfer as the weight assigned to local career concerns varies. The solid line represents the baseline scenario, whereas the dotted line illustrates the condition in which we decrease  $\chi$  by 20% in each region. The dashed line represents the scenario in which we enhance  $\chi$  by 20% in each region. In panel (a) of Figure 9, When all local governments assign lower welfare weights or pay less attention to the governor's career concerns, the optimal marginal transfer decreases. This is because with lower externalities, the motive of the policymaker to correct externalities diminishes. However, since the lump-sum part of optimal transfer increases, we see in panel (b) that optimal transfer increases at low and medium-output levels but decreases at high-output levels.

The increase in the lump-sum part of transfer under weaker career concerns stems from an improvement in efficiency. Notably, we observe an increase of 2.01% of the total transfer amount after reducing  $\chi$  by 20% from the baseline case, which indicates that reducing career concerns improves fiscal efficiency since the total transfer takes a constant share of the overall output. To explain this result, when career concerns are strong, local governors tend to overspend on investment. Thus, the optimal transfer should correct this distortion in fiscal choices at the cost of reducing economic efficiency.

It is notable that while the optimal marginal transfers under a higher risk and a lower career concern level both decrease compared to the baseline case, the absolute values of

optimal transfer under these two cases are slightly different. In panel (a) of Figure 8 we see fewer central transfers to medium-output regions with higher risks compared to the baseline. However, there should be higher transfers to these regions in the scenario of low career concern levels, as shown in panel (b) of Figure 9. This is because a high risk reduces total economic output but a lower career concern will improve it, and thus the lump-sum transfers in these two cases vary as shown in Table II.

The information rent curve in panel (c) gets flatter across local output when the nationwide levels of career concern decrease. Again, the changes in information rents are most drastic at the left tail of the ability distribution, where the information rent for extremely low-ability regions gets lower. Besides, the information rent for extremely high-ability regions also obviously becomes higher and closer to zero.

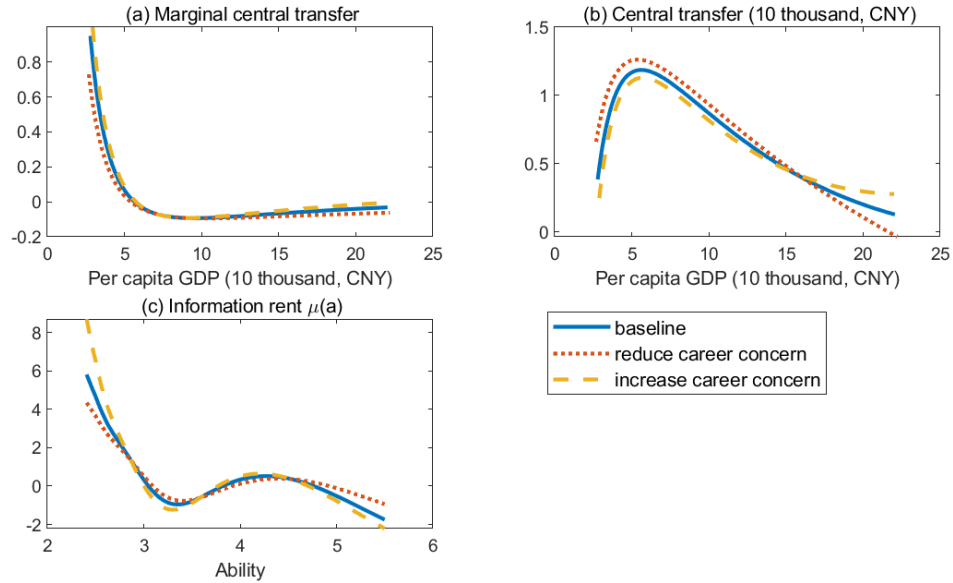


FIGURE 9.—Optimal transfer under different  $\chi$

In the mechanism design research, the optimal mechanism helps principals to infer true types of agents. A natural question is how optimal design enables the central government to reassess the governance abilities of local governments. To clarify how optimal transfer affects the career concerns, Figure 10 illustrates the local government's expectations regarding the central government's evaluation of themselves at different ability levels. Within



TABLE II  
CHANGE OF TOTAL AND LUMP-SUM TRANSFER

	baseline	high risk	low risk	high career concern	low career concern
Change in total transfer (%)	0	- 2.57	2.53	- 1.99	2.01
$T(y)$ (10 thousand, CNY)	0.38	0.71	0.20	0.25	0.66

the major part of the ability distribution (where  $a < 4.5$ ), the expected evaluation from the central government for a type- $a$  local governor under optimal transfer is significantly lower than that under the current transfer system. This suggests that optimal transfer reduces the ex-ante career concerns for most local governments.

