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Fiscal disparity leads to a yardstick bias, in that incumbents in fiscally-rich jurisdictions can provide more public goods, extract more rents and yet have a higher probability to be reelected. This study further emphasizes disparity among jurisdictions, not only in terms of fiscal resources but also of costs of rent appropriation. In a setting in which jurisdictions with a higher fiscal capacity have lower costs of rent appropriation whilst those with a lower fiscal capacity have higher costs of rent appropriation, the difference in costs of rent appropriation might moderate the bias caused by the fiscal disparity.

JEL-Codes: H71, H72, H77, D72

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Fiscal disparity, institutions and asymmetric yardstick competition

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Very Preliminary. Do not quote.

Abstract

Fiscal disparity leads to a yardstick bias, in that incumbents in fiscally-rich jurisdictions can provide more public goods, extract more rents and yet have a higher probability to be reelected. This study further emphasizes disparity among jurisdictions, not only in terms of fiscal resources but also of costs of rent appropriation. In a setting in which jurisdictions with a higher fiscal capacity have lower costs of rent appropriation whilst those with a lower fiscal capacity have higher costs of rent appropriation, the difference in costs of rent appropriation might moderate the bias caused by the fiscal disparity.

Keywords: accountability, rent, fiscal capacity, institutions, yardstick competition,
JEL classification: H71, H72, H77, D72

1 Introduction

Decentralization is argued to improve accountability of government. This argument necessitates that decentralization should encompass administrative, fiscal and political spectrum, in which the government of decentralized jurisdiction has authorities to manage and allocate their budget, is elected by and, thus, accountable to its own electorates. Here, accountability refers to "the degree to which institutions allow the government to divert rents" (Lockwood 2005). If the existing institutions allow for a higher rent appropriation, then accountability is lower, vice versa.

One mechanism through which decentralization improves accountability is via an increased competition among jurisdictions. In particular, the existence of decentralized jurisdictions brings about yardstick competition (Besley and Case 1995; Bordignon, Cerniglia, and Revelli 2004). Asymmetric information between incumbent government and voters hinders voters from assessing the true performance of their government. In this situation, voters can take advantage of information spillovers from the neighboring jurisdictions. Voters of comparable jurisdictions facing the same exogenous shock might perform yardstick voting, that is they use the performance of incumbents in neighboring jurisdictions as a yardstick to reelect or replace their incumbent. This eventually induces yardstick competition, in that incumbents seeking reelection will compare themselves to incumbents in other jurisdictions. This in turn creates an incentive for the incumbent to limit rent diversion. In this respect, yardstick competition increases the costs of rent appropriation and, thus, restricts the predatory behavior of government.

In the context of decentralization in many developing countries, yardstick competitions can be much more of significance for the overall success of decentralization agenda. This is because major arguments for decentralization such as preference matching (Oates 1972), exit options and tax competition (Tiebout 1956) are less likely in place.

Empirical evidence has also supported the existence of yardstick competition. The empirical investigations generally attempted to show that the reelection out-

comes are correlated with fiscal variables of the neighboring jurisdictions. Bordignon, Cerniglia, and Revelli (2003), for example, observed a positive spatial auto-correlation in local tax rates only in Italian jurisdictions whose mayors run for reelection and are not backed by large majorities. Along the same line, Allers and Elhorst (2005) found that Dutch municipalities governed by small majorities tax-mimic more than those governed by large majorities. Bosch and Solé-Ollé (2007) investigated Spanish municipalities and their findings suggested that a property tax increase, both at the municipal and neighborhood level, affects the incumbent's vote share.

For the case of developing countries, Martinez-Vazquez, Del Granado, and Simatupang (2008) found evidence of yardstick competition among Indonesian districts, that is incumbent's popularity is negatively correlated with its own tax revenue while positively correlated with that of neighboring districts. Modeling a yardstick from the top and testing using China data set, Caldeira (2012) also confirmed a strategic complementarity of public goods.

While the empirical evidence shows the existence of yardstick competition, it does not necessarily confirm its welfare consequences. In fact, Allers (2012) shows that yardstick competition might not adequately curb government's predatory behavior and, thus, might not improve citizens' welfare. The disciplining effect of yardstick competition becomes ineffective if jurisdictions are not identical. In this situation, yardstick mechanism works in favor of incumbents in more fiscally-rich jurisdictions, leading to a yardstick bias. Incumbent in those jurisdictions is able to extract more rent and still considered as a good performer and reelected accordingly. By contrast, incumbent in fiscally-poor jurisdictions might behave responsibly and yet is seen as an under-performer.

As one would expect, jurisdictions vary greatly. In terms of fiscal resources, for example, some jurisdictions might have a larger tax base or a higher revenue-rising capacity. Since jurisdictions are granted some authorities to manage their own affairs, decentralization might likely exacerbate fiscal disparity. In this regard, fiscal equalization scheme plays a huge role. However, fiscal equalization design is rarely ideal and its implementation is frequently so complicated as to distort local

decision makings (Kotsogiannis and Schwager 2008) and, thus, counterproductive with the notion of improving accountability.

In addition to fiscal disparity, institutions also differ among jurisdictions. For instance, using education as an indicator of institutions, voters in one jurisdiction might be more literate and well informed. Empirical research has shown that political involvement is positively related to income and education. Educated people are more likely to be politically literate and stay politically involved. As a result, they are more willing to pay attention to corruptions and government miss-conducts and, thus, making rent appropriation more costly (Glaeser and Saks 2006). This implies that differences in institutions bring about different limit to government behavior.

A brief example might be useful to clarify this notion. We consider the implementation of decentralization policies in Indonesia in 2001. The decentralization policies were adopted immediately following the fall of centralist regime. One of the motives for this abrupt reform is to respond to threats of secession from resource-abundant provinces, such as East Kalimantan, Riau, Papua and Aceh, which demanded a larger control over their own resources. Consequently, the autonomous districts in these provinces are relatively fiscally-rich in the sense that their per capita revenue are among the highest in the country. Nevertheless, having been long neglected by the centralist regime, at the starting of decentralization quality of institutions were relatively worse. Furthermore, albeit fiscally rich, the revenue is mostly spent to finance administrative expenditure, the type of expenditure that is prone to corruption and miss-use. Hence, fifteen years after the implementation of decentralization policies, institutions in these districts remain relatively less developed. Looking at selected development indicators, poverty rate is among the highest and education indicators are among the lowest in the country, indicating active citizen participation is less likely, making rent appropriation less costly.

