



# Quality of institutions, rent-seeking, and inter-jurisdictional cooperation

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## Abstract

The differing fiscal needs of municipalities introduce bias into yardstick competition among local administrators driven by pure rent-seeking motives. The influence of institutional quality on this bias varies across cases, sometimes alleviating it, while in other instances exacerbating it. Inter-municipal cooperation provides incumbents with control over political yardstick competition. However, this alliance compromises the quality of public services when rent extraction is a priority. To address the issue of collusion and enhance accountability, the central government may find it counterproductive to uniformly improve institutional quality across all districts. Instead, a more effective approach may involve targeted policy interventions in specific districts, considering the varying levels of fiscal and institutional disparities. By doing so, the central government can disrupt the incentive for collusion and rent extraction among local incumbents.

**Keywords** Yardstick competition · Fiscal disparity · Institutions · Rent appropriation · Inter-municipal cooperation · Collusion

**JEL Classification** D72, H77

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# 1 Introduction

## 1.1 Motivation and aim

Increasingly, municipalities are turning to inter-municipal cooperation (IMC) to achieve economies of scale and pool expertise in public service delivery (Bel & Warner, 2015; Muraoka & Avellaneda, 2021; Silvestre et al., 2020; Tavares & Feiock, 2018). While studies have shown that such cooperation is effective in improving efficiency in local public good provision (Bel & Sebő, 2021), the costs involved in more complex governance (Drew et al., 2019; Garrone et al., 2013; Sørensen, 2007) and greater rent extraction in municipal consortia (Di Liddo & Giuranno, 2016) must also be considered. Horizontal cooperation among local authorities offers an opportunity to create deliberate connections among rent-seeking local administrators. As Congleton (2024) emphasizes, the generation of these linkages has the effect of increasing the losses generated by the rent-seeking contests.

In this paper, we focus on this aspect of the phenomenon of local cooperation, that is, the interplay among IMC through voluntary centralisation (cooperation), yardstick competition (YC) and rent seeking, where local governments are characterized by different institutional quality. Differences in institutional quality among municipalities affect the functioning of YC and the amount of rent extracted in non-cooperative settings (Farah, 2019), which in turn may affect the incentive to cooperate for rent-seeking incumbents.

## 1.2 Setting and results

We present a theoretical model that examines the impact of fiscal and institutional disparities on IMC and rent-seeking behaviour. The model captures the municipal term limit over a two-period horizon, accounting for differences in the cost of public service provision and institutional quality among municipalities. Our model builds on the framework of Di Liddo and Giuranno (2016) by including the asymmetric costs of rent appropriation due to differences in institutional quality, as pointed out by Farah (2019).

We consider two incumbents, each aiming to extract maximum rent while ensuring re-election. As in Kotsogiannis and Schwager (2008), voters are uninformed about service costs and incumbent behaviour, and evaluate performance based on public service supplies in both jurisdictions. Municipal consortia may be formed as an alternative to decentralized provision; however, cooperation is only possible under certain institutional conditions related to the institutional quality of the municipal consortia.

Our analysis reveals that yardstick competition can be biased due to disparities between jurisdictions, but institutional disparity might compensate for fiscal disparity, leading to almost unbiased competition. However, pure rent-seekers' cooperation leads to lower service quality. Our findings highlight the importance

of considering fiscal and institutional disparities when addressing rent extraction and improving public services.

### 1.3 Outline

The remainder of the paper is organized as follows. In Sect. 2 we briefly describe the background of the literature on IMC and YC. In Sect. 3, we present the model and the non-cooperative equilibrium. In Sect. 4 we present the cooperative equilibrium. In Sect. 5 we provide some final comments and policy implications.

## 2 Related literature

Over the past 15 years, inter-municipal cooperation (IMC) has garnered significant scholarly interest, particularly from the field of public administration. Researchers have amassed a substantial collection of empirical studies exploring this alternative mode of public provision for local services. These studies span a wide array of services, including sewage and waste disposal, regional development, and tourism marketing (Bergholz, 2018). Additionally, they examine the fiscal competition incentives that may drive cooperation (Bischoff et al., 2024).

IMC has been recognized as particularly attractive for smaller rural municipalities that have lower contracting capacities and where private businesses encounter higher costs due to sparsity (Arachi et al., 2024; Bel & Costas, 2006; Bel & Fageda, 2017). Empirical studies have demonstrated that especially fiscally weak municipalities are more likely to cooperate (Bel et al., 2013; Schoute et al., 2018; Warner & Hefetz, 2002) and contract out service provision (Bel & Fageda, 2007, 2017). Other empirical and theoretical investigations show that municipalities with similar characteristics are more likely to cooperate (Di Liddo & Giuranno, 2016; Feiock et al., 2009).

Besides factors like population size and fiscal stress (Bischoff & Wolfschütz, 2021), the literature places a special focus on political factors, analysing whether interest groups influence the decision to cooperate. Garrone et al. (2013) argue that public managers favour IMC to reinforce managerial dominance and limit the influence of elected politicians on public service provision (see also Sørensen, 2007). On the other hand, Bergholz and Bischoff (2018), using data from a survey among local council members in 60 German municipalities, provide evidence suggesting that German politicians consider IMC a loss in political power.

Besley and Case (1995) provided an influential formulation of YC mechanism. They offered a political economy model of tax-setting in a multi-jurisdictional world, which has been further explored in several studies thereafter. Those models all represent the fact that voters cannot directly observe the cost of the services provided by the local administrator. Nor can they observe the rent the administrator is able to extract while being in office. To overcome these political agency problems and be able to decide whether to vote again for the incumbent in the next election, citizens compare their own administrator with those in office in other jurisdictions,

being based on some observable index of performance, such as the quality/quantity of the provided services. This rests on the common assumption that there exist jurisdictions which are identical or “similar” and can thus be compared. The comparison forces incumbents into a competitive mechanism, in which each incumbent takes the behaviour of the neighbour administrator into account to maximize her own rent, considering how the probability of re-election will thereby be affected. To be confirmed in office, incumbents will attempt to make the government they lead well placed in the cross-jurisdiction comparisons made by their respective voters. In this way, although YC cannot eliminate the informational asymmetry between administrators and voters, it will nonetheless mitigate its consequences (Di Liddo & Vinella, 2021).

Several empirical analyses provide evidence of the existence of a tax-mimicking behaviour across local governments. Among others, Besley and Case (1995) find confirmation of this phenomenon using US State data over the period 1960–1988. In turn, using data about 143 adjacent Italian municipalities, Bordignon et al. (2003) find a positive spatial autocorrelation in local property tax rates in jurisdictions whose mayors run for re-election, and no correlation in jurisdictions whose mayors face a term limit. In a more recent study, relying on data about German States and local governments, Buettner and Schwerin (2016) find empirical evidence of the existence of YC among sub-national jurisdictions in the choice of business tax rates.

As stated earlier, most studies have hitherto assumed the existence of identical (or “similar”) jurisdictions to be compared, only in recent years some attention has been devoted to the effects that disparities across jurisdictions may have on political YC. In a theoretical investigation, Allers (2012) highlights that when jurisdictions display fiscal disparities, differing in terms of revenue capacity and/or spending needs, administrators of “richer” jurisdictions can provide high-quality services while keeping the local tax burden low. Thus, whereas they extract high rents, they are also likely to be re-elected. When incumbents do not face the same expected rent, given the respective probabilities of re-election, and, hence, the ratio between rents is different from the ratio between probabilities, political yardstick competition is biased. Other theoretical investigations highlight that those fiscal disparities may be endogenously induced by local incumbents. For instance, Di Liddo and Vinella (2021) highlight that, when local rent-seeking administrators who undertake identical infrastructure projects, can choose between two contractual arrangements—traditional procurement (TP) and public–private partnership (PPP) – in the YC equilibrium, incumbents provide different levels of public services, face different re-election probabilities, and obtain different rents. In addition, by differentiating the project governance, incumbents specialize in rent extraction over time, thus hindering YC although jurisdictions are otherwise identical.