Notably, as illustrated in Figure 10, the anticipated evaluation of ability in low-ability regions negatively correlates with the actual abilities of local governors. Recall that we clarified in the previous subsection that  $G(a)$  is decreasing in  $a$  under optimal transfer. The reason is that regions with significantly low abilities can still achieve high output due to their high public investment level (shown in panel (a) of Figure 5). Consequently, these regions will be pooling with those high-ability regions, making it difficult for the central government to differentiate between them. As a result, local governors with markedly low abilities tend to expect a higher evaluation from the central government compared to regions with relatively higher abilities.

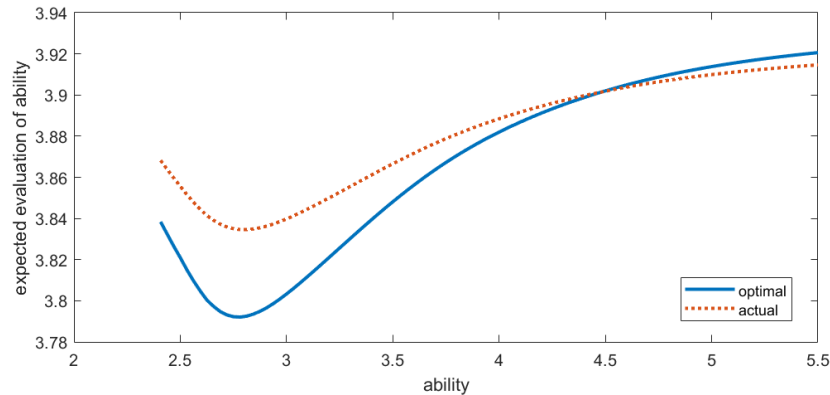


FIGURE 10.—Expected evaluation of ability from the central government

## 5. CONCLUSION

This article presents a comprehensive framework for examining the optimal design of interregional fiscal transfers under incomplete information about local heterogeneities. We incorporate regional heterogeneity and idiosyncratic local output shocks into a Mirrleesian principal-agent model to analyze transfers' dual roles in providing interregional insurance and incentivizing desired local fiscal expenditures. We also consider the tournament mechanism among regional governments by referencing the career concern model.

Our work contributes to the critical practical issue of fiscal decentralization by answering how to allocate intergovernmental transfers based on local indicators observable to the central government. These indicators are influenced not only by local heterogeneity, which is the root of interregional disparities, but also by exogenous shocks and endogenous local fiscal choices. Furthermore, this paper contributes to the theoretical resolution of the Mirrleesian mechanism design problem by addressing challenges such as adverse selection, moral hazard, and career concerns through the decomposition of information rent.

The optimal transfer in our paper is determined by: the information rent resulting from moral hazard and adverse selection, risk attitudes and self-insurance abilities of local governments, the central government's targets, and other parameters related to the tax sharing system. Specifically, beyond the canonical role of public insurance, we further analyze the incentive impact of output shocks on optimal transfer design by decomposing information rent using sufficient statistics. This decomposition highlights two key channels through which the risk factor influences optimal information rent: it alters local fiscal expenditure incentives and affects social welfare through tightness of IC constraint. The decomposition also elucidates the effects of competition and fiscal pressure on transfer design.

We use the Chinese county-level data to calibrate key parameters, including local economic shocks, local governance abilities, and the weights representing the degree of local governors' career concerns. These parameters are frequently discussed in literature on fiscal decentralization and yardstick competition, while lack quantitative estimation. Compared with the realistic policies, the optimal policy suggests increasing the transfer for regions with low per capita GDP, reflecting its interregional insurance function. The optimal transfer policy effectively mitigates local economic risks while enhancing the provision of non-productive public goods, such as education, healthcare, and public security expenditures

that are highly valued by residents. In this way, our work offers a practical blueprint for reforming existing transfer policies in countries like China.

Our analysis underscores the quantitative influence of various factors on the design of optimal transfers. The introduction of asymmetric information reverses the sign of the optimal marginal transfer, contrasting with the negative optimal marginal transfer under the full-information case. Therefore, neglecting the information aspect can result in a significant deviation from the optimal transfer design proposed by this paper. Additionally, while an increase in risk and a decrease in career concern produce both result in a decrease in the marginal transfer, the amounts of optimal transfers differ significantly due to their contrary impacts on total efficiency.

While our model exclusively focuses on information asymmetry and interregional competition by abstracting from frictions caused by household mobility and tax rate competition, one can extend our framework to address these issues in designing place-based fiscal policies. As governments' debts also provide some insurance, an intriguing avenue for future research is to extend this model in a dynamic environment to address local governments' decisions under a richer set of policy instruments.

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