This study enriches the existing literature on yardstick competition by emphasizing disparities among jurisdictions, not only in terms of fiscal resources but also institutions, and demonstrates that yardstick bias might be moderated in a specific

setting. Borrowing from Indonesia's decentralization experience and defining fiscal capacity as merely potential resources that can be taxed bring about a distinctive mixture of fiscal capacity-costs of rent appropriation, in which jurisdictions having a higher fiscal capacity tend to exhibit lower costs of rent appropriation whilst those having a lower fiscal capacity tend to exhibit higher costs of rent appropriation. Allowing for yardstick competition in this setup, the difference in costs of rent appropriation might moderate the bias caused by fiscal disparity. So long as fiscal disparity higher than costs of rent appropriation disparity, the costliness of rent appropriation in fiscally-poor jurisdiction restricts the predatory behavior of incumbent in the fiscally-rich jurisdiction, in that he must increase his supply of public goods and give up some part of his rent and yet has a lower probability of reelection. When fiscal disparity lower than costs of rent appropriation disparity, the costliness of rent appropriation in the neighboring jurisdiction hinders incumbent in the relatively fiscally-rich jurisdiction to even exploit his fiscal advantages. In order to appropriate more rent, he must decrease public goods and thus his probability of reelection is lower than his counterpart in the fiscally-poor district.

The remainder of the paper is organized as follows. In order to provide a background for our theoretical model, the subsequent section details institutional context of decentralization in Indonesia. The third section describes the model setup. The fourth section presents the equilibrium of asymmetric yardstick competition. The fifth section tailors the model presented in section 3 with the case of asymmetric costs of rent appropriation and presents the main results of the paper. The final section summarizes the main findings.

2 Institutional context

The fall of Soeharto's regime not only marked Indonesia's transition from autocracy to democracy, but also restructured central-regions relations (Aspinall and Fealy 2003). During the regime, regions merely served the interests of the central government, in that most policies were mandated from the top. This extreme centralization created a severe regional imbalances and gave rise to regional dis-

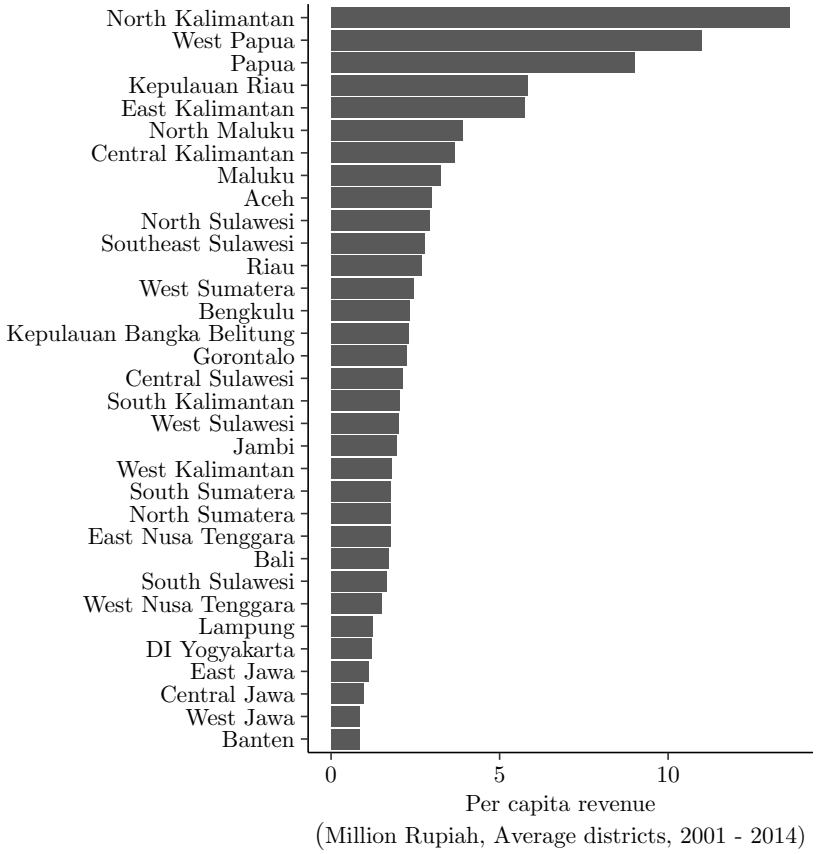
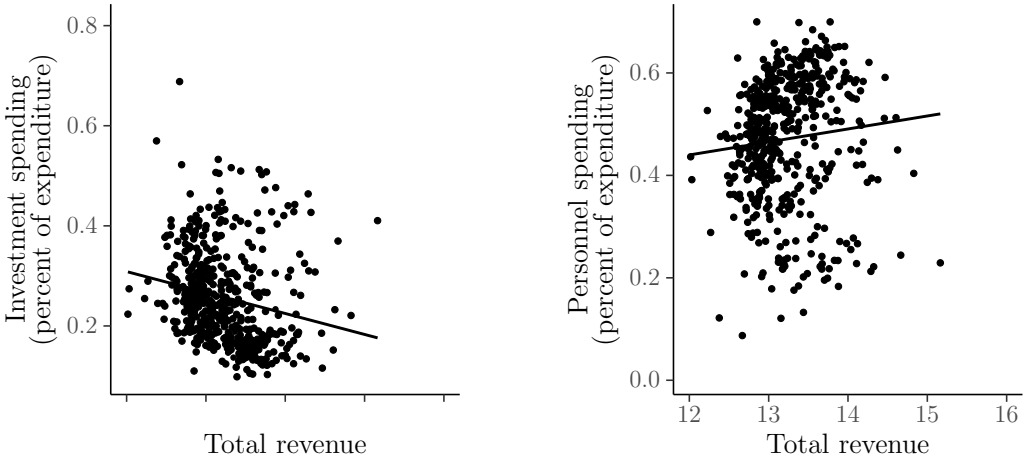


Figure 1: Average district revenue per capita (Source: the Directorate General of Fiscal Balance, Ministry of Internal Affairs, Author's calculation)

contents. The call for democracy has prompted regions to demand larger control over their own affairs, leading to threats of secession from the resource-abundant provinces. In the middle of crisis, decentralization was seen as the best means to disperse power and avoid disintegration.

As a consequence, following the adoption of decentralization, districts located in resource-abundant provinces are relatively fiscally rich. Figure 1 shows that districts in Province North Kalimantan, West Papua, Papua, Kepulauan Riau and East Kalimantan, have higher per capita revenue in average. Nevertheless, almost 50 percent of the revenue is spent for personnel expenditure and only 25 percent is allocated for investment. As displayed in Figure 2, revenue is negatively related to investment spending while positively related to personnel spending. This implies



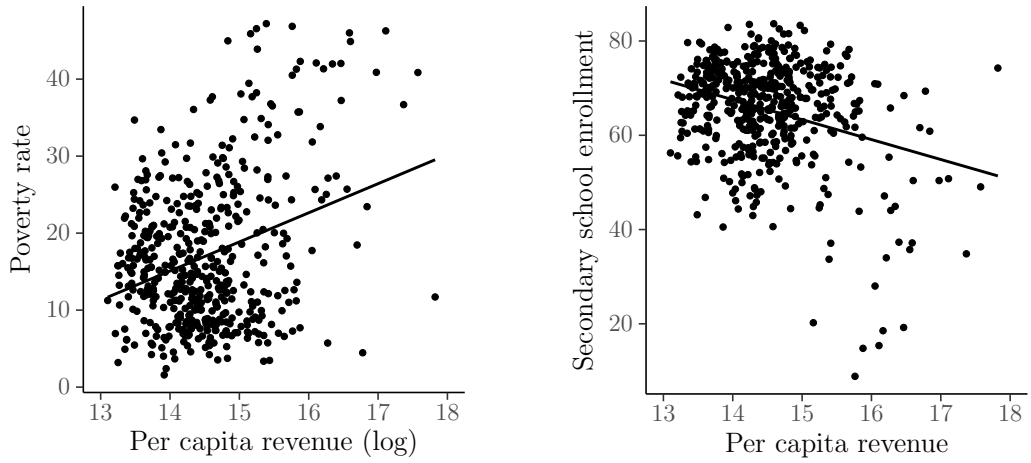
(a) (b)

