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Race to the Top and Race to the Bottom

Tax Competition in Rural China

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Contents

List of Tables

List of Figures

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ABSTRACT

Fiscal federalism has been argued to intensify regional competition and promote economic growth. This paper is the first, to our knowledge, to empirically assess the patterns and extent of strategic tax competition between geographically neighboring governments in China. Using a panel data set containing data at the county level, we apply Anselin's (1995) local indicator of spatial association (LISA) approach to statistically test the existence of local capital tax competition and examine its determining factors. We find heterogeneous tax competition behaviors across regions. Under decentralized fiscal structure and centralized merit-based governance structure, local governments have strong incentives to compete with each other to attract mobile capital. Counties in the coastal areas with favorable initial conditions of larger tax base tend to "race to the bottom" by lowering tax rates so as to create a pro-business environment. In contrast, the local governments in poor regions have difficulty in competing with the governments on the coast to attract investment and develop the local nonfarm economy. Their local revenues are sometimes barely sufficient to cover the salaries of civil servants on the public payroll. Consequently, they are more likely to levy heavy taxes on existing enterprises, worsening the business investment environment. This leads to a "race to the top" in raising effective tax rate in lagging regions.

Keywords: fiscal decentralization, regional inequality, tax competition, China, economic growth.

1. INTRODUCTION

Fiscal federalism or fiscal decentralization has been widely called for to promote economic growth in both developed and developing countries. One key view holds that fiscal competition creates disciplinary pressures to preserve market incentives (Qian and Roland, 1998). A crucial assumption in the model developed by Qian and Roland (1998) is that all the regions are identical. In the "real world," in particular in spatially large countries such as China, resource endowment differs across regions.

One key feature of fiscal federalism is tax competition. A few theoretical studies on tax competition have taken this heterogeneity into account. As shown by Kanbur and Keen (1993), and Wilson (1991), most two-agent competition models suggest an inverse relationship between jurisdictions' incentives for tax rate reduction and their tax base sizes. That is, when tax competitors differ in size, the one with a larger tax base is less willing to participate in tax competition, hence resulting in a higher tax rate. Recently, Cai and Treisman (2005) proposed an alternative model that provides opposite predictions. They assume that multiple regions with different sizes of endowments compete to attract mobile capital. Their model argues that when the differences in endowment, such as taxes bases and infrastructure, are large, poorly endowed regions tend to invest less in infrastructure and take part less actively in capital competition, as they see little hope of winning the capital competition. Both of the above two theoretical models suggest that under inter-juridical fiscal competition, different regions may choose different strategies according to their size of endowments.

While the literature has rich evidence for the presence of tax competition among states or counties in the United States, and for local units in other industrialized countries (Bartik 1991, Case et al. 1993, Brett and Pinkse 2000, Buettner 2001, Oates 2002, Hendrick et al. 2005), the empirical studies in developing or transition countries have been more scant, largely due to lack of data (Bardhan 2002). In particular, there are few studies examining whether the tax competition behavior is homogenous or not in developing countries that have large regional differences in resource endowment.

China provides a good environment for empirically testing this research question. Since the 1980s China has adopted a series of fiscal reforms aimed at improving the fiscal contract arrangements between different levels of governments. After fiscal reforms, local and upper level governments shared fiscal revenues according to a predetermined formula (Jin et al., 2005). Fiscal decentralization created a strong inter-juridical competition, forcing local governments to compete with each other to protect the local tax revenue base and attract business investment so as to prompt economic development. Jin et al. (2005) empirically show that fiscal decentralization contributed to China's rapid growth in the 1990s. In this analysis, they assume the effect of fiscal decentralization is the same for all the provinces in their analysis. Considering China's sheer size and large regional variation, it is highly likely that the regional fiscal competition behavior and related consequences will vary, as suggested by the rising regional inequality of the past two decades.

In China, studies on local tax competition behaviors are rare not only because local governments used to lack authority over local fiscal administration, but also because the official *de jure* tax rate is identical across jurisdictions; the setting of tax tables, too—whether for locally or centrally sourced tax revenues—has been solely controlled by the central government. In such a unified tax system, the effective tax rates may nonetheless vary because of difference in local discretional efforts in collecting taxes. Although such discretional activities have been widely observed in China by many case studies (see, for example, Bahl 1999), very few studies have quantitatively looked at the spatial patterns of effective tax rate.

The tax competition behavior is largely related to the evaluation system of officials. In China, the promotion of cadres is now largely based on yardstick competition in several key economic indicators, including attracted foreign direct investment, economic and fiscal revenue growth rates (Li and Zhou, 2005). Compared to labor, capital is relatively scarce in most parts of rural China. Therefore, local officials have strong incentives to attract the more scarce capital so as to promote local economic development. Providing investors with tax incentives is one of the most widely used measures by local government to achieve the above goal (Wei et al. 2001, Li and Lu 2004).

By making use of a panel data set at the county level which covers a longer and more recent period, we attempt to empirically test whether tax competition exists or not, and if yes, whether competition behavior is subject to the regions' underlying endowment. We have developed an empirical framework that is not only able to test the presence of intergovernmental tax competition within a country, but also flexible enough to reflect the variation in the degree of tax competition within different regions. In addition to presenting the patterns related thereto, this study empirically relates the endowment heterogeneity to various degrees of tax competition incentives.

Specifically, we examine whether poorly endowed regions[1] have been disciplined by capital competition in the same way as richly endowed regions. For this purpose, we compare the counties in two distinct clusters: Each is essentially a spatial cluster of similarly endowed counties, although the sizes of endowments are remarkably different between clusters. It is noted that within the cluster, counties are homogeneous in both the endowment and the geographic location dimension, which should ensure perfect competition equilibrium. Our findings verify the existence of tax competition among neighboring counties. Furthermore, we find a difference between these two types of clusters: In the cluster with large endowments, competition is in a "race to the bottom," while in the cluster with small endowments, it is in a "race to the top." Many previous studies use the terms "race to the bottom" and "race to the top" to address the welfare concerns of intergovernmental competition. In this paper, we borrow the terms to simply refer to the action of reducing tax rates or raising tax rates in the process of neighborhood competition.

The negative relationship between the tax rate and the cluster-specific endowment size implies richly endowed clusters are more motivated to compete for capital than poorly endowed ones. Initial endowment determines whether spatially clustered counties will run a "race to the bottom" or a "race to the top" in tax rate settings. In particular, the counties with poor initial endowments are less disciplined by capital competition. This lends support to the hypothesis of Cai and Treisman, as described earlier.

This paper is organized as follows. In Section 2, theoretical background for tax competition behaviors is described, and a new measure to detect tax competition at a local level is proposed. Section 3 presents the data and the spatial and temporal patterns of local tax competition behaviors in China. Next, we quantitatively examine how endowment and other factors affect tax competition choices. Finally, implications of our empirical results are assessed, followed by a conclusion.