The existence of the YC bias, due to differences in revenue capacity and/or expenditure needs, has been also corroborated by the outcome of laboratory experiments (Liddo & Morone, 2017, 2023).

However, exogenous and endogenous fiscal disparities are not the only source of asymmetries in political YC. Farah (2019) studies how differences in the quality of institutions, implying differences in the costs of rent appropriation, affect the YC outcomes. In particular, she finds that, when rent appropriation induces high

costs for one incumbent, this also restricts rent appropriation by the other incumbent. Accordingly, the incumbent of the rich jurisdiction cannot fully exploit his or her fiscal advantages. Thus, political accountability increases in a counter-intuitive manner.

About the impact of YC on IMC, the public choice literature highlights that IMC can be an instrument to decrease the accountability of local administrators. Indeed, centralizing the provision of some local public goods and services, local administrators can weaken voters' control, since the pooling of the provision eliminates the YC mechanism between local government. That is the framework provided by Liddo and Giuranno (2016) in a theoretical model showing that local governments interested in extracting rents make use of IMC to weaken the YC between local administrators and increase the rent extracted. This could be a theoretical explanation to the empirical results obtained by Bel et al. (2022) regarding the absence of cost reduction associated with IMC in some contexts. Indeed, on one hand they estimate lower costs of provision with cooperation in Spain and the Czech Republic, on the other hand, they provide mixed (or no) evidence for the Netherlands, Germany, Poland, Norway, and Italy.

From this brief analysis of the literature, it follows that YC may play an important role in determining the success of IMC agreements and the resulting quality of the municipal consortia and, in turn, of local public goods provided, via its effect on the non-cooperative rent extraction, which constitute the disagreement payoff of IMC (Di Liddo & Giuranno, 2016). In the following section we extend the model of Liddo and Giuranno (2016), introducing some elements of Farah (2019). More precisely, we extend the analysis of Liddo and Giuranno (2016), allowing for a double source of disparity: i) in the cost of provision of local services and ii) in the cost of rent extraction. The aim is to study how these differences interact in determining the IMC outcomes in the presence of pure rent-seeking local administrators.

### 3 The model

Consider two equalized municipalities  $i \in \{1, 2\}$  with identical voters and exogenously determined tax revenues, facing common exogenous shocks. We normalize both municipal population and tax revenues, set by the central government (CG), to unity. The democratically elected governments in each jurisdiction collect taxes to provide a public good or service. The incumbents primary concerns are rent and reelection. We suppose that, as in many local electoral systems (Italian municipalities, UK districts, etc.), incumbents can be in office for a maximum of two mandates. Therefore, we can model the choice problem in two periods  $t \in \{1, 2\}$ .

In each period  $t$ , each jurisdiction  $i=1,2$  provides a certain quality of a local public service,  $s_{it}$ , under constant return to scale. Furthermore, there are no spillovers between jurisdictions except for informational spillovers. Without loss of generality, since tax revenues are exogenous, we model fiscal disparities between jurisdictions assuming that the only difference between them is in their expenditure need  $e_i$ , or standard cost of provision of public service. We normalize the cost of the disadvantaged municipality (the municipality characterized by the highest cost of provision),

namely municipality 2, to the unity, and we set the cost of the advantaged municipality equal to  $e_1 \in ]0, 1[$ .

Administrators know the entity of the cost (fiscal) disparity, voters do not. Incumbents may decide whether they want to provide the service by themselves or jointly, constituting a consortium of municipalities. An example of such consortia is the Italian *Unioni di comuni* (Arachi et al., 2016; Di Liddo & Giuranno, 2020; Luca & Modrego, 2021). Institutions like the Italian *Unioni di comuni* exist in many countries. Think of the *Zweckverbände* in Germany, the *Oprachthoudende and dienstverlenende verenigingen* in Belgium (Flanders), the *Intergemeentelijke diensten* in the Netherlands, the *Sivu, Sivom, Syndicats mixtes* in France, and the *Mancomunidades* in Spain (Ferraresi et al., 2018; Luca & Modrego, 2021).

Following Di Liddo and Giuranno (2016), we assume that, from the point of view of the incumbents, there is a minimum required standard for the local service,  $\sigma$ . Such standard corresponds to the minimum expected unconditional provision as calculated by the government agency.<sup>1</sup> A lower quality of provision may trigger immediate investigation by the judicial authority, which will lead to no expected rent for the incumbent. We assume that the judicial authority knows  $e_i$  and can weight the minimum standard  $\sigma$  to compute the minimum standard conditional to local characteristics. This is the case, for example, of the Italian experience of “standard expenditure needs”.<sup>2</sup> Therefore, from the point of view of voters, each incumbent will guarantee at least the standard conditional to local characteristics; that is  $\sigma_{min} = \frac{\sigma}{e_i}$ , where  $\sigma \in ]0, 1[$ .

During the mandate  $t$ , the incumbent administrator of jurisdiction  $i$ , extracts a rent  $R_{it}$ . Municipalities are also characterized by disparity in the costs of rent appropriation caused by the difference in the institutional quality between municipalities, that leads to different accountability of local administrators (Farah, 2019). Let  $\gamma_{it} \in ]0, 1[$  denote the cost of appropriating rents. The parameter  $\gamma_{it}$  captures any costs that the incumbent may incur in appropriating the rents, such as finding, approaching, and bribing tax officials willing to collude for rent extraction. The higher the value of the parameter  $\gamma_{it}$ , the lower the costs of rent extraction and the higher the obtainable rents. Following Farah (2019), we assume that incumbents learn how to appropriate rents in period 1 and, therefore, have better knowledge of appropriating rents in period 2, i.e., incumbents have already acquired know-how about appropriating rents. Furthermore, incumbents do not invest in improving revenue-raising institutions. This implies that the costs of rent appropriation should decrease over time. Assuming that after the period 1 both incumbents perfectly learn how to extract rent, it is  $\gamma_{i2} = 1$ . It follows that we can express  $\gamma_{i1} \equiv \gamma_i$  for simplicity.<sup>3</sup> This assumption simplifies the reporting of results without affecting the logic of the problem.

<sup>1</sup> In Italy, SOSE, owned by the Italian Ministry of Economy and Finance and Banca d'Italia, has the task of calculating and evaluating the standard expenditure needs of Italian local Governments.

<sup>2</sup> <https://www.sose.it/it/comuni/fabbisogni-standard>.

<sup>3</sup> Note the difference with Kotsogiannis and Schwager (2008), who consider politicians abilities. In their framework there isn't a minimum standard. However, voters know the expected abilities of the opponent candidates and vote accordingly. Incumbents know that and provide, in the second period, a provision corresponding to the average abilities.

Following Farah (2019), Di Liddo and Giuranno (2016), and Liddo and Vinella (2021), we assume that administrators act as pure rent-seekers. In period 1 they attempt to maximize the expected rent they can obtain over the two-periods horizon. This requires considering that a second mandate, to be run in period 2, will be obtained only with some probability, which will depend on the voters' appreciation. To represent the voters' behaviour, we do not model preferences through a utility function, and only take preferences to be homogeneous between jurisdictions. In line with the literature on political yardstick competition cited above, we assume that voters take a purely retrospective behaviour. In each jurisdiction, they decide whether to confirm the incumbent, based on the results of the administrative decisions made in the two jurisdictions, which they can observe and compare. In other words, they assess the performance of one administrator relative to that of the other, using observable outcomes as a proxy for the effort the administrators exert. First, voters know that local taxation is exogenous and tax rates are equal in the two jurisdictions. Second, voters observe that an infrastructure has been built, or a local service has been provided. Furthermore, the extracted rent is either unobservable or deliberately hidden from voters.