Figure 2: Total revenue, Investment spending and personnel spending, average 2001 - 2014 (Source: the Directorate General of Fiscal Balance, Ministry of Internal Affairs, Author's calculation)

that the population in those fiscally-rich districts might not necessarily benefit from this fiscal advantage because the revenue is not largely allocated to directly improve public services. In addition, the large share of personnel spending can be prone to corruption and other type of budget miss-use. As a result, infrastructures and development outcomes in those districts are only slowly improving.

Figure 3 illustrates the relation between revenue per capita, poverty rate and secondary school enrollment rate. It shows that revenue per capita is positively related to poverty rate while negatively related to secondary school enrollment. This means that the fiscally-rich districts perform worse in alleviating poverty and improving education attainment.

As suggested by Glaeser and Saks (2006), education facilitates people to learn and understand politics more easily. Education also encourages people to stay politically involved. Accordingly, educated people are more willing to pay attention to corruptions and government miss-conducts and, thus, making rent extraction more costly. Therefore, jurisdictions with more prosperous and educated populations are expected to be less corrupt.



(a) (b)

Figure 3: Per capita revenue, poverty rate and school enrollment (Source: the Directorate General of Fiscal Balance, Ministry of Internal Affairs, Statistics Indonesia (BPS), World Bank, Author's illustration)

We collected data from Indonesian Corruption Eradication Commission (KPK) to see a general pattern of citizen participation in fighting against corruption. The commission has established a whistle-blower-system to allow citizen to report any indication of corruption. In its 2012 Annual report, KPK recorded that people in Jawa Island and Sumatera Island are the most active in reporting corruption cases during the year 2004 to 2012. Table 1 particularly informs five provinces with the highest number of citizens reporting corruption, four of which are located in Jawa Island. Districts in both islands, albeit having moderate revenue per capita in average, have relatively more developed institutions and better development outcomes.

The annual report also documented the number of corruption cases according to province. Table 2 summarizes five provinces with the highest number of corruption cases during the period of 2004 to 2012. Similar to the citizens' report, corruption cases investigated by the KPK are mostly located in Java Island and Sumatera Island.

The fact that corrupt acts mostly occur in Jawa Island and Sumatera Island does not necessarily mean that districts in both islands are more corrupt than those in

Table 1: Provinces with highest number of citizens reporting corruption case (2004 - 2012)

Province	Number of reports
DKI Jakarta	10738
East Jawa	5655
North Sumatera	5207
West Jawa	4725
Central Jawa	3814

Source: KPK (2012)

Table 2: Provinces with the highest number of corruption cases (2004 - 2012)

Province	Number of cases
West Jawa	24
Riau & Kepulauan Riau	23
DKI Jakarta	17
Central Jawa	13
East Kalimantan	11

Source: KPK (2012)

other islands. Referring to the data on citizen reporting corruption case, provinces with the highest number of corruption cases tend to have the highest number of citizens actively participating in curbing corrupt acts. This might suggest that the actively involved population increases the probability of corrupt behavior being caught, making rent appropriation more costly.

The Indonesian experience presented in this section allows us to derive a kind of relation between fiscal capacity and the costs of rent appropriation. Jurisdictions with a higher fiscal capacity tend to have relatively lower costs of rent appropriation and, conversely, jurisdictions with a lower fiscal capacity tend to have higher costs of rent appropriation.

3 The Model

Consider two identical jurisdictions $i \in \{1, 2\}$, in which the population of each jurisdiction is normalized to unity. They differ only in their fiscal capacity, which is defined simply as the available resources that can be taxed. We will later relax this assumption by introducing differences in the costs of rent appropriation. Both jurisdictions face common exogenous shocks. Furthermore, there are no spillovers between two jurisdictions except for informational spillovers.

Voters in both jurisdictions are identical and have no different taste of public good. They elect their government via local democratic elections. The informational spillovers allow voters in each jurisdiction to compare performance of their incumbent and vote accordingly. Thus, voters do yardstick voting. The premise is that yardstick voting eventually leads to yardstick competition.

The elected governments (hereafter refer to as he for jurisdiction 1 and she for jurisdiction 2) collect taxes to provide a certain level of public goods. Nevertheless, the elected governments care for only rent and reelection. For simplicity, there is no minimum required level of public goods and voters cannot anticipate the level of public goods. Thus, if possible, government will appropriate all of the tax revenues and leave nothing for public goods provision.

The tax rate is exogenously determined, by the central government for instance, and equal over jurisdictions. This is not uncommon, particularly in developing countries, in which the central government places explicit limits on the taxing authority of local governments. This also demonstrates that tax competition is often absent in those countries.

There is a term limit for governments, stipulating the incumbents are allowed to remain in the office for a maximum of two periods. In the first period of the game, both incumbents are in their first term and face threat of being replaced. Furthermore, the incumbents cannot be ejected in the middle of the term. This means the government cannot be contractually directly punished; what voters can do at best is replacing the government via democratic elections. Therefore, incumbents provide public goods in the first period in order to increase their

reelection probability.

The incumbent's budget constraint in period t is

$$r_i^t = \bar{\tau} B_i - G_i^t \ , \tag{1}$$

in which r_i^t denotes the rent extracted by the government in jurisdiction i at period t, $\bar{\tau}$ is the exogenous tax rate, B_i is the per capita tax base of jurisdiction i and G_i^t is the per capita level of public goods supplied by the government in jurisdiction i at period t. Furthermore, $B_i \in \mathbb{R}_{>0}$ and $r_i, G_i \in \mathbb{R}_{\geq 0}$. The incumbents are able to observe r_i and B_i but the voters are not.

Fiscal disparity is captured by assuming that $B_2 = \mu B_1$; $\mu \in (0, 1)$. This implies that jurisdiction 1 has a higher fiscal capacity than jurisdiction 2. In this simple model, B_1 and B_2 do not change within the two periods. The incumbents also do not attempt to invest in improving fiscal capacity.