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1 In this paper, both poor and poorly endowed regions refer to the units whose size of endowment is less than the national average. To be more specific, they are the units with GDP per capita lower than the national average.

2. RETHINKING TAX COMPETITION

A Simple Capital Flow Model for Tax Competition

We begin by presenting a simple model of county government behaviors, with the focus on a specific type of intergovernmental competition—capital tax competition. This type of interaction has been modeled as a "strategic choice" in analysis by Zodrow and Mieszkowski (1986), Wilson (1986), Wildasin (1989) and others and has also been highlight in the literature of government behaviors as indicated by Wilson (1999) and Brueckner (2003). In the simplest framework for capital tax competition, a county chooses the tax rate to maximize its objective function (*Vi*), which also depends on the amount of capital that resides within its borders (K_i). The distribution of capital among competing counties is affected by the tax rate that it chooses (t_i) and that its competitor chooses (t_{-i}). Thus, the county's tax rate, t_i, is partially determined by t_{-i}.

Consider a county that has only one revenue source from capital taxes. We assume that it maximizes a combined utility deriving from both the tax revenue and a representative citizen's welfare. Its objective function can be written as:

$$V(t_i, K_i) = U[c_i(K_i), G(t_i, K_i)] + t_i K_i, \tag{1}$$

where c_i denotes the representative citizen's private consumption in county *i* and *G* the consumption of public good or services. Throughout this paper, equations referenced are numbered to the right of the equation and in parentheses as in this example: (1). In equation (1), the private consumption is affected by K_i through the income effect, in which more capital raises the marginal productivity of workers and thus the wage rate for each worker. Meanwhile, the public good provision is assumed to be fully financed by tax revenues (that is: having no government debts), thus G_i is a function of both t_i and K_i.

The final distribution of capital across counties has to satisfy the no-arbitrage condition. That is, the after-tax return to capital should be equalized in every county. Suppose k_i represents capital per worker in county *i*, and $f(k_i)$ is the production function. This condition can be given by:

$$r = f'(k_i) - t_i = f'(k_{-i}) - t_{-i} \tag{2}$$

where $f'(k_i)$ is the marginal product of capital, or pre-tax return, in county *i*, and *r* is the equalized after-tax return. When competing units are sufficiently small, they are all price takers who regard the after-tax return as given. Equation (2) depicts the relationship between k_i and t_i—the rise in t_i causes a decrease in capital so that the marginal product of the capital stock can rise to the point where the after-tax return equals *r*.[2] Similarly, an increase in t_{-i} decreases the level of k_{-i}, thus causing k_i to increase.

The tax-induced capital flow depends on how the marginal product of capital changes in response to the change in capital stock, which can be denoted by this equation:

$$\frac{\partial k_i}{\partial t_i} = \frac{1}{f_{kk}^i} \tag{3}$$

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2 A formal proof for the statement that ki and ti are negatively correlated, assuming other things being equal, is given in the following equation. Taking derivatives with respect to ti on the first two items in (2) gives $\frac{\partial r}{\partial t_i} = f_{kk}^i \cdot \frac{\partial k_i}{\partial t_i} - 1$, where f_{kk}^i denotes the second derivative of production function f(ki) with respect to ki. It is noted that $\frac{\partial r}{\partial t_i} = 0$, because r is assumed as a constant when the number of competitors is large. Thus, $\frac{\partial k_i}{\partial t_i} = \frac{1}{f_{kk}^i} < 0$.

It is worth noting that f_{kk}^{i} is affected by the size of capital stock and other exogenous characteristics of county *i*. Therefore, the capital mobility implies that the capital stock in a particular county, K_i (note that $K_i = n_i \cdot k_i$), depends on the tax rates in all the competing counties, exogenous characteristics of *i* (X_i), as well as exogenous characteristics of all other competitors (X_{-i}). Then K_i is given by

$$K_i = K(t_i, t_{-i}, X_i, X_{-i}) \tag{4}$$

Substituting equation (4) into (1) yields as follows:

$$V(t_i, t_{-i}, X_i, X_{-i}) = U[c_i(K(t_i, t_{-i}, X_i, X_{-i})), G(t_i, K(t_i, t_{-i}, X_i, X_{-i}))] + t_i K(t_i, t_{-i}, X_i, X_{-i}) \tag{5}$$

which indicates that the optimal tax rate, t_i, is an implicit function of t_{-i} The solution to (5) reflects a Nash equilibrium in which county *i* chooses the tax rate that maximizes its utility function given a tax rate t_{-i}, which at the same time is the best choice for its competing county given t_i. Such a solution can be described by a tax reaction function as follows:

$$t_i = h(t_{-i}, X_i, X_{-i}) \tag{6}$$

This tax reaction function does not explicitly reveal whether or not t_i is positively related to t_{-i}. Brueckner and Saavedra (2001) show that the slope of this function can be positive or negative, depending on which specific functional form is used. They attribute tax rate variation to the differences in production technology or consumer preferences. On the other hand, even though the function forms are identical, the level of X_i and X_{-i} may affect the pre-tax returns $f'(k_i)$ and $f'(k_{-i})$, which in turn affects how t_i reacts to the change of t_{-i}. Therefore, without restrictive assumptions that reduce the complexity in the setting of this type of model, any attempt to obtain a unique relationship between t_i and t_{-i} will fail even under idealistic conditions of perfect capital mobility.

Most theoretical literature is based on one key assumption—that all the counties are identical and choose the same optimal tax rates (Wilson 1999). Under this assumption, the theoretical models suggest that a positive correlation of tax rates should occur for counties with similar endowments. Another prominent feature of this assumption is that capital mobility imposes a potential revenue penalty on any single county that attempts to raise the tax rate alone. Therefore, the equilibrium tax rate is lower than it would be without capital competition. Simply put, tax competition would yield the clustering of low tax rates among counties that are rather alike. This prediction has spurred a wave of new empirical studies in testing the presence of tax competition or interactions in tax rate settings. As indicated before, empirical studies testing heterogeneous tax competition behavior are rare.

