Yardstick competition in a Federation: Theory and Evidence from China

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Abstract

While some scholars argue that fiscal decentralization gave Chinese local officials strong incentives to promote local economic growth, traditional fiscal federalism theories are not directly relevant to explain such an effect in the particular context of China. In this paper, we explain the existence of interjurisdictional competition among Chinese local officials using a model of yardstick competition "from the top", in which the central government (and not local voters) creates a competition among local officials by rewarding or punishing them on the basis of relative economic performance. Our model predicts that, in this context, local governments are forced to care about what other incumbents are doing and that public spending settings are strategic complements. Then, by estimating a spatial lag dynamic model for a panel data of 29 Chinese provinces from 1980 to 2004, we provide empirical evidence of the existence of such public spending interactions. We propose a rigorous empirical framework which takes into account heterogeneity, simultaneity and endogeneity problems and spatial error dependence. The results are encouraging to the view that there are some strategic interactions among Chinese provinces, resulting from a yardstick competition created by the central government.

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1   Introduction

China's remarkable growth in the 1980s and 1990s coincided with the fiscal decentralization. Some scholars argue that the latter gave Chinese local officials strong incentives to promote local economic growth, creating a basis for nationwide high economic performance (Qian and Weingast (1997), Zhuravskaya (2000), Qian (2003) and Jin, Qian, and Weingast (2005)). Though, traditional fiscal federalism theories are not directly relevant to explain such an effect in the context of China. In particular, the existence of a yardstick competition among local governments, a traditional argument in favor of decentralization in democratic countries, is not relevant *a priori* in China where the local officials are not elected by citizens. Blanchard and Shleifer (2000) have previously argued that in China, the central government is in a strong position both to reward or to punish local administrations, insuring political accountability of local officials. We provide here evidence of a yardstick competition "from the top", in which the principal is the central government and not the local population. Thus, we propose an explanation of the existence of interjurisdictional competition among Chinese local governments.

Fiscal decentralization has been a critical component of economic reform in China. Indeed, substantial efforts have been made to decentralize its formerly highly centralized fiscal management system to provincial governments. The latter have been given considerable latitude in shaping local policies and managing fiscal resources: more than 70 percent of the entire public expenditure was made at the sub-national levels in 2004 (see Figure 2 in Appendix A.2.1).[1] However, as noted before, "Chinese style decentralization" is actually conceptually different from decentralization in many other countries. Indeed, China's current fiscal system is largely decentralized while its governance structure is rather centralized with strong top-down mandates and a homogenous governance structure. For Maskin, Qian, and Xu (1997), it can be described as a multidivisional-form hierarchy structure. The cen-

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[1] Provincial levels are first-level local state administrative organs in China. In this paper, we will focus on this jurisdiction level. The country is divided into three levels: the province, the county, and the township. However, two more levels have been inserted in actual implementation: the prefecture, under the provincial level; and the village, under the township level. By conventional measure, there are five tiers in China fiscal system: the central government, 33 province-level regions, 333 prefecture-level regions, 2,862 county-level regions and 44,741 township-level regions. The 33 provincial-level administrative units include 22 provinces, five autonomous regions, four municipalities and two special administrative regions.

tral government exerts great influence on the local administrations' actions.[2] Moreover, the power of provincial governments is not based on a system of electoral representation: the governors are appointed by the central government in Beijing. Lastly, the population mobility between local jurisdictions still limited in spite of the relaxations of the Hukou system. In this context, traditional disciplining devices such as local election and exit option are far from perfect. Indeed, in traditional fiscal federalism theory, decentralization is supposed to increase the efficiency of public spending by inducing interjurisdictional competition among political powers, through a "vote with feet" or a yardstick competition created by local voters. *A priori*, these theories are not relevant in the context of China.[3]

However, following Blanchard and Shleifer (2000), we argue that vertical control can ensure local accountability of local officials and induces some interjurisdictional competition. Indeed, Tsui (2005) describes how Chinese provincial leaders operate within a well-defined career structure inside the political hierarchy. They undergo detailed performance reviews by their superiors, and are rewarded or penalized based on their success in achieving specific targets. Promotions, demotions, and job related benefits all depend on such reviews, which have become increasingly formal.[4] Maskin, Qian, and Xu (1997) actually show that provincial officials are more often promoted to the Party's Central Committee if their province's relative growth rate increases. Similarly, Li and Zhou (2005) examine careers of top officials in 28 provinces form 1979 to 1995 and find that promotions are significantly more likely in provinces with higher growth. This confirms anecdotal evidence showing that Chinese cadres are evaluated in accordance with their economic performance. So, career concerns may create strong incentives to improve economic performance like in democratic countries. Local governors may consider the risk of damaging their career since the probability of their reappointment depends on how well they perform in fulfilling their mandates from above.[5]

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[2] China's intergovernmental relations are a hierarchical system of bureaucratic control where provincial governments must accept the unified leadership of the State Council which has the power to decide on the division of responsibilities and to annul inappropriate decisions and orders of provincial governments. A representative of the Communist Party of China is appointed by their supervisors and acts as the policy maker. The Party Secretary is always in precedence above the leader of the People's Government.

[3] We can note that there are elections at village level. In this context, using a sample of rural Chinese villages, Brandt and Turner (2006) find that even very poorly conducted elections can have large incentive effects: elections provide a disincentive for rent seeking.

[4] Under Mao, promotion in part depended on ideological conformity but as reformers came to dominate in the 1980s, targets increasingly focused on economics. As of the mid-1990s, the system for evaluating provincial leaders assigned 60 out of 100 points to targets related to economic performance (Zhang (2006)).

[5] In addition with career concerns, Di Tella and Fisman (2004) show that gubernatorial pay is correlated

Under this structure, the central government can make comparisons between local jurisdictions to appraise local government's relative performance and create a yardstick competition among local officials by rewarding or punishing them on the basis of economic performance.

The idea that performance of local governments can be evaluated by cross-jurisdictional comparisons was previously proposed by Salmon (1987) and formally developed by Besley and Case (1995b). Here, we modify the model of the latter to apply yardstick competition to China. This competition is "from the top" since the principal is the central government, and not the local "voting" populations. A second modification with respect to Besley and Case (1995b) is to introduce the possibility of being promoted. By this way, we propose a possible explanation of the existence of interjurisdictional competition among Chinese local governments despite the absence of electoral accountability.

This paper develops a model of public spending setting in a multijurisdictional world with asymmetric information, where the central government makes comparisons between local jurisdictions to overcome political agency problems. Finally, as in the traditional yardstick competition model, information spillovers from other jurisdictions affect the delivery of public services in a jurisdiction. This forces local officials into a yardstick competition in which they care about what other local officials are doing. Thus, the theoretical model predicts that, when the central government uses neighboring performance to judge a governor, the latter is encouraged to follow neighboring fiscal choices in order not to be signaled as bad local government and to be reappointed. So, in presence of yardstick competition "from the top", we should observe strategic interactions among local decision-makers and public choices should be strategic complements. Strategic complements refer to the definition by Bulow, Geanakoplos, and Klemperer (1985) of the nature of competition. The latter define public spending as strategic complements when the marginal utility of public spending in jurisdiction i is increasing in the level of local public spending in the other jurisdictions.

Then, this paper proposes a rigorous empirical framework which takes into account heterogeneity, simultaneity and endogeneity problems and spatial error dependence to test theoretical model's predictions. Our empirical analysis actually provides evidence of the existence of interjurisdictional competition among local governments embedded in a vertical

with economic performance, reflecting reward-for-performance motives in US.

bureaucratic control system. To our knowledge, this study is the first attempt to test public spending interactions in China. Indeed, most of the empirical literature focuses on strategic interactions with respect to taxes in developed countries. Little attention has been paid to the public expenditures side[6] *a fortiori* in developing or emerging countries.[7]

The paper is structured as followed: Section 2 develops a theoretical model of yardstick competition "from the top"; Section 3 estimates a spatial lag model for a panel data of 29 Chinese provinces from 1980 to 2004 to test the existence of public spending interactions, resulting from a yardstick competition "from the top". Section 4 concludes.

2 Theoretical framework: decentralization and yardstick competition "from the top"

As Besley and Case (1995a) showed, economic considerations alone cannot characterize economic policy choices at local level. Political mechanisms and electoral accountability seem to affect economic policy choices. The idea that residents consider neighboring jurisdictions as a yardstick to compare the performance of their local government and judge whether they waste resources and deserve to remain in office was initially proposed by Salmon (1987). He insights that much of the thinking behind the theory of labor tournaments of Lazear and Rosen (1981), Holmstrom (1982) or Shleifer (1985) could be applied to interjurisdictional competition. Besley and Case (1995b) introduced yardstick competition between jurisdictions as a discipline device for rent-seeking politicians in the context of a developed and democratic country.

This paper modifies the traditional approach of Besley and Case (1995b) by considering a model of yardstick competition "from the top" in which the principal is the central government and not local populations. Moreover, we focus on the public spending side and

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[6] We can mention the works of Redoano (2007) or Foucault, Madies, and Paty (2008). They find that some interactions take place among neighboring jurisdictions with respect to expenditures for respectively EU countries and French municipalities.

[7] Akin, Hutchinson, and Strumpf (2005) analyze the decentralization of health care competences in Uganda and provide evidence for the hypothesis that spillover effects cause spending on public goods in one district to reduce spending in neighboring districts. Arze, Martinez-Vasquez, and Puwanti (2008) focus on local discretionary expenditures in Indonesia and highlight strategic complementarity of local public spending. Caldeira, Foucault and Rota-Graziosi (2009) have also found strategic complementarity among local public spending among Beninese municipalities.

introduce the possibility for local governments to be promoted.[8]

2.1 The model

Following Besley and Case (1995b), we consider a principal/agent model.

1. The agents are local officials. They are assumed to know more about the short term economic shocks at local level than do the central government.

2. The principal is here, the central government. He is assumed to use performance cues of other local officials as a benchmark to appraise whether agents waste resources and deserve to remain in office.

3. The main incentive mechanisms used to discipline governors are reappointment and promotion (instead of elections). The central government decides whether or not to reappoint an agent and can promote an agent who is non-revealed as bad.[9]

We consider a jurisdiction whose local government provides public services of a given quality (G_i) financed by taxes (t). The final level of fiscal revenue is $t\theta_k$, with θ_k stochastic and observed only by the local government. As in Besley and Case (1995b), the product θ_k can take one of three values, high (H), medium (M) or low (L) with probabilities q_H, q_M and q_L. So, we have three values of taxes revenue, assumed to be evenly spaced with difference Δ (as Besley and Case (1995b) do).

The local governments are potentially of two kinds: "good" (g) or "bad" (b).[10] Agent's strategies are denoted:

$$G(\theta_k; j), \tag{1}$$

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[8] We generally simplify matters by assuming that bureaucrats may either be re-appointed or dismissed. In reality, other rewards and punishments may be meted out to them in China. Indeed, upper levels of governments have the power to appoint and dismiss but also to promote subordinate cadres. The promotion opportunities that lie ahead for provincial secretaries include membership of the State Council, the vice premiership, the premiership and membership of the Politburo or the Politburo Standing Committee.

[9] Theoretically, it is equivalent to consider the reappointment and the promotion for a non revealed bad official or the "retirement" and the demotion for the revealed bad official.

[10] We could consider a dynamic process in which good politicians might become bad.

with $k \, \epsilon \, (H; M; L)$ and $j \, \epsilon \, (g; b)$. Good local governors do not rent-seeking or waste resources while bad ones do it. The latter can subtract Δ or 2Δ as rent or waste. Formally, we have:

$$G(\theta_k; g) = t\theta_k, \tag{2}$$

and

$$G(\theta_k; b) = t\theta_k - r_i,$$

with r_i, the rent which may take two values: Δ and 2Δ.

As in Besley and Case (1995b), we consider two time periods. The discount factor is δ and satisfies $1 > \delta > 1/2$. The central government observes public spending decisions and updates its beliefs that the agent is good. Then, it chooses whether or not to reappoint him since it wants to maximize public spending for a given level of taxes. The central government strategy is denoted by

$$\mu(G_i)\epsilon[0; 1], \tag{3}$$

which corresponds to the probability that he reappoints an local governor who sets a public spending level G_i.

Bad local official chooses public spending to maximize his discount utility which positively depends on the rent in period 1 and on expected rent and promotion in period 2:

$$E\left[V\left(G_i \, |\theta_k\right)\right] = r_i + \mu(G_i)\delta(2\Delta + \varphi p), \tag{4}$$

A bad official who is reappointed sets no period 2 discipline and takes a rent equal to 2Δ. Moreover, a non revealed bad agent can be promoted in period 2 with an exogenous probability of φ, which gives him an utility of p.[11] So, he arbitrates between the rent in period 1 and the expected utility in period 2 knowing that his probability of being reappointed depends on the level of public spending provided in period 1.[12]

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[11] A promotion means a move by a provincial leader up to his position.

[12] Note that, by assumption, there is no sanction, i.e, local government is not bound to give back what he took as rent in period 1.

2.2 Perfect information: the centralized fiscal system

As a benchmark, we first consider the case in which the fiscal system is centralized and information is perfect.

All tax revenues are collected by the central government at local level and transferred back to local governments according to a plan of spending made by the center. Formally, we have:

$$G_i = T_i - r_i, \tag{5}$$

with G_i, the level of public spending, T_i, the fiscal revenue transferred by the central government and r_i, the rent.