Following Liddo and Giuranno (2016), we model the re-election probability by using a "contest function" (see Hirshleifer 1989). This function defines the probability of winning an election as a function of incumbents' effort; in this case the level of per capita public goods that they provide. The function takes the following form:

$$P_i(G_1, G_2) = \frac{G_i^\alpha}{\sum_i G_i^\alpha}, \tag{2}$$

where P_i, which denotes the probability of incumbent in jurisdiction i to win an election, is a function of G_1 and G_2. Accordingly, $\frac{\partial P_i}{\partial G_i} \geq 0$, $\frac{\partial^2 P_i}{\partial G_i} \leq 0$ and $\frac{\partial P_i}{\partial G_{-i}} \leq 0$. Parameter α captures the marginal increase in the probability of winning an election caused by higher efforts. For simplicity we assume $\alpha = 1$.

4 The yardstick bias

Incumbents determine the supply of public goods in order to maximize the expected total rents over the two periods. Since there is no minimum required level

of public goods, the reelected incumbents appropriate all of the tax revenues in the second period and, thus, provide no public good (i.e. $G_i^2 = 0$ and $r_i^2 = \bar{\tau}B_i$). This is possible because voters are assumed to not be able to anticipate the level of public goods in the second period. Incumbent's inter-temporal problem can thus be written as follows:

$$\max_{G_i^1} R_i = \bar{\tau}B_i - G_i^1 + P_i(G_1, G_2)\delta\bar{\tau}B_i, \tag{3}$$

in which R_i denotes the total expected rent appropriated by incumbent in jurisdiction i. Both incumbents seek for re-election and have the same discount factor δ, where $\delta \in [\frac{1}{2}, 1]$. A high discount factor ensures that the incumbents pursue the second term.

The Nash equilibrium of per capita public good is given by

$$(G_1^*, G_2^*) = \left(\frac{\mu}{(1+\mu)^2}\delta\bar{\tau}B_1, \frac{\mu^2}{(1+\mu)^2}\delta\bar{\tau}B_1 \right) \tag{4}$$

The Nash equilibrium shows that $G_1^* > G_2^*$, implying that the level of per capita public goods is higher in the fiscally-rich jurisdiction. Accordingly, having a higher level of public goods, the reelection probability is higher for the incumbent in jurisdiction 1 than 2, that is $\frac{1}{1+\mu} = P_1 > P_2 = \frac{\mu}{1+\mu}$.

Finally, the total expected rent for each incumbent in equilibrium, which is given by

$$R_1^* = \Big[1 + \frac{\delta}{(1+\mu)^2}\Big]\bar{\tau}B_1 \tag{5}$$

$$R_2^* = \mu\Big[1 + \frac{\mu^2\delta}{(1+\mu)^2}\Big]\bar{\tau}B_1, \tag{6}$$

also shows that $R_1^* > R_2^*$.

This suggests that incumbent in the fiscally-rich jurisdiction is able to appropriate more rent and provide more public goods yet have a higher probability of being reelected. This is possible because a higher fiscal capacity provides more scope

for him to provide slightly higher per capita public goods and, at the same time, appropriate a higher rent. With yardstick voting in place, he is seen as more responsible than his counterpart in fiscally-poor jurisdction and, thus, is more likely to be reelected.

The first derivative with regard to μ shows that $\frac{\partial G_1^*}{\partial \mu} > 0$, $\frac{\partial P_1^*}{\partial \mu} < 0$, and $\frac{\partial R_1^*}{\partial \mu} < 0$, meaning a higher fiscal disparity lowers per capita public goods provided by incumbent in jurisdiction 1 but increases his rent and reelection probability. In contrast, $\frac{\partial G_2^*}{\partial \mu} > 0$, $\frac{\partial P_2^*}{\partial \mu} > 0$ and $\frac{\partial R_2^*}{\partial \mu} > 0$, implying a higher fiscal disparity lowers per capita public goods, the reelection probability, and the rent extracted in jurisdiction 2. This suggests fiscal disparity causes yardstick competition to be bias toward the more fiscally-rich jurisdictions, making it less effective to discipline incumbent in those jurisdictions (see Allers (2012)).

In order to permit an unbiased relative performance assessment, Allers (2012) further suggests the necessity for fiscal equalization such as through a system of intergovernmental transfers. The crux of the matter is that fiscal equalization design is rarely ideal and its implementation is frequently so complicated as to distort local decision makings (Kotsogiannis and Schwager 2008) and, thus, counterproductive with the notion of improving accountability.

The following section illustrates a possibility in which the costliness of rent appropriation might hinder incumbent in the fiscally-rich jurisdiction to exploit his fiscal advantage.

5 Equilibrium with asymmetric costs of rent appropriation

As we illustrate earlier, jurisdictions differ not only in terms of fiscal capacity but also in terms of institutions. Differences in institutions in turn create a difference limit to government behavior, leading to some jurisdictions having higher costs of rent appropriation than others. We introduce exogenous costs of rent appropriation in the government budget constraint

$$r_i^t = \gamma_i^t(\bar{\tau} B_i - \mathcal{G}_i^t) \ , \tag{7}$$

where $\gamma_i \in (0,1)$ indicates costs associated with rent appropriation (Persson and Tabellini 2000, p. 70). The higher is γ_i, the lower are costs of rent appropriation, the easier is the incumbent to appropriate rent. Conversely, the lower is γ_i, the higher are costs of rent appropriation, the harder is rent appropriation. We might also interpret γ_i^t more clearly by considering $(1-\gamma_i^t)(\bar{\tau}B_i - \mathcal{G}_i^t)$ as a part of rent that the incumbents should lose to hide their rent seeking activities. How much cost they should bear depends on many factors; among other things, citizen active involvement in politics.

We modify the notation of per capita public goods, total expected rent and probability of reelection to distinguish the equilibrium under asymmetric fiscal capacity and the equilibrium under both asymmetric fiscal disparity and asymmetric costs of rent appropriation, in which the calligraphic notation $\mathcal{G}_i$, $\mathcal{R}_i$, and $\mathcal{P}_i$ denote the latter. Nonetheless, notations are defined as in section 4.

We retain the assumption that $B_1 = \mu B_2$; $\mu \in (0,1)$. In addition, we introduce a difference in the costs of rent appropriation into the model. Referring to an example provided in section 2, in which revenue per capita is negatively related to citizens' active involvement in reporting corruption and also negatively related to the number of corruption found, we assume $\gamma_2 = \sigma\gamma_1$; $\sigma \in (0,1)$[1]. If $\sigma \in (0,1)$, then $\gamma_1 > \gamma_2$. This implies that the fiscally-rich jurisdiction has lower costs of rent appropriation and, thus, incumbent in jurisdiction 1 puts less efforts to hide his rent seeking activities than his counterpart in jurisdiction 2. Furthermore, the lower σ is, the higher is the difference in costs of rent appropriation.