Empirical Tests for Tax Competition

The method that many empirical studies have applied to test the hypothesis of tax competition relies on a key parameter which describes how a government unit's tax rate changes in response to a change in its competitors' tax rate (Bartik 1991). Most often this parameter has been estimated based on a rather stringent assumption that all the units in the sample share the same responsiveness, and therefore it has failed to reflect the intrinsic heterogeneity of competition incentives. The approach we adopt for avoiding the specification bias is the local indicators of spatial association (LISA), also called the "local Moran's I," which was originally developed by Anselin (1995) and studied by Bao and Henry (1996), among others. In our definition, the localized tax rate correlation coefficient ρ_i is estimated by using an extended version of local Moran's I:

$$\ddot{\rho}_i = \frac{(t_{1i} - t_1^*) \sum_k w_{ik} (t_{0k} - t_0^*)}{\sum_i (t_{1i} - t_1^*)^2 / n}, \tag{7}$$

where the subscripts 1 and 0 represent the current and last year, respectively; t_i is the observed value of t at location i; t^* is the mean of t; w_{ik} is the spatial weight between i and k; and n is the number of observed units. This localized statistic fits into our research for several reasons. First, it is conveniently computable, even when using a cross-sectional data set. Second, it has direct and rich implications for the spatial distribution of data. A positive value of $\ddot{\rho}_i$ indicates a positive correlation. Given this result, if t_{1i} is also greater than t_1^*, then high values are located near to each other; otherwise, low values are clustered. On the other hand, a negative value of $\ddot{\rho}_i$ indicates a negative spatial autocorrelation. Depending on whether t_{1i} exceeds t_1^*, a pattern of the spatial outlier can be determined as either a high valued unit in contrast to low valued neighbors or the opposite. Third, this statistic reflects the relationship between unit *i*'s tax rate and the lagged tax rates of its neighbors. This is a device that enables us to avoid a serious endogeneity problem caused by the simultaneity of neighboring units' tax rate setting behaviors. We can reasonably assume that the lagged tax rates of neighbors are exogenous to unit *i*'s current tax rate.

It is worth noting that the statistical test for the significance of local Moran's I should be implemented with great caution. As shown by Anselin and many others, when the sample size is relatively small, the asymmetric distribution of I_i deviates away from normal, suggesting that a distribution-based test is largely unreliable. In this paper, we follow the suggestion of Anselin (1995) to take a conditional randomization or permutation approach (as described on page 96 in Anselin 1995) to calculate pseudo- significance levels.

Another important concern for estimating the tax rate correlation is about how to define competitors. In this paper, we consider the geographic proximity as the primary standard in the definition of competitors. The study units of this paper are rural counties in China, which are the smallest administrative unit to have local autonomy of fiscal policies. Each county's size also makes it vulnerable to the influence of its geographic neighbors (defined, in this case, as nearby areas or regions). In addition, several theoretical arguments explain that geographical proximity matters for capital tax competition. If a business was planning to set up in a certain jurisdiction in order to minimize transportation cost to its consumers, only jurisdictions within a small commuting distance could be viewed as good locations for such a business. Local units, even with the constraint of capital immobility, tend to mimic their neighbors' tax policies, because officials are disciplined by voters who use neighboring units as benchmarks to judge local achievement. This creates the so-called "yardstick competition," as illustrated by Besley and Case (1995).

In the spatial econometrics literature, there is no consensus about how to define geographical neighbors. Several choices have been identified. As reviewed by Brett and Pinkse (2000), they include the following: the common boundary neighbors, great-circle neighbors, and nearest-distance neighbors. Since our results are generally robust in relation to any of these measures, the rest of this paper will focus on the "four-nearest" neighbors concept under which unit *j* is a neighbor of *i* if it is one of the four closest units to *i*. Applying this concept, we can test a spatial tax competition hypothesis that a county unit *i*'s tax rate is positively affected by the tax rate of its geographic neighbors. This conclusion is particularly consistent with the perfect competition model.

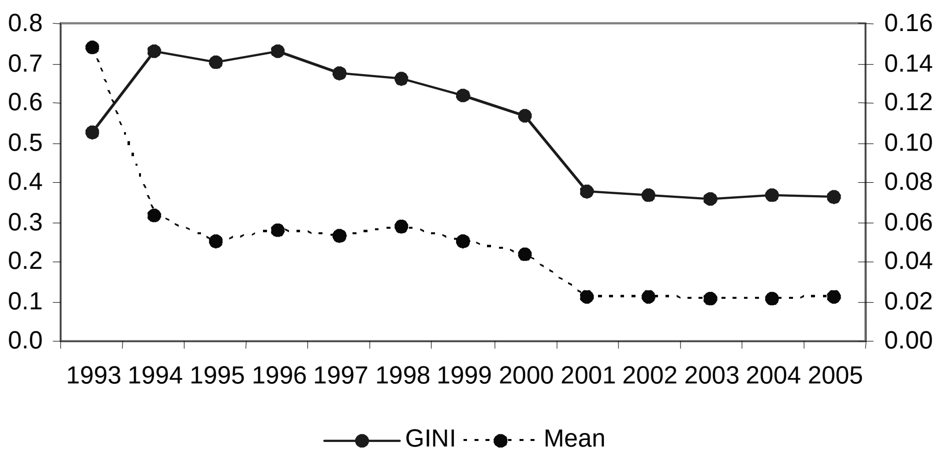
3. THE EXISTENCE AND PATTERN OF TAX COMPETITION BEHAVIORS

Data Description

To provide a broad view of intergovernmental competition behaviors among grassroots administration units, we constructed a panel data set, consisting of 2094 rural counties and county-level municipalities[3] for the period from 1993 to 2005. Our sample covers all the rural counties as of 1993 except a small portion with missing tax or income information. Technically, we have employed two procedures to ensure the temporal and spatial consistency of the data set. First, considering that in almost every year some county units have experienced boundary changes either by merging or splitting, the data after 1993 have been aggregated to match the county definition as of 1993, so that the analytical outcome will be comparable intertemporally. Second, in order to combine the economic and geographical data, we created a geo-coding system which links the records of various years to the county-level base map at the end of 1993, which is derived from a 1990 China county-level administration map (provided by China In Time And Space—CITAS, University of Washington) using publications on administrative coverage changes posted on the website of the Chinese Ministry of Civil Affairs.

As a measure of tax burdens on capital investment, we followed the method used in Knight (2002) to calculate the effective tax rate by first adding up all the taxes imposed on firms or business, and then dividing by the non-agriculture GDP, a proxy for the tax base.[4] The numerator includes two types of locally sourced taxes: the value-added tax (VAT) and business taxes. For these two, tax revenues are shared between the local and the central governments, only the proportion of the actual collection that eventually belongs to local control—usually 25 percent—is included in our calculation. Because in rural areas these taxes are mostly borne by non-agricultural production or services, we partition the GDP between agriculture and non-agriculture in proportion to the magnitudes of the county-specific gross value of industrial output (GVIO) and gross value of agriculture output (GVAO), and use non-agriculture GDP to approximate the tax base of capital stock.