We calculate the re-election probability,  $P_j$ , of incumbent  $j \in \{1, \dots, n\}$  by employing the Contest Success Function (CSF) proposed by Tullock (1980) in which the probabilities of winning depend on (relative) effort  $s_j$

$$P_j(s_1, s_2, \dots, s_n) = \frac{f(s_j)}{\sum_{h=1}^n f(s_h)}$$

If  $f(\bullet)$  is a non-negative, strictly increasing function, the additive form avoids asymmetric effects of contestant efforts on the probabilities of winning.

Following Long (2013), we use the linear function that, in the case of two players involved in our model, takes the form:

$$P_i(s_{i1}, s_{j1}) = \frac{s_{i1}}{s_{i1} + s_{j1}}. \tag{1}$$

In Eq. (1), the effort  $s_{i1}$  is given by the quality of a local public service in the first period.

In the case of perfect service-mimicking behaviour,  $s_{i1} = s_{j1}$ , it is  $P_i = P_j = 1/2$ . Instead, when  $s_{i1} > s_{j1}$ , then  $P_i > P_j$ . Furthermore,  $\frac{\partial P_i}{\partial s_{i1}} > 0$  and  $\frac{\partial P_i}{\partial s_{j1}} < 0$ .

Note that Eq. (1) assumes an election contest, where voters in jurisdiction  $i$  compare the incumbent not against her opponent in the same jurisdiction, but against the incumbent of jurisdiction  $j$ . That is, we are implicitly assuming that internal political factors are the same in both jurisdictions, and that the comparison with the neighbour jurisdiction is crucial in determining voters' decisions.

Both incumbents care enough about re-election and have the same discount factor  $\delta \in [0, 1]$ . Furthermore, in the first period of the game, both incumbents are in their first mandate.

Given our assumptions, we can express the generic rent of incumbent  $i$  in period  $t$  as:

$$R_{it} = \gamma_{it}(1 - e_i s_{it}). \quad (2)$$

In the next sections, we will compute, the rents extracted in the non-cooperative equilibrium, comparing them with those in the cooperative solution.

### 3.1 Non-cooperative equilibrium

The decentralised non-cooperative service levels correspond to the Nash equilibrium of the game in which incumbents autonomously maximize their two mandates total rents, which are extracted separately. During the second mandate, since there are no re-election concerns, both incumbents set the minimum standard service quality  $s_{\min}$  (Liddo & Giuranno, 2016). That is, we assume that the incumbent does not consider the effect on her party's successor.<sup>4</sup> For simplicity, this assumption allows us to express  $s_{i2} \equiv s_i$ . In the first period, the service quality set by incumbent  $i$  is chosen to maximize the expected total rent over the two mandates as follows,

$$\max_{s_i} \left( \gamma_i(1 - e_i s_i) + \frac{s_i}{s_i + s_j} \delta(1 - \sigma) \right), \quad \text{with } i, j \in 1, 2 \text{ and } i \neq j \quad (3)$$

The first order condition (FOC) of incumbent 1 is:

$$\frac{(\delta(1 - \sigma) - 2e_1 \gamma_1 s_1) s_2 - e_1 \gamma_1 (s_1^2 + s_2^2)}{(s_1 + s_2)^2} = 0 \quad (4)$$

The FOC of incumbent 2 is:

$$\frac{(\delta(1 - \sigma) - 2\gamma_2 s_2) s_1 - \gamma_2 (s_1^2 + s_2^2)}{(s_1 + s_2)^2} = 0 \quad (5)$$

Dividing FOC (4) by FOC (5), we obtain:

$$s_1 = s_2 \frac{\gamma_2}{e_1 \gamma_1} \quad (6)$$

That is, the level of the public service set by incumbent 1 is proportional to the level of the service in jurisdiction 2, and the factor of proportionality is the ratio between the products of the share of rent and the costs of the public services.

The Nash equilibrium of the game is given by

$$(s_1^*, s_2^*) = \left( \frac{\gamma_2 \delta(1 - \sigma)}{(e_1 \gamma_1 + \gamma_2)^2}, \frac{e_1 \gamma_1 \delta(1 - \sigma)}{(e_1 \gamma_1 + \gamma_2)^2} \right) \quad (7)$$

<sup>4</sup> Furthermore, if in one jurisdiction the incumbent is in her first term and in the other jurisdiction the incumbent is in her second term, the latter will set the minimum quality, while the quality set by the former will increase with the parameter  $\delta$ .



Accordingly,  $s_1^* > s_2^*$  if  $e_1\gamma_1 < \gamma_2$ . With the same fiscal cost,  $e_1 = 1$ , the quality of the service is higher in the jurisdiction where the quality of the institutions is higher, i.e., with a lower  $\gamma$ . In general, with different fiscal cost,  $e_1 \leq 1$ , the quality of the service is higher in the jurisdiction where the cost of extracting the rent, weighted by the cost of providing the service,  $e_i\gamma_i$ , is higher; that is, service quality is higher in the jurisdiction with the highest weighted institutional quality, where the weights are the local cost of service provision.

Indeed,  $\frac{\partial s_1^*}{\partial \gamma_1} < 0$  and  $\frac{\partial s_2^*}{\partial \gamma_2} < 0$ . This means that increasing the quality of institutions in the two jurisdictions improves the quality of services.

Instead,  $\frac{\partial s_1^*}{\partial e_1} < 0$ ; that is, the higher the fiscal/cost disparity (the lower  $e_1$ ), the higher the service quality in the advantaged jurisdiction. In fact, when the quality of institutions is uniform,  $\gamma_1 = \gamma_2$ , the level of services is higher in the tax-advantaged jurisdiction, i.e., jurisdiction 1.

Furthermore, regarding the effect of the cost of rent appropriation of the neighbour jurisdiction, we have:

$$\frac{\partial s_1^*}{\partial \gamma_2} = \frac{\delta(1 - \sigma)(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{8}$$

Note that  $\frac{\partial s_1^*}{\partial \gamma_2} \geq 0$  if  $e_1\gamma_1 \geq \gamma_2$

Regarding the fiscally disadvantaged incumbent, we have that:

$$\frac{\partial s_2^*}{\partial \gamma_1} = -\frac{\delta(1 - \sigma)e_1(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{9}$$

$$\frac{\partial s_2^*}{\partial e_1} = -\frac{\delta(1 - \sigma)\gamma_1(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{10}$$

From (9) and (10) we have that  $\frac{\partial s_2^*}{\partial \gamma_1} > 0$  and  $\frac{\partial s_2^*}{\partial e_1} > 0$  if  $e_1\gamma_1 < \gamma_2$ . Table 1 summarizes the results provided by Eqs. (8)-(10).