In this simple model, we retain the assumption that the incumbents cannot be discharged in the middle of the term and there is no minimum required level of public good. Because the incumbents cannot be discharged in the middle of the term, they do not need to take any action to conceal their rent-seeking behavior at period 2. Therefore, we assume that there are no costs of rent appropriation in

1. We might also consider a less attractive case in which $\sigma \in (1, \frac{1}{\gamma_1})$, implying that jurisdiction 1, the fiscally-rich jurisdiction has higher costs of rent appropriation. In this setting, incumbent in 1 will necessarily curb his predatory behavior due to the costliness of rent appropriation in his own jurisdiction.

the the second period. The inter-temporal choice of the incumbent becomes

$$\max_{\mathcal{G}_i^1} \mathcal{R}_i = \gamma_i(\bar{\tau}B_i - \mathcal{G}_i^1) + P_i(\mathcal{G}_1, \mathcal{G}_2)\delta\bar{\tau}B_i, \tag{8}$$

The Nash equilibrium per capita public goods is

$$(\mathcal{G}_1^*, \mathcal{G}_2^*) = \left(\frac{\mu\sigma}{\gamma_1(\sigma+\mu)^2}\delta\bar{\tau}B_1, \frac{\mu^2}{\gamma_1(\sigma+\mu)^2}\delta\bar{\tau}B_1 \right) \tag{9}$$

Accordingly, probability of reelection for incumbent in jurisdiction 1 and jurisdiction 2 are $\mathcal{P}_1 = \frac{\sigma}{\sigma+\mu}$ and $\mathcal{P}_2 = \frac{\mu}{\sigma+\mu}$ respectively. The total expected rent is given by

$$\mathcal{R}_1^* = \left[\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2}\right]\bar{\tau}B_1 \tag{10}$$

$$\mathcal{R}_2^* = \mu\left[\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2}\right]\bar{\tau}B_1, \tag{11}$$

Now we analyze two different cases, namely one in which $\sigma \geq \mu$ and another in which $\sigma < \mu$.

For the first case, $\sigma \geq \mu$, fiscal disparity is higher or equal to costs of rent appropriation disparity. In this case, the Nash equilibrium under two asymmetries implies that $\mathcal{G}_1^* \geq \mathcal{G}_2^*$, $\mathcal{P}_1 \geq \mathcal{P}_2$ and $\mathcal{R}_1^* > \mathcal{R}_2^*$. This means that yardstick is still bias towards the fiscally-rich jurisdiction in that incumbent in fiscally-rich jurisdiction is still able to provide a higher public goods, take a higher rent and have a higher probability of reelected.

However, the difference in costs of rent appropriation might moderate the bias caused by fiscal disparity. We can compare the Nash equilibrium under asymmetric fiscal capacity with one under both asymmetric fiscal capacity and asymmetric costs of rent appropriation and show that there exists a Nash equilibrium implying that $\mathcal{G}_1^* > G_1^*$ and $\mathcal{G}_2^* > G_2^*$, $\mathcal{P}_1^* < P_1$ and $\mathcal{P}_2^* > P_2$, $\mathcal{R}_1^* < R_1^*$ and $\mathcal{R}_2^* < R_2^*$, for $\sigma \geq \mu$.

An intuitive interpretation would be as follows. With higher costs of rent appropriation, incumbent in jurisdiction 2 should put more efforts to hide her rent seeking activities, that is by increasing the level of public goods. The lower is σ, the larger is the disparity in costs of rent appropriation, the more public goods she should provide in order to catch up with the neighboring jurisdiction. On the one hand a higher level of public goods lowers her first period rent, but on the other, it increases her probability of reelection. The total expected rent thus depends on how much rent she gives up in the first period and the increase in the probability of reelection.

Allowing for yardstick competition, voters in jurisdiction 1 might also benefit from the costliness of rent appropriation in jurisdiction 2. The increased level of public goods in jurisdiction 2 induces a higher level of public goods in jurisdiction 1 so long as fiscal disparity higher than costs of rent appropriation disparity. However, the reelection probability of incumbent in jurisdiction 1 lowers because the increase of public goods in 2 is relatively higher than in 1. This leads to a lower expected rent in the second period. Since $\gamma_1 < 1$, the total expected rent appropriated by incumbent in jurisdiction 1 decreases. Therefore, in this setting the costliness of rent appropriation in fiscally-poor jurisdiction restricts the predatory behavior of incumbent in the fiscally-rich jurisdiction, in that he must increase his supply of public goods and give up some part of his rent and yet has a lower probability of reelection.

For the second case, $\sigma < \mu$, fiscal disparity is less severe than costs of rent appropriation disparity. The Nash equilibrium under both asymmetries shows $\mathcal{G}_1^* < \mathcal{G}_2^*$ and $\mathcal{P}_1 < \mathcal{P}_2$. However, the effect on total expected rent is ambiguous, in which $\mathcal{R}_1 < \mathcal{R}_2$ only if $(1 - \mu\sigma)\gamma_i < \frac{(\mu^3 - \sigma^2)\delta}{\sigma + \mu}$. Furthermore, comparing the Nash equilibrium under asymmetric fiscal capacity with one under both asymmetries, there exists a Nash equilibrium implying that $\mathcal{G}_1^* < G_1^*$ and $\mathcal{G}_2^* > G_2^*$, $\mathcal{P}_1^* < P_1$ and $\mathcal{P}_2^* > P_2$, $\mathcal{R}_1^* < R_1^*$ and $\mathcal{R}_2^* < R_2^*$, for $\sigma < \mu$.

Intuitively, this suggests that when both jurisdictions are relatively fiscally identical, the costliness of rent appropriation in the neighboring jurisdiction hinders incumbent in the relatively fiscally-rich jurisdiction to exploit his fiscal advantages.

In order to appropriate more rent, he must decrease public goods and thus lowers his probability of reelection.

Figure 4 and 5 illustrate one possibility of the mechanisms at work, in which $\sigma = 0.5$ and $\gamma_1 = 1$. Figure 4 shows that, holding μ constant, the solid line is generally higher than the dashed line, implying per capita public goods in both jurisdictions are generally higher with disparity in costs of rent appropriation in place. So long as $\sigma \geq \mu$, per capita public goods in both jurisdictions increases. Further to the right, fiscal disparity is lower relative to the difference in the costs of rent appropriation ($\sigma < \mu$). Hence, due to higher cost of rent appropriation, incumbent in jurisdiction 2 must provide even higher per capita public goods than incumbent in jurisdiction 1. This lowers her her first period rent but grants her a higher probability of reelection than her counterpart, leading to a higher total expected rent.

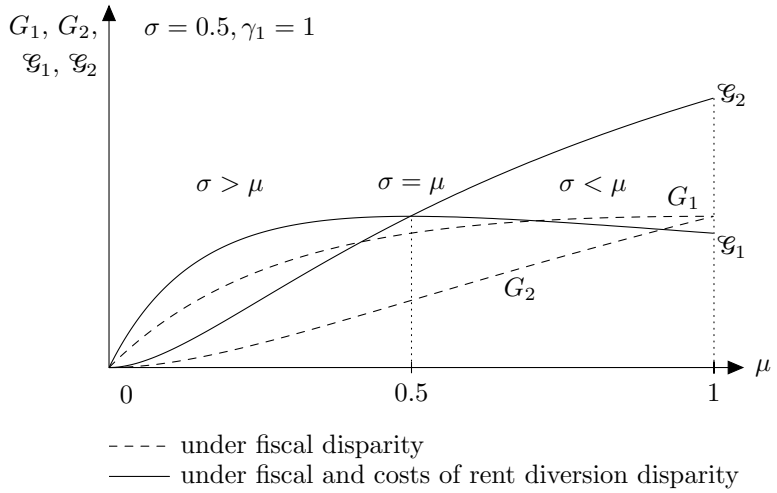


Figure 4: Per capita public goods in which $\sigma \in (0, 1)$

Figure 5 shows the associated total expected rent. Incumbent in fiscally-rich jurisdiction generally can appropriate more rent. However, the costliness of rent appropriation in the fiscally-poor neighboring jurisdiction limits his predatory behavior, compelling him to reduce his rent. With costs of rent appropriation in place, the overall welfare increases.

