THE IMPACT OF FISCAL DECENTRALIZATION ON GROWTH, INEQUALITY AND LOCAL GOVERNANCE IN RURAL CHINA

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This dissertation investigates empirically the consequences of recent fiscal policy changes on China's rural development. It uses a county-level dataset covering over 90 percent of rural counties and a period of 13 years since 1993, in which China started to experience a series of fiscal reforms to decentralize government expenditures and authority to local governments.

After a brief introduction in the first chapter, the second chapter assesses the dynamic changes in GDP and fiscal resource distributions from 1993 to 2005. In particular, it focuses on how the coastal-inland gap, the between-province gap, and the gap between poor and non-poor counties contribute to the growth of inequality by devising a decomposition approach in a multi-tier hierarchical economy. It is shown that the inland gap between poor and non-poor is larger than the coastal gap in GDP, but smaller in public spending. This suggests that fiscal equalization policies, though effective in equalizing public service provision, failed to equalize income in inland areas.

The third chapter explores the incentive mechanism of intergovernmental grants. It brings a single-threshold linear-spline model to the data of 2002 and reveals a non-linear relationship between grants and recipients' local revenues. The finding supports the argument that grants, though increasingly used as a policy device to reduce fiscal disparity, have produced an anti-equalization effect favorable to urban

recipients with larger revenues and induced rent-seeking in rural recipients with less revenues.

The fourth chapter assesses the extent to which county level governments compete for capital investment and the determinants of their behavior. It initiates an approach using Moran's I statistics to investigate tax competition behavior between units that are both geographically connected and relatively small in size. Contrary to the regression approach, it finds tax competition behavior is not globally uniform. Instead, counties with favorable endowment in coastal areas tend to race to the bottom by lowering tax rates, while counties within a poorly endowed neighborhood in interior areas have a greater propensity to run a 'race to the top tax rate'. This result predicts a trend toward polarization, which may challenge the convergence view in growth economics.

BIOGRAPHICAL SKETCH

Yi Yao was born in Tianjin China in 1975. In 1998, she graduated from Nankai University in Tianjin, with an honor in International Economics and Business. In 2000, she went to the United States to start a would-be eight-year study abroad. In 2002, she received a Master of Arts in Economics from the University of Hawaii at Manoa. The same year, she began the Ph.D. program at Cornell in the Department of Applied Economics and Management. Her daughter, Yuning, was born in 2007. One year later, she made two achievements: finishing the final draft of her dissertation and teaching the little toddler to walk by herself.

For my parents, husband and daughter

谨以此文献给我的父亲母亲，亲爱的女儿及老公

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

In the last decade, China has experienced a steady and rapid economic growth in terms of national GDP; however, many studies (Chen and Ravallion 1996, Kanbur and Zhang 1999, 2005, Yang 1999, Knight and Song 2001, Démurger et al. 2002) show that the aggregate growth has yet to contribute to a balanced income distribution among regions and rural urban areas.

Among many factors that cause or affect this unequal growth process, the role of institutions or governance is especially critical in China. Since the 1980s, China has engaged in a series of reforms of its old fiscal system, which include the fiscal contracting reform in 1983, the tax sharing reform in 1994 and other minor policy adjustments. A basic characteristic of these reforms is the devolving of fiscal authority in revenue collection and public spending to local governments, which can serve to create and stimulate local incentives that promote economic growth. The earlier studies on the impact of the fiscal decentralization process in China, however, have produced controversial results. On the one hand, Jin et al. (2005) find that fiscal decentralization in China can function as a mechanism for preserving market incentives and therefore lead to equal development. On the other hand, many other studies (West and Wong 1995, Lin and Liu 2000, Knight and Song 2001, Cai and Treisman 2005) agree that fiscal decentralization is negatively related to equality. Because most of the existing studies use data up to the early 1990s, they cannot overcome the bias inherent in a short-term analysis, nor can they document the consequences of the most recent fiscal reforms.

This dissertation has two empirical advantages over the above studies. First, more recent data will be used to examine the fiscal decentralization process after 1994, which will be identified to possess a tendency toward fiscal equalization. Second, while most studies use provincial data to evaluate the regional or national inequality, the county-level data we will use not only enable us to reexamine the distributional outcome at the more disaggregated level, but also provide an opportunity to extend the studies of development to the county-level. In China, the government structure consists of five levels including the central government, provinces, prefectures, counties and townships. Possibly due to data scarcity, studies on policy issues below the provincial level are very rare. However, the decentralization process, by its nature, highlights the power of local governance, especially the governance in a small territory. This suggests the importance of looking at the lower level governments in studying decentralization.

In short, this dissertation aims to use the most recent and disaggregated data to illustrate the new patterns of recent fiscal reforms in China and to reveal their potential impact on regional growth, income distribution and local governance.

The main purpose of Chapter 2 is to increase the understanding of the income and fiscal inequality trends during the post-fiscal-decentralization period. Using a dataset of 2094 rural counties in China, it describes dynamic changes in income, fiscal expenditure and tax revenue distributions over the period of 1993-2005. In particular, it focuses on how the coastal-inland gap, the between-province gap, and the gap between poor and non-poor counties contribute to the growth of inequality. In doing so, a decomposition approach based on the General Entropy (GE) class of measures is devised to assess the order of inter-group inequality's contribution to the overall inequality in a multi-tier hierarchical economy. The major finding reveals that after a turning point, 1998, most income and fiscal inequality trends started to grow together, yet at different rates. The changes in these national inequalities, however, can better be explained by the changes in the between-province gap than by the coastal-inland and poor-and-non-poor gaps.

From the observation of fiscal spending and revenue distributions, Chapter 2 also derives important implications for fiscal equalization policies. On the one hand, the fact that the spending gap between the poor and non-poor rural counties is smaller in inland areas than in coastal areas indicates that the fiscal equalization policy functioned better in the inland. On the other hand, the finding that inland areas still have a larger income gap between the poor and non-poor counties than coastal areas raises doubt about the effectiveness of the fiscal equalization policies in achieving the goal of poverty alleviation.

The results in Chapter 2 may raise concerns for the design of intergovernmental grants (transfers) in China. As responses, Chapter 3 reviews the structure of China's intergovernmental grant system after the 1994 reform and conducts an empirical examination of how the grants were actually allocated among county recipients with different locally collected revenues. Using a comprehensive dataset of 2755 counties in 2002, both rural and urban, this chapter evaluates the recent grant policies from two major perspectives: the ultimate equalization effect and the disincentive effect.

First, while the conventional linear model finds no evidence for the equalizing effect, Hansen (1999)'s procedure is applied to estimate a single-threshold linear-spline model, which reveals a significant equalizing effect of grants to rural counties with small local revenues yet a significant anti-equalizing effect of grants to urban ones with large local revenues. The threshold model reflects a non-linear grant-revenue relationship, which is theoretically consistent with the co-existence of grantors' preferences for equality and preferences for investment return.

Second, robust results reveal an economically significant crowding-out effect of equalization grants, indicating that the grant seeking incentives, which reduce local revenues, can lead to weak incentive to promote growth and undermine the economic efficiency of current grant policies. This disincentive effect, probably ignored in previous grant management, raises an important question to be answered by future studies: how can developing countries that comprise of regions with remarkable heterogeneity in economic and fiscal capabilities design an efficient government institution that will align local responsibilities with equity purposes?

One issue essential to fiscal decentralization is how to improve local accountabilities and therefore create competitive incentives among local governments. When it comes to the context of China, accountability may become a controversial issue. It is often argued that China's centralized administration and top-down appointment system make local governments, provinces or counties, more responsible to their supervisors, the upper level governments. Therefore, it is doubtful whether the reforms of fiscal decentralization can work as well in making the local officials accountable to local needs. To shed some light on this question, chapter 4 turns to look at the degree of tax competition in rural China.

Chapter 4 assesses the extent to which county level governments compete for capital investment and the determinant factors to their varied behaviors. It initiates an approach using the Moran's I statistics, a spatial economics instrument, to investigate tax competition behaviors between units which are both geographically connected and relatively small in size. The results verify the existence of tax competition behaviors among rural counties. But, contrary to most empirical studies relying on the conventional regression approach, it is found that tax competition behaviors of rural counties are not globally uniform. Instead, robust evidence supports that counties in the coastal areas with favorable endowment tend to race to the bottom by lowering tax rates, while counties within a poorly endowed neighborhood in the interior region have a greater propensity to run a 'race to the top tax rate', implying that they are less disciplined by competition for mobile private capital.

The findings in Chapter 4 challenge the convergence theory in growth economics by casting a polarization picture for regions with sharp difference in initial endowment and fiscal capacity. More importantly, these findings reveal that current government structure and fiscal system still have problems that may prevent competitive incentives from spreading to poorly endowed counties.

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Chapter 2

Evolution of Income and Fiscal Disparity in Rural China[1]

2.1 Introduction

During China's transition from a planned economy to a market economy, economic inequality has increased sharply. In the span of just 12 years, 1983 to 1995, the Gini coefficient of household per capita income rose by 18.42 percent, from 38 to 45 percent (Knight and Song, 2001). Among the many dimensions of inequality, rural-urban and coastal-inland gaps have been widely examined in the inequality literature. For example, Kanbur and Zhang (1999), applying an inequality decomposition analysis to provincial consumption expenditures, find a rapidly growing contribution of the coast-inland gap to the overall inequality in the period of 1983-1995, and a profound, yet slightly decreasing, contribution of the rural-urban gap in the same period.

The purpose of this chapter is to enrich the understanding of the uneven growth trends in China by using a comprehensive and disaggregated dataset to examine the most recent changes in rural income and fiscal distribution patterns. Our study can add to the previous literature of growth and inequality in three ways. First, this study draws on a unique panel dataset which spans a twelve-year period, 1993-2005, and comprises 2094 rural counties, accounting for 79 percent of the national population in 2005. Such a dataset ensures that the inequality patterns described in our chapter are more broad-based and precise. The county unit, less aggregated than the province, will allow the inequality calculation to take account of the intra-province inequality, thereby enabling us to correct for underestimation of overall inequalities. Using a county unit, however, is limited by being unable to capture the within-county inequality. Knight and Song (2001) and many others explored the inequality measures

[1] This chapter is co-authored with Shenggen Fan.

using the household unit. They overcame the disaggregate problem, but the use of the household unit, which requires costly and time-consuming data collection through surveys, restricted their analysis in both spatial and temporal dimensions. To our knowledge, no studies up to date have touched on the inequality issue by using such a widespread dataset consisting of county units. Among the few pioneers who employ county-level data to estimate inequality patterns, Tsui (1993) was restricted to a single year, 1982, and Park et al. (1996) carried out their fiscal disparity analysis in only two provinces.