To conclude, looking at the equilibrium values of Eq. (7) when there are no disparities, which implies  $\gamma_1 = \gamma_2 = \gamma$  and  $e_1=1$ , we find that incumbents provide the same quality of the local service  $s_i^* = 1/4 \frac{\delta(1-\sigma)}{\gamma}$

### 3.2 Re-election probabilities in the non-cooperative equilibrium

From (7) it follows that, in the equilibrium, the resulting re-election probabilities are:

$$(P_1^*, P_2^*) = \left( \frac{\gamma_2}{e_1\gamma_1 + \gamma_2}, \frac{e_1\gamma_1}{e_1\gamma_1 + \gamma_2} \right). \tag{11}$$

**Table 1** Effects of the parameters on the non-cooperative service quality in the equilibrium

Case 1: the cost of rent extraction inverts fiscal disparities: $e_1\gamma_1 < \gamma_2$	Case 2: the cost of rent extraction does not invert fiscal disparities: $e_1\gamma_1 > \gamma_2$
$\frac{\partial s_1^*}{\partial e_1} < 0; \frac{\partial s_2^*}{\partial e_1} > 0$	$\frac{\partial s_1^*}{\partial e_1} < 0; \frac{\partial s_2^*}{\partial e_1} < 0$
$\frac{\partial s_1^*}{\partial \gamma_1} < 0; \frac{\partial s_2^*}{\partial \gamma_2} < 0$	$\frac{\partial s_1^*}{\partial \gamma_1} < 0; \frac{\partial s_2^*}{\partial \gamma_2} < 0$
$\frac{\partial s_1^*}{\partial \gamma_2} < 0; \frac{\partial s_2^*}{\partial \gamma_1} > 0$	$\frac{\partial s_1^*}{\partial \gamma_2} > 0; \frac{\partial s_2^*}{\partial \gamma_1} < 0$

From (11) it follows that  $P_1^* > P_2^*$  if  $e_1\gamma_1 < \gamma_2$ . Note that  $\frac{\partial P_1^*}{\partial \gamma_1} < 0$ ,  $\frac{\partial P_1^*}{\partial e_1} < 0$ , and  $\frac{\partial P_2^*}{\partial \gamma_2} < 0$ . In addition,  $\frac{\partial P_1^*}{\partial \gamma_2} > 0$ ,  $\frac{\partial P_2^*}{\partial \gamma_1} > 0$ , and  $\frac{\partial P_2^*}{\partial e_1} > 0$ . Indeed, it is:

$$\frac{\partial P_1^*}{\partial \gamma_2} = \frac{e_1\gamma_1}{(e_1\gamma_1 + \gamma_2)^2} \quad (12)$$

$$\frac{\partial P_2^*}{\partial \gamma_1} = \frac{e_1\gamma_2}{(e_1\gamma_1 + \gamma_2)^2} \quad (13)$$

$$\frac{\partial P_2^*}{\partial e_1} = \frac{\gamma_1\gamma_2}{(e_1\gamma_1 + \gamma_2)^2} \quad (14)$$

Note that, as expected, when there are no disparities, i.e.,  $\gamma_1 = \gamma_2$  and  $e_1 = 1$ , both incumbents have the same re-election probability  $P_1^* = P_2^* = \frac{1}{2}$ . Table 2 summarizes the results provided by Eqs. (12)-(14).

### 3.3 Rents in the non-cooperative equilibrium

#### 3.3.1 Rents in the first period

Substituting (7) into (2), we obtain the equilibrium rents extracted in the first period:

$$(R_{11}^*, R_{21}^*) = \left( \gamma_1 \left( 1 - \frac{e_1\gamma_2\delta(1-\sigma)}{(e_1\gamma_1 + \gamma_2)^2} \right), \gamma_2 \left( 1 - \frac{e_1\gamma_1\delta(1-\sigma)}{(e_1\gamma_1 + \gamma_2)^2} \right) \right) \quad (15)$$

Note that, interestingly, in the first period,  $R_{11}^* > R_{21}^*$  if  $\gamma_1 > \gamma_2$ . This means the incumbent from the jurisdiction with lower rent extraction costs secures larger rents in the initial period.

Regarding the influence of the various parameters on the size of extracted rents, we have:

**Table 2** Effects of the parameters on the non-cooperative equilibrium re-election probabilities

Case 1: the cost of rent extraction inverts fiscal disparities: $e_1\gamma_1 < \gamma_2$	Case 2: the cost of rent extraction does not invert fiscal disparities: $e_1\gamma_1 > \gamma_2$
$\frac{\partial P_1^*}{\partial e_1} < 0; \frac{\partial P_2^*}{\partial e_1} > 0$	$\frac{\partial P_1^*}{\partial e_1} < 0; \frac{\partial P_2^*}{\partial e_1} > 0$
$\frac{\partial P_1^*}{\partial \gamma_1} < 0; \frac{\partial P_2^*}{\partial \gamma_1} < 0$	$\frac{\partial P_1^*}{\partial \gamma_1} < 0; \frac{\partial P_2^*}{\partial \gamma_1} < 0$
$\frac{\partial P_1^*}{\gamma_2} > 0; \frac{\partial P_2^*}{\partial \gamma_1} > 0$	$\frac{\partial P_1^*}{\gamma_2} > 0; \frac{\partial P_2^*}{\partial \gamma_1} > 0$

$$\frac{\partial R_{11}^*}{\partial \gamma_1} = 1 + \frac{e_1\gamma_2(1 - \sigma)(e_1\gamma_1 - \gamma_2)\delta}{(e_1\gamma_1 + \gamma_2)^3} \tag{16}$$

From equation (16), we have that  $\frac{\partial R_{11}^*}{\partial \gamma_1} > 0$  if  $e_1\gamma_1 > \gamma_2$

Furthermore, we have:

$$\frac{\partial R_{11}^*}{\partial e_1} = \frac{\gamma_1\gamma_2\delta(1 - \sigma)(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{17}$$

From equation (17), it follows that,  $\frac{\partial R_{11}^*}{\partial e_1} < 0$  if  $e_1\gamma_1 < \gamma_2$ . In addition, we have:

$$\frac{\partial R_{11}^*}{\partial \gamma_2} = -\frac{e_1\gamma_1\delta(1 - \sigma)(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{18}$$

From equation (18), it follows that  $\frac{\partial R_{11}^*}{\partial \gamma_2} > 0$  if  $e_1\gamma_1 < \gamma_2$ . Therefore, in the extreme case where rent extraction for an incumbent becomes impossible, the other incumbent faces a trade-off between increasing rent extraction in the first period or decreasing it to enhance her re-election probability.

Now we can study how the rent of incumbent 2 is affected by  $e_1, \gamma_1$  and  $\gamma_2$ . We have:

$$\frac{\partial R_{21}^*}{\partial \gamma_2} = 1 - \frac{e_1\gamma_1(1 - \sigma)(e_1\gamma_1 - \gamma_2)\delta}{(e_1\gamma_1 + \gamma_2)^3} \tag{19}$$

$$\frac{\partial R_{21}^*}{\partial e_1} = \frac{\gamma_1\gamma_2\delta(1 - \sigma)(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{20}$$

$$\frac{\partial R_{21}^*}{\partial \gamma_1} = \frac{e_1\gamma_2\delta(1 - \sigma)(e_1\gamma_1 - \gamma_2)}{(e_1\gamma_1 + \gamma_2)^3} \tag{21}$$

**Table 3** Effects of the parameters on the non-cooperative equilibrium first period rents

Case 1: the cost of rent extraction inverts fiscal disparities: $e_1\gamma_1 < \gamma_2$	Case 2: the cost of rent extraction does not invert fiscal disparities: $e_1\gamma_1 > \gamma_2$
$\frac{\partial R_{11}^*}{\partial e_1} < 0$ ; $\frac{\partial R_{21}^*}{\partial e_1} < 0$	$\frac{\partial R_{11}^*}{\partial e_1} > 0$ ; $\frac{\partial R_{21}^*}{\partial e_1} > 0$
$\frac{\partial R_{11}^*}{\partial \gamma_1} < 0$ ; $\frac{\partial R_{21}^*}{\partial \gamma_2} < 0$	$\frac{\partial R_{11}^*}{\partial \gamma_1} > 0$ ; $\frac{\partial R_{21}^*}{\partial \gamma_2} > 0$
$\frac{\partial R_{11}^*}{\partial \gamma_2} > 0$ ; $\frac{\partial R_{21}^*}{\partial \gamma_1} < 0$	$\frac{\partial R_{11}^*}{\partial \gamma_2} < 0$ ; $\frac{\partial R_{21}^*}{\partial \gamma_1} > 0$