In this case, a local government who sets a level of public spending smaller than the fiscal revenue transferred by the central government will be automatically signaled as bad local government and will not be reappointed. Hence, if the expected utility of being promoted is high enough, bad official will always take no rent in period 1 to be reappointed in period 2, with or without yardstick competition. Indeed, since there is no information to reveal, yardstick competition is useless and has no effect on local official public spending choices which are independent on what other agents are doing.

Proposition 1   *Under perfect information, the equilibrium is:*

(i) All types of agents [13] *set:*

$$G_i = T_i.^{14}$$

(ii) Central government sets:

$$\mu(T_i - \Delta) = \mu(T_i - 2\Delta) = 0 \text{ and } \mu(T_i) = 1.$$

Proof. See Appendix A.1.1 ∎

Corollary 1   *Under perfect information:*

(i) The yardstick competition "from the top" has no impact on local governments' spending

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[13] For bad local government, this is the case if $\varphi p > (2 - 2\delta)/\delta * \Delta$. We consider that it is the case for the rest of the paper.

decisions;

(ii) Public spending choices are independent from each other: there is no horizontal strategic interaction;

In a centralized fiscal system, the central government knows the level of tax revenue. He does not need to make comparisons between local jurisdictions to determinate local official's type. Yardstick competition is useless and public spending choices are independent from each other. So, when the fiscal system is centralized, we should not observe any horizontal strategic interactions among local governments.

2.3 Asymmetric information: the decentralized fiscal system

We now consider the decentralized case with asymmetric information between the local officials and the central government.

First, as in Besley and Case (1995b), we consider that nature selects the type of the local government which will be "good" with probability γ and "bad" with probability $(1 - \gamma)$. Nature determines also the product which will be high with probability q_H, medium with probability q_M and low with probability q_L.[15]

Second, we deduce five possible public spending levels, $\{G_1; G_2; G_3; G_4; G_5\}$ with $G_1 > G_2 > G_3 > G_4 > G_5$ where:

- Good governor provides services consistent with the true level of tax revenue in the two periods:

$$G(\theta_H; g) = t\theta_H = G_1 \text{ and } G(\theta_M; g) = t\theta_M = G_2 \text{ and } G(\theta_L; g) = t\theta_L = G_3.$$

- Bad governor can choose to take no rent, a rent of Δ or a rent of 2Δ. According to the products, the level of public spending can be:

  - when the product is high:

$$G(\theta_H; b) = t.\theta_H = G_1 \text{ or } t\theta_H - \Delta = t\theta_M = G_2 \text{ or } t.\theta_H - 2\Delta = t.\theta_L = G_3,$$

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[15] To simplify, we consider $q_H = q_M = q_L = 1/3$.

8

– when the product is medium:

$$G(\theta_M; b) = t\theta_M = G_2 \text{ or } t\theta_M - \Delta = t.\theta_L = G_3 \text{ or } t\theta_M - 2\Delta = G_4,$$

– when the product is low: $G(\theta_L; b) = t\theta_L = G_3$ or $t\theta_L - \Delta = t\theta_M - 2\Delta = G_4$ or $t\theta_L - 2\Delta = G_5$.

The following table sums up the possible levels of public spending:

Agent \ Product	High			Medium			Low		
Good	G_1			G_2			G_3		
Bad	$\mathbf{r = 0}$	$\mathbf{r = \Delta}$	$\mathbf{r = 2\Delta}$	$\mathbf{r = 0}$	$\mathbf{r = \Delta}$	$\mathbf{r = 2\Delta}$	$\mathbf{r = 0}$	$\mathbf{r = \Delta}$	$\mathbf{r = 2\Delta}$
	G_1	G_2	G_3	G_2	G_3	G_4	G_3	G_4	G_5

Third, the central government observes public spending and choices whether or not to reappoint the local government to maximize expected public spending in period 2.

See the extensive-form game in Appendix A.1.2.

2.3.1 Perfect Bayesian equilibrium without Yardstick Competition

We consider first, one jurisdiction and we find perfect Bayesian equilibrium of the public spending game.

Our model predicts that without yardstick competition, the bad official takes a maximal rent when the product is low (θ_L) or medium (θ_M). Indeed, in those cases, the central government will always believe that a local government who sets G_4 or G_5 is bad but it also does not find it worthwhile to reappoint any local governor who sets G_2 or G_3. So, providing higher level of public spending $(G_2$ or $G_3)$ gets less rent with no gain in the probability of being reappointed. Hence, bad local official is not encouraged to reduce his rent when the product is low or medium.

On the contrary, when the product is high (θ_H), the central government is willing to reappoint a local government who sets G_1. Hence, with a high enough value of φp, bad official prefers to take no rent in period 1 to be reappointed in period 2.

Proposition 2   *Without yardstick competition, the equilibrium is:*

(i) Good local governor sets:

$$\begin{cases} G(\theta_H; g) = t\theta_H = G_1, \\ G(\theta_M; g) = t\theta_M = G_2, \\ G(\theta_L; g) = t\theta_L = G_3. \end{cases}$$

(ii) Bad local governor sets:[16]

$$\begin{cases} G(\theta_H; b) = t\theta_H = G_1, \\ G(\theta_M; b) = t\theta_M - 2\Delta = G_4, \\ G(\theta_L; b) = t\theta_L - 2\Delta = G_5.^{17} \end{cases}$$

(iii) Central government sets:

$$\begin{cases} \mu(G_1) = 1, \\ \mu(G_2) = \mu(G_3) = \mu(G_4) = \mu(G_5) = 0.^{18} \end{cases}$$

Proof. See Appendix A.1.3 ∎

In a decentralized fiscal system with asymmetric information between the central government and local governments, the latter are not encouraged to reduce their rent. This is the case because, when the conjuncture is bad or medium, they are not able to convince individually the central government that they are good.

2.3.2   Perfect Bayesian equilibrium with Yardstick Competition

We now consider two jurisdictions with identical environments and shocks in which appointed officials may be of different types. As Besley and Case (1995b), we consider that local officials know each other types.[19] We analyze the effect of the central government information about

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[16] As we said before, we consider that $\varphi p > (2 - 2\delta)/\delta * \Delta$. But note that, if $\varphi p < (2 - 2\delta)/\delta * \Delta$, bad incumbent sets: $G(\theta_H; b) = t\theta_H - 2\Delta = G_3$; $G(\theta_M; b) = t\theta_M - 2\Delta = G_4$; $G(\theta_L; b) = t\theta_L - 2\Delta = G_5$

[19] In other words, we suppose that neighboring local governments know more about each other than the central government do. The full information is maybe a bit strong.

public spending in both jurisdictions. We have two cases to consider.[20]

Both local governments are bad First, we consider the case where both agents are bad. The equilibrium is a perfect Bayesian equilibrium for the two agents. The full characterization of the equilibrium is given at the Appendix A.1.4.

Now, we show that both local governors choosing the same strategy gives the central government more confidence that a local government is good.

In particular, the probability that a local government is good if we observe G_3 in both jurisdiction is, now, higher than γ if $\gamma > 0.7$. In this case, the central government is willing to reappoint a local government who sets G_3. So, both agents decide to reduce their rent when the product is low (θ_L) to be reappointed. Hence, since we have $\mu(G_3) = 1$ and $\mu(G_4) = \mu(G_5) = 0$, bad governments play

$$G(\theta_L; b) = t\theta_L = G_3,$$

and take no rent in period 1.[21]

Under this condition, the probability that a local government is good if we observe G_2 in both jurisdictions is also higher than γ. So, the central government finds it worthwhile to reappoint a local official who sets G_2. But since playing G_2 when the product is medium (θ_M) gets less rent with no gain in the probability of staying in office than playing G_3, bad agents decide to reduce their rent only up to G_3 and play:

$$G(\theta_M; b) = t\theta_M - \Delta = G_3.$$

Lastly, when the product is high (θ_H), since $\mu(G_1) = \mu(G_2) = \mu(G_3) = 1$, providing a higher level of public spending gets less rent with no gain in the probability of being reappointed. Bad local governor can now play:

$$G(\theta_H; b) = t\theta_M - 2\Delta = G_3,$$

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[20] Besley and Case (1995b) also consider the case in which both local officials are good but this case in trivial.

[21] Note that $\varphi k > (2 - 2\delta)/\delta * \Delta$ is required, as previously.

Proposition 3   *With yardstick competition "from the top", if both local governments are bad, the equilibrium is:*

(i) Bad local governments set:

$$\begin{cases} G(\theta_H; g) = t\theta_M - 2\Delta = G_3, \\ G(\theta_M; g) = t\theta_M - \Delta = G_3, \\ G(\theta_L; g) = t\theta_L = G_3.^{22} \end{cases}$$

(ii) Central government sets:

$$\begin{cases} \mu(G_1) = \mu(G_2) = \mu(G_3) = 1, \\ \mu(G_4) = \mu(G_5) = 0. \end{cases}$$

Proof. See Appendix A.1.4 ∎

In presence of yardstick competition, local governors are able to make the central government believe that both are good, by reducing together their rent. Indeed, choosing the same strategy gives the central government more confidence that both are good. So, both local governments are, now, encouraged to reduce their rent when the conjuncture is bad or medium so that they will be reappointed.

One local government is good and the other is bad   Second, we consider the case where one government is good and the other is bad. The full characterization of the equilibrium is given at the Appendix A.1.5.

In this case, the bad local governor will be found out by setting public spending above its neighbor. Now, playing G_3 when the product is high or medium results in being unseat: $\mu(G_3) = 0$ when θ_H or θ_M. So, the bad officials will reduce their rent and act as good governments. Indeed, whatever the product level, local official prefers to take no rent in period 1 to be reappointed.

Proposition 4   *With yardstick competition "from the top", if one government is good and the other is bad, the equilibrium is:*

(*i*) *Bad local governor and good local governor set:*

$$
\begin{cases}
G(\theta_H; g) = t\theta_H = G_1, \\
G(\theta_M; g) = t\theta_M = G_2, \\
G(\theta_L; g) = t\theta_L = G_3.^{23}
\end{cases}
$$

(*ii*) *Central government sets:*

$$
\begin{cases}
\mu(G_1) = \mu(G_2) = \mu(G_3) = 1,^{24} \\
\mu(G_4) = \mu(G_5) = 0.
\end{cases}
$$

Proof. See Appendix A.1.5. ∎

In presence of yardstick competition, when a bad local government is compared with a good one, the bad local governor chooses the same strategy as the good one in order not to be found out.

Yardstick Competition "from the top" effect   When the central government makes comparisons between local jurisdictions, this forces local officials to care about what other local governments are doing, creating horizontal strategic interactions which are complements.

Corollary 2   *Under our assumptions,*

(*i*) *The yardstick competition "from the top" involves horizontal strategic interactions among neighboring jurisdictions;*

(*ii*) *Under yardstick competition, public spending are strategic complements.*

Local governor public spending behavior is affected by the central government looking at neighboring jurisdictions. Hence, the yardstick competition created by the central government to overcome political agency problems implies horizontal strategic interactions among local officials.

Moreover, in presence of yardstick competition, public spending settings appear to be strategic complements. We have studied two cases. First, when both local officials are bad, choosing the same strategy gives the central government more confidence that governors are good so that both bad local officials decide, as soon as possible, to reduce together their rent

so that they will be reappointed. Second, good local government inflicts an externality on the bad one, conducing them to act as good governments to be reappointed. Finally, if a bad official has low performance relative to its neighbor, the central government interprets this as evidence that the official is bad and unseats him at the next appointment. So, an increase in the level of public goods in neighboring province forces i's local government to rise its own spending if he wants to be reappointed, conducing to strategic complementary of public spending.

These results are usual in yardstick competition model. In their model of yardstick competition in which jurisdictions face the alternative to choose between an old and a new policy, Rincke (2005) also concludes that "An equilibrium with yardstick competition is shown to exist where bad governments having a good government in their neighborhood choose the new policy more often compared to an equilibrium without relative performance evaluation." Our results are also similar to those of Besley and Case (1995b). However, while Besley and Case (1995b) focus on the effect of relative performance on the probability of being reelected, we focus on the effect of yardstick competition on the existence of strategic interactions among local governments and their nature. Indeed, according to Canegrati (2006), we distinguish two effects of the yardstick competition: a selection effects, which separates good governments from bad governments and a discipline effect, which forces bad governments to act as if they were good. We focus on the second one and we show how local governments are less corrupt or more efficient because of more intense interjurisdictional yardstick competition.

2.3.3   Comparison on the equilibrium public spending

We can note that there is no common agreement among researchers about the ability of the yardstick competition to reach citizens' welfare. Some economists who believe that government is benevolent are prone to see inter-governmental competition as a source of negative externalities which lower welfare. On the contrary, the public choice perspective which assumes the existence of Leviathan governments sees yardstick competition as potentially beneficial for welfare (Besley and Smart (2002)).[25] Brülhart and Jametti (2007) support the

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[25] Both approaches to the issue – the Pigouvian and Leviathan models – take an extreme position on the behavior of government.

view that tax competition can be second-best welfare enhancing by constraining the scope for public-sector revenue maximization. They find evidence of welfare-increasing "Leviathan taming". Economic theory also provides statements of the conditions under which tax competition may be "a force for good" or "a force for bad". Edwards and Keen (1996), for instance, show that the net welfare effect of tax competition hinges on the relative magnitude of two parameters: the marginal excess burden of taxation and the government's marginal ability to divert tax revenue for its own uses.[26]

In our case, it is straightforward to show that the total level of public spending provided by a bad government is higher with yardstick competition in period 1, with tax held fixed (see Appendix A.1.6).[27] It is not the case in period 2 since, with yardstick competition, bad local governments are more likely to be reappointed and we have made the assumption that in period 2 they set no discipline and raise their rent to the maximum. Otherwise, good officials without yardstick competition are also less likely to be reappointed which reduces the previous effect. Finally, yardstick competition induces strategic interactions among local officials which encourage them to raise the level of public spending in their jurisdiction as long as incentive mechanisms are used to discipline them (up to the last period).