The second contribution of this chapter is to provide deeper insights to the most recent evolution of the relative contribution of inequality among different hierarchical levels. To be specific, we examine the changes in the relative significance of between-province versus within-province inequality, between-region versus within-region inequality, and between-the-poor-and-non-poor-group versus within-the-poor-and-non-poor-group inequality. In doing so, this chapter extends the coastal-inland inequality study into the most recent period. While Kanbur and Zhang (1999) report that the contribution of coast-inland gaps to the overall rural inequality dramatically rose to 0.44 prior to 1994, our finding shows that it remained stable— between 0.2 and 0.3—in the post-1994 period. The difference in the estimated level results might be attributed to the different datasets we have used; however, the slower growth rate in our result can imply that the coastal-inland divergence slowed down after its rapid growth in the early 90s.

It is worth noting that our study fills the blank left in other studies by expanding the inequality assessment into two new fields. Dividing the economy into high and low income groups according to the centrally designated poverty county criteria, we evaluate the dynamic changes in within-the-poor inequality, within-the-non-poor inequality, and the gap between these two groups. The results thus provide a unique foundation for assessing the general outcomes of poverty alleviation policies in the study period. Another new, and perhaps most important, attempt in this chapter is to extend the standard two-tier inequality decomposition approach into a three-tier or multi-tier hierarchical analytical framework. Such an attempt appears to have been worthwhile, because more interesting features of distribution patterns can be revealed. For example, our result bears out that the inland gap between poor and non-poor is wider than the coastal gap and deserves more serious attention—a point that hasn't been raised by previous studies.

Lastly, this chapter also applies spatial inequality analysis to evaluate the distributional consequence of a nationwide fiscal reform in 1994. The reform, as shown in a later section, can cause mixed incentives of local officials, which in turn results in uneven management quality of local governments with different resource endowments, eventually leading to complex redistribution of fiscal resource. To better understand the distributional consequence of the 1994 fiscal reform, we will address the following related questions. Has the reform equalized public good and service provision across different jurisdictions? How has the reform affected the availability and distribution of fiscal resources? What are the implications for future fiscal reform toward an equalizing growth?

The rest of this chapter starts with a brief introduction of the data and basic methodology in section 2.2. The trends of distributional patterns for county-level GDP will be presented and discussed in section 2.3. Then section 2.4 reports the results for county-level revenues and expenditures and interprets the implications for the ongoing fiscal reform. Section 2.5 concludes the chapter.

2.2 Data and methodology

2.2.1 Data

The data for this chapter come from three sources. The major source is *China Public Finance Statistics Materials for Prefectures, Cities and Counties* (CPFSMPCC), which has been published annually by the China Ministry of Finance since 1993. This publication contains budgetary revenues, expenditures and their compositions for all the rural county-level administrative units, which are rural counties and county level municipalities, and reports the same information for urban units— namely districts in the city-level municipalities— but only in the years after 1999. Also available from this source are the gross value of industrial and agricultural output (GVIAO), GDP and population. Considering that GVIAO, which includes the values of intermediate inputs, usually overestimates industrial incomes, we choose GDP[2] as the primary measure of county level income.

CPFSMPCC reports county-level population only for a limited period of 1993 to 2000. We extend the population coverage to 2005 by using t*he Social and Economic Statistics for Counties* (SESC), a publication of the China Statistics Bureau.

Lastly, from the *China Statistics Yearbook*, we extract the annual price indices from 1980 to 2005. Price variation across provinces has been widely observed in China, especially since the 1990s. Following Kanbur and Zhang (1999), who argue that the price levels can be assumed identical across provinces in the early stage of China's economic reform, we use the provincial rural CPIs with the common base of 1980 as price deflators to net out the price effect in spatial and temporal dimensions. In the case of missing rural CPIs for certain provinces, the median of all the available provincial price deflators in the same year is used as a proxy.

[2] Appendix describes details about how to cope with the problem of missing GDP.

The observation units to be used in this chapter are the rural counties in 1993, including rural counties and county-level municipalities. Because of rapid urbanization process, China's central administration annually upgrades a few rural counties to urban districts, and some county-level municipalities to prefecture-level cities. Therefore, the total number of rural counties in China has dropped continuously from 2166 in 1993 to 2022 in 2005. To ensure a comprehensive coverage, we use the 1993 definition[3].

We fix the sample of rural counties over the whole study period as a way to ensure dynamic comparability. In doing so, some rural counties with missing information are excluded from the study. For example, because CPFSMPCC only includes rural counties as of the current year for the period before 1999, the rural counties which were upgraded to urban districts before 1999 were missing between the year of upgrade and 1999. After dropping the rural counties with missing values, we arrive at a dataset of 2094 counties, representing 97 percent of the rural counties in 1993.

The counties in our sample are further divided into provinces, coastal and inland regions, and poor and non-poor groups, according to their administrative connection, geographical location, and average income level respectively. Table 2.1 describes our sample coverage and group formation. Indicated by Table 2.1, our sample covers the whole nation's 79.47 percent of population. The coastal region in our sample, which includes 12 provinces—Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi and Hainan, has 647 rural counties representing 75.43 percent of the coastal population, while the numbers for the inland region are 1,447 and 82.23 percent, respectively. The sample

[3] Because of upgrading, merging or splitting, a huge number of rural counties have changed their names or boundary definition. These changes are cautiously traced according to the annual official reports of public administration changes, posted at the website of the Ministry of Civil Affairs.

Table 2.1 Sample description

Region	Province	Number of Counties	County Population [1]		Population Coverage [2] % (2005)	Region	Province	Number of Counties	County Population [1]		Population Coverage [2] % (2005)
			mean	Std					mean	Std	
Nation		2094	45.90	33.31	79.47						
Coastal		647	57.13	32.10	75.43	***Inland***		1447	40.87	32.63	82.23
1	Beijing	8	43.57	12.43	30.84	13	Shanxi	100	25.26	13.62	80.25
2	Tianjin	5	61.67	19.05	34.07	14	InnerMongolia	83	22.74	15.02	81.45
3	Hebei	139	40.93	16.51	85.86	15	Jilin	39	46.07	27.03	67.59
4	Liaoning	44	53.97	22.15	58.13	16	Heilongjiang	67	37.69	21.29	70.40
5	Shanghai	6	55.80	9.02	25.31	17	Anhui	65	76.61	41.07	80.76
6	Jiangsu	57	92.15	32.78	74.99	18	Jiangxi	82	43.94	24.79	86.98
7	Zhejiang	61	55.71	29.03	83.46	19	Henan	111	72.52	29.60	84.96
8	Fujian	61	43.17	28.22	81.29	20	Hubei	64	66.49	35.09	72.35
9	Shandong	96	71.50	27.65	76.78	21	Hunan	92	61.36	30.41	86.70
10	Guangdong	77	69.86	40.84	81.76	22	Chongqing	29	82.83	31.22	77.91
11	Guangxi	77	49.26	31.74	83.71	23	Sichuan	141	48.07	40.30	82.06
12	Hainan	16	36.57	18.60	90.58	24	Guizhou	79	42.48	24.72	92.67
						25	Yunnan	117	31.02	19.92	90.02
						26	Tibet	72	3.19	1.88	94.59
						27	Shaanxi	93	32.68	20.27	85.13
						28	Gansu	72	27.93	17.15	81.13
						29	Qinghai	38	10.38	12.11	83.43
						30	Ningxia	18	24.71	12.22	78.73
						31	Xinjiang	85	18.74	12.20	88.20
Non-Poor		1523	48.99	34.59	75.36	***Poor***		571	37.63	28.03	97.79

Note: 1. Unit in 10,000 people

2. Percentage proportion of the sample population to the total population

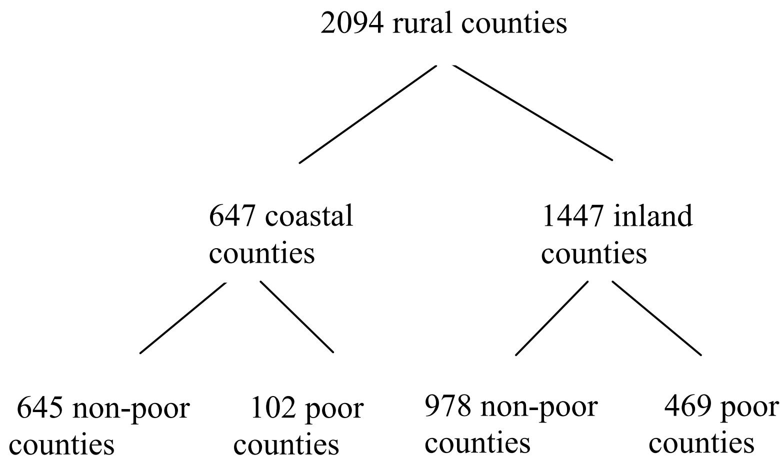

Figure 2.1 Data structure for poor and non-poor counties

coverage in population also varies across provinces, but it exceeds 70 percent for most provinces except Beijing, Tianjin, Shanghai, Liaoning and Jilin.

In this chapter, the poor counties refer to the counties designated by China's central government as the targets for poverty alleviation in 1998. 571 of these 589 poor counties are included in our sample. Their population covers 97.79 percent of the total population of the 589 counties. In particular, 82 percent of the poor counties within our sample (469 out of 571) are located inland, and they account for 32 percent of the inland counties. Figure 2.1 illustrates the data structure for poor and non-poor groups.

The population of counties, used as analytical weights in computing inequality measures, differs remarkably between provinces, with a maximum of 92.15 in Jiangsu and a minimum of 3.19 in Tibet. In contrast, Table 2.1 indicates that the within-province variation of county population is rather small. Although great caution should be exercised in attempting to compare within-province inequalities using population weighted inequality measures, our study on the temporal changes in a specified inequality measure is generally free from the weight-related bias.

2.2.2 Inequality measures

Two classes of inequality issues will be examined in this chapter. First for facilitating comparisons with other studies of inequality issues in China, the Gini coefficient is used to compute and compare the overall inequalities.