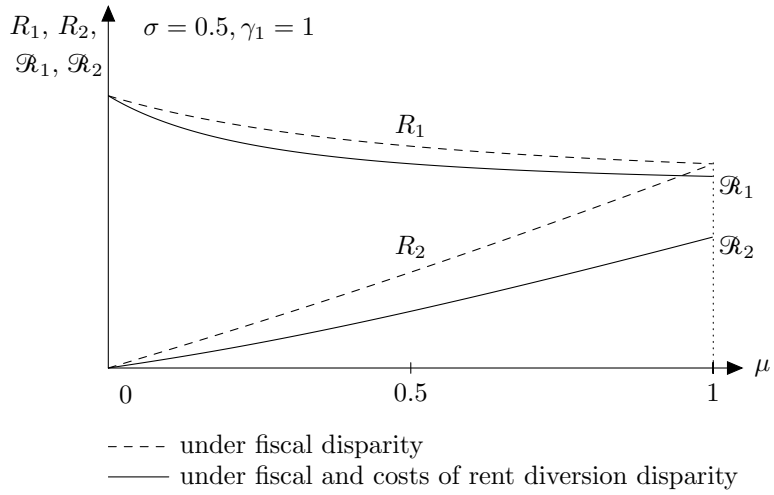


Figure 5: Total expected rent in which $\sigma \in (0, 1)$

6 Concluding remarks

When fiscal disparity exists, Allers (2012) shows that yardstick competition is bias toward fiscally-rich jurisdictions and, thus, cannot sufficiently curb the predatory behavior of incumbent in those jurisdictions. This study emphasizes disparities among jurisdictions further, that is not only in terms of fiscal but also in term of costs of rent appropriation.

In particular, in a setting in which jurisdictions with high fiscal capacity having low costs of rent appropriation whilst those having low fiscal capacity having higher costs of rent appropriation, if voters are able to asses the relative performance of their government, the difference in costs of rent appropriation might moderate the bias caused by fiscal disparity. So long as fiscal disparity higher than costs of rent appropriation disparity, the costliness of rent appropriation in fiscally-poor jurisdiction restricts the predatory behavior of incumbent in the fiscally-rich jurisdiction, in that he must increase his supply of public goods and give up some part of his rent and yet has a lower probability of reelection. When fiscal disparity lower than costs of rent appropriation disparity, the costliness of rent appropriation in the neighboring jurisdiction hinders incumbent in the relatively fiscally-rich

jurisdiction to exploit his fiscal advantages. In order to appropriate more rent, he must decrease public goods and thus lowers his probability of reelection.

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A Appendix

A.1 The yardstick bias

The government's maximization problem is

$$\max_{G_i^1} \bar{\tau} B_i - G_i^1 + P_i(G_1, G_2)\delta\bar{\tau}B_i$$

The maximization yields:

$$-1 + \frac{\delta\bar{\tau}B_i(G_1+G_2) - \delta\bar{\tau}B_iG_i}{(G_1+G_2)^2} \stackrel{!}{=} 0$$
$$\delta\bar{\tau}B_i(G_1+G_2) - \delta\bar{\tau}B_iG_i = (G_1+G_2)^2$$

With $B_2 = \mu B_1$, the reaction function of incumbent in jurisdiction 1 and 2 are respectively:

$$\delta\bar{\tau}B_1G_2 = (G_1+G_2)^2 \tag{A.1.1}$$
$$\delta\bar{\tau}\mu B_1G_1 = (G_1+G_2)^2 \tag{A.1.2}$$

By manipulating equation (A.1.1) and (A.1.2), we get

$$G_2 = \mu G_1$$
$$(G_2 + \mu G_1)\delta\bar{\tau}B_1 = 2(G_1+G_2)^2$$

We derive the Nash equilibrium of public goods as follows

$$2\mu G_1\delta\bar{\tau}B_1 = 2(G_1+\mu G_1)^2$$
$$2\mu G_1\delta\bar{\tau}B_1 = 2G_1^2(1+\mu)^2$$
$$\mu\delta\bar{\tau}B_1 = G_1(1+\mu)^2$$
$$G_1^* = \frac{\mu}{(1+\mu)^2}\delta\bar{\tau}B_1 \tag{A.1.3}$$

Accordingly,

$$G_2^* = \frac{\mu^2}{(1+\mu)^2}\delta\bar{\tau}B_1 \tag{A.1.4}$$

The reelection probability for the incumbent in 1 and 2 are

$$P_1 = \frac{G_1}{G_1+G_2} = \frac{1}{1+\mu} \tag{A.1.5}$$

$$P_2 = \frac{G_2}{G_1+G_2} = \frac{\mu}{1+\mu} \tag{A.1.6}$$

In equilibrium, the total rent

$$\begin{aligned} R_1^* &= \bar{\tau}B_1 - \frac{\mu}{(1+\mu)^2}\delta\bar{\tau}B_1 + \frac{1}{1+\mu}\delta\bar{\tau}B_1 \\ R_1^* &= \bar{\tau}B_1 - \frac{\mu-(1+\mu)}{(1+\mu)^2}\delta\bar{\tau}B_1 \\ R_1^* &= \Big[1+\frac{\delta}{(1+\mu)^2}\Big]\bar{\tau}B_1 \end{aligned} \tag{A.1.7}$$

Using the same fashion, the total rent for jurisdiction j is

$$R_2^* = \mu\Big[1+\frac{\mu^2\delta}{(1+\mu)^2}\Big]\bar{\tau}B_1 \tag{A.1.8}$$

A.2 Equilibrium with asymmetric costs of rent appropriation

The government's maximization problem is

$$\max_{\mathcal{G}_i^1} \mathcal{R}_i = \gamma_i(\bar{\tau}B_i - \mathcal{G}_i^1) + P_i(\mathcal{G}_1, \mathcal{G}_2)\delta\bar{\tau}B_i,$$

The maximization yields:

$$-\gamma_i + \frac{\delta\bar{\tau}B_i(\mathcal{G}_1 + \mathcal{G}_2) - \delta\bar{\tau}B_i\mathcal{G}_i}{(\mathcal{G}_1 + \mathcal{G}_2)^2} \stackrel{!}{=} 0$$
$$\delta\bar{\tau}B_i(\mathcal{G}_1 + \mathcal{G}_2) - \delta\bar{\tau}B_i\mathcal{G}_i = -\gamma_i(\mathcal{G}_1 + \mathcal{G}_2)^2$$