3   Empirical evidence of strategic interactions among Chinese provinces

Our empirical work aims at testing corollary 1 and 2.

Our theoretical framework (corollary 2) shows that the yardstick competition created by the central government to overcome political agency problems forces local officials to care about what other local governments are doing and to adopt a mimicking behavior. Hence, first, we empirically test the existence of horizontal strategic interactions and the strategic complementarity of public spending setting. We extend our empirical analyze by testing the importance of strategic interactions for each category of public spending.

Second, according to the corollary 1, when the fiscal system is centralized, we should not

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[26] Belleflamme and Hindriks (2002) analyze the role of yardstick competition for improving political decisions and find a general neutrality result.

[27] It is 5Δ higher.

have any horizontal strategic interactions. Empirically, we test the effect of the decentralization degree on the existence of horizontal strategic interactions. We expect the horizontal strategic interactions being higher, the higher the decentralization degree is.

Before that, we provide an overview of the decentralization process in China and some descriptive statistics. By doing this, we discuss the necessary hypothesis of local government autonomy to determine the amount of their spending. Moreover, we better understand our empirical work main difficulty: the distinction between strategic interaction process among jurisdictions and exogenous correlation in provinces characteristics or spatial common shocks.

Our results provide evidence for the existence of horizontal strategic interactions and the strategic complementarity of public spending among Chinese provinces.

3.1 Decentralization process in China

The basic hypothesis of our analysis is that the Chinese provinces acquired an autonomous budgetary power which allows them to determine the amount of their spending.[28] One of the major objectives of the fiscal reform was to make localities fiscally self-sufficient. Here, we ascertain that provinces actually became independent fiscal entities that have both the responsibility for local expenditures and the unprecedented rights to use the revenue that they retained.

Before 1979, China practiced a "unitarian budgetary system" (*tongshou tongzhi*). This fiscal system was characterized by centralized revenue collection and centralized fiscal transfers. Most taxes and profits were collected by local governments and were remitted to the central government, and then in part transferred back to the local governments according to expenditure needs approved by the center. The central government made a plan of spending for each province. This system, called "eating from one big pot" (*chi daguofan*), was coherent with the planned economy. It is the perfect illustration of a centralized system: the central government decides the amount of fiscal transfers and public spending for each province. So, we do not consider this period in our empirical analyze to test the existence of strategic interactions.

The fiscal decentralization policy was implemented in 1980. The highly centralized sys-

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[28] Jin, Qian, and Weingast (2005) provide a more detailed overview of the decentralization process in China.

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tem was changed into a revenue-sharing system called "fiscal contracting system"(*caizheng chengbao zhi*), also known by its nickname "eating from separate kitchens" (*fenzao chifan*). If the central government still kept the responsibility for defining the fiscal system, the administration and the collection of taxes were widely devolved to provinces. There were three basic types of revenue under the reformed system: central revenues that accrue to the center, local revenues that accrue to the local governments, and shared revenues. Almost all revenues, except customs duties and a few minor central revenues, were collected by the local tax bureaus. However, the bases and rates of all taxes, whether shared or fixed, were determined by national tax laws. But, during this period, the local governments controlled the effective tax rates and bases by offering varying degrees of tax concessions to enterprises and shifted budgetary funds to extrabudgetary funds (Du and Feng (1994)). They, thus, minimized tax sharing with the central government. Moreover, for most local governments, there was a strong incentive to conceal their revenue capacities, as the center tended to revise the rules of the game to penalize local governments with fast growing revenues.[29] This period is generally considered as a period of great autonomy for provincial governments.

However, from 1980 to 1993, the central government's share of total budgetary revenue declined from 51 percent to 28 percent. These changes led to increase government deficits and reduced the central government's flexibility in using fiscal policy instruments in stabilization and redistribution. In an attempt to raise the central government's ability to use tax and expenditure policy instruments, the central government decided in late 1993, to replace the "fiscal contracting system" with a "separating tax system", which redefined the sources of revenue for the central and local governments. A system of affectation of the various categories of taxes between the center and the provinces was substituted to the system of tax sharing. The center and provinces became respectively responsible for the administration and for the collection of their own taxes. However, the central government would give back a lump-sum grant to the local government to make sure that the local revenue would at least be as large as that in 1993. To a certain extent, the reform may have strengthened the fiscal autonomy of provinces. Indeed, local governments' tax revenue do not depend on a negotiation with the center anymore, provinces' taxes have an important fiscal potential[30]

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[29] This phenomenon may accentuate our theoretical predictions.

[30] Income taxes from all enterprises other than central government enterprises, business tax from the sales

and they benefit from tax revenues they collect.

Actually, provinces autonomy results in a fiscal effort extremely different from a province to another (Bahl (1999)) and in the existence of deficits during the execution of the budgets.[31] Even if provinces' fiscal autonomy evolution is subject to controversy, we agree to consider that they have a big freedom as regards the amount of their extrabudgetary spending. In spite of their name, these fiscal revenues belong to the budget since provinces plan formally to collect them and to spend them. They are officially known by the central government.[32] The development of the extrabudgetary financing illustrates central government's tolerance to the fiscal initiatives of local governments (Zhang (1999)). We can conclude that the local governments are not deprived of their freedoms to determine the amount of their spending.

3.2 Descriptive statistics

Our panel dataset covers the period 1980-2004 for 29 provinces. We consider the 22 provinces or *sheng* (Anhui, Fujian, Gansu, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Yunnan and Zhejiang), the 5 autonomous regions or *zizhiqu* (Guangxi, Nei Mongol, Ningxia, Xinjiang Uygur, Xizang) and the 4 municipalities or *shi* (Beijing, Chongqing, Shanghai and Tianjin).[33]

Over the past 30 years, China has transformed itself, posting extraordinary rates of growth. At the same time, China has become a far less equal nation, with vast differences emerging between those living in rural versus urban areas, inland versus coastal areas, and globally oriented versus more insular areas. In particular, incomes in coastal areas have grown faster than income outside inland provinces, opening a coastal-inland income gap that

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of services, and personal income tax.

[31] These deficits can be justified by a natural disaster or an overestimation of the economic growth. But it seems that they could be voluntary: cost estimates are not realistic so that the principle of fiscal balance is not respected (Agarwala (1992)). The budget deficits are financed by central government's subsidies or loans, by extrabudgetary funds or by short-term banking loans.

[32] In 1978, total extra-budgetary revenue was about 10% of the GDP while total budgetary revenue was about 31%. In 1993, the extra-budgetary revenue was up to 16% of the GDP and the budgetary revenue was down to 16% of the GDP (Statistical Yearbook of China, 1995). While about three-quarters of the extra-budgetary funds are earnings retained by SOEs and by their supervisory government agencies at the central and local levels, about 30% of the extra-budgetary funds are used for government expenditures to supplement the budgetary funds (Fan, 1996).

[33] We excluded the region Xizang (Tibet) since data are likely to be overvalued. Moreover, in 1997, Chongqing separated from Sichuan to become an independent prefecture in its own right but we have no data for this prefecture before 1997. So, we have retied Chongqing to Sichuan.

has widened continuously. This pattern is not surprising given that much of China's recent economic development was led by rapidly expanding exports, financed to a considerable extent by foreign direct investment. As we can see in the Table 1 (see Appendix A.2.2), the coastal provinces concentrate more than 60 % of the GDP per capita on the whole period. Our econometrical framework will take into account such spatial heterogeneity among provinces which may affect fiscal policies.

Data for provinces' public expenditures come from China Statistical Yearbook in various years. Public expenditures are divided into five categories of spending:

o   Appropriation for Capital Construction,

o   Expenditure for Enterprises Innovation,

o   Expenditure for supporting agricultural production and agricultural operation,

o   Culture, Education, Science & Health Care,

o   Government Administration Spending.

As you can see in the Figure 3 (see Appendix A.2.1), Social expenditures in Culture, Education, Science and Health Care represent around 40% of local government expenditures and this is the most important category of public spending since 1980. Capital expenditures also represent an important share of public spending maybe because local jurisdictions try to attract firms and capital with infrastructures supply. Spending in enterprises innovation registers the lowest amount of expenditures (less than 10%). Expenditures for supporting agricultural production and government administration spending represent around 15% and 20% of local government expenditures. We will test the importance of strategic interactions for each category of public spending. Table 2 (see Appendix A.2.2) gives descriptive statistics for these different categories of public spending in the 29 provinces.

Local governments play an essential role in providing social services: in 2004, sub-national governments together financed 90 percent of public spending on education, 95 percent on health care, and 85 percent on social security. However, many local governments, especially those in poor Western regions, are providing fewer and lower quality of public services. Regarding global public spending we can notice that, once again, littoral provinces, which represent 40% of the sample, concentrate 65% of local government expenditures. The distribution of per capita central transfers by province in 2004 increases these inequalities:

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Shanghai, the richest province, is the highest recipient of central transfers per capita (5,079 yuan) and Henan is the lowest (646 yuan), with 1117 yuan per capita. So, fiscal disparity among the Eastern, the Middle, and the Western areas of China are continually enlarging. Figure 4 illustrates these disparities (see Appendix A.2.1). It confirms that our econometrical specification has to take into account spatial disparities since it appears to have important effect on public spending level. We will also consider central government transfers to focus on local government public spending choices and because it may also constitutes a spatial economic shock or, more generally, an explanatory variable spatially correlated.

Finally, the level of public spending seems to be largely spatially correlated due to spatial heterogeneity or inequalities. Our empirical framework consists in testing the existence of substantive strategic interaction between Chinese local governments. We have to ascertain that the observed spatial auto-correlation can be attributed to a real strategic interaction process among jurisdictions and not to exogenous correlation in omitted provinces characteristics or common shocks to local fiscal policy, which may provide false evidence of strategic interactions.

3.3 Econometric framework

Horizontal strategic interactions among Chinese provinces entail a fiscal reaction function that depicts how the decision variable for a given province depends on the decisions of other provinces. To test the existence of such strategic interactions, in line of the earlier literature,[34] we consider a specification in which (the log of) public expenditures in province i in year t, E_{it}, are a function of (the log of) its neighbors public spending, E_{jt}. We allow E_{it} to depend on a vector of specific controls X_{it} and we include a province specific effect α_i. All time-invariant community characteristics, observed or unobserved can be represented by community-specific intercepts.

$$E_{it} = \sum_{ij} \rho_{ij} E_{jt} + \beta X_{it} + \alpha_i + \varepsilon_{it}, \tag{6}$$

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[34] See, for instance, Devereux, Lockwood, and Redoano (2008), Foucault, Madies, and Paty (2008) or Redoano (2007).

where $i = 1, \ldots, n$ denotes a province and $t = 1, \ldots, T$ a time period, ρ_{ij}, β and α are unknown parameter vectors and ε_{it} a random error.

Since there are too many parameters ρ_{ij} to be estimated, we estimate:

$$E_{it} = \rho A_{jt} + \beta X_{it} + \alpha_i + \varepsilon_{it}, \tag{7}$$

where $A_{jt} = \sum w_{ij}.E_{jt}$. E_{it}, the vector of public spending in a local government i at time t, depends on A_{jt}, the weighted average vector of public spending in the set of the other local governments j at time t and a set of specific controls X_{it}. In our theoretical model, the central government induces a yardstick competition among local jurisdictions with identical environments and shocks. So, we have to consider local governments which are similar, "close". A scheme that assigns weights based on geographical proximity is commonly used in the relevant empirical literature. So, first, we have chosen two common geographical definitions of neighboring communities. The first one is based on the Euclidean distance between jurisdictions, w^{dist}.[35] The second one is based on a contiguity matrix where the value 1 is assigned if two jurisdictions share the same border and zero otherwise. This scheme is given by the weight matrix w^{cont}. Moreover, following Lockwood and Migali (2009), we compare these weights to 'placebo' weights, w^{plac}, which are chosen in a random way without regard to any economic considerations.[36] This placebo weighting scheme will give us a useful benchmark to ascertain that the potential observed spatial auto-correlation can be attributed to a substantive strategic interaction process since, if we find evidence of strategic interactions with the placebo matrix, which might indicate some general positive correlation between all public spending generated by omitted common shocks.[37]

Following Devereux, Lockwood, and Redoano (2008), Foucault, Madies, and Paty (2008), Veiga and Veiga (2007) and Redoano (2007), we introduce the lagged dependent variable, E_{it-1}, as a right hand side in order to take into account the persistency in public expenditures:

$$E_{it} = \lambda E_{it-1} + \rho A_{jt} + \beta X_{it} + \alpha_i + \varepsilon_{it}. \tag{8}$$

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[35] Weights w_{ij} are given by $1/d_{ij}$ where d_{ij} is the Euclidian distance between provinces i and j for $j \neq i$.