Figure 1. Dynamic patterns of county-level tax rates: GINI and mean in China



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[3] According to China's State Council (1986), a rural county with a total population of more than 500,000 can be approved to upgrade as a county-level municipality only if its annual GDP exceeds 400 million yuan and its non-agricultural population in the town of the county capital exceeds 120,000 people. Pu (2004) points out that the practice of upgrading a rural county to a county-level municipality in the late 1980s and early 1990s did not place much emphasis on the division of urban and rural economies, and unavoidably led to the conceptual confusion between cities and rural counties. In our sample, some rural counties were upgraded to county-level municipalities in the years after 1993. However, in keeping with Pu's arguments, we assume this upgrading process did not affect the characteristics of rural economy.

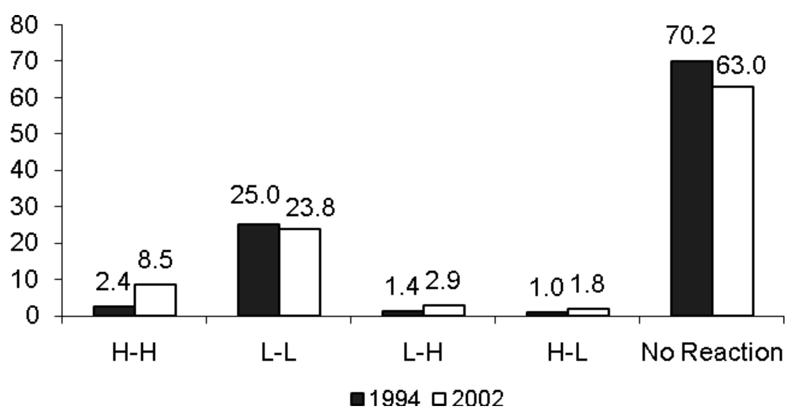
[4] The computation of GDP in the period from 1993 to 1996 is based on a linear approximation method, which is explained in Yao (2006).

As presented inFigure 1, the county-level tax rates for capital vary remarkably across the nation. The Gini coefficient rose to 0.73 in 1994 and slowly decreased to 0.57 from 1996 to 2000. In the period between 2001 and 2005, this coefficient stabilized at an even lower level—at 0.36. In a similar pattern, the nationwide average effective tax rate has continued to decrease at an annual rate of 9.08 percent since 1994. The fact that both the mean and variation of the tax rate for capital decreased in the rural area seems to suggest a converging trend toward the bottom. Even so, the trend at the global level is still likely to differ from some local trends, in light of the sizable variation in county-level tax rates.

Identification of Local Spatial Tax Competition

To lessen the impact of autocorrelation at the temporal dimension, we considered five discontinued years to examine spatial tax competition: 1994, 1996, 1998, 2000 and 2002[5]. Counties are assumed to take into account their neighbors' tax rates in the previous year and neglect the potential impact that their own choices may impose on their neighbors' future choices. Using Geoda, the spatial analysis software developed by Luc Anselin, we calculate local Moran's I, defined by equation (7), and its *p*-value for each county unit year by year. The estimates not only indicate which unit's tax choice is significantly related to its spatial neighbors' tax choices, but also enable us to further classify the units with significant correlated tax choices into four tax strategy groups, as follows[6]: "high-high" (H-H), "low-low" (L-L), "low-high" (L-H), and "high-low" (H-L) tax rate clusters. (Note that the description before the hyphen refers to unit *i*, and the one after the hyphen refers to its neighbors.) Among these groups, the clusters of low tax rates identify the counties in a race to the bottom; the clusters of high tax rates are the counties in a race to the top; and the clusters of dissimilar values are spatial outliers, contradicting the spatial tax competition hypothesis.

Figure 2. Tax strategy distribution among 2094 rural counties in China



Note: 1. Relative frequency is labeled above the bars and expressed in percentages.
2. H-H=high-high; L-L=low-low, L-H=low-high; H-L=high-low

[5] We exclude 2003 and 2004 from the analysis of local spatial tax competition behaviors because the tax rates in 2004 are not comparable to those in 2003 and earlier years. Firstly, the GDP estimation in 2004 was based on the results of the National Economic Census in 2004, while the GDP estimation for the period from 1993 to 2003 was based on the results of the National Economic Census in 1992. Although the State Statistic Bureau adjusted the GDP estimation for 1993 to 2002 using the latest census results, the county-level data after adjustment have not yet been published. Secondly, in 2003, the occurrence of a rapidly spread fatal disease, SARS, produced a huge impact on China's economy. Therefore, the GDP and tax revenues in 2003 cannot be compared to other years. Lastly, several fiscal reforms, such as the export VAT rebate-sharing reform, and the conversion of VAT from a production-based tax to a consumption-based tax, started to take effect in 2004. These reforms can change local VAT revenues in uncertain ways.

[6] The significance level is 5 percent. Our results in subsequent sections are robust to other significance levels, such as 10 percent.

In Figure 2, we compare the national distribution of tax competition strategy choices in 1994 and 2002. In both years, the majority of the sample counties, 70.2 percent and 63.0 percent for 1994 and 2002, respectively, did not yield a significant tax rate correlation, implying that local tax rate decision is not responsive to the decision of spatial neighbors. On the other hand, out of the 1994 sample, 25.0 percent had a significant spatial clustering of low tax rates, 2.4 percent with a significant clustering of high tax rates, and 2.4 percent with a clustering of dissimilar tax rates. Comparison between the two years reveals an interesting trend toward more counties in a "race to the top" and fewer counties in a "race to the bottom," as the percentage of H-H units increased to 8.5 percent, and the percentage of L-L units decreased to 23.8 percent in 2002.

What causes the sharp difference in counties' tax competition behaviors? In this paper, we investigate three factors: regional or provincial location, time, and the relationship between competitors' endowments.

Spatial and Temporal Changes

Table 1 reports how counties with different tax competition strategies were distributed in coastal and inland areas.[7] It is observed, for instance, that in 1994, 301 of 524 clusters of low tax rates were located in the eastern coastal areas and accounted for 46.1 percent of coastal counties, while 49 of 51 clusters of high tax rates were in the western inland areas. Generally speaking, Table 1 suggests that the regional location—regardless of whether the county is located in a certain province or a region—can affect its tax competition strategy. We examine the provincial and regional effect by applying the Chi-square test for a pair of categorical variables, which hypothesizes that one categorical variable, the tax strategy choice, is independent of the other categorical variable, provincial or regional location. The results, as reported in the first two columns of Table 2, suggest that the hypothesis of there being no provincial or regional effect is not significantly supported by our data. This conclusion is robust across various years.