With $B_2 = \mu B_1$ and $\gamma_2 = \sigma\gamma_1$, the reaction function of incumbent in 1 and 2 are respectively:

$$\delta\bar{\tau}B_1\mathcal{G}_2 = \gamma_1(\mathcal{G}_1 + \mathcal{G}_2)^2 \tag{A.2.1}$$
$$\delta\bar{\tau}\mu B_1\mathcal{G}_1 = \sigma\gamma_1(\mathcal{G}_1 + \mathcal{G}_2)^2 \tag{A.2.2}$$

By manipulating equation (A.2.1) and (A.2.2), we get

$$\mathcal{G}_2 = \frac{\mu}{\sigma}\mathcal{G}_1$$
$$(\mu\mathcal{G}_1 + \mathcal{G}_2)\delta\bar{\tau}B_1 = \gamma_1(1+\sigma)(\mathcal{G}_1 + \mathcal{G}_2)^2$$

Using equation (A.2.1) and (A.2.2), we derive the Nash equilibrium of public good

$$(\mu\mathcal{G}_1 + \frac{\mu}{\sigma}\mathcal{G}_1)\delta\bar{\tau}B_1 = \gamma_1(1+\sigma)(\mathcal{G}_1 + \frac{\mu}{\sigma}\mathcal{G}_1)^2$$
$$\mu\mathcal{G}_1\Big(\frac{1+\sigma}{\sigma}\Big)\delta\bar{\tau}B_1 = \gamma_1(1+\sigma)\Big(\frac{\sigma+\mu}{\sigma}\Big)^2\mathcal{G}_1^2$$
$$\mu\delta\bar{\tau}B_1 = \gamma_1\frac{(\sigma+\mu)^2}{\sigma}\mathcal{G}_1$$
$$\mathcal{G}_1^* = \frac{\mu\sigma}{\gamma_1(\sigma+\mu)^2}\delta\bar{\tau}B_1 \tag{A.2.3}$$

Accordingly,

$$\mathcal{G}_2^* = \frac{\mu^2}{\gamma_1(\sigma+\mu)^2}\delta\bar{\tau}B_1 \tag{A.2.4}$$

The reelection probability for the incumbent is

$$\mathscr{P}_1 = \frac{\mathscr{G}_1}{\mathscr{G}_1 + \mathscr{G}_2} = \frac{\sigma}{\sigma + \mu} \tag{A.2.5}$$

$$\mathscr{P}_2 = \frac{\mathscr{G}_2}{\mathscr{G}_1 + \mathscr{G}_2} = \frac{\mu}{\sigma + \mu} \tag{A.2.6}$$

In equilibrium, the total rent for the incumbent in jurisdiction 1

$$\begin{aligned}
\mathscr{R}_1^* &= \gamma_1 \bar{\tau} B_1 - \gamma_1 \frac{\mu\sigma}{\gamma_1(\sigma+\mu)^2} \delta \bar{\tau} B_1 + \frac{\sigma}{\sigma+\mu} \delta \bar{\tau} B_1 \\
\mathscr{R}_1^* &= \gamma_1 \bar{\tau} B_1 + \frac{\sigma(\sigma+\mu) - \mu\sigma}{(\sigma+\mu)^2} \delta \bar{\tau} B_i \\
\mathscr{R}_1^* &= \Big[\gamma_1 + \frac{\sigma^2 \delta}{(\sigma+\mu)^2}\Big] \bar{\tau} B_i
\end{aligned} \tag{A.2.7}$$

Using the same fashion, the total rent the incumbent in j is

$$\begin{aligned}
\mathscr{R}_2^* &= \gamma_2 \bar{\tau} B_2 - \gamma_2 \frac{\mu^2}{\gamma_1(\sigma+\mu)^2} \delta \bar{\tau} B_1 + \frac{\mu}{\sigma+\mu} \delta \bar{\tau} B_2 \\
\mathscr{R}_2^* &= \mu\sigma\gamma_1 \bar{\tau} B_1 - \sigma\gamma_1 \frac{\mu^2}{\gamma_1(\sigma+\mu)^2} \delta \bar{\tau} B_1 + \frac{\mu^2}{\sigma+\mu} \delta \bar{\tau} B_1 \\
\mathscr{R}_2^* &= \mu\sigma\gamma_1 \bar{\tau} B_1 + \frac{\mu^2(\sigma+\mu) - \mu^2\sigma}{(\sigma+\mu)^2} \delta \bar{\tau} B_i \\
\mathscr{R}_2^* &= \Big[\mu\sigma\gamma_1 + \frac{\mu^3 \delta}{(\sigma+\mu)^2}\Big] \bar{\tau} B_i
\end{aligned} \tag{A.2.8}$$

A.3 Yardstick bias under $\sigma \geq \mu$

We first show that yardstick is still bias, in that $\mathscr{G}_1^* \geq \mathscr{G}_2^*$, $\mathscr{P}_1^* \geq \mathscr{P}_2^*$ and $\mathscr{R}_1^* > \mathscr{R}_2^*$.

$$\begin{aligned}
\mathscr{G}_1^* &\geq \mathscr{G}_2^* \\
\frac{\mu\sigma}{\gamma_1(\sigma+\mu)^2} \delta \bar{\tau} B_1 &\geq \frac{\mu^2}{\gamma_1(\sigma+\mu)^2} \delta \bar{\tau} B_1
\end{aligned} \tag{A.3.1}$$

$$\begin{aligned} \mathscr{P}_1^* &\geq \mathscr{P}_2^* \\ \frac{\sigma}{\sigma+\mu} &\geq \frac{\mu}{\sigma+\mu} \end{aligned} \tag{A.3.2}$$

$$\begin{aligned} \mathscr{R}_1^* &> \mathscr{R}_2^* \\ \Big[\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2}\Big]\bar{\tau}B_i &> \mu\Big[\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2}\Big]\bar{\tau}B_i \\ \Big[\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2}\Big] &> \mu\Big[\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2}\Big] \end{aligned} \tag{A.3.3}$$

With $\sigma \geq \mu$, the left-hand side is larger than the term on the bracket of the right-hand side. Since $\mu \in (0,1)$, the left-hand side is larger than the right-hand side

The following part shows that when costs of rent appropriation differ, there exists a Nash equilibrium in which yardstick bias is moderated, that is $\mathscr{G}_1^* > G_1^*$ and $\mathscr{G}_2^* > G_2^*$, $\mathscr{P}_1^* < P_1$ and $\mathscr{P}_2^* > P_2$, $\mathscr{R}_1^* < R_1^*$ and $\mathscr{R}_2^* < R_2^*$, for $\sigma \geq \mu$.