[36] We generate a random number distributed between 0 and 1 for each province. Then, the value 1 is assigned if the difference between random numbers of two provinces is higher than 0.5 and 0 otherwise.

[37] Weights are normalized so that their sum equals unity for each i for all weight matrices. This assumes that spatial interactions are homogeneous: each neighbor has the same impact on the province.

Lastly, we introduce a trend variable and specific control variables to ascertain that the observed spatial auto-correlation can be attributed to a substantive strategic interaction process and not to exogenous correlation in omitted provinces characteristics or common shocks to local fiscal policy,

$$E_{it} = \lambda E_{it-1} + \rho A_{jt} + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 U_{it} + \beta_4 O_{it} + \beta_5 F_{it} + \beta_6 C_{it} + \beta_7 T_t + \alpha_i + \varepsilon_{it}, \quad (9)$$

where E_{it} is per capita expenditures of province i on year t, E_{it-1} is the lagged value of our dependent variable, A_{jt} is the weighted average vector of per capita public spending in the set of the other local governments j at time t.[38] We add some specific control variables to avoid the omission of explanatory variables that are spatially dependent and may generate spatial error dependence: P_{it} is the population of jurisdiction i on year t, which captures the possibility of scale economies in public spending, G_{it} is the Gross Domestic Product (GDP) growth rate in province i on year t, an indicator of the economic conjuncture which allows controlling for common shocks spatially correlated, U_{it} is the share of urban population in the total provinces population, knowing that urbanization is spatially distributed and may increase public spending needs in particular in terms of infrastructures (Guillaumont Jeanneney and Hua (2001), Rodrik (1998)), O_{it} is a trade openness measure at provincial level which could have many effects on public finances,[39] as well as F_{it}, the foreign direct investment inflow in province i on year t. C_{it} is the central government transfers for province i on year t and T_t is a trend variable which captures common trend for all provinces.[40] Note that the central government transfers are introduced only as robustness check because of the lack of data.[41]

In estimating this reaction function we are confronted to important econometric issues

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[38] Per capita expenditures and population are in log.

[39] Rodrik (1998) shows that there exists a positive correlation between an economy's exposure to international trade and the size of its government because government spending plays a risk-reducing role in economies exposed to a significant amount of external risk. As Combes and Saadi-Sedik (2006) have shown, even if trade openness increases a country's exposure to external shocks and thereby adversely affects its budget balances, an outward looking policy strategy should lead to an overall strengthening of its budget balance.

[40] We can't introduce time dummies since we use GMM System with external instruments and we have too many instruments with time dummies. However, this is a good way to ascertain that the potential observed spatial auto-correlation can be attributed to a substantive strategic interaction process and not to a "common trend". Indeed, Manski (1993) suggests that fiscal choices appear to be interdependent not because jurisdictions behave strategically but because they actually follow a "common trend" that drives fiscal choices in the same directions.

[41] Data for the central government transfers come from China Financial Yearbook from 1995 to 2004.

(Brueckner (2003)).

- First, as said before, the omission of explanatory variables that are spatially dependent may generate spatial dependence in the error term, which is given by: $\varepsilon_{it} = \tau w \varepsilon_{it} + v_{it}$. When spatial error dependence is ignored, estimation can provide false evidence of strategic interactions. To deal with this problem, one possible approach is to use the ML estimator, taking into account the error structure or the IV method which yields consistent estimations even with spatial error dependence (see Kelejian and Prucha (1998)).[42] Brueckner and Saavedra (2000), Saavedra (2000) or Foucault, Madies, and Paty (2008) use the tests of Anselin, Bera, Florax, and Yoon (1996) to verify the hypothesis of error independence. We can note that the use of panel help eliminate spatial error dependence which arises through spatial autocorrelation of omitted variable which are time-invariant.

- Secondly, because of strategic interactions, public expenditures in different provinces are jointly determined: if local governments react to each others' spending choices, neighbors' decisions are endogenous and correlated with the error term ε_{it}. In this case, ordinary least squares estimation of the parameters are inconsistent, requiring alternative estimation methods based on the instrumental variables (IV) method or on the maximum likelihood (ML). Under IV approach, a typically procedure is to use the weighted average of neighbors' control variables as instruments (Kelejian and Prucha (1998)). The ML method consists in using a non-linear optimization routine to estimate the spatial coefficient ρ (Brueckner (2003)).

- Lastly, since we introduce the lagged dependent variable as a right hand side to consider the autoregressive component of the time series, the previous estimators are inconsistent (Nickell (1981)).

We propose to use the GMM-System estimator in addition to the IV estimator of the spatial coefficient, after verifying the hypothesis of error independence and estimating the

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[42] Case, Rosen, and Hines (1993), Besley and Case (1995b), Brueckner (1998) and Brueckner and Saavedra (2000) use the maximum likelihood approach. Brett and Pinkse (1998), Heyndels and Vuchelen (1998), Figlio, Kolpin, and Reid (1999) and Buettner (2001) are examples of empirical studies that use the IV approach to estimate spatial coefficients.

static model with ML estimator. As for the neighbors' spending decisions, following Redoano (2007), Devereux, Lockwood, and Redoano (2008) and Foucault, Madies, and Paty (2008), we use the weighted average of neighbors' control variables, i.e., their socio-economic characteristics $(w_{ij}X_{jt})$, as instruments. The GMM estimators allow controlling for both unobserved country-specific effects and potential endogeneity of the explanatory variables.[43] The GMM-System estimator combines in one system, the regressions in difference and the regressions in level. Blundell and Bond (1998) show that this extended GMM estimator is preferable to that of Arellano and Bond (1991) when the dependent variable, the independent variables, or both are persistent.

3.4 Public spending interactions and strategic complementarity

To investigate whether spatial lag or spatial error dependence are the more likely sources of correlation, we use two robust tests based on the Lagrange Multiplier principle for panel data that indicate what is the most likely source of spatial dependence (Anselin, Le Gallo, and Jayet (2006)). We compute these robust tests for spatial lag dependence and for spatial error dependence. As you can see in the Table 3 (see Appendix A.2.3), spatial tests indicate the presence of spatial lag dependence for public spending but not the existence of spatial error dependence for both matrices. As the hypothesis of error independence is verified, we estimate the equation (9) using ML with specific-effects for both contiguity and distance matrices without taking into account the lagged value of our dependent variable $(\lambda = 0)$. The estimation results are shown in Table 3. In these first estimations, the coefficient of the weighted average vector of public expenditures in the set of other local governments is always significant and positive, for both matrices.

We then estimate with GMM-System the dynamic model (equation 4) for both weighting schemes taking into account the lagged value of our dependent variable $(\lambda \neq 0)$. We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of other

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[43] There are conceptual and statistical shortcomings with the first-difference GMM estimator as it exacerbates the bias due to errors in variables (Hausman, Hall, and Griliches (1984)). Thus, we use an alternative system estimator that reduces the potential biases and imprecision associated with the usual difference estimators (Arellano and Bover (1995) and Blundell and Bond (1998)) and also greatly reduces the finite sample bias (Blundell, Bond, and Windmeijer (2000)).

explanatory variables.[44] As noted before, the weighted average vector of per capita public spending in other provinces is also instrumented by the weighted average of neighbors' control variables. We collapse instruments and limit its number since too many instruments leads to inaccurate estimation of the optimal weight matrix, biased standard errors and, therefore, incorrect inference in overidentification tests (see Roodman (2009)).[45] Table 4 shows these estimation results for distance matrix and Table 5 for contiguity matrix (see Appendix A.2.3).

The consistency of GMM-System estimator is given by two specification tests (Arellano and Bond (1991)). With the Hansen test, we cannot reject the null hypothesis of the overall validity of instruments' orthogonality conditions. The second tests concern the serial correlation of residuals: we reject the null hypothesis of no first-order serial correlation and do not reject the null hypothesis of no second-order serial correlation of differenced residuals. So, we conclude that orthogonality conditions are correct and instruments used valid. We introduce the control variables progressively to check the robustness of our results.

We can note first that the coefficient on lagged dependent variable is always significant and positive. As this coefficient provides an estimated λ varying between 0.45 and 0.89 significant at 1% level, the result indicates persistency of public expenditures and confirms the consistency of the autoregressive specification.

The coefficient of the weighted average vector of public expenditures in the set of other provinces is significant at least at 5% level and positive for both matrices. Moreover, it is robust and relatively stable with the introduction of the control variables. However, if we continue to find evidence of strategic interactions with the placebo matrix, that might indicate some general positive correlation between all public spending generated by omitted common shocks. It would cast doubt on our claim that we have found evidence of public spending interactions. But, we see from Table 5 on the last column, that placebo matrix do not show any evidence of positive strategic interactions. This shows that the phenomenon of fiscal interactions detected with geographical matrices is not an artefact of the estimation procedure. So, we can conclude that there are some strategic interactions between Chinese

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[44] Population density, trend and urbanization rate.

[45] The lags of at least two periods earlier for weak exogenous variables and three periods earlier for endogenous variables are used as instruments. The lagged dependent variable is instrumented by lags of the dependent variable from at least two periods earlier.

We use two lags for endogenous and weak exogenous variables. Note that we consider external instruments as weak exogenous but we use only one lag when the number of instruments exceeds the number of units.

provinces and public expenditures seem to be strategic complements: an average public spending increase of 10% in the neighboring provinces induces an increase of around 5,9% with the distance matrix and 2,8% for with contiguity matrix in provincial expenditures.

As expected, the parameter associated with population is negative and significant: it indicates the presence of scale economies in public spending. We find a positive and significant sign for the parameter associated with the GDP growth rate, which indicates the effect of economic conjuncture. Results also tend to show that urbanization actually increases public spending needs. The coefficient associated with the central government transfers is also positively correlated with the level of public expenditures, as it is generally the case for trade openness. However, the coefficient of foreign direct investment inflow is, for the most part, non significant.

Since, in China, the central government considers different groups of provinces (coastal, south...) in these economic reforms, the competition may also appear among provinces which belong to the same group. Moreover, among these groups, provinces have generally the same characteristics so that governors can be compared. So, we also consider a weighting scheme (w^{reg}) where the value 1 is assigned if two jurisdictions belong to the same group and zero otherwise.[46] However, as you can see in the Table 6 (see Appendix A.2.3), results are similar with the contiguity matrix.[47]

Finally, our results provide evidence for the existence of horizontal strategic interactions and the strategic complementarity of public spending among "close" Chinese provinces. We can notice that this result is close to those obtained in previous tests carried out in other countries.[48]

We extend our empirical analysis by testing the existence of horizontal strategic interactions for each category of public spending. Indeed, Case, Rosen, and Hines (1993) and

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[46] Beijing, Tianjin, Hebei, Shanxi and InnerMong belong to the "North", Liaoning, Jilin and Heilongjiang to the "Northeast", Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi and Shandong to the "East", Henan, Hubei, Hunan, Guangdong, Guangxi and Hainan to the "South Central ", Sichuan, Guizhou and Yunnan to the "South West" and Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang to the "North West".

[47] That's not surprising since the correlation coefficient between the weighted average vector of public spending with the two matrices is 0.96.

[48] The empirical evidence of public spending interactions and their strategic complementarity relates to the United States (Case, Rosen, and Hines (1993), Figlio, Kolpin, and Reid (1999)), European counties (Redoano (2007)), Indonesia (Arze, Martinez-Vasquez, and Puwanti (2008)) or French municipalities (Foucault, Madies, and Paty (2008)). For empirical evidence of yardstick competition see Besley and Case (1995b) for United States), Ashworth and Heyndels (1997) for Flemish Belgium, Bordignon, Cerniglia, and Revelli (2003) for Italy, Schaltegger and Kuttel (2002) for Switzerland and Revelli (2006) for the United Kingdom.

Foucault, Madies, and Paty (2008) suggested that there is no reason to assume that patterns of expenditures interdependence are identical for all categories of public spending. Results are provided in Table 7 and 8 (see Appendix A.2.4) for distance and contiguity matrix. Regarding coefficients associated with weighted average vector of public expenditures in neighboring provinces for the various categories of public spending, we notice that public spending interactions seem to be strongest and most significant for the category "appropriation for capital construction" and for "expenditures for enterprises innovation". Estimations provide estimated coefficients varying between 0.35 and 0.24, significant at 1% level with the distance matrix. This result may reflect competition among Chinese provinces to attract firms and capital with infrastructures supply, which is an important indicator of performance for the central government. We have similar result with Foucault, Madies, and Paty (2008) who found a higher coefficient for investment expenditures and argued that there are spending interactions between neighboring French municipalities for the most "visible" category of expenditures. Strategic interactions are smaller for local social expenditures ("culture, education, science & health care"). Lastly, results provide no evidence for expenditures for supporting agricultural production and local government administration spending.

Finally, strategic interactions vary according to categories of public expenditures and results seem to reflect competition among local governments to attract firms with infrastructures supply, resulting from a yardstick competition created by the central government.

3.5 Decentralization degree and strategic interactions

As said before, according to the corollary 1, when the fiscal system is centralized, local officials do not care about what other local governments are doing so that we should not have any horizontal strategic interactions. We cannot test directly this hypothesis since we lack of data for the period before the decentralization. So, we propose to test the effect of the decentralization degree on the existence of horizontal strategic interactions. The horizontal strategic interactions should be higher, the higher the decentralization degree is.