Table 1. Distribution of tax competition strategies by region and endowment clustering group

	Year of observation		**H-H**		**L-L**		**L-H**		**H-L**		**No response**	
	1994	2002	1994	2002	1994	2002	1994	2002	1994	2002	1994	2002
Nation	2094	2094	51	178	524	498	29	61	21	38	1469	1319
Coastal	647	647	2	33	301	202	1	9	10	7	333	396
Inland	1447	1447	49	145	223	296	28	52	11	31	1136	923
E1 (H-H)	175	222	0	16	106	56	0	3	1	0	68	147
E2 (L-L)	484	488	29	75	9	39	7	31	1	8	438	335
E3 (L-H)	33	16	0	1	11	1	0	0	0	0	22	14
E4 (H-L)	10	23	1	2	1	2	0	2	0	0	8	17
E0 (No GDP correlation)	1392	1345	21	84	397	400	22	25	19	30	933	806

Note: Numbers shown indicate frequency.

[7] Following the convention of China's Statistics Bureau, the coastal region includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi and Hainan. The inland region includes the rest of the 19 provinces. As shown in Table 1, our sample includes 647 counties in the coastal region, and 1,447 counties in the inland area.

Table 2. The chi-square test of independence for tax competition choices and spatial location variables

Year	(1) Provinces			(2) Regions			(3) Endowment clusters		
	D.F.	$\chi2$	P value	D.F.	$\chi2$	P value	D.F.	$\chi2$	P value
1994	30	2500	0.000	1	249.8927	0.000	4	292.77	0.000
1996	30	2700	0.000	1	257.4119	0.000	4	382.40	0.000
1998	30	2400	0.000	1	173.1465	0.000	4	539.90	0.000
2000	30	2000	0.000	1	121.6528	0.000	4	332.44	0.000
2002	30	1900	0.000	1	45.2078	0.000	4	154.19	0.000

When it comes to the temporal effect, we conduct a number of pairwise chi-square tests to observe the difference in the distributions of tax competition strategy choices between two different years. The test results all indicate the same significant temporal changes.

Endowments

The concept of endowment is defined here in general terms to reflect a combination of economic development levels, capital stocks, natural resource endowment, and labor skills. Although a further breakdown into different classes of endowments may reveal more interesting and reasonable behaviors, the lack of data at the county level only allows us to use per capita GDP as a proxy for general endowments. It is hypothesized that whether a county unit and its representative competitor have large and closely related GDP, small and closely related GDP, or an extremely different GDP level will affect their choices among the five tax competition strategies.

To explore this, four groups of significant spatial clusters as well as a group of insignificant ones are identified for county-level economic endowments, measured by real per capita GDP. The spatial clusters of economic endowments are examined in a different set of years, including 1993, 1995, 1997, 1999 and 2001, which are one year ahead of those used in the tax competition analysis. It is worth noting that endowments and tax rates are studied in different periods. The purpose of using per capita GDP (as a proxy for endowment) in preceding years is to reduce the causal impact of tax rate on it. For simplicity, endowment clusters will be labeled in accordance with the tax year for the rest of this paper's discussion of them.

Notably, the clusters of high economic achievements mainly showed up in coastal areas, and clusters of low economic achievements were largely concentrated in western and central areas. In 1994, L-L GDP clusters accounted for 23.1 percent of the population, whereas H-H GDP clusters came to only 8.3 percent. Moreover, 87.4 percent of H-H clusters were in the coastal region, while 85.9 percent of the L-L clusters were in the inland area. The percentages did not change much in 2002. However, it is worth noting that the proportion of the population that exhibited a significant and positive spatial correlation in GDP rose continuously in the period under study, increasing from 31.4 percent in 1994 to 33.9 percent by 2002.

The majority, however, do not possess such a strong connection to their neighbors. That is, in 1994 and 2002, respectively, 66.5 and 64.2 percent of the population were not significantly correlated to their neighbors' economic development. By contrast, a small number of these populations was found to exhibit a significant and negative correlation to their spatial neighbors in terms of economic development. Their share of the total population averaged 2.05 percent during this period, falling slightly from 2.1 to 1.9 percent between 1994 and 2002.

To test the null hypothesis in which spatial tax rate competition is free of influence from endowment clusters, we construct frequency tables for each tax year using the endowment cluster type as the row category variable, and the tax rate cluster type as the column category variable. We then apply the chi-square test to see if there is a dependent relationship between the two category variables. The last five rows in Table 1 present the frequency tables in 1994 and 2002, indicating that the tax competition choices are distributed in substantially different patterns among different endowment clusters. The results of chi-square tests, as shown in the third column of Table 2, also suggest that the hypothesis of independence should be rejected, therefore supporting the presence of a statistically significant endowment cluster effect.

4. THE CHOICE MODEL OF TAX COMPETITION STRATEGY

In this section, we adopt a multinomial logistic regression approach to examine the factors that underlie the variation of tax rate competition behaviors. From a game theory perspective, the five types of tax rate clusters that were identified earlier reflect five potential equilibriums as to how the county government chooses the optimal tax rate strategy in response to its spatial neighbors' tax choices. Suppose the five types of equilibriums are exhaustive in the game outcome domain. Let π_{ij} denote the probability for unit i to choose the j^{th} strategy so that $\pi_{i0}+ \pi_{i1} + \pi_{i2} + \pi_{i3} + \pi_{i4} = 1$, where j equals 0, 1, … or 4. The probabilities are estimated by using a logistic density function, which is described as follows:

$$\Pr ob(y_i = j) = \pi_{ij} = \frac{\exp(V_{ij})}{\sum_{j=0}^{4} \exp(V_{ij})}, \tag{8}$$

where y_i is the choice variable for unit i, and V_{ij} is a linear combination of variables that explains choice j.

As for the determinant factors in the choice decisions, this paper has already provided strong evidence for the regional, temporal, and endowment effects. Although they are straightforward, the formulae and tests in the previous section of this paper share a common shortcoming in that they do not allow for more than one explainable variable to be taken into account. The regression approach includes all variables to explain the choices of tax strategies: Given that other factors have been controlled for, it is able to sort out how each factor affects the unit's choice among the five competition behaviors. Therefore, adapting this to our data, we use the following specification:

$$V_{ij} = \sum_{k=1}^{4} \beta_j^k E_i^k + \gamma_j R_i + \delta_j T + \varphi_j X_i + \varepsilon_{ij} \tag{9}$$

where subscripts i and j denote observation and choice category respectively; k denotes the endowment category; β_j, γ_j, δ_j and φ_j represent choice-specific coefficients, and ε_{ij} represents the disturbance term associated with choice j. The explanatory variables include dummy variables for the endowment cluster types, denoted by E^k; a dummy variable for the coastal region, denoted by R; and a vector of dummy variables for various years, T.

In addition, also included in equation (9) is a vector of other economic variables, X, which comprises the agriculture share in GDP (*AGSH*) and the government employee (people employed or financially supported by local governments) share in population (*GESH*). *GESH* measures government fiscal burden. China's government spending structure has been decentralized in the last decade. Many studies, including that by Zhang (2006), find that the need to finance local government's administration costs—especially the salary and social welfare costs associated with government employees—can drive local officials into revenue-seeking behaviors. Since these financial needs are usually rigid, local governments are induced to value immediate revenue-raising methods such as predation in tax collection. *GESH* is therefore hypothesized as a factor to support the H-H tax rate competition.