As expected, from equations (19) to (21), it follows that it is  $\frac{\partial R_{21}^*}{\partial e_1} > 0$  and  $\frac{\partial R_{21}^*}{\partial \gamma_1} > 0$  if  $e_1\gamma_1 > \gamma_2$ . Instead, it is  $\frac{\partial R_{21}^*}{\partial \gamma_2} > 0$  if  $e_1\gamma_1 > \gamma_2$ . and  $\delta < \delta'$  and  $\frac{\partial R_{21}^*}{\partial \gamma_2} < 0$  if  $e_1\gamma_1 < \gamma_2$  and  $\delta > \delta'$ , where  $\delta' = \frac{(e_1\gamma_1 + \gamma_2)^3}{(1-\sigma)e_1\gamma_1(e_1\gamma_1 - \gamma_2)}$ . However, given our assumptions on  $\delta$ , it is  $\frac{\partial R_{21}^*}{\partial \gamma_2} > 0$  if  $e_1\gamma_1 > \gamma_2$  and  $\frac{\partial R_{21}^*}{\partial \gamma_2} < 0$  if  $e_1\gamma_1 < \gamma_2$ . Table 3 summarizes the results provided by Eqs. (16)-(21).

### 3.3.2 Total expected rents in the two mandates

The equilibrium total expected rents over the two periods for both incumbents ( $R_1^*$ ,  $R_2^*$ ), where  $R_i^*$  is given by (2), are:

$$R_1^* = \frac{(\gamma_1 + (1 - \sigma)\delta)\gamma_2^2 + 2e_1\gamma_1^2\gamma_2 + e_1^2\gamma_1^3}{(e_1\gamma_1 + \gamma_2)^2} \quad (22)$$

$$R_2^* = \frac{(\gamma_2 + (1 - \sigma)\delta)\gamma_1^2e_1^2 + 2e_1\gamma_1\gamma_2^2 + \gamma_2^3}{(e_1\gamma_1 + \gamma_2)^2} \quad (23)$$

Note that  $R_1^* < R_2^*$  if  $\delta < \frac{(\gamma_1 - \gamma_2)(e_1\gamma_1 + \gamma_2)}{(e_1\gamma_1 - \gamma_2)(1 - \sigma)}$ , which is admissible since the ratio is greater than zero. Regarding the influence of the various parameters on the total expected rents of administrator 1, we have:

$$\frac{\partial R_1^*}{\partial e_1} = -2 \frac{\delta\gamma_1\gamma_2^2(1 - \sigma)}{(e_1\gamma_1 + \gamma_2)^3} \quad (24)$$

$$\frac{\partial R_1^*}{\partial \gamma_1} = \frac{\gamma_2^3 + 2e_1\left(\frac{3}{2}\gamma_1 - \delta(1 - \sigma)\right)\gamma_2^2 + 3\gamma_1^2e_1^2\gamma_2 + \gamma_1^3e_1^3}{(e_1\gamma_1 + \gamma_2)^3} \quad (25)$$

$$\frac{\partial R_1^*}{\partial \gamma_2} = 2 \frac{\delta e_1 \gamma_1 \gamma_2 (1 - \sigma)}{(e_1 \gamma_1 + \gamma_2)^3} \tag{26}$$

From (24)-(26) it follows that it is  $\frac{\partial R_1^*}{\partial e_1} < 0$ ,  $\frac{\partial R_1^*}{\partial \gamma_2} > 0$ . Instead,  $\frac{\partial R_1^*}{\partial \gamma_1} > 0$  if  $\delta < \frac{(e_1 \gamma_1 + \gamma_2)^3}{2e_1 \gamma_1^2 (1 - \sigma)}$ .

Regarding the influence of the various parameters on the size of total expected rents of administrator 2, we have:

$$\frac{\partial R_2^*}{\partial e_1} = 2 \frac{\delta e_1 \gamma_1^2 \gamma_2 (1 - \sigma)}{(e_1 \gamma_1 + \gamma_2)^3} \tag{27}$$

$$\frac{\partial R_2^*}{\partial \gamma_1} = 2 \frac{\delta e_1^2 \gamma_1 \gamma_2 (1 - \sigma)}{(e_1 \gamma_1 + \gamma_2)^3} \tag{28}$$

$$\frac{\partial R_2^*}{\partial \gamma_2} = \frac{e_1^3 \gamma_1^3 + 2 \left( \frac{3}{2} \gamma_2 - \delta (1 - \sigma) \right) e_1^2 \gamma_1^2 + 3 e_1 \gamma_1 \gamma_2^2 + \gamma_2^3}{(e_1 \gamma_1 + \gamma_2)^3} \tag{29}$$

From (27)-(29) it follows that it is  $\frac{\partial R_2^*}{\partial e_1} > 0$ ,  $\frac{\partial R_2^*}{\partial \gamma_1} > 0$ . Instead,  $\frac{\partial R_2^*}{\partial \gamma_2} > 0$  if  $\delta < \frac{(e_1 \gamma_1 + \gamma_2)^3}{2e_1 \gamma_1^2 (1 - \sigma)}$ .

Thus, as the cost of rent extraction diminishes, the expected total rents for both incumbents rise, provided the discount factor is sufficiently low, meaning the future's value is deemed low enough.

Interestingly, the fact that  $\frac{\partial R_1^*}{\partial \gamma_2} > 0$  implies that first period rent extracted by incumbent 1 increases when the quality of institution of the other jurisdiction decreases. Considering that this is also true for jurisdiction 2, as  $\frac{\partial R_2^*}{\partial \gamma_2} > 0$ , we can conclude that if at least one jurisdiction is characterised by a lower institutional quality the accountability decreases in all jurisdictions. The rationale for this is that if the neighbour jurisdiction is characterised by low institutional quality, then the neighbour administrator will set a low level of the public service. It follows that it would be easier for the incumbent to extract high rent by setting a low level of the public service without compromising the re-election probability, as it results from the comparison of the outputs in the two jurisdictions.

### 3.4 Discussion of the non-cooperative outcome

Here, we discuss the main results of the non-cooperative setting, summarized in Tables 1, 2, and 3. As we can see, the effect of  $e_1$  on the service level (Table 1) and the re-election probability of jurisdiction 1 (Table 2) is unambiguous, both decrease with  $e_1$ . The impact on the rent extracted by incumbent 1 is ambiguous (Table 3) since, when  $e_1$  increases, the service decreases and, if the decrease in the service

quality compensates for the increasing cost, then the rent increases. In the opposite situation, rent decreases. More precisely, when  $e_1\gamma_1 < \gamma_2$ , then  $R_{11}^*$  decreases in  $e_1$ . When  $e_1\gamma_1 > \gamma_2$ , then  $R_{11}^*$  increases in  $e_1$ . That is,  $R_{11}^*$  increases in  $e_1$  when  $\gamma_1$  is relatively high; it decreases in the opposite case.

The effect of  $e_1$  on the non-cooperative outcome of jurisdiction 2 is more articulated. On one hand, since the re-election probability of incumbent 1 decreases in  $e_1$ , then the re-election probability of incumbent 2 increases in  $e_1$  (Table 2). On the other hand, if  $\gamma_2$  is large enough ( $e_1\gamma_1 < \gamma_2$ ), then for incumbent 2 it is convenient to increase the quality of the service when the cost of provision of the neighbour municipalities increases, still extracting enough rent and gaining an even higher re-election probability. When  $\gamma_2$  is relatively small the incentive is to decrease the quality of the service to extract a higher rent in the first period (Table 1). This impacts the effect of  $e_1$  on the rent extracted by incumbent 2 in the first period, which moves in the opposite direction to the equilibrium service quality  $s_2^*$  (Table 3).