To test this, we interact the neighbors' spending decisions (A_{jt}) with an indicator of

decentralization degree (Dec_{it}) and we estimate:

$$E_{it} = \lambda E_{it-1} + \rho' A_{jt} + \rho''(A_{jt}*Dec_{it}) + \beta_1 P_{it} + \beta_2 G_{it} + \beta_3 N_{it} + \beta_4 O_{it} + \beta_5 U_{it} + \beta_6 T_t + \beta_7 Dec_{it} + \alpha_i + \varepsilon_{it},$$

$$(10)$$

If the decentralization actually reinforces strategic interactions, we should observe the coefficient ρ' and ρ'' being both significantly positive. Following the relevant literature,[49] we choose two usual approximations of fiscal decentralization: subnational expenditure as a percentage of national expenditure and transfers from central government as a percentage of subnational government revenue.[50]

Table 9 (see Appendix A.2.5) gives the estimation results for both matrices. Our results tend actually to show that public spending interactions are reinforced by the fiscal decentralization. Indeed, for both matrices, coefficients associated with A_{jt} and $(A_{jt}*Dec_{it})$ are significantly positive with the first approximation of fiscal decentralization (column (1) and (2)).[51] There are horizontal strategic interactions among local governments which are complements and reinforced by a higher degree of decentralization. These results are consistent with those of Huther and Shah (1998), Barenstein and de Mello (2001) and Fisman and Gatti (2002) who all report that a larger subnational share of public expenditures was associated with lower corruption and those of Treisman (2000) and Arikan (2004) who explored whether smaller local units were associated with less corruption because of more intense interjurisdictional competition.

As robustness test, as said before, we use an alternative approximation of fiscal decentralization and evaluate the effect of the transfers from central government as a percentage of subnational government revenue on the existence of strategic interactions in column (3) and (4). It can be considered as an indicator of degree of dependence and a sign of weakness in terms of subnational resources. As expected, on the contrary, public spending interactions are reduced by "fiscal centralization". Indeed, central government transfers have a positive effect

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[49] In particular, Huther and Shah (1998), Barenstein and de Mello (2001), Fisman and Gatti (2002), Arikan (2004), Rodríguez-Pose and Krøijer (2008) or Enikolopov and Zhuravskaya (2007) in their studies of the effects of fiscal decentralization on governance, corruption, growth and political institutions.

[50] More precisely, we use the ratio of jurisdictions' public spending per capita over the total central government public spending per capita, for each jurisdiction and the share of central government transfers per capita relative to local revenue per capita of the local government.

[51] Note that we tested the joint significance of the coefficients.

on the level of public spending in provinces but it reduces interjurisdictional competition: the coefficient associated with the interaction between the neighbors' spending decisions (A_{jt}) and an indicator of centralization (C_{it}) is significantly negative while coefficients associated with (A_{jt}) and (C_{it}) are both positive.

Finally, first, our empirical work provides evidence for the existence of horizontal strategic interactions and the strategic complementarity of public spending among Chinese provinces which is consistent with the corollary 2 of our theoretical model. We have also shown that strategic interactions vary according to categories of public expenditures and results seem to reflect competition among local governments to attract firms with infrastructures supply, resulting from a yardstick competition created by the central government. Second, our results tend to show that the horizontal strategic interactions are higher, the higher the decentralization degree is, as we can expect from the corollary 1 of our theoretical work.

4 Conclusion

Some scholars argue that fiscal decentralization in China was the key for Chinese remarkable growth, by creating strong incentives to promote local economic growth. However, "Chinese style decentralization" is conceptually different from the decentralization in many other countries. In particular, there is a divergence between the assumptions of orthodox fiscal federalism theory and the institutional and economic realities in China. Indeed, China's current fiscal system is largely decentralized while its governance structure is rather centralized, the power of provincial governments is not based on a system of electoral representation and the population mobility is limited. Here, following Blanchard and Shleifer (2000), we argue that, when disciplining devices such as local election and the exit option are far from perfect, vertical control can ensure local accountability. Under this centralized political system, the government can create a yardstick competition among local officials by rewarding or punishing them on the basis of economic performance like voters do in democratic countries (Besley and Case (1995b)).

So, we have developed a model of public spending setting in a multijurisdictional world with asymmetric information, where the central government makes comparisons between

local jurisdictions to overcome political agency problems. Finally, information spillovers from other jurisdictions affect the delivery of public services in jurisdiction i and forces local officials into a yardstick competition in which they care about what other local governments are doing. When the central government uses neighboring performance to judge a governor, the latter are encouraged to follow neighboring fiscal choices in order not to be signaled as bad local government and to be reappointed.

Then, we have empirically explores the existence of public spending interactions among subnational governments embedded in a vertical bureaucratic control system. This study is the first attempt made to test whether the central government can induce public spending interactions. By estimating a spatial lag model for a panel data of 29 provinces from 1980 to 2004, we find first that there exists interjurisdictional competition among Chinese provincial governments. Indeed, there are some strategic interactions as regards total local expenditures and it appears to be strategic complements. Second, strategic interactions appear to vary according to categories of public expenditures and it seems to reflect competition among local governments to attract firms with infrastructures supply, resulting from a yardstick competition created by the central government. Lastly, public spending interactions are reinforced by the fiscal decentralization degree.

Generally, a necessary assumption for the existence of interjurisdictional competition is that local governments are directly elected by the constituents. Moreover, the fiscal decentralization process has to be total. In China, on the contrary, this is the centralized political system associated with the decentralized fiscal system which seems to create a vertical control and ensure political accountabilility of local leaders and, finally, induces interjurisdictional competition. So, even if the institutional context and the structure of incentives in China are quite different from those in advanced industrial economies, it is not always necessary "to go beyond the traditional fiscal federalism literature", as Bardhan (2002) argued. Indeed, the fact that principals can use yardstick competition to evaluate local agents' performance is equally valid whether the principals are local voters or central leaders. Finally, an alternative explanation for local officials' increasing efforts to promote growth is the system's enduring centralization. We can finally wonder if the control by the citizens is always more effective than the administrative control.

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A   Appendix

A.1   Theoretical framework

A.1.1   Proof of Lemma 1: Symmetric information

- If the central government observes G_i smaller than T_i ($G_i = T_i - \Delta$ or $G_i = T_i - 2\Delta$), it will always believe that the local government is bad with probability 1, so, we have:

$$\mu(T_i - \Delta) = \mu(T_i - 2\Delta) = 0. \tag{11}$$

Since $\mu(T_i - \Delta) = \mu(T_i - 2\Delta) = 0$, we establish by applying strict dominance argument that local governments will never play $G_i = T_i - \Delta$, since

$$
\begin{aligned}
E\left[V\left(T_i - \Delta\right)\right] &= \Delta + \mu(T_i - \Delta)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(T_i - 2\Delta\right)\right] = 2\Delta + \mu(T_i - \Delta)\delta(2\Delta + \varphi p) = 2\Delta.
\end{aligned}
$$

Indeed, playing $G_i = T_i - \Delta$ gets less rent with no gain in the probability of staying governor.

- If the central government observes $G_i = T_i$, it will always believe that the local government is good and reappoints him:

$$\mu(T_i) = 1. \tag{12}$$

Since $\mu(T_i) = 1$, we have

$$\begin{aligned} E\left[V\left(T_i\right)\right] &= 0 + \mu(T_i)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p) \\ &> E\left[V\left(T_i - 2\Delta\right)\right] = 2\Delta \text{ if } \varphi p > (2 - 2\delta)/\delta * \Delta, \end{aligned}$$

so that , a bad local government chooses

$$G_i = T_i, \tag{13}$$

if $\varphi p > (2-2\delta)/\delta * \Delta$ that is to say, a high enough value of φp is needed for it to be sufficiently interesting to take no rent in order to be reappointed. We assume that it is the case.

Yardstick competition has no effect on public spending choices since there is no information to reveal.

A.1.2 Extensive-form game
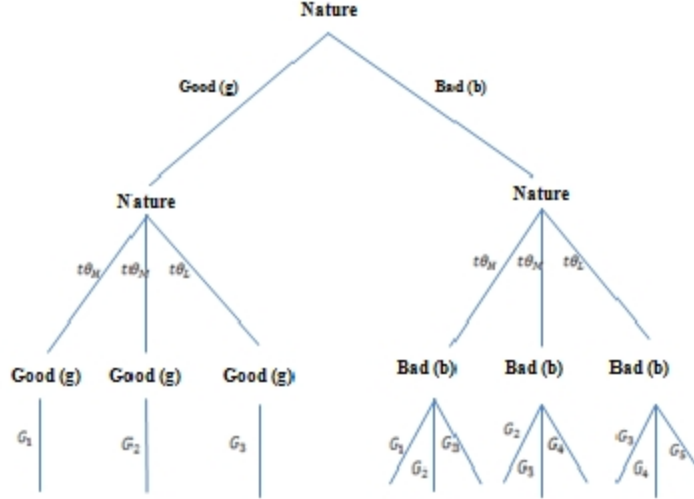
A.1.3 Proof of Lemma 2: Perfect Bayesian equilibrium with Yardstick Competition

We consider several situations:

- The central government observes G_4 or G_5. It will always believe that a local official who sets G_4 or G_5 is bad with probability 1, or in other terms we have

$$P\left[g\left|G_4\right.\right] = P\left[g\left|G_5\right.\right] = 0,$$

and then we have

$$\mu(G_4) = \mu(G_5) = 0. \tag{14}$$

Hence, we establish by applying strict dominance argument that local governments will never play $G(\theta_L; b) = G_4$, since

$$
\begin{aligned}
E\left[V\left(G_4\left|\theta_L\right.\right)\right] &= \Delta + \mu(G_4)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(G_5\left|\theta_L\right.\right)\right] = 2\Delta + \mu(G_5)\delta(2\Delta + \varphi p) = 2\Delta.
\end{aligned}
$$

- The central government observes G_3. It believes that a local governor is good with the following probability

$$P[g|G_3] = \frac{\gamma q_L}{\gamma q_L + 1 - \gamma}.$$

Since $P[g|G_3]$ is always smaller than γ, the central government is not willing to reappoint a local government who sets G_3, in other terms we have

$$\mu(G_3) = 0. \tag{15}$$

Since $\mu(G_3) = \mu(G_4) = \mu(G_5) = 0$ and $E[V(G_3|\theta_L)] = 0 < E[V(G_4|\theta_L)] < E[V(G_5|\theta_L)]$, a local government will always chooses

$$G(\theta_L; b) = G_5. \tag{16}$$

Playing G_3 or G_4 gets less rent with no gain in the probability of staying governor when θ_L.

Moreover, we establish by applying strict dominance argument that local governments will never play $G(\theta_M; b) = G_3$, since

$$
\begin{aligned}
E[V(G_3|\theta_M)] &= \Delta + \mu(G_3)\delta(2\Delta + \varphi p) = \Delta \\
&< E[V(G_4|\theta_M)] = 2\Delta + \mu(G_4)\delta(2\Delta + \varphi p) = 2\Delta.
\end{aligned}
$$

- The central government observes G_2. It believes that a local government is good with the following probability

$$P[g|G_2] = \frac{\gamma q_M}{\gamma q_M + (1 - \gamma)(q_H + q_M)}.$$

Since $P[g|G_2]$ is always smaller than γ, the central government is not willing to reappoint a local government who sets G_2, in other terms we have

$$\mu(G_2) = 0. \tag{17}$$

Since $\mu(G_2) = \mu(G_3) = \mu(G_4) = 0$ and $E\left[V\left(G_2 | \theta_M\right)\right] = 0 < E\left[V\left(G_3 | \theta_M\right)\right] < E\left[V\left(G_4 | \theta_M\right)\right]$, a local government will always chooses

$$G(\theta_M; b) = G_4. \tag{18}$$

Moreover, we establish by applying strict dominance argument that local governments will never play $G(\theta_H; b) = G_2$, since

$$
\begin{aligned}
E\left[V\left(G_2 | \theta_H\right)\right] &= \Delta + \mu(G_2)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(G_3 | \theta_H\right)\right] = 2\Delta + \mu(G_4)\delta(2\Delta + \varphi p) = 2\Delta.
\end{aligned}
$$

- The central government observes G_1. It believes that a local government is good with the following probability

$$P\left[g | G_1\right] = \frac{\gamma q_H}{\gamma q_H + (1-\gamma)q_H}.$$

Since $P\left[g | G_1\right] \geqslant \gamma$, the central government is willing to reappoint a local government who sets G_1:, in other terms we have

$$\mu(G_1) = 1. \tag{19}$$

Since $\mu(G_1) = 1$ and $\mu(G_2) = \mu(G_3) = 0$,

$$
\begin{aligned}
E\left[V\left(G_1 | \theta_H\right)\right] &= 0 + \mu(G_1)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p) \\
&> E\left[V\left(G_3 | \theta_H\right)\right] = 2\Delta \text{ if } \varphi p > (2 - 2\delta)/\delta * \Delta.
\end{aligned}
$$

So, a bad local government chooses

$$G(\theta_H; b) = G_1. \tag{20}$$

if $\varphi p > (2 - 2\delta)/\delta * \Delta$. In this case, it is not worthwhile to deviate to G_3 given that he will not then be reappointed.