AGSH is a proxy for industrial structure. The impact of *AGSH* on the local tax rate setting can, however, be twofold. One technical concern is that the average tax rate will be affected by industrial structure when the tax table sets different rates for different economic sectors. In China's VAT system, the tax rate for most manufactured products is 17 percent, and that for agricultural products is 13 percent, suggestive of a tax table effect that predicts lower tax rates in regions with larger agricultural share in GDP. On the other hand, the degree of industrialization reflects the relative importance of the manufacturing and agricultural sector in raising local revenue capacity and promoting GDP growth. It can be assumed that governments in the more industrialized regions place emphasis more on the development of the non-agricultural industry than on that of the agricultural sector. In China, most investment in agriculture comes from government sources, while capital investment in the non-agricultural sector relies more on the private market[8], which tends to very competitive. Under market pressure, governments in regions with a higher degree of industrialization may be more willing to take part in tax competition as a way to support local industrial development. This preferred industry effect thus predicts higher tax rates in regions with a larger agricultural share in GDP. This contradicts the tax table effect, leaving our empirical tests to prove which one has a stronger impact in rural China.

Table 3. Summaries of tax strategy choices and explanatory variables

	Description	Mean	Std. dev.
Dependent variables			
Y=H-H	Dummy for the H-H tax cluster	0.043	0.203
Y=L-L	Dummy for the L-L tax cluster	0.247	0.432
Y=L-H	Dummy for the L-H tax cluster	0.014	0.117
Y=H-L	Dummy for the H-L tax cluster	0.009	0.092
Y=insignificant correlation	No tax rate correlation	0.687	0.464
Explanatory variables			
E1 (H-H)	Dummy for the H-H endowment cluster*	0.107	0.309
E2 (L-L)	Dummy for the L-L endowment cluster*	0.235	0.424
E3 (L-H)	Dummy for the H-L endowment cluster*	0.010	0.100
E4 (H-L)	Dummy for the L-H endowment cluster*	0.008	0.091
E0 (insignificant correlation)	Dummy for no endowment clustering*	0.639	0.480
Coastal	Dummy for the coastal region	0.309	0.462
Year=1994 (or any other)	Dummy for a specific tax year	0.200	0.400
AGSH	Agricultural GDP in every 100 yuan of total GDP*	43.043	22.867
GESH	People employed or financially supported by local governments in every 100 local residents*	3.213	2.222

Note: * An asterisk indicates variables lagged by one year. "Std. dev." stands for "standard deviation."

To avoid potential endogeneity problems, *AGSH* and *GESH* are lagged by one year, as are the endowment cluster indicators. Table 3 summarizes the means and standard deviations for all the variables to be used in the estimation. With regard to the two new variables, it shows that as an average of the five years studied, the agricultural sector accounted for 43.0 percent of the total GDP in rural counties, and out of every 100 residents, about three worked for the governments or depended on local fiscal funding.

We adopt a "maximum likelihood method" to estimate the tax strategy choice equations and report the results in Table 4. In each determination equation, we report the exponentiated coefficients, which have an informative interpretation of relative risk ratios (RRR)[9]—the ratio of the relative risk for a one-unit increase in the explanatory variable *x* to the relative risk when *x* is unchanged. The RRRs are relative to the base category, here corresponding to the no-response-to-neighbors strategy, which is indicated by insignificant tax rate correlations. In such a setting, we focus on how the unit-specific factors affect their preference for an active tax rate reaction strategy in comparison with the passive no-response strategy. It can be captured with precision by RRR. For instance, if an explanatory variable came with a

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[8] According to our calculations, using the *China Statistical Yearbook for Fixed Assets Investment* (2003), government-sourced funds accounted for 67.8 percent of fixed assets investment in the agricultural sector, while it accounted for only 24.6 percent of fixed assets investment in the non-agricultural sector in 2002.

[9] Gould (2000) provides a definition for RRR used in the STATA environment. It is expressed as

$$RRR = \frac{P(y=1/x+1)/P(y=base\ category/x+1)}{P(y=1/x)/P(y=base\ category/x)}.$$

RRR greater than one, then a marginal increase in this variable would make the associated choice more preferable than the base category choice.

Table 4. Two scenarios using the multinomial logistic estimates for the tax strategy choice

	(1)				**(2)**			
	Y=H-H	**Y=L-L**	**Y=L-H**	**Y=H-L**	**Y=H-H**	**Y=L-L**	**Y=L-H**	**Y=H-L**
E1 (H-H)	0.472	2.132	3.227	4.939	0.385	1.616	4.016	6.040
	(0.46)	(0.000**)	(0.004**)	(0.000**)	(0.54)	(0.000**)	(0.002**)	(0.000**)
E2 (L-L)	3.992	0.075	3.402	0.139	2.166	0.091	2.896	0.121
	(0.000**)	(0.000**)	(0.000**)	(0.007**)	(0.000**)	(0.000**)	(0.000**)	(0.004**)
E3 (L-H)	0.783	0.905	0.000	2.065	1.174	0.827	0.000	2.144
	(0.81)	(0.63)	(0.000**)	(0.48)	(0.95)	(0.40)	(0.000**)	(0.46)
E4 (H-L)	2.744	0.112	4.462	0.000	2.434	0.094	4.894	0.000
	(0.035*)	(0.000**)	(0.005**)	(0.000**)	(0.11)	(0.000**)	(0.006**)	(0.000**)
Coastal	0.00	1.829	0.347	1.404	0.000	1.403	0.563	1.265
	(0.000**)	(0.000**)	(0.002**)	(0.25)	(0.000**)	(0.000**)	(0.08)	(0.45)
AGSH					1.117	0.981	1.029	1.014
					(0.000**)	(0.000**)	(0.000**)	(0.15)
GESH					1.259	0.509	1.257	0.885
					(0.000**)	(0.000**)	(0.000**)	(0.32)
Observation	10470				10470			
AIC*n	14406.006				12483.900			
Log likelihood ratio	-7163.003				-6193.950			

Note: (1) Model (1) is the basic model excluding AGSH and GESH. Model (2) is the extended model including AGSH and GESH. (2) year dummies are omitted. (3) p values are included in parentheses, while * indicates significant at 5%; ** significant at 1%.

Table 4 includes two models with and without *AGSH* and *GESH*. Compared with Model (1), which excludes the two variables, Model (2) significantly improves the estimation efficiency by reducing the AIC (Akaike information criterion) statistic from 14,406 to 12,483, and increasing the log likelihood ratio from -7,163 to -6,193. This suggests that the specification including these economic variables has a better fit. In the meantime, there are no extreme changes in the estimated effects for endowments, coastal location, or time changes between these two models.