The second class of inequality measures, Generalized Entropy (GE), developed by Shorrocks (1980, 1984), and used by Tsui (1993) and Kanbur and Zhang (1999), is adopted in the application of inequality decomposition analysis. Suppose the population is broken into K mutually-exclusive groups, each $GE(a)$ index can be decomposed as

$$GE(a) = \sum_{k=1}^{K} w_k GE_k(a) + GE_b(a) \tag{2.1}$$

where $GE_b(a)$, the element for between-group inequality, is derived assuming every county within a given subgroup k received k's mean income; $GE_k(a)$, inequality for subgroup k, is calculated as if the subgroup were a separate population; and, the weight for group k is w_k, defined by

$$w_k = \frac{{v_k}^{(1-a)}}{{s_k}^{a}} \tag{2.2}$$

where v_k and s_k are subgroup k's population share and income share respectively. Following Kanbur and Zhang (1999), we define the k^{th} subgroup's contribution to overall inequality as $\frac{w_k GE_k(a)}{GE(a)}$, and the between-group inequality's contribution as the ratio of $GE_b(a)$ to $GE(a)$.

If the population in the k^{th} subgroup is further divided into h groups, we can apply the decomposition procedure expressed in (2.1) to $GE_k(a)$. Substituting the decomposed $GE_k(a)$ into equation (2.1) gives us the contribution of the between-group inequality in the k^{th} subgroup to the total inequality, $C_b{}^k$, which is expressed by $\frac{w_k GE_b^k}{GE(a)}$, where $GE_b{}^k$ is the between-group inequality within the k^{th} subgroup. This measure provides a new and straightforward instrument for the comparison of between-group inequalities (groups at the third tier) within different subgroups at the second tier. In particular, the use of this instrument allows us to address the following questions: Which between-province inequality has a greater impact on the total inequality, inland or coastal? Or similarly, does the inland gap between poor and non-poor counties have a greater impact on the total inequality than the coastal gap?

A technical issue is what value should be chosen for the sensitive parameter in our GE estimation. Our results reflect that the choice of this parameter has little influence on the interpretation of intertemporal changes of regional inequalities in the period of our interest. Therefore, this chapter reports only the Theil index, which is *GE(1)*.

2.3 Income distribution from 1993 to 2005

2.3.1 Overall inequality

Our unique county-level dataset enables us to examine the evolution of the overall inequality at national, regional and provincial levels, or for poor and non-poor groups. In Figure 2.2, we compare the Gini coefficient with the *GE(1)* for the GDP inequality at the national level. It is quite clear that the curve for the Gini coefficient parallels that for the *GE(1)*, implying that in explaining the dynamic trends of the overall inequality there is no difference between the two measures. In the rest of this chapter, we will use the Gini coefficient as a representative measure to describe the evolution of the overall inequality.

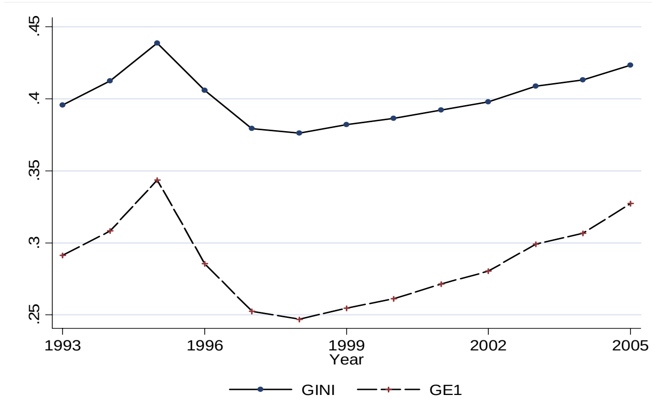

Figure 2.2 Comparison of the Gini and Theil index for within-nation inequality of GDP

Table 2.2 Evolution of income distribution at different levels

Region	Province	Income GINI Mean	1993	1998	2005	Region	Province	Income GINI Mean	1993	1998	2005
Nation		0.40	0.40	0.38	0.42						
Coastal		0.37	0.38	0.33	0.41	***Inland***		0.33	0.32	0.32	0.34
1	Beijing	0.17	0.17	0.14	0.23	13	Shanxi	0.28	0.27	0.26	0.33
2	Tianjin	0.16	0.27	0.14	0.10	14	InnerMongolia	0.29	0.25	0.28	0.38
3	Hebei	0.27	0.26	0.25	0.30	15	Jilin	0.17	0.19	0.19	0.17
4	Liaoning	0.34	0.26	0.34	0.31	16	Heilongjiang	0.27	0.18	0.29	0.31
5	Shanghai	0.22	0.18	0.22	0.29	17	Anhui	0.21	0.14	0.21	0.22
6	Jiangsu	0.39	0.37	0.37	0.46	18	Jiangxi	0.23	0.35	0.21	0.23
7	Zhejiang	0.26	0.33	0.24	0.28	19	Henan	0.31	0.37	0.26	0.31
8	Fujian	0.28	0.29	0.27	0.29	20	Hubei	0.26	0.21	0.33	0.23
9	Shandong	0.29	0.25	0.30	0.32	21	Hunan	0.24	0.29	0.20	0.25
10	Guangdong	0.43	0.48	0.38	0.48	22	Chongqing	0.24	0.16	0.23	0.24
11	Guangxi	0.24	0.25	0.21	0.29	23	Sichuan	0.33	0.25	0.30	0.31
12	Hainan	0.22	0.20	0.21	0.31	24	Guizhou	0.29	0.29	0.26	0.29
						25	Yunnan	0.45	0.36	0.47	0.38
						26	Tibet	0.27	0.28	0.30	0.26
						27	Shaanxi	0.27	0.33	0.24	0.34
						28	Gansu	0.36	0.29	0.40	0.39
						29	Qinghai	0.24	0.22	0.23	0.38
						30	Ningxia	0.38	0.33	0.38	0.36
						31	Xinjiang	0.37	0.25	0.33	0.44
Non-Poor		0.37	0.37	0.34	0.40	***Poor***		0.31	0.30	0.29	0.33

Table 2.2 provides a comparison of the overall inequality trends at different levels from 1993 to 2005. The mean of the Gini coefficient in this period is presented in the first column, in which we find the national-level Gini was averaged at 0.40 over the twelve years; the coastal Gini exceeded the inland Gini by 4 percent; and the non-poor-group Gini was greater than the poor-group Gini by 6 percent. Among 31 provinces, Yunnan ranked first with a level of 45 percent. Provinces in the top 10 also include Guangdong, Jiangsu, Ningxia, Xinjiang, Gansu, Liaoning, Sichuan and Henan. It is noted that Beijing, Tianjin and Shanghai, the three province-level municipalities, have the lowest average rural inequalities.

Columns (2) - (4) present the Gini coefficients in 1993, 1998 and 2005, respectively. The national rural inequality, as also depicted in Figure 2.3 , decreased at an annual rate of 0.58 percent from 1993 to 1998, and then increased at a much higher rate, 1.72 percent, in the next seven years, finally rising from 1993's 0.40 to 2005's 0.42. This `U' shaped trend was followed by the coastal, poor, and non-poor inequalities, while the inland inequality remained non-decreasing between 1993 and 1998. At the provincial level, six provinces such as Liaoning and Hubei showed an inverse `U' shaped trend; eleven provinces including Shanghai, Jiangsu, Inner Mongolia and others displayed an upward linear trend; two provinces, Tianjin and Jilin, went with a downward linear trend; the rest of twelve provinces followed the `U' shaped trend.

From 1993 to 2005, the rural inequality increased in all the regions except eight provinces, five of which are located inland. The provinces with the highest growth rate of the rural inequality are mostly located inland too. For instance, the within-province rural inequality rose by more than four percent only in four provinces: Shanghai, Heilongjiang, Xinjiang and Qinghai. We employ an F test for the hypothesis that the rural inequality grew no faster in inland provinces than that in coastal

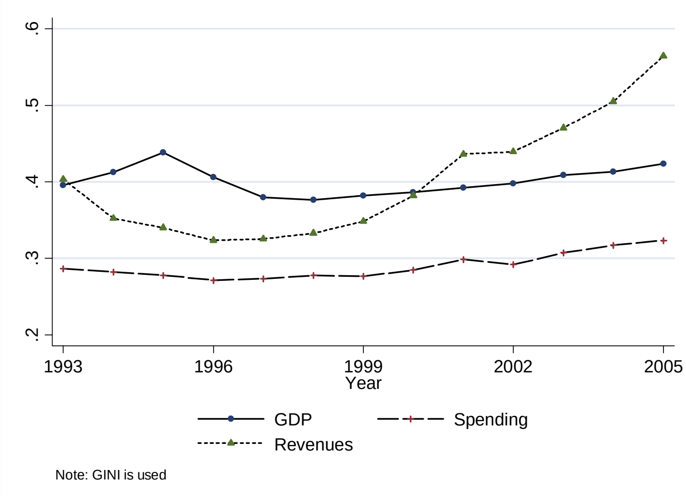

Figure 2.3 Evolution of GINI inequality at the national level

provinces during 1993-2005. The result significantly rejects the null, supporting that the vice versa is true.

2.3.2 Contributions of between-group inequalities at the second tier

We apply *GE (1)*, also called the Theil index, to investigate the evolution of the between-group inequality's relative contribution to the overall inequality. Rural counties are divided between coastal and inland regions, between poor and non-poor groups, and between provinces. The trends of the three between-group's relative contributions are compared in Figure 2.4, showing that the between-province curve lay entirely above 0.35, while the between-region curve was completely between 0.2 and 0.3, and the between-poor-and-non-poor-group curve below 0.2. The fact that none of the between-group inequality contributions exceeded 0.5 implies that all the between-group gaps could not compare with their corresponding within-group gaps in explaining the overall inequality in the study period. Because the number of groups is much greater by provincial classification than that by the other two, it is not surprising

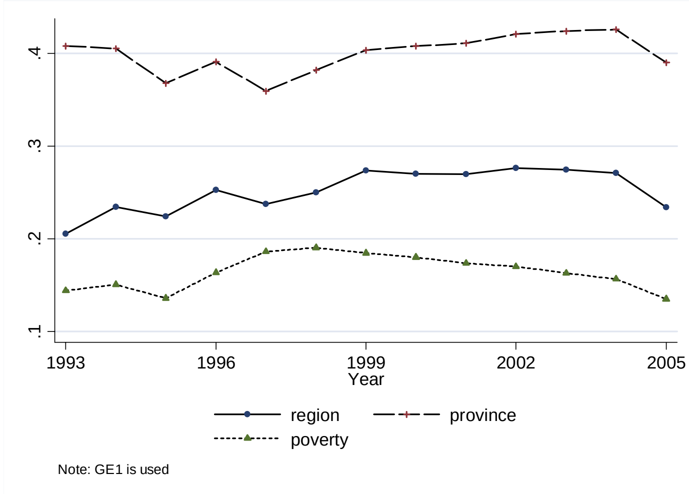

Figure 2.4 Contributions of between-group inequalities to overall inequality: GDP

to see that the between-province inequality had the largest relative importance to the growth of the overall inequality. More interestingly, even with the same number of groups, the coastal-inland inequality seemed to have more significant power over the overall inequality than the between-poor-and-non-poor-group inequality.