For jurisdiction 1:

For some parameter $\sigma \geq \mu$, there exists $\mathscr{G}_1^*$ in which $\mathscr{G}_1^* > G_1^*$, if $1+\mu > \sqrt{\gamma_2}(1+\frac{\mu}{\sigma})$.

$$
\begin{aligned}
\mathscr{G}_1^* &> G_1^* \\
\frac{\mu\sigma}{\gamma_1(\sigma+\mu)^2}\delta\bar{\tau}B_1 &> \frac{\mu}{(1+\mu)^2}\delta\bar{\tau}B_1 \\
\frac{\sigma}{\gamma_1} &> \frac{(\sigma+\mu)^2}{(1+\mu)^2} \\
\frac{\gamma_2}{\gamma_1^2} &> \frac{(\sigma+\mu)^2}{(1+\mu)^2} \\
\frac{\sqrt{\gamma_2}}{\gamma_1} &> \frac{\sigma+\mu}{1+\mu} \\
\sqrt{\gamma_2}(1+\mu) &> \gamma_1(\sigma+\mu) \\
\sqrt{\gamma_2}(1+\mu) &> \sqrt{\gamma_2}(\sqrt{\gamma_2}+\frac{\mu}{\sigma}\sqrt{\gamma_2}) \\
1+\mu &> \sqrt{\gamma_2}(1+\frac{\mu}{\sigma})
\end{aligned}
\tag{A.3.4}
$$

For each parameter $\sigma \geq \mu$, $\mathscr{P}_1 < P_1$.

$$
\begin{aligned}
\mathscr{P}_1 &< P_1 \\
\frac{\sigma}{\sigma+\mu} &< \frac{1}{1+\mu} \\
\sigma(1+\mu) &< \sigma+\mu \\
\sigma &< 1
\end{aligned}
\tag{A.3.5}
$$

For each parameter $\sigma \geq \mu$, $\mathscr{R}_1^* < R_1^*$.

$$
\begin{aligned}
\mathscr{R}_1^* &< R_1^* \\
\Big[\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2}\Big]\bar{\tau}B_i &< \Big[1+\frac{\delta}{(1+\mu)^2}\Big]\bar{\tau}B_1 \\
\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2} &< 1+\frac{\delta}{(1+\mu)^2}
\end{aligned}
$$

Since $\gamma_1 < 1$, if $\dfrac{\sigma^2\delta}{(\sigma+\mu)^2} < \dfrac{\delta}{(1+\mu)^2}$, then $\mathscr{R}_1^* < R_1^*$.

$$\begin{aligned}
\frac{\sigma^2\delta}{(\sigma+\mu)^2} &< \frac{\delta}{(1+\mu)^2} \\
\sigma^2(1+\mu)^2 &< (\sigma+\mu)^2 \\
\sigma^2 + 2\mu\sigma^2 + \mu^2 &< \sigma^2 + 2\mu\sigma + \mu^2 \\
\sigma^2 &< \sigma
\end{aligned} \tag{A.3.6}$$

For jurisdiction 2:

For each parameter $\sigma \geq \mu$, $\mathscr{G}_2^* > G_2^*$.

$$\begin{aligned}
\mathscr{G}_2^* &> G_2^* \\
\frac{\mu^2}{\gamma_1(\sigma+\mu)^2}\delta\bar{\tau}B_1 &> \frac{\mu^2}{(1+\mu)^2}\delta\bar{\tau}B_1 \\
\frac{1}{\gamma_1(\sigma+\mu)^2} &> \frac{1}{(1+\mu)^2} \\
(1+\mu)^2 &> \gamma_1(\sigma+\mu)^2
\end{aligned} \tag{A.3.7}$$

For each parameter $\sigma \geq \mu$, $\mathscr{P}_2^* > P_2^*$.

$$\begin{aligned}
\mathscr{P}_2 &> P_2 \\
\frac{\mu}{\sigma+\mu} &> \frac{\mu}{1+\mu} \\
1+\mu &> \sigma+\mu \\
1 &> \mu
\end{aligned} \tag{A.3.8}$$

For some parameter $\sigma \geq \mu$, there exists $\mathscr{R}_2^*$ in which $\mathscr{R}_2^* < R_2^*$, if $\Big[\dfrac{1}{(\sigma+\mu)^2} - \dfrac{1}{(1+\mu)^2}\Big]\mu^2\delta < 1 - \sigma\gamma_1$.

$$
\begin{aligned}
\mathscr{R}_2^* &< R_2^* \\
\mu\Big[\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2}\Big]\bar{\tau}B_1 &< \mu\Big[1 + \frac{\delta\mu^2}{(1+\mu)^2}\Big]\bar{\tau}B_1 \\
\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2} &< 1 + \frac{\mu^2\delta}{(1+\mu)^2} \\
\Big[\frac{1}{(\sigma+\mu)^2} - \frac{1}{(1+\mu)^2}\Big]\mu^2\delta &< 1 - \sigma\gamma_1
\end{aligned} \tag{A.3.9}
$$

A.4 Yardstick bias under $\sigma < \mu$

Following equation A.3.1 and A.3.2, it is straightforward to show that $\mathscr{G}_1^* < \mathscr{G}_2^*$ and $\mathscr{P}_1^* < \mathscr{P}_2^*$. However, the effect on total expected rent is ambiguous, in which $\mathscr{R}_1 < \mathscr{R}_2$ only if $(1-\mu\sigma)\gamma_i < \frac{(\mu^3-\sigma^2)\delta}{\sigma+\mu}$.

$$
\begin{aligned}
\mathscr{R}_1^* &< \mathscr{R}_2^* \\
\Big[\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2}\Big]\bar{\tau}B_i &< \mu\Big[\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2}\Big]\bar{\tau}B_i \\
\Big[\gamma_1 + \frac{\sigma^2\delta}{(\sigma+\mu)^2}\Big] &< \mu\Big[\sigma\gamma_1 + \frac{\mu^2\delta}{(\sigma+\mu)^2}\Big] \\
(1-\mu\sigma)\gamma_i &< \frac{(\mu^3-\sigma^2)\delta}{\sigma+\mu}
\end{aligned} \tag{A.4.1}
$$

We now compare the Nash equilibrium under asymmetric fiscal capacity with one under both asymmetries and show that there exists a Nash equilibrium implying that $\mathscr{G}_1^* < G_1^*$ and $\mathscr{G}_2^* > G_2^*$, $\mathscr{P}_1^* < P_1$ and $\mathscr{P}_2^* > P_2$, $\mathscr{R}_1^* < R_1^*$ and $\mathscr{R}_2^* < R_2^*$, for $\sigma < \mu$.

From equation A.3.4, if $\sigma < \mu$, $\frac{\mu}{\sigma} > 1$, and thus the left-hand side is much smaller than the term in the bracket of the right-hand side. This implies: for some parameter $\sigma < \mu$, there exists $\mathscr{G}_1^*$ in which $\mathscr{G}_1^* < G_1^*$ if $1 + \mu < \sqrt{\gamma_2}(1 + \frac{\mu}{\sigma})$. This likely occurs when μ is large enough.

We only need to show $\mathcal{G}_1^* < G_1^*$, since the other conditions remains as under $\sigma \geq \mu$.

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