Now we can provide some intuitions on the effect of the own cost of extracting rent in jurisdictions on the non-cooperative outcome. From Table 1 we can note that, in general, when the cost of extracting rent in period 1 in jurisdiction  $i$  decreases, there is an incentive to decrease the quality of the local service, also decreasing the re-election probability. The effect on the rent extracted (Table 3) in the first period depends again on the relative size of  $e_1\gamma_1$  and  $\gamma_2$ , which changes the direction of the effects on the rents.

The effect of the cost of extracting rent in the neighbour jurisdictions  $j$  on the non-cooperative rent of incumbent  $i$  is more articulated. When the cost of extracting rent in period 1 in the neighbour jurisdiction  $j$  decreases ( $\gamma_j$  increases), the neighbour incumbent decreases her service quality to extract higher rent in period 1 (Table 1) and the re-election probability of incumbent  $j$  decreases while the re-election probability of incumbent  $i$  increases (Table 2). It follows that incumbent  $i$  can react in two different ways, depending on its cost profile. She may increase the service quality to further increase re-election probability if her net available rent share in period 1 is high enough to ensure a satisfactory rent in period 1. Alternatively, she may decrease the service quality to further increase rent in period 1 if her available net rent share in period 1 is relatively small, still ensuring a satisfactory re-election probability. Consequently, the effect of the cost of extracting rent in the neighbour jurisdiction has opposite effect on the first period rent of incumbents and the sign of this effect changes when the relative advantage in costs of provision and rent extraction changes (Table 3).

### 3.5 YC bias

Following Allers (2012), YC is biased when it does not result in reaction functions with an identical slope for different jurisdictions, as has been assumed in the literature (Besley & Case, 1995). In fact, the slope of the reaction function depends on the relative fiscal advantage of the municipality. Looking at FOCS (4) and (5), it is apparent that the differences between costs (of provision and rent extraction) lead to a bias in the YC. Here we are interested in the magnitude

of this bias. Indeed, if  $R_{11}^* > R_{21}^*$  and  $P_1^* < P_2^*$ , then YC is still partially functioning since the administrator who extracts higher rent is re-elected with lower probability, even if the ratio between the re-election probabilities does not reflect the ratio between the rents extracted in the first period.

We have already seen that  $P_1^* > P_2^*$  if  $e_1\gamma_1 < \gamma_2$ , and  $R_{11}^* > R_{21}^*$  if  $\gamma_1 > \gamma_2$ . It follows that we must distinguish different cases.

- *Case 1:*  $\gamma_1 < \gamma_2 < \frac{\gamma_2}{e_1}$ . In this case  $R_{11}^* < R_{21}^*$  and  $P_1^* > P_2^*$ . It follows that YC partially works since the incumbent who extracts higher rent in the first period is re-elected with smaller probability.
- *Case 2:*  $\gamma_2 < \gamma_1 < \frac{\gamma_2}{e_1}$ . In this case  $R_{11}^* > R_{21}^*$  and  $P_1^* > P_2^*$ . It follows that YC does not work since the incumbent who extracts higher rent in the first period is re-elected with greater probability.
- *Case 3:*  $\gamma_2 < \frac{\gamma_2}{e_1} < \gamma_1$ . In this case  $R_{11}^* > R_{21}^*$  and  $P_1^* < P_2^*$ . YC is partially effective, similarly to case 1.

It follows that YC competition is biased by the presence of fiscal disparities and different institutional quality at local level since the incumbent reaction functions have different slope (Allers, 2012). However, in some cases, when the difference in the institutional quality compensates the difference in expenditure needs, the bias is mitigated.

This concludes the analysis of the results of the non-cooperative provision of local public services. In the next section we will study how the yardstick bias affects the centralized, cooperative provision of the local service, and the decision to cooperate or not between the two incumbents.

#### 4 Rent seeking under IMC: the cooperative outcome

In this section, following Di Liddo and Giuranno's (2016) approach, we study the determinants of rent-seeking when incumbents cooperate and form an inter-municipal consortium. The latter also affects both the quality of the local service  $s$  in the two jurisdictions and the distribution of the joint rent between incumbents.

The quality of the service and the rent share  $q$  will be the result of a Nash bargaining (Nash, 1950) between the two incumbents. Note that  $q$  and  $(1 - q)$  denote the shares of the rent assigned by bargaining to incumbent 1 and 2 respectively, where  $q \in [0, 1]$ .

Incumbents cannot commit to future provision, as they cannot know whether they will be reappointed. Therefore, in each period, there will be a different bargaining round between the administrators in office in the two jurisdictions. During the second and final mandate, to maximise the extracted rent, the re-elected incumbents will certainly set the lowest quality of service either with or without cooperation. This is true whether both incumbents, or only one of them, will be reappointed. Indeed, in the second period, three scenarios are possible. In the first scenario,

neither incumbent is re-elected. In the second scenario, both incumbents are re-elected. Here, an agreement on an  $s > s_{min}$  will lead to negative net gains for both incumbents, as rent creation declines. In the third case, only one incumbent is re-elected. Again, an agreement on  $s > s_{min}$  will reduce rent creation in both jurisdictions, as the probability of being re-appointed for the first mandate incumbent cannot increase with respect to the non-cooperative outcome. As a result, the incumbent in her second mandate will always set the minimum standard  $s_{min}$ .

Therefore, cooperation during the second period is intrinsically unstable, as incumbents will be indifferent between cooperating or not cooperating in their second mandates. Using the maximand in (3) (see also Di Liddo & Giuranno, 2016), given the second period uniform outcome, the expected total rent  $R$ , jointly extracted by the consortium over the two periods is:

$$R = (2 - e_1 s - s) \frac{\gamma_1 + \gamma_2}{2} + 2 \frac{s}{s+s} \delta(1 - \sigma) = (2 - e_1 s - s) \frac{\gamma_1 + \gamma_2}{2} + \delta(1 - \sigma) \quad (30)$$

where the joint cost of rent extraction is the average cost of the two jurisdictions, assuming that the institutional quality of the consortium is the average of the institutional qualities of the single jurisdictions.

From (30), we note that, interestingly, the service quality that maximises the consortium rent, independently from the rent quota  $q$ , is  $s^* = s_{min}$ . In fact, there is no conflict of interest on the service quality as both incumbents are interested in maximising the total consortium rent. Following Di Liddo and Giuranno (2016), substituting  $s^* = s_{min}$  in Eq. (30) we obtain:

$$R^* = (1 - \sigma)(\delta + \gamma_1 + \gamma_2) \quad (31)$$

We can express the agreement payoffs  $\omega_i$  as a function of the quota  $q$  of the rent allocated to incumbent 1. The remaining quota  $(1 - q)$  goes to incumbent 2:

$$\omega_1(q) = q(1 - \sigma)(\delta + \gamma_1 + \gamma_2) \quad (32)$$

$$\omega_2(q) = (1 - q)(1 - \sigma)(\delta + \gamma_1 + \gamma_2) \quad (33)$$

The disagreement payoffs are the expected total rents  $(R_1^*, R_2^*)$  of incumbents over the two periods in the non-cooperative scenario, expressed by Eqs. (22) and (23).