A.1.4 Proof of Lemma 3: Perfect Bayesian equilibrium with Yardstick Competition and both local governments bad

Once again, we consider several situations:

- The central government observes G_4 or G_5. As previously, it will always believe that a local government who sets G_4 or G_5 is bad with probability 1,

$$P[g|G_4] = P[g|G_5] = 0,$$

and then we have

$$\mu(G_4) = \mu(G_5) = 0. \tag{21}$$

Hence, we also establish by applying strict dominance argument that local governments will never play $G(\theta_L; b) = G_4$, since

$$
\begin{aligned}
E\left[V\left(G_4 \left|\theta_L\right.\right)\right] &= \Delta + \mu(G_4)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(G_5 \left|\theta_L\right.\right)\right] = 2\Delta + \mu(G_5)\delta(2\Delta + \varphi p) = 2\Delta.
\end{aligned}
$$

- The central government observes G_3 in both local governments. It believes that a local government is good with the following probability

$$P[g|G_3] = \frac{\gamma^2 q_L}{\gamma^2 q_L + (1-\gamma)^2}.$$

$P[g|G_3] > \gamma$ if $\gamma > 0.7$. In this case, the central government is willing to reappoint a local government who sets G_3, in other terms we have

$$\mu(G_3) = 1. \tag{22}$$

Since $\mu(G_3) = 1$ and $\mu(G_4) = \mu(G_5) = 0$

$$E\left[V\left(G_3\,|\theta_L\right)\right] \quad = \quad 0 + \mu(G_3)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p)$$

$$> \quad E\left[V\left(G_5\,|\theta_H\right)\right] = 2\Delta \text{ if } \varphi p > (2 - 2\delta)/\delta * \Delta.$$

So, a local government will always chooses

$$G(\theta_L; b) = G_3. \tag{23}$$

Finally, both local government choosing the same strategy gives the central government more confidence that both are good: they both decide to reduce their rent when the product is θ_L to be reappointed in presence of yardstick competition.

- The central government observes G_2 in both local governments. It believes that a local government is good with the following probability

$$P\left[g\,|G_2\right] = \frac{\gamma^2 q_M}{\gamma^2 q_M + (1 - \gamma)^2(q_H + q_M)}.$$

$P\left[g\,|G_2\right] > \gamma$ if $\gamma > 0.6$. In this case, the central government is willing to reappoint a local government who sets G_2, in other terms we have

$$\mu(G_2) = 1. \tag{24}$$

Since $\mu(G_2) = \mu(G_3) = 1$ and $\mu(G_4) = 0$, we establish by applying strict dominance argument that local governments will never play $G(\theta_L; b) = G_2$, since

$$E\left[V\left(G_2\,|\theta_M\right)\right] \quad = \quad 0 + \mu(G_2)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p)$$

$$< \quad E\left[V\left(G_3\,|\theta_M\right)\right] = \Delta + \mu(G_3)\delta(2\Delta + \varphi p) = \Delta + \delta(2\Delta + \varphi p),$$

and,

$$E\left[V\left(G_3\,|\theta_M\right)\right] = \Delta + \delta(2\Delta + \varphi p)$$
$$> \quad E\left[V\left(G_4\,|\theta_M\right)\right] = 2\Delta \text{ if } \varphi p > (2 - 2\delta)/\delta * \Delta.$$

Bad local governments decide to reduce their rent when the product is θ_M to be reappointed but only up to G_3 which is sufficient to be reappointed:

$$G(\theta_M; b) = G_3. \tag{25}$$

- The central government observes G_1. It believes that a local government is good with the following probability

$$P\left[g\,|G_2\right] = \frac{\gamma^2 q_H}{\gamma^2 q_H + (1 - \gamma)^2 q_H}.$$

Since $P\left[g\,|G_1\right] \geqslant \gamma$, the central government is willing to reappoint a local government who sets G_1, in other terms we have

$$\mu(G_1) = 1. \tag{26}$$

Since $\mu(G_1) = \mu(G_2) = \mu(G_3) = 1$, we establish by applying strict dominance argument that local governments will never play $G(\theta_H; b) = G_1$ or G_2, since

$$E\left[V\left(G_1\,|\theta_H\right)\right] = 0 + \mu(G_1)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p)$$
$$< \quad E\left[V\left(G_2\,|\theta_H\right)\right] = \Delta + \mu(G_2)\delta(2\Delta + \varphi p) = \Delta + \delta(2\Delta + \varphi p)$$
$$< \quad E\left[V\left(G_3\,|\theta_H\right)\right] = 2\Delta + \mu(G_3)\delta(2\Delta + \varphi p) = 2\Delta + \delta(2\Delta + \varphi p).$$

So, both bad local governments can now play

$$G(\theta_H; b) = G_3, \tag{27}$$

since playing a higher level of public spending gets less rent with no gain in the probability of being reappointed.

Full characterization of the equilibrium   We have to consider two other cases: $0.6 < \gamma < 0.7$ and $\gamma \leqslant 0.6$.

We consider the first case:

- If $\gamma < 0.7$, $P\left[g\,|G_3\right] < \gamma$ so that the central government is not willing to reappoint a local government who sets G_3, in other terms we have

$$\mu(G_3) = 0. \tag{28}$$

Since $\mu(G_3) = 0$ and $\mu(G_4) = \mu(G_5) = 0$

$$
\begin{aligned}
E\left[V\left(G_3\,|\theta_L\right)\right] &= 0 + \mu(G_3)\delta(2\Delta + \varphi p) = 0 \\
&< E\left[V\left(G_4\,|\theta_H\right)\right] = \Delta + \mu(G_4)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(G_3\,|\theta_H\right)\right] = 2\Delta + \mu(G_5)\delta(2\Delta + \varphi p) = 2\Delta,
\end{aligned}
$$

so that a local government will always chooses

$$G(\theta_L; b) = G_5. \tag{29}$$

- If $\gamma > 0.6$, $P\left[g\,|G_2\right] > \gamma$ so that the central government is willing to reappoint a local government who sets G_2, in other terms we have

$$\mu(G_2) = 1. \tag{30}$$

Since $\mu(G_2) = 1$ and $\mu(G_3) = \mu(G_4) = 0$, we establish that local governments will never

play $G(\theta_L; b) = G_3$, since

$$
\begin{aligned}
E\left[V\left(G_3 \,|\theta_M\right)\right] &= \Delta + \mu(G_3)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(G_4 \,|\theta_M\right)\right] = 2\Delta + \mu(G_4)\delta(2\Delta + \varphi p) = 2\Delta,
\end{aligned}
$$

and,

$$
\begin{aligned}
E\left[V\left(G_2 \,|\theta_M\right)\right] &= 0 + \delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p) \\
&> E\left[V\left(G_4 \,|\theta_M\right)\right] = 2\Delta \text{ if } \varphi p > (2 - 2\delta)/\delta * \Delta.
\end{aligned}
$$

Bad local governments decide to reduce their rent when the product is θ_M to be reappointed:

$$
G(\theta_M; b) = G_2. \tag{31}
$$

- Since $P\left[g\,|G_1\right] \geqslant \gamma$, the central government is willing to reappoint a local government who sets G_1, in other terms we have

$$
\mu(G_1) = 1. \tag{32}
$$

Since now $\mu(G_1) = \mu(G_2) = 1$ and $\mu(G_3) = 0$, we establish by applying strict dominance argument that local governments will never play $G(\theta_H; b) = G_1$ or G_2, since

$$
\begin{aligned}
E\left[V\left(G_1 \,|\theta_H\right)\right] &= 0 + \mu(G_1)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p) \\
&< E\left[V\left(G_2 \,|\theta_H\right)\right] = \Delta + \mu(G_2)\delta(2\Delta + \varphi p) = \Delta + \delta(2\Delta + \varphi p),
\end{aligned}
$$

and

$$
\begin{aligned}
E\left[V\left(G_3 \,|\theta_H\right)\right] &= 2\Delta + \mu(G_3)\delta(2\Delta + \varphi p) = 2\Delta \\
&< E\left[V\left(G_2 \,|\theta_H\right)\right] = \Delta + \mu(G_2)\delta(2\Delta + \varphi p) = \Delta + \delta(2\Delta + \varphi p).
\end{aligned}
$$

So, both bad local governments now play

$$G(\theta_H; b) = G_2, \tag{33}$$

since playing a higher level of public spending gets less rent with no gain in the probability of being reappointed.

So, if $\gamma < 0.7$ and $\gamma > 0.6$, both bad local governments set $G(\theta_H; b) = G_2$, $G(\theta_M; b) = G_2$ and $G(\theta_L; b) = G_5$[52] and the central government sets $\mu(G_1) = \mu(G_2) = 1$, $\mu(G_3) = \mu(G_4) = \mu(G_5) = 0$.

We consider the second case:

- If $\gamma < 0.6$, $P[g|G_3] < \gamma$ so that the central government is not willing to reappoint a local government who sets G_3, in other terms we have

$$\mu(G_3) = 0. \tag{34}$$

and, as previously, a local government will always chooses

$$G(\theta_L; b) = G_5. \tag{35}$$

- If $\gamma < 0.6$, $P[g|G_2] < \gamma$ so that the central government is not willing to reappoint a local government who sets G_2, in other terms we have

$$\mu(G_2) = 0. \tag{36}$$

Since $\mu(G_2) = \mu(G_3) = \mu(G_4) = 0$, we establish by applying strict dominance that

$$
\begin{aligned}
E\left[V\left(G_2 \mid \theta_M\right)\right] &= 0 + \mu(G_2)\delta(2\Delta + \varphi p) = 0 \\
&< E\left[V\left(G_3 \mid \theta_M\right)\right] = \Delta + \mu(G_3)\delta(2\Delta + \varphi p) = \Delta, \\
&< E\left[V\left(G_4 \mid \theta_M\right)\right] = 2\Delta + \mu(G_4)\delta(2\Delta + \varphi p) = 2\Delta,
\end{aligned}
$$

_____
[52] The final payoffs are respectively, $\Delta + \delta(2\Delta + \varphi k)$, $\delta(2\Delta + \varphi k)$ and 2Δ.

so that a bad local governments play, when the product is θ_M:

$$G(\theta_M; b) = G_4. \tag{37}$$

- Since $P[g|G_1] \geqslant \gamma$, the central government is willing to reappoint a local government who sets G_1 :

$$\mu(G_1) = 1. \tag{38}$$

Since now $\mu(G_1) = 1$ and $\mu(G_2) = \mu(G_3) = 0$, we establish by applying strict dominance argument that local governments will never play $G(\theta_H; b) = G_2$, since

$$
\begin{aligned}
E\left[V\left(G_2\,|\theta_H\right)\right] &= \Delta + \mu(G_1)\delta(2\Delta + \varphi p) = \Delta \\
&< E\left[V\left(G_3\,|\theta_H\right)\right] = 2\Delta + \mu(G_{32})\delta(2\Delta + \varphi p) = 2\Delta.
\end{aligned}
$$

and

$$
\begin{aligned}
E\left[V\left(G_3\,|\theta_H\right)\right] &= 2\Delta + \mu(G_3)\delta(2\Delta + \varphi p) = 2\Delta \\
&< E\left[V\left(G_1\,|\theta_H\right)\right] = 0 + \mu(G_1)\delta(2\Delta + \varphi p) = \delta(2\Delta + \varphi p).
\end{aligned}
$$

So, both bad local governments now play

$$G(\theta_H; b) = G_1, \tag{39}$$

to be reappointed.

So, if $\gamma < 0.7$ and $\gamma < 2/3$, the following constitute an equilibrium, both bad local governments set $G(\theta_H; b) = G_1$, $G(\theta_M; b) = G_4$ and $G(\theta_L; b) = G_5$[53] and the central government sets $\mu(G_1) = 1$, $\mu(G_2) = \mu(G_3) = \mu(G_4) = \mu(G_5) = 0$.

A.1.5 Proof of Lemma 4: Perfect Bayesian equilibrium with Yardstick Compe-

---

[53] The final payoffs are respectively, $\delta(2\Delta + \varphi k)$, 2Δ and 2Δ.

tition and one government is good

- Since the bad local government is compared to the good one, the bad local government will be found out by setting public spending above its neighbor. Now, playing G_3 when θ_H or θ_M results to be unseat. So, we have:

$$\mu(G_4) = \mu(G_5) = 0, \tag{40}$$

$$\mu(G_3) = \mu(G_4) = 0 \text{ when } \theta_M, \tag{41}$$

$$\mu(G_2) = \mu(G_3) = 0 \text{ when } \theta_H. \tag{42}$$

- Playing G_3 when θ_L or G_2 when θ_M induces to be reappointed under the same condition as previously since the good government always plays, by assumption, $G(\theta_L; g) = G_3$ and $G(\theta_M; g) = G_2$.

$$P\left[g \,|G_3\right] = \frac{\gamma^2 q_L}{\gamma^2 q_L + (1-\gamma)^2} \text{ when } \theta_M,$$

and

$$P\left[g \,|G_2\right] = \frac{\gamma^2 q_H}{\gamma^2 q_H + (1-\gamma)^2 q_H} \text{ when } \theta_L.$$

So, under the same conditions as previously (if $\gamma > 0.7$), theses probabilities are higher than γ and the bad officials will reduce his rent and acts as a good government:

$$G(\theta_H; b) = G_1, \tag{43}$$

$$G(\theta_M; b) = G_2, \tag{44}$$

$$G(\theta_L; b) = G_3. \tag{45}$$

Full characterization of the equilibrium   We have to consider two other cases: $0.6 <$

$\gamma < 0.7$ and $\gamma \leqslant 0.6$.