Most variables that are significant in model (1) still have a significant effect in model (2), whereas a few dummies for years become significant in model (2) although not in model (1). As for the magnitude of estimates, no change between the two models has been found large enough to convert the implication for influence directions. It is observed that no RRR estimate above one in one model falls below one in the other model or vice versa. For instance, in the H-H tax rate strategy equation, the RRR of the L-L GDP cluster declines from 3.99 in model (1) to 2.17 in model (2). In spite of the difference in magnitude, the fact that both of them are greater than one suggests that a switch into the L-L GDP cluster generally causes a county to prefer the H-H tax rate strategy more than the no-response strategy. Because of the reasons outlined above, we focus on model (2) to discuss the implications of tax competition behaviors.

As indicated by the first column in model (2), several variables, L-L, L-H, and H-L GDP clusters, *AGSH*, and *GESH* significantly increase the relative risk (preference) for the choice of the H-H tax strategy over the base choice. The only variable significantly depressing the preference for the H-H tax strategy over the no-response strategy is the coastal region dummy. For our purposes, the estimate for the H-H GDP cluster is not significant, but its magnitude of 0.39 indicates that this GDP cluster may discourage the H-H tax strategy.

It is more enlightening to compare the first two columns in model (2). On the one hand, all the variables that increase the relative preference for the H-H tax strategy tend to lower the relative preference to the L-L tax strategy. On the other hand, the variables that raise the relative preference for the L-L tax strategy also include those that lower the relative preference for the H-H tax strategy. Examples are the L-L GDP cluster and coastal region dummy, respectively. Simply put, the first group of variables supports the H-H tax rate competition in particular, but does not support L-L tax rate competition; the second group behaves in a converse manner. To make this point clear, we ran the multinomial logistic regression again using the H-H tax competition strategy as the basic choice. These results are shown in Table 5.

Table 5. Tests for factors that support choosing the L-L over H-H tax strategies

	1994-2002	
Variable	**RRR (L-L vs. H-H)**	**P-value**
E1 (H-H)	4.195	(0.362)
E2 (L-L)	0.042	(0.000**)
E3 (L-H)	0.704	(0.884)
E4 (H-L)	0.039	(0.000**)
Coastal	3.51E+09	(0.000**)
AGSH	0.878	(0.000**)
GESH	0.404	(0.000**)

According to Table 5, the H-H GDP cluster was a stark contrast to the L-L GDP cluster during 1994-2002: the H-H GDP cluster belongs to the group supporting the L-L competition behaviors, while the L-L GDP cluster belongs to the other. This implies that the racing-to-the-bottom tax behaviors largely apply to homogeneous competitors with relatively large endowments, rather than all the homogeneous competitors. More importantly, this also implies that the existence of homogeneous competitors with small endowments seems to constitute one of the driving forces behind the emergence of races to the top, indicating that they might have a penchant for high tax rates over capital inflows.

Also shown in Tables 4 and 5, both *AGSH* and *GESH* are in the club of factors that induce the H-H competition behaviors. This association provides support to our hypothesis about *GESH* and, at the same time, proves that, concerning *AGSH*, the preferred industry effect counteracts the tax table effect. Figures 3a and 3b depict how the increase in *AGSH* affects the probability of choosing the H-H and L-L tax competition. It is clearly shown in these two figures that regardless of whether a county belongs to the H-H or L-L GDP cluster, a rise in the agricultural share of GDP increases its probability of choosing the H-H tax competition, but decreases its probability of choosing the L-L tax competition. In a striking threshold pattern, both of the H-H competition probability curves begin to rise steeply immediately after the agricultural share in GDP reaches 60 percent. This suggests that counties that have reached a certain degree of industrialization tend to care more about capital flow and dislike the option of the H-H tax competition, even when they are in a cluster of poor endowments. Also observed in Figures 3a and 3b, the curve for L-L GDP clusters displays a steeper slope than that for H-H GDP clusters in Figure 3a, but a less steep slope in Figure 3b. This indicates a substantial difference in how the economic structure can affect different GDP clusters.

Figure 3a. The impact of the agricultural share of GDP on tax competition behavior: The H-H tax strategy

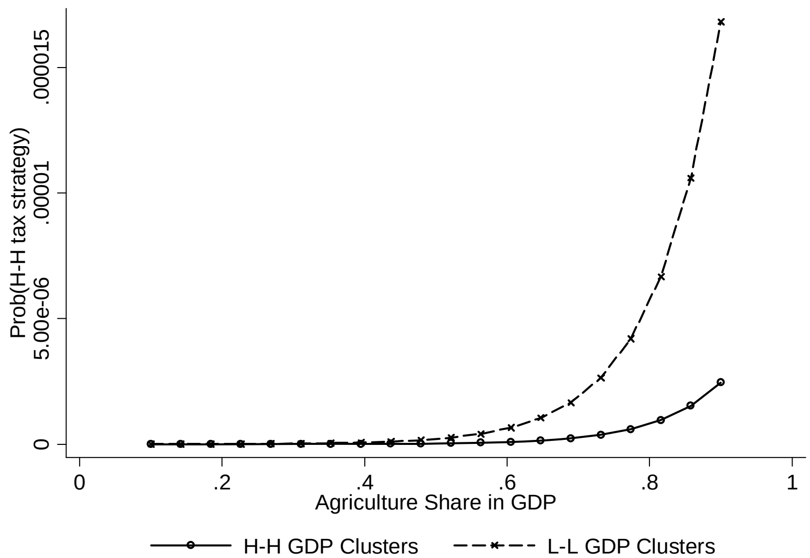
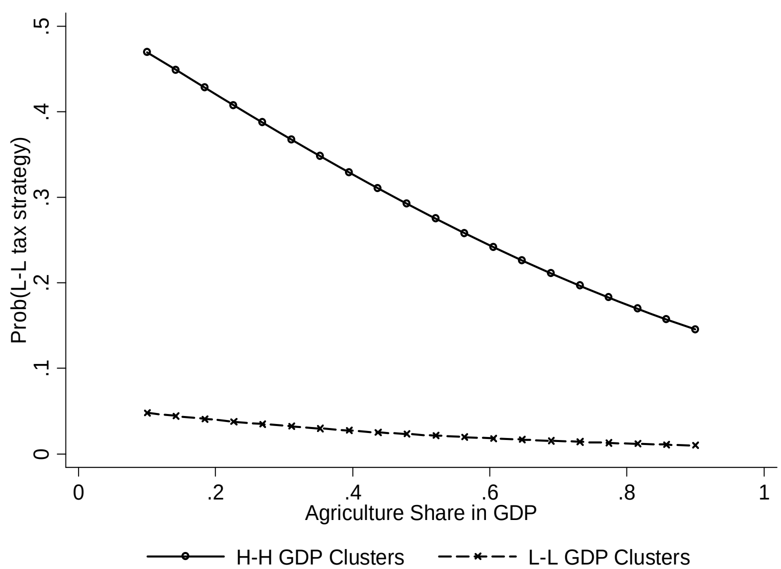