The value of  $q$  that constitutes the Nash bargaining solution is:

$$q^* = \arg \max ((\omega_1 - R_1^*)(\omega_2 - R_2^*)) \quad (34)$$

After substituting (22)-(23) and (32)-(33) in (34), maximizing we obtain:

$$q^* = \frac{((2 - (1 + e_1)\sigma)\gamma_1 + 2\delta(1 - \sigma))\gamma_2 + e_1\gamma_1^2(2 - \sigma) - \sigma\gamma_2^2}{2(1 - \sigma)(\delta + \gamma_1 + \gamma_2)(e_1\gamma_1 + \gamma_2)} \quad (35)$$



Accordingly, the joint provision of the local service is equal to the minimum quality allowed in each jurisdiction in both mandates and is independent of the ex-ante disparities in expenditure needs. Furthermore, according to the bargaining solution (35), incumbents equally split the total rent produced by the consortium when there are both no fiscal disparity ( $e_1 = 1$ ) and the same institutional quality ( $\gamma_1 = \gamma_2$ ), indeed in this case, from (35), we have  $q^* = 1/2$ . In the presence of fiscal and institutional disparities, the consequent YC bias leads to asymmetric rent share.

Here, we derive the condition for collusion. Indeed, in equilibrium, the net gains from collusion,  $\omega_i(q^*) - R_i^*$  with  $i=1,2$ , must be both positive. If at least one of the net gains is negative, then incumbents cannot reach an agreement to collude. The net gain of each incumbent from colluding is positive if (see proofs in appendices A1 and A2):

$$\delta > \underline{\delta} \equiv \frac{\sigma (\gamma_1 + \gamma_2) (e_1 \gamma_1 + \gamma_2)^2}{2e_1 \gamma_1 \gamma_2 (1 - \sigma)} \tag{36}$$

The threshold  $\delta$  tells us how likely is to observe collusion between rent seeking incumbents with the aim to internalize the information spillovers and eventually increase rent extraction. Therefore, a higher  $\delta$  increases accountability.

Note that  $\delta$  is increasing in the minimum standard  $\sigma$ . It follows that higher standards decrease the probability to incur in collusion;  $\delta$  is increasing in  $\gamma_2$  if  $e_1 < \frac{\gamma_2(2\gamma_2 + \gamma_1)}{\gamma_1^2} = \bar{e}_1$  and, similarly,  $\delta$  is increasing in  $\gamma_1$  if  $e_1 > \frac{\gamma_2^2}{\gamma_1(\gamma_2 + 2\gamma_1)} = \underline{e}_1$ . It follows that if  $e_1 < \underline{e}_1 < \bar{e}_1$  the probability to incur in collusion is higher when the institutional costs are lower as administrators can extract enough rents in the non-cooperative framework. If the cost  $e_1$  is too small or too high, then institutional disparities increase the probability to observe cooperation.

Table 4, which summarises the results. It is useful to derive some policy implications in the three different scenarios characterised by high, intermediate, and low degrees of fiscal disparity. Accordingly:

- when fiscal disparity (in favour of jurisdictions 1) is high,  $e_1 < \underline{e}_1$ , in order to increase  $\delta$ , which makes collusion between rent seekers less convenient, the central government may make an effort to decrease corruption in jurisdiction 1;
- when fiscal disparity is intermediate,  $\underline{e}_1 < e_1 < \bar{e}_1$ , increasing institutional quality also increases the incentive for collusion between rent-seeking governments;
- when fiscal disparity is low,  $e_1 > \bar{e}_1$ , accountability may be enhanced by increasing institutional quality in jurisdiction 2.

**Table 4** Impact of local institutional quality on rent-seekers collusion

$\frac{\partial \delta}{\partial \gamma_i}$	Fiscal disparity $e_j$ (in favour of jurisdiction 1)		
	High $e_1 < \bar{e}_1$	Intermediate $\bar{e}_1 < e_1 < \bar{e}_1$	Low $e_1 > \bar{e}_1$
$\frac{\partial \delta}{\partial \gamma_1}$	-	-	1
$\frac{\partial \delta}{\partial \gamma_1}$	Decreases	Increases	Increases
$\frac{\partial \delta}{\partial \gamma_2}$	Increases	Increases	Decreases

## 5 Final remarks

The joint provision of local public goods and services in fragmented municipalities is on the agenda of many local and central governments. Rent-seeking behavior among cooperating local administrators may have a negative impact on the provision of public goods and services. This is because cooperation between municipalities can provide an opportunity for administrators to gain control over the yardstick competition mechanism, which can be used to manipulate voters' choices. In turn, this can lead to a decrease in political accountability and an increase in rent extraction by lowering the quality of public goods and services. On the other hand, fiscal disparities and institutional quality differences affect the cooperative rent share among incumbents.

A policy implication of our results is that, to increase accountability in the whole system, in some cases it is sufficient to invest in improving the institutional quality only of a few jurisdictions. Specifically, with intermediate levels of fiscal disparities, if the central government decides to increase the quality of government in either jurisdiction, incumbents have a higher incentive to collude, increasing the probability of inducing collusion, which worsens accountability. The point is that upgrading the quality of institutions in either district may worsen the disagreement utilities for both incumbents. This creates a commonality of interests which strengthens collusion. While in other cases it is possible to limit collusion by exacerbating the conflict of interest between the rent seekers. The impact of collusion on rent appropriation is ambiguous in the cases with either high or low fiscal disparity. In the latter situations, rent seeking incumbents have conflicting interests. Here, the ambiguity can be resolved by targeting only one jurisdiction. That is, with high fiscal disparity, a reduction in rent seekers collusion can be achieved by improving the institutional quality of the wealthier jurisdiction. Indeed, in this case, even a small increase in the quality of institution in the wealthier jurisdiction leads to a very high decrease in the amount of rent extracted in the cooperation. Instead, with low fiscal disparity it is sufficient to improve the quality of the poorer jurisdiction. Indeed, in this case, his/her possibility of rent extraction declines more sharply leading to less collusion. From the point of view of the fiscally advantaged incumbent it is also less convenient to cooperate with the disadvantaged incumbent as rent extraction in that jurisdiction becomes more difficult.

**Appendix A1. Proof that  $\omega_1(q^*) - R_1^* > 0$  for  $\delta > \delta$**

Replacing (35) in (32) and (22) and subtracting, we obtain:

$$\omega_1(q^*) - R_1^* \equiv \frac{2\gamma_2\gamma_1\left(\delta e_1(1 - \sigma) - \sigma\left(e_1 + \frac{1}{2}\right)\gamma_2\right) - \sigma c_1^2\gamma_1^3 - \sigma e_1\gamma_2(e_1 + 2)\gamma_1^2 - \sigma\gamma_2^3}{2(e_1\gamma_1 + \gamma_2)^2}$$

It follows that  $\omega_1(q^*) - R_1^* > 0$  if the numerator of the ratio is positive. The numerator is positive if

$$\delta > \frac{\sigma(\gamma_1 + \gamma_2)(e_1\gamma_1 + \gamma_2)^2}{2e_1\gamma_1\gamma_2(1 - \sigma)} \equiv \delta$$

and  $-e_1\gamma_1\gamma_2(1 - \sigma) < 0$ . The latter condition is always true in the domain of the variables. Overall,  $\omega_1(q^*) - R_1^* > 0$  for  $\delta > \delta$ .

**A2. Proof that  $\omega_2(q^*) - R_2^* > 0$  for  $\delta > \delta$**

Replacing (35) in (33) and (23) and subtracting, we obtain:

$$\omega_2(q^*) - R_2^* \equiv \frac{2\gamma_2\left(\delta e_1(1 - \sigma) - \sigma\left(e_1 + \frac{1}{2}\right)\gamma_2\right)\gamma_1 - \sigma c_1^2\gamma_1^3 - \sigma e_1\gamma_2(e_1 + 2)\gamma_1^2 - \sigma\gamma_2^3}{2(e_1\gamma_1 + \gamma_2)^2}$$

It follows that  $\omega_2(q^*) - R_2^* > 0$  if the numerator of the ratio is positive. The numerator is positive if

$$\delta > \frac{\sigma(\gamma_1 + \gamma_2)(e_1\gamma_1 + \gamma_2)^2}{2e_1\gamma_1\gamma_2(1 - \sigma)} \equiv \delta$$

and  $-e_1\gamma_1\gamma_2(1 - \sigma) < 0$ . The latter condition is always true in the domain of the variables. Overall,  $\omega_2(q^*) - R_2^* > 0$  for  $\delta > \delta$ .