A rising relative contribution of the between-group gap implies that the between-group gap indeed grows faster than the within-group inequality. The curve for the contribution of the gap between the poor and non-poor groups was inverse-'U' shaped after 1994—increasing dramatically until 1998 and decreasing weakly but consistently afterward—implying that the poor-and-non-poor disparity did not grow as fast as the within-the-poor/non-poor-group gaps in recent years. This fact, furthermore, suggests that the central government's poverty alleviation effort may have started to take effect in the late 1990s. Regional policies, however, didn't appear to produce such an equalizing effect. The coastal-inland gap's contribution exhibited irregular growth patterns in the whole period, resulting in a slight increase from 0.20 to 0.23. Unlike the gap between the poor and the non-poor, the between-province inequality's contribution went ups and downs before 1997 and increased continuously from 0.36 to 0.43 afterwards (except a sudden drop in 2005). We notice that the period when the contribution of between-province gap was growing nonstop overlapped with the period when the overall national inequality sustained a continuous growth (as shown in Figure 2.3). Their co-movement lasted six years from 1998 to 2004.

2.3.3 Contributions of between-group inequalities at the third tier

The inland and coastal regions can be further divided between provinces, or into the poor and non-poor groups. Each divide will create an economy of three hierarchical levels. In a top down order, these levels are nation, regions and provinces, or nation, regions, and the poor and non-poor groups. (For details of the two divisions, please refer to Table 2.1 and Figure 2.1.) With the new statistics, C_b^k , that we derived in section 2.2.2), the between-province gaps in coastal and inland regions are compared in Figure 2.5 and the gaps between the poor and non-poor are compared in Figure 2.6. A striking finding is that while the inland contribution of the between-province inequality is almost below the coastal contribution, the inland contribution of the poor-and-non-poor gap has been at least twice as large as the coastal contribution all the time but in1993.

Although the between-province inequality's contributions in coastal and inland regions exhibit opposite growth patterns in the prior-1999 period, they both started to grow steadily since 1999. While the inland contribution of the between-province inequality rose steadily in 1999-2005 from 7.03% to 7.09%, the coastal one jumped more rapidly from 10.73% to 12.28%.

The two trends in Figure 2.6, however, possess similar patterns in all the years. Despite a sharp rise from 5.36 percent to 9.70 percent in the years prior to 1998, the contribution of the inland gap between poor and non-poor groups continued to decrease afterwards and arrived at 6.44 percent in 2005. The coastal curve for the poor-and-non-poor gap's contribution mostly co-moves with the inland curve, except

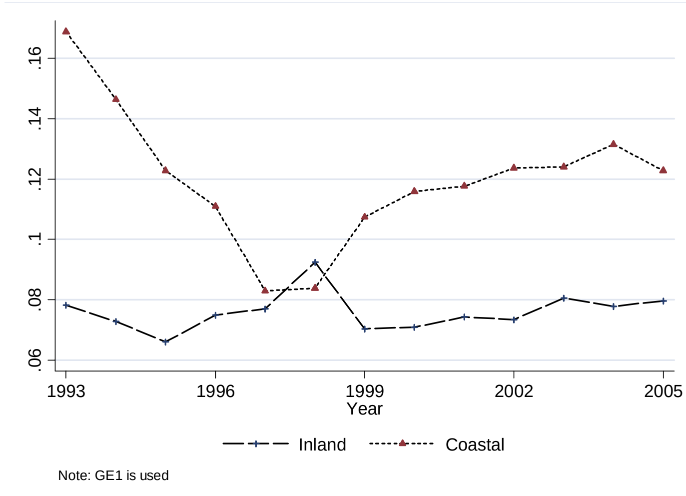

Figure 2.5 Comparison of between-province inequalities in coastal and inland regions: GDP

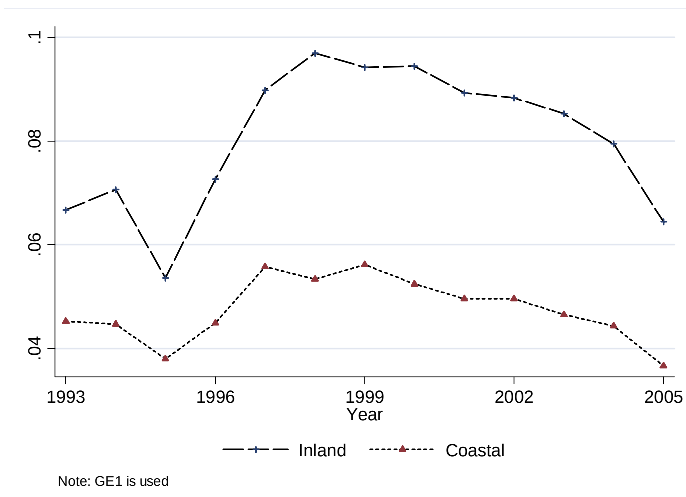

Figure 2.6 Comparison of coastal and inland gaps between poor and non-poor counties: GDP

that its fluctuation is less intensive. The year of 1998 was observed as a common turning point for the relative contributions of the between-the-poor-and-non-poor-groups inequalities, no matter inland or coastal. This seemed not arbitrary to us. Since the poverty alleviation policies enforced nationwide in 1998 were mainly targeted toward the 589 poor counties, such a reduced gap between these poor and other counties, in some extent, suggested the success of implementing these policies.

In sum, the above procedure sheds some light on the concern: which between-group inequality can better explain the dynamic changes of the overall inequality. Among the three candidates at the second tier, the between-province inequality contributed most to the total inequality, and at the third tier, the between-province inequality at the coastal region did. This conclusion, in part, explains the co-movement between the overall inequality measured by *GE(1)* (the dashed line in Figure 2.2), the share of between-province inequality (the dashed line in Figure 2.4) and the share of coastal between-province inequality (the dotted line in Figure 2.5).

Lastly, but most importantly, decomposing the regional inequality into the third tier invites new perspectives about the difference between inland and coastal regions. Our result highlights the uneven growth of coastal provinces by showing that the GDP gap between coastal provinces was relatively large and growing rapidly in recent years. On the other hand, strong evidence supports the idea that the inland gap between the poor and non-poor played a more important role than its coastal counterpart in explaining the overall inequality, implying that future poverty alleviation policies may induce a magnificent equalizing effect if priorities are placed on inland poor counties.

2.4 Fiscal distribution in 1993-2005

2.4.1 Redistribution through fiscal policies

Since 1994, the year that China started the tax-sharing fiscal reform, great changes have taken place in the intergovernmental fiscal relationship between the central and provincial governments, and between the provincial and local governments. During the reform period, the central government, which sought to balance the need for central control and local autonomy, established an objective-based tax sharing regime aimed at stimulating local governments' incentives for local tax base expansion by granting a tax rebate proportional to the increment in centrally collected sharing revenues, namely value added taxes and commercial taxes. The reform, on the other hand, provides incentives for increased tax effort mobilization through devolving expenditure responsibilities and financial authority to local governments. The two incentive mechanisms, to an ideal extent, not only can align the local administration's interest with central government's interest in accumulating revenues, but more importantly can align local fiscal interests with good local development performance (Jin et al. 2005).

The tax sharing scheme, however, has a tendency to trigger less desirable trends. The tax sharing system has assigned the center a greater portion of the increased sharing revenues, which might undermine the local interest in increasing the tax base for shared revenues. Under the rule of tax sharing, a local economy with profitable structure and good economic standing can easily attain revenue rebates, while a poorly structured economy can not improve its revenue capacity in a short time, thereby being placed in a disadvantaged position for revenue rebates. Given that China has already encountered vast income gaps between regions, such a favoring-the-rich rule, if not accompanied by equalizing grants, will exacerbate the previously existing fiscal disparities (Bahl, 1999).

On the other hand, the fiscal expenditure decentralization reform that hardens the budget constraint for all the local governments can undermine the revenue-scarce jurisdictions' ability to provide public goods and services to match basic local needs (Park et al., 1996). To a worse extent, a decentralized expenditure system that allows upper level governments to pass on expenditure responsibilities to the lower levels, will empower the bureaucrats at the upper level to squeeze most of the revenues, thereby aggravating the lower level governments' fiscal burden and preventing them from pursing investment strategies to future economic development (Jin and Zou

2003). As a consequence, the income and fiscal gap between poor and non-poor jurisdictions will both be widened.

The mixing incentive mechanisms inherent in the 1994 reform increase the complexity for evaluating and predicting the impact of this fiscal reform. This chapter will add to the understanding of this reform by providing a broad picture about the evolution of fiscal disparity across different provinces and regions in rural China. Two important fiscal indicators are chosen for this purpose. The local government spending reflects to what extent the local public good and service are provided by local authority. The local revenues, including locally collected taxes and locally retained shared revenues (which are collected by the central tax administration), have a twofold meaning: from the tax authority's perspective, local revenues indicate self-financing abilities, which are constrained by local tax capacity and the administration's tax effort; from tax payers' perspective, tax revenues, the part of income leaking away from their pockets, are equivalent to an extra burden on their economic activities. Thus, the spatial distribution of per capita tax revenues not only reflects how local authority's financing abilities differ across regions, but also reveals how the tax burden faced by individuals varies in the spatial dimension.

2.4.2 Fiscal equalization over time

We repeat the analytical procedure in section 2.3 by using two fiscal variables. Table 2.3 and Table 2.4 report the Gini coefficients associated with real public spending per capita and real fiscal revenues per capita at different levels. The results of decomposing public spending inequality are displayed in figures 2.7, 2.8 and 2.9. And figures 2.10, 2.11 and 2.12 contain the results of revenue inequality decomposition.