- So, we keep:

$$\mu(G_4) = \mu(G_5) = 0, \tag{46}$$

$$\mu(G_3) = \mu(G_4) = 0 \text{ when } \theta_M, \tag{47}$$

$$\mu(G_2) = \mu(G_3) = 0 \text{ when } \theta_H. \tag{48}$$

- Playing G_3 when θ_L or G_2 when θ_M induces to be reappointed under the same condition as previously so that if $0.6 < \gamma < 0.7$, a local government who plays G_3 when θ_L will not be reappointed and a local government who plays G_2 when θ_M will be reappointed. So the bad local government chooses:

$$G(\theta_H; b) = G_1, \tag{49}$$

$$G(\theta_M; b) = G_2, \tag{50}$$

$$G(\theta_L; b) = G_5. \tag{51}$$

If $\gamma \leqslant 0.6$, a local government who plays G_3 when θ_L or G_2 when θ_M will not be reappointed so that he chooses:

$$G(\theta_H; b) = G_1, \tag{52}$$

$$G(\theta_M; b) = G_4, \tag{53}$$

$$G(\theta_L; b) = G_5. \tag{54}$$

A.1.6 Comparison on the equilibrium public spending

Without yardstick competition

	good	bad
θ_H	$G_1; G_1$	$G_1; G_1$
θ_M	$G_2; \gamma G_2 + (1-\gamma)G_4$	$G_2; \gamma G_2 + (1-\gamma)G_4$
θ_L	$G_3; \gamma G_3 + (1-\gamma)G_5$	$G_3; \gamma G_3 + (1-\gamma)G_5$

	good	bad
θ_H	$G_1; G_1$	$G_1; G_3$
θ_M	$G_2; \gamma G_2 + (1-\gamma)G_4$	$G_4; \gamma G_2 + (1-\gamma)G_4$
θ_L	$G_3; \gamma G_3 + (1-\gamma)G_5$	$G_5; \gamma G_3 + (1-\gamma)G_5$

	bad	bad
θ_H	$G_1; G_3$	$G_1; G_3$
θ_M	$G_4; \gamma G_2 + (1-\gamma)G_4$	$G_4; \gamma G_2 + (1-\gamma)G_4$
θ_L	$G_5; \gamma G_3 + (1-\gamma)G_5$	$G_5; \gamma G_3 + (1-\gamma)G_5$

With yardstick competition[54]

	good	good	good	bad	bad	bad
θ_H	$G_1; G_1$	$G_1; G_1$	$G_1; G_1$	$G_1; G_3$	$G_3; G_3$	$G_3; G_3$
θ_M	$G_2; G_2$	$G_2; G_2$	$G_2; G_2$	$G_2; G_4$	$G_3; G_4$	$G_3; G_4$
θ_L	$G_3; G_3$	$G_3; G_3$	$G_3; G_3$	$G_3; G_5$	$G_3; G_5$	$G_3; G_5$

[54] If $\varphi p > (2 - 2\delta)/\delta * \Delta$ and $\gamma > 0.7$.

A.2 Empirical analysis

A.2.1 Figures

Figure 1: China provinces
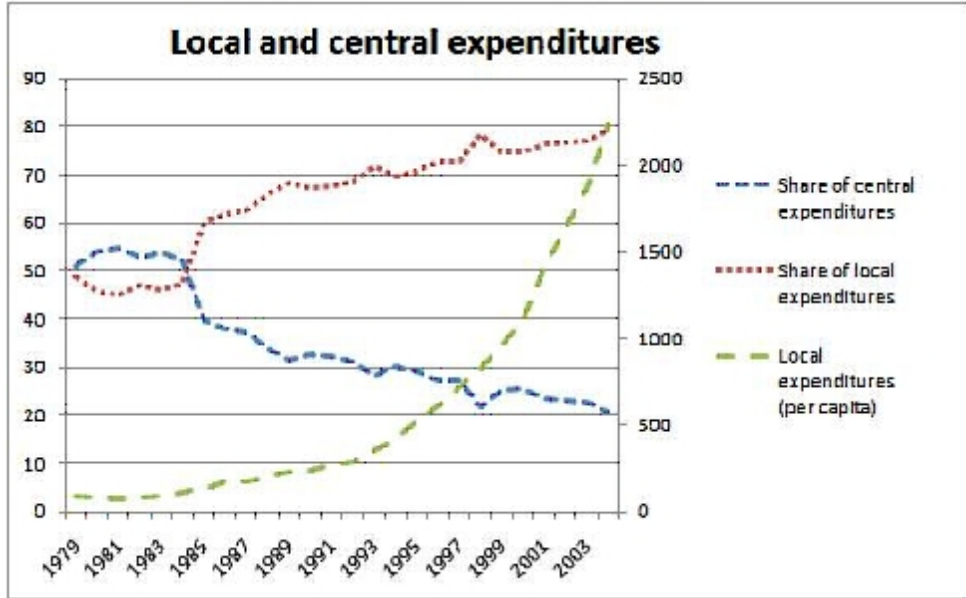
Figure 2: Local and central expenditures
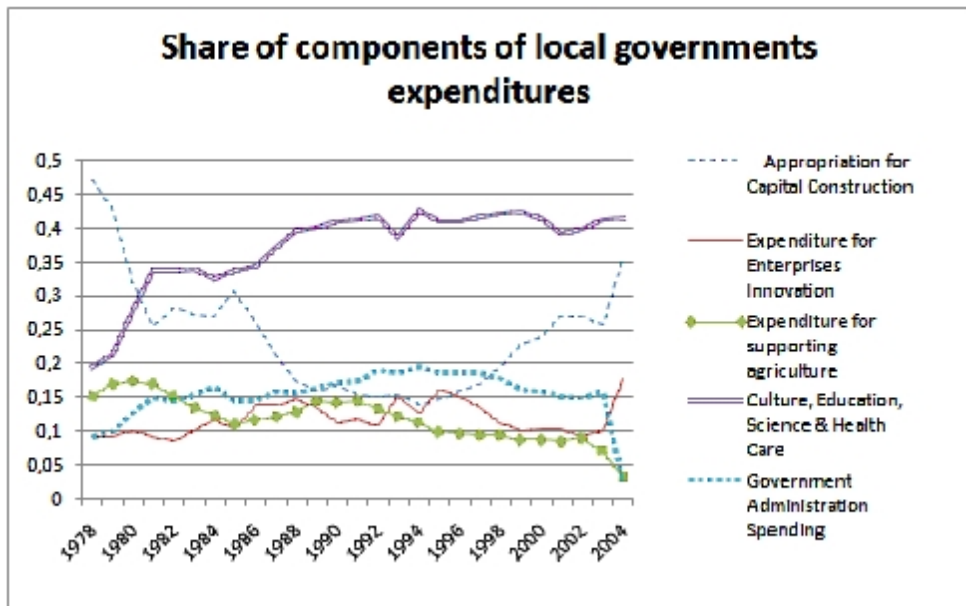
Figure 3: Share of components of local governments expenditures

51
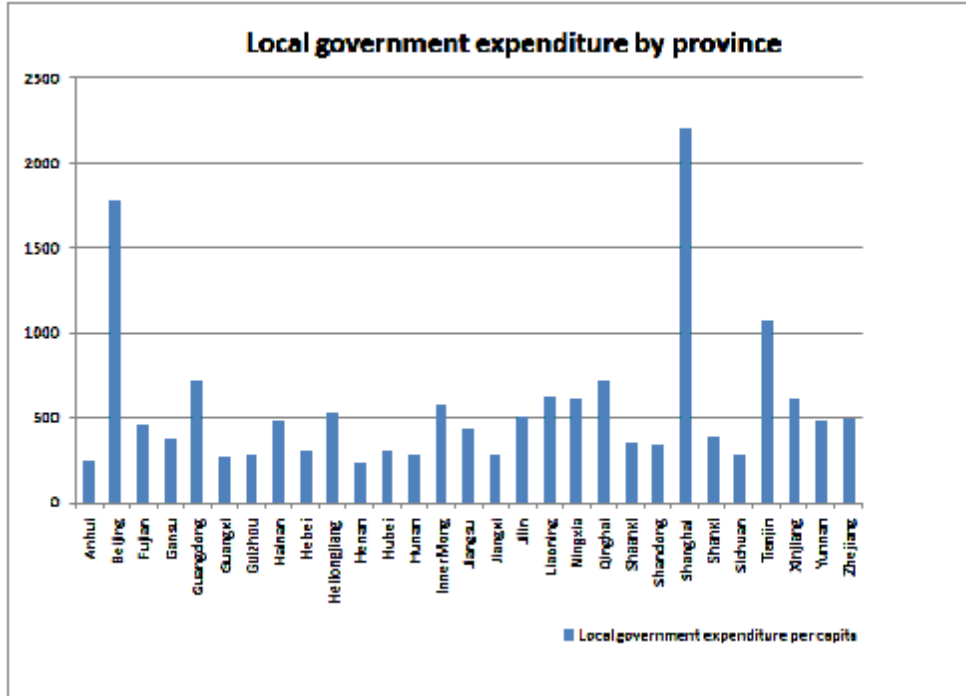
Figure 4: Local government expenditure by province

A.2.2 Descriptive statistics

Table 1:	Local Gov. exp. (per capita)	Capital constr. (%)	Enterprises innovation (%)	Agriculture support (%)	Social expenditures (%)	Gov. administration (%)
Beijing	1780	24.8%	29.1%	5.1%	28.2%	12.7%
Tianjin	1071	30%	9.9%	6.2%	37.1%	8.5%
Hebei	305	17.8%	9.2%	8.1%	46.1%	18.6%
Shanxi	381	20.4%	5.4%	12.8%	41.2%	20.1%
InnerMong	573	19.6%	8.5%	19.6%	34.4%	17.7%
Liaoning	618	21.6%	12.4%	12.8%	38.6%	14.4%
Jilin	510	-	-	-	-	-
Heilongjiang	519	17.9%	11.7%	11.7%	40.1%	18.3%
Jiangsu	2201	33.3%	21%	5.5%	34%	6%
Shanghai	430	16.6%	7.5%	14.7%	44.1%	16.9%
Zhejiang	490	15.7%	11.6%	9.3%	45.7%	17.5%
Anhui	246	14.3%	7.7%	13.8%	44.8%	19.2%
Fujian	454	20.6%	6.4%	13.5%	40.9%	18.4%
Jiangxi	283	19.2%	8.7%	8%	45.6%	18.3%
Shandong	332	13%	6.6%	11.2%	49.7%	19.2%
Henan	232	13.6%	9.1%	13.9%	42.5%	20.7%
Hubei	305	18.3%	2%	12%	46.5%	20.9%
Hunan	277	17.3%	7.2%	15.1%	42.6%	17.5%
Guangdong	718	-	-	-	-	-
Guangxi	267	17.9%	6.7%	14.8%	49.5%	18.8%
Hainan	484	-	-	-	-	-
Sichuan	272	20.7%	8.5%	9.1%	40.7%	20.7%
Guizhou	277	17.8%	6.9%	15.8%	37.2%	22.1%
Yunnan	483	23.2%	8.5%	18.2%	34.4%	15.4%
Shaanxi	351	16.8%	5.8%	17.2%	39.9%	20%
Gansu	369	18.6%	5.7%	17.4%	38.6%	19.4%
Qinghai	713	2 1.3%	4.8%	18.7%	30%	24.9%
Ningxia	608	25%	7.1%	20.3%	34.5%	12.9%
Xinjiang	606	20.6%	4.5%	16.4%	36.2%	22%

Table 2:	Gross Domestic Product (GDP) (100 million yuan)	GDP per capita (yuan)	Population (10,000 persons)	Urban population (% of population)
Beijing	1186	9908	1083	59%
Tianjin	784	8745	850	56%
Hebei	2349	3254	6040	16%
Shanxi	862	2522	2906	74%
InnerMong	701	2706	2157	31%
Liaoning	2211	5412	3871	42%
Jilin	895	3151	2442	39%
Heilongjiang	1579	4254	3542	41%
Jiangsu	2090	14475	1259	68%
Shanghai	4839	5046	6703	22%
Zhejiang	2830	5625	4225	17%
Anhui	1467	2462	5645	16%
Fujian	1694	5128	2982	18%
Jiangxi	983	2190	3805	19%
Shandong	4012	4073	8290	19%
Henan	2392	2350	8559	14%
Hubei	1941	3083	5406	23%
Hunan	1708	2713	6040	18%
Guangdong	4326	3843	5844	72%
Guangxi	1016	2043	4239	14%
Hainan	249	3184	662	21%
Sichuan	1948	2160	7869	15%
Guizhou	493	1284	3300	13%
Yunnan	924	2090	3761	13%
Shaanxi	821	2108	3287	19%
Gansu	480	1961	2264	17%
Qinghai	133	2689	453	27%
Ningxia	132	2313	472	24%
Xinjiang	630	3246	1559	33%

A.2.3 Estimation results - Strategic interactions and complementarity of public expenditures

Table 3: Estimation results with LM - Specific effects and LM tests

Dependent variable: Local Government expenditures				
Weighting scheme:	w^{dist}		w^{cont}	
Spending in j	0.659***	(0.10)	0.462***	(0.02)
Population density	-0.278	(0.18)	-1.600***	(0.33)
GDP growth rate	0.633***	(0.03)	-0.041	(0.06)
Urbanization rate	1.001***	(0.12)	1.559***	(0.25)
Trade openness	0.067***	(0.01)	0.015*	(0.01)
FDI inflow	0.960***	(0.13)	1.700	(2.60)
Trend	0.025*	(0.01)	-0.120***	(0.03)
Log-Likelihood	-377.17		-381.12	
LMlag (p-value)	12.33	(0.002)	11.32	(0.002)
LMerr (p-value)	1.35	(0.25)	1.25	(0.25)

Robust standard errors are in brackets.***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level.