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## Declarations

**Conflict of interest** The authors declare no competing interests.

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## References

- Allers, M. A. (2012). Yardstick competition, fiscal disparities, and equalization. *Economics Letters*, 117(1), 4–6.
- Arachi, G., Assisi, D., Cesi, B., Giuranno, M. G., & Russo, F. (2024). Inter-municipal cooperation in public procurement. *Regional Studies*. <https://doi.org/10.1080/00343404.2024.2350615>
- Arachi, G., Di Liddo, G., & Giuranno, M. G. (2016). Cooperazione locale in Italia: Le unioni di comuni. *Economia Pubblica/Italian Journal of Public Economics*, 1, 11–36.
- Bel, G., Bischoff, I., Blåka, S., Casula, M., Lysek, J., Swianiewicz, P., Tavares, A.F. and Voorn, B., 2022. Styles of inter-municipal cooperation and the multiple principal problem: a comparative analysis of European economic area countries. *Local Government Studies*.
- Bel, G., & Costas, A. (2006). Do public sector reforms get rusty? *The Journal of Policy Reform*, 9(1), 1–24.
- Bel, G., & Fageda, X. (2007). Why do local governments privatise public services? A survey of empirical studies. *Local Government Studies*, 33(4), 517–534.
- Bel, G., & Fageda, X. (2017). What have we learned from the last three decades of empirical studies on factors driving local privatisation? *Local Government Studies*, 43(4), 503–511.
- Bel, G., Fageda, X., & Mur, M. (2013). Why do municipalities cooperate to provide local public services? *Local Government Studies*, 39(3), 435–454.
- Bel, G., & Sebó, M. (2021). Does inter-municipal cooperation really reduce delivery costs? an empirical evaluation of the role of scale economies, transaction costs, and governance arrangements. *Urban Affairs Review*, 57(1), 153–188.
- Bel, G., & Warner, M. E. (2015). Inter-municipal Cooperation and Costs: Expectations and Evidence. *Public Administration*, 93(1), 52–67.
- Bergholz, C. (2018). Inter-municipal Cooperation in the Case of Spillovers. *Local Government Studies*, 44(1), 22–43.
- Bergholz, C., & Bischoff, I. (2018). Local Council Members' View on Intermunicipal Cooperation: Does Office-related Self-interest Matter? *Regional Studies*, 52(12), 1624–1635.
- Besley, T., & Case, A. (1995). Incumbent behavior: Vote seeking, tax setting and yardstick competition. *American Economic Review*, 85, 25–45.
- Bischoff, I., Bergholz, C., Haug, P., & Melch, S. (2024). Does intense tax competition boost public acceptance for inter-municipal cooperation? evidence from a survey among German citizens and local politicians. *Journal of Economic Policy Reform*, 27(2), 140–161.
- Bischoff, I., & Wolfschütz, E. (2021). Inter-municipal cooperation in administrative tasks – the role of population dynamics and elections. *Local Government Studies*, 47(4), 568–592.
- Buettner, T., & von Schwerin, A. (2016). Yardstick competition and partial coordination: Exploring the empirical distribution of local business tax rates. *Journal of Economic Behaviour & Organization*, 124, 178–201.
- Cerniglia, B. M., & F. and Revelli, F. (2003). In search of yardstick competition: A spatial analysis of Italian municipality property tax setting. *Journal of Urban Economics*, 54(2), 199–217.

- Congleton, R.D., 2024. Rent Seeking in a Constitutional Context: Linkages and Constraints. Paper presented at the 2024 European Public Choice Society Conference in Vienna.
- Congleton, R. D., & Hillman, H. L. (2015). *Companion to the Political Economy of Rent Seeking*. Edward Elgar.
- Di Liddo, G., & Giuranno, M. G. (2016). Asymmetric yardstick competition and municipal cooperation. *Economics Letters*, 141, 64–66.
- Di Liddo, G., & Giuranno, M. G. (2020). The political economy of municipal consortia and municipal mergers. *Economia Politica: Journal of Analytical and Institutional Economics*, 37(1), 105–135.
- Di Liddo, G., & Morone, A. (2017). Yardstick competition and fiscal disparities: An experimental study. *Economics Letters*, 159, 134–137.
- Di Liddo, G., & Morone, A. (2023). Local income inequality, rent-seeking detection, and equalization: A laboratory experiment. *Public Choice*, 196(3), 257–275.
- Drew, J., McQuestin, D., & Dollery, B. E. (2019). Good to Share? the pecuniary implications of moving to shared service production for local government services. *Public Administration*, 97(1), 132–146.
- Farah, A. (2019). Fiscal disparity, institutions, and asymmetric yardstick competition. *Economics Letters*, 181, 74–76.
- Feiock, R. C., Steinacker, A., & Park, H. J. (2009). Institutional collective action and economic development joint ventures. *Public Administration Review*, 69(2), 256–270.
- Ferraresi, M., Migali, G., & Rizzo, L. (2018). Does intermunicipal cooperation promote efficiency gains? Evidence from Italian municipal unions. *Journal of Regional Science*, 58(5), 1017–1044.
- Garrone, P., Grilli, L., & Rousseau, X. (2013). Management discretion and political interference in municipal enterprises: evidence from Italian utilities. *Local Government Studies*, 39(4), 514–540.
- Kotsogiannis, C., & Schwager, R. (2008). Accountability and fiscal equalization. *Journal of Public Economics*, 92, 2336–2349.
- Di Liddo, G. and Vinella, A., 2021. Asymmetric yardstick competition: traditional procurement versus public-private partnerships. *Italian Economic Journal*.
- Long, N. V. (2013). The theory of contests: a unified model and review of the literature. *European Journal of Political Economy* 32, 161–181. Reprinted in: *Congleton and Hillman, 2015*, 19–52.
- Luca, D., & Modrego, F. (2021). Stronger together? assessing the causal effect of inter-municipal cooperation on the efficiency of small Italian municipalities. *Journal of Regional Science*, 61(1), 261–293.
- Muraoka, T., & Avellaneda, C. N. (2021). Do the networks of inter-municipal cooperation enhance local government performance? *Local Government Studies*, 47(4), 616–636.
- Nash, J. F. (1950). The Bargaining Problem. *Econometrica*, 18(2), 155–162.
- Schoute, M., Budding, T., & Gradus, R. (2018). Municipalities' Choices of Service Delivery Modes. *International Public Management Journal*, 12(6), 1–31.
- Silvestre, H. C., Marques, R. C., Dollery, B., & Correia, A. M. (2020). Is cooperation cost reducing? an analysis of public–public partnerships and Inter-municipal cooperation in Brazilian local government. *Local Government Studies*, 46(1), 68–90.
- Sørensen, R. J. (2007). Does dispersed public ownership impair efficiency? the case of refuse collection in Norway. *Public Administration*, 85(4), 1045–1058.
- Tavares, A. F., & Feiock, R. C. (2018). Applying an institutional collective action framework to investigate intermunicipal cooperation in Europe. *Perspectives on Public Management and Governance*, 1(4), 299–316.
- Tullock, G. (2001). Efficient Rent Seeking. In A. A. Lockard & G. Tullock (Eds.), *Efficient Rent-Seeking*. Boston, MA: Springer.
- Warner, M., & Hefetz, A. (2002). Applying market solutions to public services. *Urban Affairs Review*, 38(1), 70–89.

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