We first address the soft-budget concern to local governments by comparing the distributions of fiscal expenditures and revenues. Under the strict assumption of

Table 2.3 Evolution of the distribution of public spending (service) at different levels

Region	Province	Public Spending GINI				Region	Province	Public Spending GINI			
		Mean	1993	1998	2005			Mean	1993	1998	2005
Nation		0.29	0.29	0.28	0.32						
Coastal		0.30	0.27	0.26	0.38	***Inland***		0.26	0.29	0.26	0.26
1	Beijing	0.16	0.18	0.20	0.10	13	Shanxi	0.16	0.16	0.16	0.20
2	Tianjin	0.12	0.10	0.10	0.12	14	InnerMongolia	0.26	0.26	0.25	0.29
3	Hebei	0.17	0.18	0.16	0.21	15	Jilin	0.21	0.23	0.23	0.22
4	Liaoning	0.16	0.14	0.16	0.16	16	Heilongjiang	0.19	0.20	0.22	0.19
5	Shanghai	0.15	0.05	0.11	0.21	17	Anhui	0.18	0.21	0.16	0.21
6	Jiangsu	0.28	0.23	0.22	0.39	18	Jiangxi	0.14	0.16	0.14	0.13
7	Zhejiang	0.17	0.13	0.18	0.22	19	Henan	0.20	0.19	0.20	0.20
8	Fujian	0.19	0.24	0.16	0.20	20	Hubei	0.17	0.19	0.17	0.14
9	Shandong	0.20	0.16	0.19	0.27	21	Hunan	0.18	0.22	0.19	0.15
10	Guangdong	0.36	0.37	0.33	0.40	22	Chongqing	0.16	0.17	0.16	0.17
11	Guangxi	0.20	0.19	0.21	0.25	23	Sichuan	0.26	0.26	0.27	0.24
12	Hainan	0.17	0.12	0.17	0.25	24	Guizhou	0.15	0.18	0.14	0.12
						25	Yunnan	0.24	0.29	0.24	0.21
						26	Tibet	0.22	0.22	0.24	0.22
						27	Shaanxi	0.23	0.21	0.22	0.30
						28	Gansu	0.21	0.23	0.21	0.20
						29	Qinghai	0.22	0.20	0.23	0.25
						30	Ningxia	0.15	0.15	0.13	0.16
						31	Xinjiang	0.22	0.22	0.23	0.21
Non-Poor		0.30	0.29	0.28	0.34	***Poor***		0.25	0.27	0.25	0.24

Table 2.4 **Evolution of the distribution of tax revenues at different levels**

Region	Province	Tax Revenue GINI				Region	Province	Tax Revenue GINI			
		Mean	1993	1998	2005			Mean	1993	1998	2005
Nation		0.40	0.40	0.33	0.56						
Coastal		0.41	0.40	0.34	0.57	***Inland***		0.33	0.37	0.29	0.45
1	Beijing	0.15	0.12	0.18	0.17	13	Shanxi	0.30	0.34	0.27	0.41
2	Tianjin	0.16	0.22	0.13	0.13	14	InnerMongolia	0.40	0.38	0.34	0.58
3	Hebei	0.27	0.29	0.22	0.43	15	Jilin	0.26	0.35	0.20	0.34
4	Liaoning	0.26	0.28	0.23	0.32	16	Heilongjiang	0.23	0.27	0.19	0.39
5	Shanghai	0.18	0.08	0.14	0.26	17	Anhui	0.22	0.28	0.17	0.39
6	Jiangsu	0.45	0.44	0.36	0.59	18	Jiangxi	0.22	0.30	0.23	0.25
7	Zhejiang	0.26	0.26	0.24	0.31	19	Henan	0.32	0.35	0.27	0.48
8	Fujian	0.28	0.34	0.21	0.35	20	Hubei	0.22	0.24	0.22	0.26
9	Shandong	0.29	0.28	0.26	0.40	21	Hunan	0.23	0.28	0.20	0.30
10	Guangdong	0.55	0.49	0.50	0.63	22	Chongqing	0.20	0.30	0.16	0.31
11	Guangxi	0.26	0.23	0.25	0.31	23	Sichuan	0.33	0.37	0.29	0.46
12	Hainan	0.23	0.29	0.22	0.40	24	Guizhou	0.26	0.33	0.22	0.30
						25	Yunnan	0.38	0.45	0.36	0.41
						26	Tibet	0.47	0.54	0.49	0.39
						27	Shaanxi	0.34	0.39	0.26	0.63
						28	Gansu	0.42	0.50	0.41	0.46
						29	Qinghai	0.28	0.25	0.27	0.39
						30	Ningxia	0.44	0.43	0.45	0.48
						31	Xinjiang	0.45	0.46	0.44	0.52
Non-Poor		0.39	0.39	0.32	0.56	***Poor***		0.31	0.33	0.27	0.46

the hard budget constraint, the expenditures should be highly correlated with local governments' revenues. This implies the distribution of local expenditures should mimic that of local revenues if the budget constraint has been hardened. In our results, the spending inequality at the national level (the dashed curve in Figure 2.3 and the first row in Table 2.3) was persistently lower and much more stable than the revenue inequality (the dotted curve in Figure 2.3 and the first row in Table 2.4), suggesting that local expenditures were not highly related to local revenues. We further extend the comparison to the coastal/inland regions, provinces and the poor/non-poor groups, all rendered similar results, indicating a prevalent soft-budget constraint problem.

In Figure 2.3, we find that the revenue inequality at the national level rose rapidly and consistently in the post-1996 period, indicating that not only the gap of county-level governments' self-financing abilities but also the gap of tax payers' tax burdens were widened. On the one hand, this enlarged revenue gap probably resulted from a soft budget constraint problem in which more and more resource-scarce counties became transfer-dependent and less fiscally responsible, thus purposely reducing their tax efforts. On the other hand, it can also be the consequence of hardened budget constraints that limited resource-scarce counties' tax revenues to its poor tax base. Since the measurement of local fiscal revenues doesn't allow us to distinguish a tax-base effect from a tax-effort effect, the policy implication of this result largely remains ambiguous. Nevertheless, from the tax burden's perspective, one can at least clearly infer that the mobility of labor and capital across rural counties is too low to allow regional competition to effectively prevent the diverging growth of tax burdens.

Table 2.3 reveals the fact that the spending inequality decreased consistently in the inland region and the poor group, but increased in the coastal region and the non-poor group. From 1993 to 2005, all but seven inland provinces reduced the rural spending inequality within their boundaries. In the same period, only two out of twelve coastal provinces equalized within-province spending. These contrasting results uncover that the inland fiscal policies tend to induce more equalized public spending or service provision.

In Table 2.4, we find that most provinces, regions and groups experienced a reduction in the revenue inequality prior to 1998, but in the post-1998 period the revenue inequality increased dramatically in both regions as well as in the poor and non-poor groups. During the recent period, the revenue inequality even grew at a 2-digit annual rate in provinces such as Hebei (11.22 percent), Hainan (12.51 percent), Heilongjiang (12.96 percent), Anhui (14.60 percent) and Shaanxi (15.19 percent). These rapid upward movements in fiscal gaps deserve our close attention.

Like the income inequality, the overall inequalities of both fiscal variables are most seriously affected by the inter-province inequalities. This is supported by Figure 2.7 and Figure 2.10, in which the contribution curves of the between-province inequalities are located well above the other two between-group inequalities. Figure 2.7 doesn't show much fluctuation in the three contribution curves, while in Figure 2.10 we can find that the between-province revenue inequality rapidly increased its contribution between 1996 and 2001 and so did the between-region inequality, indicating that the two between-group inequalities of fiscal revenues grew much faster than their corresponding within-group inequalities in this period. It is also observable from Figure 2.10 that the poor-and-non-poor revenue gap's contribution declined continuously ever since 1994, implying that the revenue gap between poor and non-poor counties didn't grow as fast as the variations within the poor or non-poor counties.

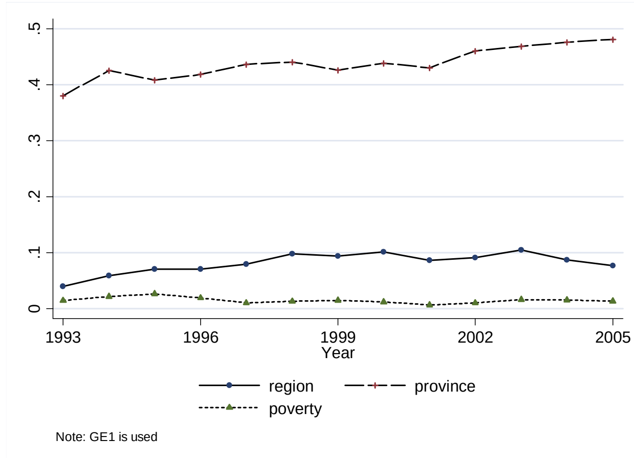

Figure 2.7 **Contributions of between-group inequalities to the overall inequality: public spending**

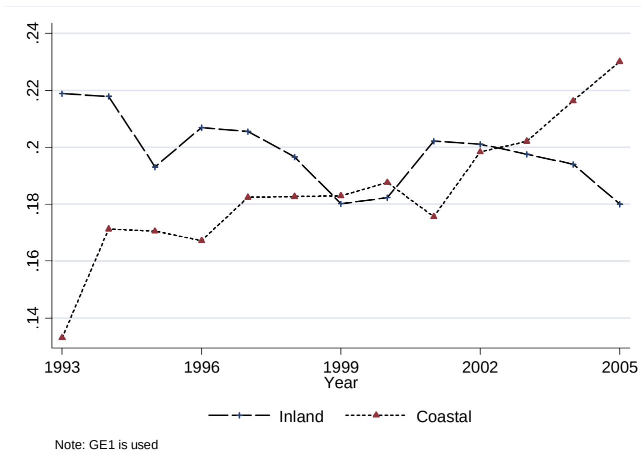

Figure 2.8 **Comparison of between-province inequalities in coastal and inland regions: public spending**