We use ML-Estimation with specific effects. The robust Anselin tests for spatial lag dependence and for spatial error

dependence are based on the Lagrange Mutiplier principle and require only the OLS residuals from the non-spatial model.

Table 4: Estimation results with GMM-System - Distance matrix

Dependent variable: Local Government expenditures							
Lagged dep.var	0.524***	0.573***	0.526***	0.452***	0.461***	0.490***	0.783***
	(0.07)	(0.08)	(0.08)	(0.08)	(0.13)	(0.12)	(0.08)
Spending in j	0.511***	0.459***	0.479***	0.550***	0.532***	0.596***	0.459**
	(0.07)	(0.07)	(0.07)	(0.07)	(0.12)	(0.15)	(0.20)
Population density	-0.203***	-0.184***	-0.164***	-0.196***	-0.178***	-0.166***	-0.006
	(0.04)	(0.04)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)
GDP growth rate		0.378***	0.283***	0.241*	0.181	0.172	0.144
		(0.11)	(0.10)	(0.12)	(0.12)	(0.12)	(0.15)
Urbanization rate			0.578**	0.431*	0.448*	0.417*	0.086
			(0.25)	(0.21)	(0.25)	(0.23)	(0.07)
Trade openness				2.169***	2.035**	1.844**	1.185
				(0.77)	(0.79)	(0.71)	(0.76)
FDI inflow					0.619*	0.805*	-0.518
					(0.34)	(0.40)	(0.51)
Central transfers							0.022**
							(0.01)
Trend						-0.013	-0.063**
						(0.01)	(0.03)
AR(1) test: p-value	0.001	0.000	0.001	0.001	0.019	0.010	0.017
AR(2) test: p-value	0.114	0.115	0.174	0.205	0.120	0.163	0.366
Hansen: p-value	0.139	0.227	0.220	0.278	0.114	0.142	0.169
Nb of instruments	23	26	27	28	26	27	27
Nb of units	29	29	29	29	29	29	29
Observations	745	741	705	689	574	574	191

Robust standard errors are in brackets.***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level. We use one-step robust GMM-Estimation. We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of population density, trend and urbanization rate. The weighted average vector of per capita public spending in other provinces is also instrumented by the weighted average of neighbors' control variables. We collapse instruments and limit its number.

Table 5: Estimation results with GMM-System - Contiguity and Placebo matrix

Weighting scheme:	w^{cont}						w^{plac}	
Dependent variable:	Local Government expenditures							
Lagged dep.var	0.642***	0.763***	0.685***	0.768***	0.760***	0.768***	0.893***	0.894***
	(0.09)	(0.09)	(0.10)	(0.09)	(0.08)	(0.10)	(0.09)	(0.07)
Spending in j	0.395***	0.270***	0.335***	0.257***	0.240***	0.286***	0.258**	0.013
	(0.09)	(0.08)	(0.10)	(0.09)	(0.07)	(0.09)	(0.11)	(0.01)
Population density	-0.103***	-0.069*	-0.069*	-0.047*	-0.045*	-0.036	-0.047	-0.023
	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)
GDP growth rate	0.523***	0.491***	0.491***	0.521***	0.434***	0.420***	0.085	0.389***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.10)	(0.11)	(0.18)	(0.09)
Urbanization rate			0.361*	0.204*	0.242*	0.216*	0.083	0.104
			(0.16)	(0.11)	(0.12)	(0.12)	(0.09)	(0.08)
Trade openness				0.646	0.765**	0.668*	0.695	0.735**
				(0.44)	(0.35)	(0.38)	(0.71)	(0.34)
FDI inflow					-0.168	0.071	-1.66**	-0.009
					(0.27)	(0.36)	(0.72)	(0.37)
Central transfers							0.020**	
							(0.08)	
Trend						-0.005	-0.047*	0.016
						(0.01)	(0.02)	(0.01)
AR(1) test: p-value	0.001	0.000	0.001	0.000	0.000	0.000	0.015	0.000
AR(2) test: p-value	0.271	0.195	0.196	0.259	0.133	0.172	0.305	0.144
Hansen: p-value	0.170	0.165	0.208	0.155	0.283	0.213	0.225	0.070
Nb of instruments	23	26	27	28	26	27	27	27
Nb of units	29	29	29	29	29	29	29	29
Observations	721	717	685	675	572	572	191	574

Robust standard errors are in brackets. ***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level. We use one-step robust GMM-Estimation. We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of population density, trend and urbanization rate. The weighted average vector of per capita public spending in other provinces is also instrumented by the weighted average of neighbors' control variables. We collapse instruments and limit its number.

Table 6: Estimation results with GMM-System - Regional matrix

	Weighting scheme: w^{reg}					
Dependent variable:	Local Government expenditures					
Lagged dep.var	0.835***	0.722***	0.710***	0.787***	0.723***	0.797***
	(0.04)	(0.04)	(0.06)	(0.09)	(0.11)	(0.06)
Spending in j	0.203***	0.302***	0.314***	0.211**	0.251**	0.103*
	(0.04)	(0.03)	(0.05)	(0.09)	(0.10)	(0.05)
Population density	-0.059**	-0.084***	-0.081***	-0.058**	-0.078**	-0.008
	(0.02)	(0.01)	(0.01)	(0.02)	(0.03)	(0.11)
GDP growth rate	0.449***	0.413***	0.373***	0.375***	0.318***	-0.091
	(0.08)	(0.09)	(0.11)	(0.11)	(0.11)	(0.08)
Urbanization rate		0.264	0.074	0.115	0.134	0.077
		(0.19)	(0.48)	(0.14)	(0.17)	(0.08)
Trade openness			2.08***	1.389**	1.690**	1.408*
			(0.75)	(0.63)	(0.64)	(0.72)
FDI inflow				0.226	0.569	-0.420
				(0.26)	(0.39)	(0.40)
Central transfers						0.019**
						(0.008)
Trend					0.005	-0.005
					(0.01)	(0.01)
AR(1) test: p-value	0.000	0.000	0.001	0.001	0.001	0.024
AR(2) test: p-value	0.036	0.053	0.087	0.191	0.240	0.230
Hansen: p-value	0.143	0.167	0.138	0.119	0.106	0.280
Nb of instruments	26	27	28	26	27	27
Nb of units	29	29	29	29	29	29
Observations	741	705	689	574	574	191

Robust standard errors are in brackets. ***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level. We use one-step robust GMM-Estimation. We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of population density, trend and urbanization rate. The weighted average vector of per capita public spending in other provinces is also instrumented by the weighted average of neighbors' control variables. We collapse instruments and limit its number.

A.2.4   Estimation results - Extension

Table 7: Estimation results with GMM-System for each category - Distance matrix

Weighting scheme: w^{dist}

Dependent variable:	Appropriation for capital construction	Enterprises innovation	Agriculture support	Social expenditures	Government administration
Lagged dep.var	0.665***	0.822***	0.763***	0.800***	0.812***
	(0.05)	(0.07)	(0.13)	(0.06)	(0.04)
Spending in j	0.353***	0.240***	0.169	0.160***	0.020
	(0.09)	(0.11)	(0.12)	(0.05)	(0.07)
Population density	-0.159***	-0.053	-0.122*	-0.044**	-0.057**
	(0.03)	(0.03)	(0.06)	(0.01)	(0.02)
GDP growth rate	0.338	0.547	0.483***	0.463***	0.537***
	(0.28)	(0.43)	(0.15)	(0.05)	(0.09)
Urbanization rate	0.245	0.201	-0.049	0.171*	0.097
	(0.23)	(0.31)	(0.08)	(0.08)	(0.06)
Trade openness	1.178	1.333	1.415**	1.08**	0.060
	(0.99)	(1.41)	(0.58)	(0.42)	(0.42)
FDI inflow	4.173***	1.414***	-1.513**	0.128	0.251
	(1.34)	(1.73)	(0.66)	(0.26)	(0.46)
Trend	-0.003	-0.004	0.018	0.007	0.025***
	(0.009)	(0.01)	(0.02)	(0.06)	(0.007)
AR(1) test: p-value	0.000	0.000	0.002	0.013	0.000
AR(2) test: p-value	0.359	0.127	0.563	0.158	0.293
Hansen test: p-value	0.122	0.402	0.201	0.172	0.097
Nb of instruments	27	27	27	27	27
Nb of units	28	28	28	28	28
Observations	550	502	546	550	555

Robust standard errors are in brackets.***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level. We use one-step robust GMM-Estimation.We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of population density, trend and urbanization rate. The weighted average vector of per capita public spending in other provinces is also instrumented by the weighted average of neighbors' control variables. We collapse instruments and limit its number.

Table 8: Estimation results with GMM-System for each category - Contiguity matrix

Weighting scheme: w^{cont}

Dependent variable:	Appropriation for capital construction	Enterprises innovation	Agriculture support	Social expenditures	Government administration
Lagged dep.var	0.710***	0.740***	0.742***	0.822***	0.738***
	(0.09)	(0.13)	(0.14)	(0.06)	(0.09)
Spending in j	0.251*	0.358*	0.123	0.055*	0.172
	(0.12)	(0.20)	(0.09)	(0.03)	(0.15)
Population density	-0.122***	-0.022	-0.120*	-0.038*	-0.068*
	(0.04)	(0.07)	(0.07)	(0.02)	(0.04)
GDP growth rate	-0.280	0.170	0.303*	0.540***	0.418***
	(0.32)	(0.61)	(0.24)	(0.09)	(0.12)
Urbanization rate	0.177	0.211	0.042	0.138**	0.093
	(0.19)	(0.36)	(0.10)	(0.05)	(0.12)
Trade openness	1.265	1.504	1.079*	1.011**	0.200
	(0.99)	(1.24)	(0.61)	(0.38)	(0.34)
FDI inflow	4.153**	2.536	-0.946	0.605	0.456
	(1.79)	(1.86)	(0.65)	(0.53)	(0.71)
Trend	0.007	-0.012	0.023	0.018**	0.014
	(0.01)	(0.014)	(0.01)	(0.008)	(0.01)
AR(1) test: p-value	0.001	0.013	0.008	0.034	0.010
AR(2) test: p-value	0.705	0.555	0.511	0.520	0.407
Hansen test: p-value	0.422	0.932	0.538	0.305	0.248
Nb of instruments	27	27	27	27	27
Nb of units	28	28	28	28	28
Observations	401	286	387	401	446

Robust standard errors are in brackets.***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level. We use one-step robust GMM-Estimation. We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of population density, trend and urbanization rate. The weighted average vector of per capita public spending in other provinces is also instrumented by the weighted average of neighbors' control variables. We collapse instruments and limit its number.

A.2.5 Estimation results - Decentralization and strategic interactions.

Table 9: Estimation results with GMM-System for decentralization degree effect

Dependent variable: Local Government expenditures				
Weighting scheme:	(1) w^{dist}	(2) w^{cont}	(3) w^{dist}	(4) w^{cont}
Lagged dep. var.	0.643***	0.838***	0.690***	0.708***
	(0.07)	(0.05)	(0.07)	(0.10)
A_{jt}	0.619***	0.652**	0.783***	0.244***
	(0.12)	(0.03)	(0.22)	(0.06)
$(A_{jt} * Dec_{it})$	0.288**	0.291**		
	(0.10)	(0.11)		
$(A_{jt} * C_{it})$			-0.031***	-0.011***
			(0.007)	(0.003)
Population density	-0.080**	-0.021	-0.072	0.029
	(0.03)	(0.01)	(0.02)	(0.27)
GDP growth rate	0.124	0.293***	0.169	-0.098
	(0.09)	(0.07)	(0.15)	(0.13)
Urbanization rate	0.146	0.087	0.097	0.129*
	(0.10)	(0.05)	(0.09)	(0.07)
Trade openness	0.731	-0.334	1.535***	1.608*
	(0.49)	(0.44)	(0.64)	(0.79)
FDI inflow	1.782***	0.421	-0.739	-1.012**
	(0.47)	(0.43)	(0.56)	(0.42)
Dec_{it}	-0.530	1.048*		
	(0.53)	(0.55)		
C_{it}			0.229***	0.112***
			(0.04)	(0.03)
Trend	-0.042***	-0.013*	-0.066**	-0.019
	(0.01)	(0.007)	(0.03)	(0.02)
AR(1) test: p-value	0.006	0.000	0.003	0.030
AR(2) test: p-value	0.521	0.608	0.262	0.405
Hansen test: p-value	0.522	0.243	0.752	0.875
F-test: p-value	0.019	0.0001	0.0006	0.0004
Observations	454	454	191	191

Robust standard errors are in brackets.***: coefficient significant at 1 % level, **: at 5 % level, *: at 10 % level. We use one-step robust GMM-Estimation. We adopt the assumption of weak exogeneity of GDP growth rate, trade openness, foreign direct investment inflow and central government transfers and the assumption of strict exogeneity of population density, trend and urbanization rate. The weighted average vector of per capita public spending in other provinces is also