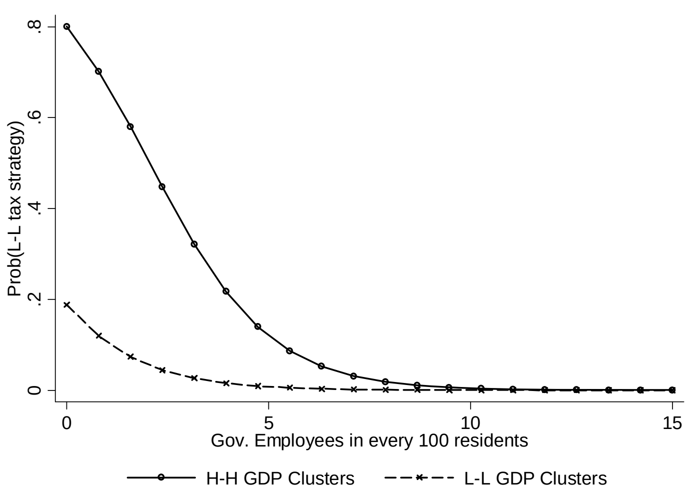
Figure 3b. The impact of the agricultural share of GDP on tax competition behavior: The L-L tax strategy



The impact of *GESH* on the probability of choosing H-H and L-L tax competition behaviors, as shown in Figures 4a and 4b, is similar to that of *AGSH* except that the probability curves for L-L tax competition behaviors (See Figure 4b) exhibit a threshold pattern in which a government employee share greater than 9 out of 100 would prevent both GDP clusters from taking part in L-L tax competition.

Figure 4a. The impact of the government employee share in population on tax competition behavior: The H-H tax strategy

Figure 4b. The impact of the government employee share in population on tax competition behavior: The L-L tax strategy



Last but not least, it is surprising to find in Table 4 that, in the last two columns in model (2), the homogeneous GDP clusters (H-H or L-L GDP clusters) also have greater propensity to choose substantially dissimilar tax rates. What drives the similarly situated competitors to adopt diverging tax decisions is a question that we are unable to empirically sort out with the current data set, because there are too few observations for heterogeneous tax rate strategies.

5. CONCLUSION

Tax competition is a key feature of fiscal federalism or fiscal decentralization. However, empirical evidence on the spatial patterns of tax competition in the presence of heterogeneity in developing countries is lacking. Based on a unique county-level panel data set in rural China, this paper makes use of a state-of-the-art geographic statistical method, LISA, and a sequence of rigorous statistical tests, to describe the patterns of localized tax rate correlations. The approach has emphasized the possibility of heterogeneous local behaviors by allowing for an estimation of spatial tax rate correlations at every individual location. Just as for most studies in the empirical literature on tax competition, we take into account the nearest neighborhood effect of local tax rate determination. Applying LISA to our data, we find strong evidence for spatial clustering of tax rates in some regions, but weak or no tax competition in others. As noted, the relationships between neighboring tax rates are found to vary across five distinct groups. In other words, tax competition behaviors are not globally uniform.

In the second step of the empirical study, we examine the determinants of location-specific competition behaviors. The regional effect is statistically significant, either in a univariate or multivariate model. Our finding shows that the coastal region is a factor that profoundly contributes to the choice of L-L tax strategy over other strategies. This suggests that the tax reduction method is more effective in attracting direct capital investment in the coastal region than in the inland region. This tendency may be due to the huge differences between coastal and inland regions—the differences in supportive policies, transportation, and human capital stocks, to name a few. In China, the reform toward a market-oriented open economy was started in coastal provinces and gradually applied to inland provinces; therefore, the market system has matured more in the coastal region. At the same time, because of its unique geographical and historical composition, the coastal region–with a convenient transportation system and a fast spreading entrepreneurial spirit—has a big advantage in promoting industrial and business development.

The other factor, and probably of greater importance, is the relationship of endowments between competitors. As suggested by various theories, the different endowment levels can trigger strategic tax rate settings rather than a unique equilibrium. According to our results, the tax competition behaviors differ not only between symmetrically endowed units and asymmetrically endowed units, but they also differ between symmetric units at different endowment levels. During the rather long period of 1994-2002, the clustered rich units were in a competition to reduce tax rates, while the clustered poor units were in a competition to raise tax rates.

Although few theoretical studies to date have recognized, let alone interpreted, the "race to the top" behaviors in raising effective tax rate among poor counties, these behaviors can also be reasonably explained by several simple intuitions. First of all, poor counties in China are faced with much tighter budget constraints than rich counties, so the pressure to self-finance the basic spending needs probably prevented them from taking active actions on tax reduction. Instead of creating enabling investment environments, the poor counties may be involved in predatory tax practices against the industrial and business sectors. To a large extent, the fixed cost to run a local government is rather similar across regions. Under fiscal decentralization, the burden to finance the fixed cost compared to local revenue bases in the poor regions is heavier than that in the rich regions. As shown in Zhang (2006), the rigid governance structure, coupled with fiscal decentralization forces, leads some local governments in the lagging regions to impose higher average tax rates on capital investment.

Secondly, it is inevitable that regions comprised of poor counties in clusters are likely to encounter poorly maintained public facilities, undereducated workers, and weak consumption demand. The adverse investment environment in the area can exert a negative externality on the business development for every single county within the region, thereby discouraging these counties from being involved in capital competition. Last but not least, because the intergovernmental transfer policies in general favor regions with lower revenue capacity (Yao 2006), poor counties may devote more of their energies in securing central transfers instead of engaging in tax rate reduction, even though the latter is expected to induce more direct investment and boost fiscal capacity in the long run. Such a choice can be prevalent among local governments that expect that a rise in tax rate can lead to a smaller size of local revenue in the near future.

The divergent behaviors between rich and poor counties may have important implications for development policies. The higher tax rate in the poor counties will prevent them from attracting more capital investment, which in turn will further widen the gap with the rich counties on the coast. At this point, our finding supports the theoretical predictions in Cai and Treisman (2005). In addition to the endowment effect, we also find that the local government's fiscal burden also matters to the tax competition behavior. Consequently, the central and provincial governments that attempt to unleash competitive incentives within the poor regions should also consider reforming the governance structure and subsidizing the fixed cost of running a government in the poor areas.

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