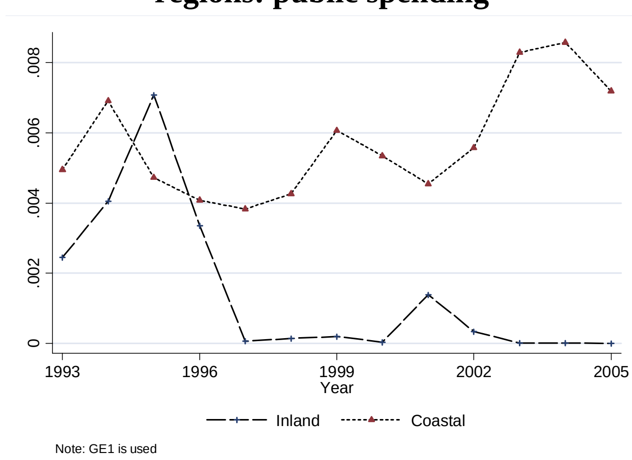

Figure 2.9 **Comparison of coastal and inland gaps between poor and non-poor counties: public spending**

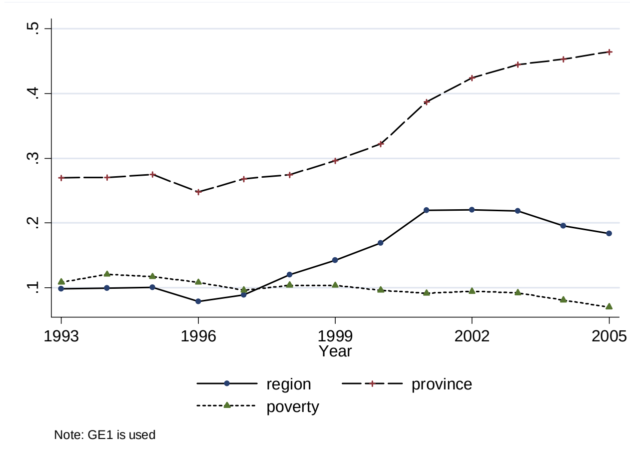

Figure 2.10 Contributions of between-group inequalities to the overall inequality: fiscal revenues

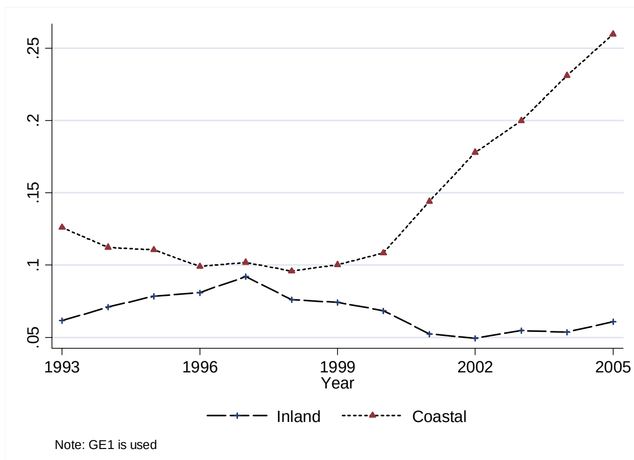

Figure 2.11 Comparison of between-province inequalities in coastal and inland regions: fiscal revenues

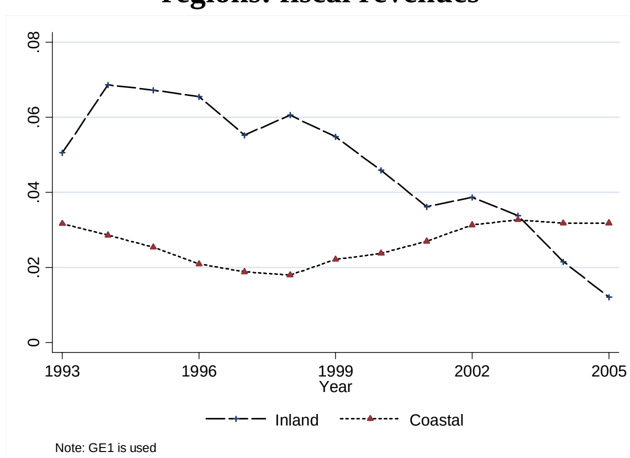

Figure 2.12 Comparison of coastal and inland gaps between poor and non-poor counties: fiscal revenues

When the revenue and spending inequalities at the regional level are broken down into between-province and within-province inequalities, we compare the inland and coastal between-province inequalities in Figure 2.8 and Figure 2.11. Figure 2.11 reveals that the revenue gaps between coastal provinces exceeded their inland counterpart by a large margin. This essentially agrees with the conjecture that the coastal between-province inequality accounted for a relatively larger portion of the total inequality than the inland between-province inequality. This conjecture, however, was only supported by the spending inequality after 2002. Prior to 2002, the coastal contribution of the between-province spending gaps mainly fell behind of the inland contribution. Nevertheless, the overall results from the investigation of GDP, spending and revenue inequalities provide collaborative evidence in favor of this conjecture.

The inland contribution of the spending gap between poor and non-poor counties, as described in Figure 2.9, fell sharply between 1995 and1997. Likewise, the inland contribution of the fiscal revenue gap between the poor and non-poor groups, as shown in Figure 2.12, declined continuously after 1994. These patterns suggest that fiscal redistribution policies functioned well in inland areas as a way to effectively equalize expenditures and revenues between the poor and non-poor counties. Our result, however, produces no evidence to support the idea that fiscal policies in coastal areas had any significant equalizing effect.

From Figure 2.9 and Figure 2.12, we can also observe that for the public spending, the relative contribution of the between-the-poor-and-non-poor gap was generally greater in the coastal area than in the inland area, but for the fiscal revenue, the case was the opposite ever since 1993 and didn't change until 2003. Combining with our previous findings in Figure 2.6 that the inland GDP gap between the poor and non-poor groups contributed more to the overall inequality than the coastal counterpart leads us to the conclusion that the existing poverty alleviation policies still need to pay more attention to GDP and revenue equalization between the inland poor and non-poor counties, though they seemed to have induced prominent equalizing effect for inland public spending. It is worth noting that, due to the consistent decrease in recent years, the inland poor-and-non-poor gap in fiscal revenues started to fall below the coastal gap in 2003 and continued the trend thereafter. This may imply a recent success of the inland region in equalizing revenue resources between the poor and non-poor groups.

2.5 Conclusion

Our study focuses on the regional distribution of income, fiscal spending and local tax revenues in rural China over the period between 1993 and 2005. Our results strongly support the fact that the overall GDP inequality rose nonstop in most recent years, and its dynamic changes can better be explained by the changes in the between-province gap than by the coastal-inland and poor-and-non-poor gaps. Despite this, one still can argue that the dominance of the provincial gap may have been exaggerated because it can be mainly due to a large number of groups in a provincial divide. Nevertheless, this result adds to the general understanding of China's regional inequality by providing substantial evidence for a recent trend toward rising divergence between provinces.

Though unexpectedly, we find evidence for the lack of correlation between fiscal spending and revenues, which in turn suggests that recent fiscal reforms have softened the budget constraints on rural county governments. This conclusion disagrees with Jin et al. (2005), who find hard budget constraints in their study period, 1983-1998. The soft-budget-constraint problem may become particularly prominent after the 1994 reform, because the tax sharing arrangement greatly increases the central government's revenue share in the total and the ratio of revenue to GDP for most provinces, therefore increasing the central and provincial abilities of fiscal resource redistribution, or their abilities to rescuing poor counties. On the other hand, the soft budget constraints to county level governments may reflect the central and provincial governments' increasing concerns for reducing regional inequalities.

However, our study finds that fiscal equalization policies, which are more effective in equalizing public service provision in the inland region, didn't produce a significant income equalization effect in this region. The finding that inland areas still have a larger income gap between the poor and non-poor counties than coastal areas raises doubt about the effectiveness of the fiscal equalization policies in achieving the goal of poverty alleviation.

Despite the above, our study strongly support that the target method enforced in the process of poverty alleviation has achieved a huge success in reducing the gap between the designated poor counties and others. According to our analysis, the between-group gaps have declined remarkably relative to the within- poor- or- non-poor- group gaps. This, in particular, calls for a redefinition for the targeted counties, which, we believe, may help increase the effectiveness of future target supporting programs.

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APPENDIX : DATA

Prior to 1996, GVIAO and its agricultural share were calculated and extensively used in China, but they were gradually replaced by GDP measures between 1997 and 2000. This transition has been clearly reflected in the annually published CPFSMPCC, which reported GVIAO before 2000 and GDP measures after 1997.

In order to build up a consistent dataset for 1993-2002, we develop a reasonable and practical method to approximate the GDP levels for the period of 1993-1996. In our approach, GDP is approximated by a weighted sum of the two exclusive components for GVIAO, namely the gross value of industrial output (GVIO) and agricultural output (GVAO), by using a weight identical within a province but varying across province boundaries. The method thus comprises two stages. First, the weights are estimated through a regression of GDP on GVIO and GVAO province by province using the pooled county-level data from 1997 to 2000. Second, the county level GVIO and GVAO prior to 1997 are summed with the estimated provincial weights. Almost all the regressions at the first stage yield R^2 greater than 0.95, indicating a good fit of these GDP prediction models to our data. Therefore, the estimated GDP of 1993 to 1996, together with the reported GDP since 1997, are used as proxies for county level nominal income.

Chapter 3

Equalizing or not? Assessing the Intergovernmental Grants and their Incentive Effects in China's Fiscal Reform

3.1 Introduction

Intergovernmental grants, fiscal transfers between different tiers of the government system, have assumed an important role in China's fiscal reform. At times, these grants are directly designed for the purpose of intergovernmental fiscal equalization. At other times, the grants are by-products of general government programs that have been motivated by specific development concerns. In spite of the variation in their nature, the total amount of different grants is often huge and critical to the current process of fiscal expenditure decentralization. For instance, in 2002, the overall grant funding received by county level governments exceeded 39 percent of these local governments' total budgetary revenue and 43 percent of their budgetary expenditure.

Our goal in this chapter is to study how responsive intergovernmental grants received by local government units are to fiscal revenues collected by those units. The first and foremost concern over the relationship is for the degree of regional equity that grants have generated. From an efficiency perspective, it is desirable to implement intergovernmental grants that enable poorer regions to compete effectively with fiscally stronger ones. Such an equalization function may best fit current need in China, where the regional disparity, mainly attributed to biased industrial policies that have allowed policy-favored regions to exploit their position to promote growth at the expense of poorer ones, has grown rapidly in the past fifty years and is continuing to grow (Kanbur and Zhang 2005).

A secondary concern, however, is for the possibility of long-run grant dependency and the disincentive effect. Parallel to the case of individual transfers, intergovernmental grants that target the poor can probably cause an adverse incentive problem in recipients: if expecting that revenue reduction would induce a sharp increase in grants, potential recipients may spontaneously reduce their self-raising tax revenues; otherwise, they may increase revenues as much as possible (Chernick, 1979, Moffitt, 1992). These distortionary behaviors, which will be called as grant-driven "crowding out" or "crowding in" later in this chapter, can seriously undermine the efficiency of fiscal decentralization because transfer-dependent local governments have weak incentives to be fiscally accountable (Rodden, et al. 2003)

In the literature of public finance, the grant-driven crowding effect has been largely ignored. For example, the grant level is usually taken as an exogenous variable in many studies of the impact of grants on public spending. Most empirical tests (Weicher 1972, Gramlich, et al. 1973, Feldstein 1975, Case et al. 1993, Olmsted et al. 1993) in the context of the United States have found that a wide range of grants indeed increase the recipient's public spending, rather than reduce the tax revenue. The results, though overwhelming, are doubtful because they may have simply over-estimated the reaction of spending to grant receipts by failing to account for the possibility of the grant-driven "crowding in" effect. This point, for instance, is addressed by Knight (2002), who has developed a legislative bargaining model in which grant levels positively relate to preferences for public goods. Contrasting to previous studies, his empirical estimates imply that after correcting the endogeneity, grants do crowd out public spending.

Knight's study, in particular, highlights that grant allocation policies, under certain design limitations, are vulnerable to grant-seeking behavior of recipients who have substantially strong preference for grants. Such behavior not only supports the endogeneity of grant allocation, but can also play an even more important role than other existing arguments (Bradford and Oates 1971a, b, Courant, et al. 1979, Hines and Thaler, 1995) in determining the relationship of grants and tax revenue or public spending. Although Bradford and Oates's (1971a, b) collective choice model predicts that unconditional lump-sum grants, equivalent to a tax cut, lead to little or no increase in spending, Knight reveals that public spending on high-way projects positively correlates with actually received grants, but negatively correlates with as-if-exogenous grants, indicating that the grant-driven "crowding in" effect can dominate the 'normal' crowding out effect.

Recipients, however, may take varying strategies to seek for increased grant funds. The characteristic of grant polices are essential for predicting and understanding their fiscal responses. For example, the United States may be the wrong place to look for grant-driven crowding out behaviors, because fiscal equalization grants, which usually cause grants to negatively relate to revenues, have never amounted to much in its grant system (Oates 1999). In other words, the recipients' fiscal behavior relies on their expectation about how grants respond to tax revenues, which will eventually depend on observable characteristics of national or sub-national grant policies. This chapter will demonstrate that when a grant system consists of multiple motives, for instance fiscal equalization and project-implementation, the relationship of grants and tax revenues can be highly nonlinear, thereby resulting in differential behaviors among recipients with different fiscal capabilities.

The intuition for non-linearity in grant-and-tax-revenue relationships comes from the conjecture that grant responsiveness to local tax revenue depends on grantor governments' motives, and the motives will in turn depend on local revenue resources. The grantor government, for example, can have two different motives: fiscal equalization and project finance. The fiscal equalization motive suggests that the grant supply should respond negatively and substantially to locally sourced revenue whenever the local revenue level is at a very low margin. When the local revenue exceeds a benchmark, the rescue motivation might evaporate, even though the overall grants might not. They could continue to exist to fund projects or task assignments. However, the key point is that the second form of grants has mixed relations with local revenues, which will not necessarily yield dramatic and negative grant responsiveness. A similar logic has been employed in Cox, et al. (2004), where a significant nonlinear relationship between private income transfers and household income is found to be consistent with the co-existence of altruistic and exchange motives.

Does China's grant system produce the above nonlinear relationship? To answer the question, we test a variety of linear and non-linear models on the grant determination equation among county level governments in China. It turns out that a single-threshold linear spline model, which requires that counties with revenues below a threshold and counties with revenues above the threshold have different revenue coefficients, best fits our data. Above all, this finding provides strong evidence against the traditional linear specification for the grant-revenue relationship, indicating that recipients with different revenue capacities should not expect uniform responsiveness of grants to local revenues.

The second question of our interest is whether the grant allocation policies in China have lead to grant-driven crowding out (in) behaviors among recipients. This question can be answered by testing the endogeneity of locally generated revenues with respect to grants. Not to our surprise, the testing result supports the hypothesis of endogeneity, implying a divergent consequence that low-revenue-capacity counties tend to under provide tax effort while high-revenue-capacity counties tend to over provide. Since these behaviors can seriously undermine the efficiency of a grant system, future study on grant policies have to highlight the importance of policy design to incorporate the reactions of grant recipients.

Another interesting finding in this chapter is the remarkable disparity between rural and urban grant policies. Indicated by our estimation, rural grants negatively respond to revenues in the lower range and bear no relationship to revenues in the higher range, while urban grants positively relate to revenues in the high range and have no relation with revenues in the low range. The contrasting result, on one hand, implies that rural counties are more likely to receive equalization grants but less likely to obtain project-purposed grants. Accordingly, rural counties with high revenue capacity or urban counties with low revenue capacity might have been largely under-funded. On the other hand, since the rural pattern creates incentives for reducing tax effort and the urban pattern for increasing tax effort, the fiscal capacity gap that has already been present between rural and urban will probably be enlarged in the long run.

The rest of this chapter will proceed as follows. Section 3.2 examines the structure of intergovernmental grant system in China after the 1994 reform. Section 3.3 introduces the empirical methodology we will apply to test the nonlinear relationship and other hypotheses. The results are presented and discussed in section 3.4. And section 3.5 concludes the chapter.

3.2 China's grant system

A feature of China's grant system is that the grant flow is entirely vertical, as horizontal transfers are almost nonexistent. In such a framework, the government at the next level up is the only possible grant provider to a local government. Essentially, we will demonstrate that because upper-level governments have two different motives for giving grants, namely safety net provision and project implementation, the grant-revenue relationship could vary with the dominant motive, which in turn depends on local revenue resources.

The multi-tier government system may add complexity to our analysis, since it is always possible that sub-national governments, such as provinces, prefectures and counties, might not implement a policy in exactly the way that the center expected. Actually, sub-national governments, after receiving grants from their upper level government, are free to make their own reallocation decisions according to local conditions (State Council 2002). Therefore, even though the center seems to have placed great importance on fiscal equalization objective, it is still in doubt whether those sub-national governments will follow the center closely. In other words, all the governments at the intermediate level, as well as the center, are critical in assessing grant policy outcomes.

3.2.1 The central government's grant policy

Previous studies have shown that China's grant system reflects three major objectives of the center: taxation mobility, fiscal task implementation and fiscal resource equalization.

The 1994 fiscal reform initiated a special category of grant called "tax return" to enhance lower-level governments' taxation mobility within a tax-sharing framework. The level of tax return is set to increase proportionally to the additional increment in VAT and consumption tax that have been collected by the central tax administration, i.e. State administration of taxation (SAT later), from a local tax base. Bahl (1999) argues that the tax return is essentially an incentive mechanism by which the center can induce local governments to increase potential tax bases for centrally collected taxes, and thereby has no clear role in regional redistribution. However, it is observed by Li (2003) that the tax return can largely act against fiscal equalization in that regions with large revenue capacity usually receive a greater amount of tax return grant money than regions with small revenue capacity. The reason underlying this observation is that local governments, in fact, have no discretion to raise the tax rate, and their ability to expand the tax base necessarily relies on economic prosperity.

Meanwhile, it has been shown that the earmarked grant, one of the largest grants in China, bears little relevance to fiscal equalization. Li (2003) indicates that the earmarked grant is made up of a wide range of project- or spending- oriented grants, among which those targeted to economically underdeveloped areas, consisted of only 11.85% in 1997. Additionally, because some grants under this category require recipients to provide matching funds, the earmarked grant has often been proved to tilt toward more economically developed areas.

However, some evidence suggests that since 1994, a series of transitional reforms have been implemented to address the concerns of regional disparity of public resources and services. Liu (2003) documents that a new category of grant, called the "transfer payment subsidy", was introduced in 1995 to cover the gap in local standard public spending and local standard revenue, especially in regions with unusual fiscal difficulties. While Li (2003) argued that its overall size has been too small to correct the unequal fiscal resource distribution, the transfer payment subsidy has dramatically increased its share in the central government's total revenue, namely from 0.64% in 1995 to 1.61% in 2001, indicating fiscal equalization has attracted growing attention in the dynamic central-provincial grant system. In addition, according to Zhang (2003), another type of grant called the "minority region subsidy" was initiated in 2000 and set to target those traditionally minority-populated areas, which are usually backward in economic conditions for geographical or historical reasons. Undoubtedly, this move also indicates the center's objective to remove the fiscal gap in very poor regions.

Tracing the history of the center's grant policies, we can perceive that while fiscal equalization is not a driving force of the 1994 tax reform, it has become more and more important in the subsequent adjustments of intergovernmental relationships. However, equalization grants are not set to achieve absolutely equal public spending in spite of local fiscal capacities. Their function, to a greater degree, is to offer a fiscal safety net to regions with scarce revenue capacity so that their basic need for public service could be matched. Meanwhile, self-sufficient regions, which usually have no access to equalization grants, may obtain earmarked grants associated with specific development projects.

3.2.2 Grant structures and the decision power of sub-national governments

According to a classification by the Ministry of Finance, thirteen categories of grants are available to county-level governments in 2002. Several documents indicate that the tax return is regulated by the center and usually calculated by identical formulas even among different provinces. Since we will focus on the grants under the discretion of sub-national governments, the tax return will be excluded from our empirical analysis.

The rest of twelve grants can be further divided according to their practical objectives into three major classes: general-purpose grants, policy related grants and earmarked grants. The general-purpose grants, which are the old system grant, the transfer payment grant and the minority region grant, are provided on a need basis. Policy related grants are those given to help implement certain income or macro policies; they are the wage grant, the income-tax-base adjustment grant, the clearance grant, the agriculture reform grant, the bond issuance grant, the schoolteacher grant and the policy adjustment grant. Earmarked grants are those that are conditional on spending projects, such as capital constructions and social relief for calamities.

General-purpose grants are essentially priority transfers to regions in dire fiscal straits. The transfer payment grant, started in 1995, is designed to rescue counties whose "standard revenue" can't afford to pay off their "standard expenditure". The minority region grant is designed to help minority-populated regions with backward economic conditions. Slightly different is the old system grant, in which both donors and recipients were selected in 1988 and seldom changed since then. This grant can roughly belong to this class, because all the recipients, except for a few, are regions with deficient public services and stagnant economic conditions, as indicated by Liu (2003). It is worth noting that, in addition to their common function in assisting fiscal equalization, a distinctive feature of these three grants is that their distribution process are both transparent and objective, leaving sub-national governments little room to play against the center's purpose.

Policy-related grants are more complex in nature. On one hand, most of these grants are to compensate local governments for fiscal loss caused by the center's macro or income policies. Thus, the level of a policy grant usually depends on how seriously the local government will be affected by the policy. For example, the forest reservation grant, which mostly goes to the western or mountain counties, can serve to channel more fiscal resources to poor regions. On the other hand, the allocation rules for several policy grants such as the wage grant and the bond issuance grant may already take into account regional economic inequality. Zhang (2003) indicates that when the center raised the wage rate for government employees in 1999 and 2001, only western and central regions were offered the wage grant to cover the additional expenditure.

According to Li (2003), the center has increased the number of earmarked grants, some of which, despite being relatively small, have an equalizing function in that they are funds supporting construction in inland and economic underdeveloped areas. However, the majority of earmarked grants such as those for capital construction require local matching funds, which can counteract equalization grants by making regions with small fiscal capacity less competitive in grant application than ones with large fiscal capacity. Another feature that may undermine the role of earmarked grants as an equalization tool is the absence of clear and uniform formulas for allocation. Under such a condition, earmarked grants as well as most policy-related grants are likely to be exposed to arbitrary allocation processes, and thus could become redistribution loopholes, by which sub-national governments may reinforce or offset the center's equalization policy.

It is noted a sub-set of policy-related or earmarked grants are capable of serving as instruments for fiscal equalization, even though their original purposes don't state so. This will happen especially when the allocation rules of these grants are subject to the discretion of sub-national governments seeking to redress regional inequality. Taking account of this point, this chapter will use an aggregate of all the grants (excluding the tax return), rather than the general-purpose grant alone, to study the allocation of fiscal equalization grants.

Figure 3.1 gives the relative size of each grant received by 2815 counties in 2002, indicating that the share of general-purpose grants is only 8.9%, while the shares of earmarked grants and policy-related grants are 22.4% and 46% respectively. Figure 3.2 compares the structure of grants received by rural counties with that of grants received by urban counties. From this figure, it can be observed that rural counties tend to receive more funds in almost all the grant categories except for the earmarked grant, the income-tax-base adjustment grant, the clearance grant and the "others grant". Since urban counties have average per capita revenues twice as large as rural counties, the result might imply that these four grants can be viewed as anti-equalization grants.

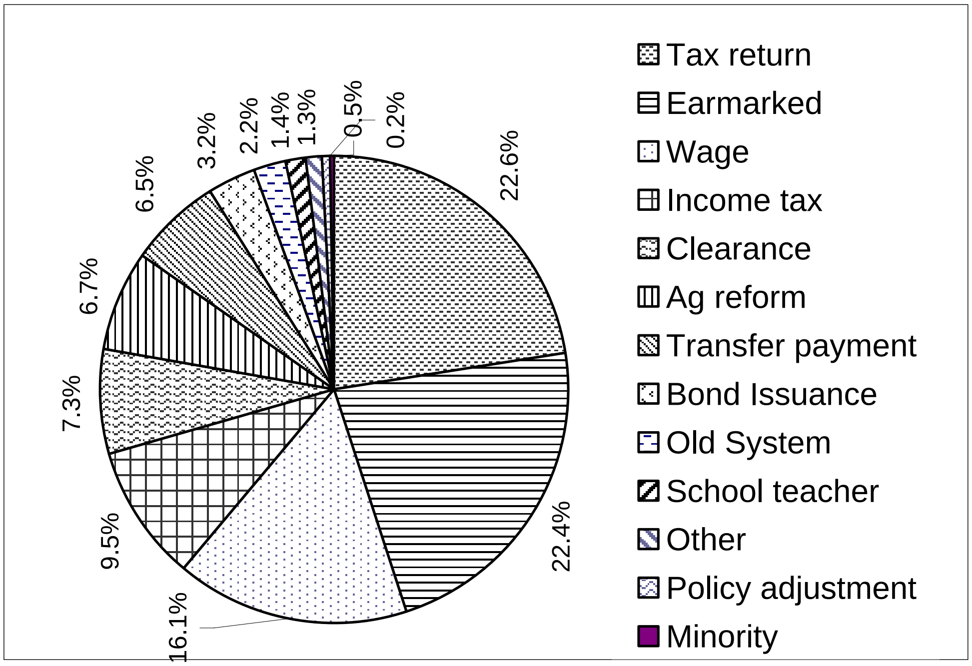

Figure 3.1 Composition of grants received by counties in 2002

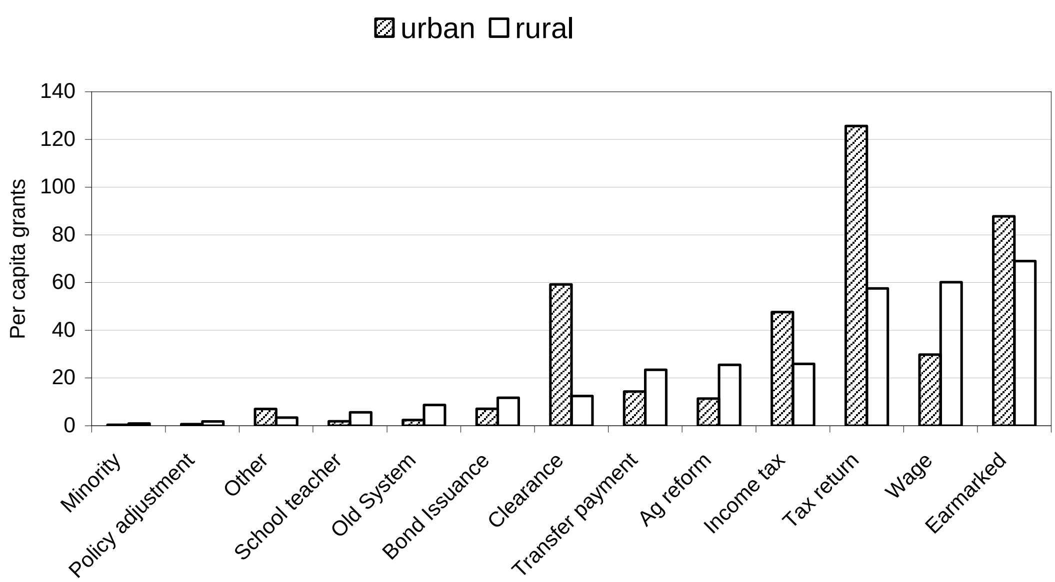

Figure 3.2 Comparison of grant structure in rural and urban counties: 2002

Most importantly, China's grant funds to local governments, as demonstrated above, comprise two major purposes: provision of a fiscal safety net to revenue-scarce jurisdictions and exchange for project or policy implementation in local jurisdictions. Ideally, the safety-net grant, ensuring minimum standard public services to be provided at jurisdictions lacking revenue capacity, varies strongly and negatively to the local revenue level only if the local revenue collection can't match the standard spending need. When the local revenue otherwise exceeds the standard, the safety-net grant becomes zero and locally received grant becomes purely project-oriented. Since the project-implementation grant, which most often requires matching funds from recipients, is biased in favor of high-revenue jurisdictions[4], the response of overall grant supply to local revenues, therefore, is expected to be positive for self-sufficient recipients, but negative for the self-insufficient ones.

3.3 Methodology

Our policy analysis predicts a non-linear grant-revenue relationship, which is featured by a dramatic turning point at a certain value of tax revenues. To verify this relationship, we apply a threshold model to estimate net grant receipts, *G*, the gross grants received by counties deducted by gross transfers to the upper level governments.

3.3.1 Specification

The grant supply function is estimated by a continuous linear spline model with a single knot. The essence of the model lies in three points: (1) The regression function of the dependent variable, *G*, is restricted to being linear and continuous in all the explanatory variables; (2) the coefficient on the regressor of our interest, which is the budgetary tax revenue, *R*, is not constant in two regimes which are determined by

[4] Bradhan and Mookherjee (2006) pose that with the capture of the local (province) government, there is a tendency for the local (province) government to over-provide the service to local elites (rich counties) at the expense of the non-elite.

whether or not the budgetary tax revenue does exceed a threshold value; (3) the threshold value is assumed to be exogenous, implying that other regressors don't influence the regime switching[5]. Suppose K is the threshold level of the budgetary tax revenue, at which the slope of the linear regression line changes. Let $d(K)$ denote a dummy variable whose value is unitary if $R \leq K$ and zero otherwise, where R is the local revenue level. Then the spline regression function for grant allocation can be specified as

$$G = \alpha_1 d(K)(K - R) + \alpha_2 (1 - d(K))(R - K) + \beta Z + \varepsilon \quad (3.1)$$

where α_1, α_2, and β are constants, Z represents other regressors, and ε is an error term. Clearly, equation (3.1) says that the partial effect of R on G can take either $-\alpha_1$ or α_2, depending on whether a low-revenue or high-revenue regime exists.

Table 3.1 lists the dependent and independent variables to be used in our estimation. To control for local fiscal needs, we include in the grant function a number of demographic and economic variables, which are per capita GDP, agriculture share in production, manufacture share in production, population size, fiscal surplus in the previous year, and government employee share in population. First, since county level governments are responsible for providing infrastructure investment for agriculture or manufacture production, we will use per capita GDP, agriculture share and manufacture share in production to control for counties' need for basic infrastructure investment. Second, because counties are also responsible for providing most public services such as school education, health care and social security, demographic variables such as population size and shares of young people and old people in the population should be used to control for the standard need for public service. But

[5] This exogeneity assumption is made to insure statistical consistency and efficiency. We will discuss how to relax this assumption in section 3.3.4 and 3.3.5.

Table 3.1 Summaries of fiscal, economic and demographic variables for grant recipients in 2002

		Urban		Rural		Pooled	
	Unit	Mean	Std	Mean	Std	Mean	Std
observations		726		2029		2755	
Fiscal variables							
Grants	yuan per capita	279.84	270.56	403.26	400.27	370.74	374.45
Local revenues	yuan per capita	509.67	685.03	225.24	242.25	300.19	427.15
Tax returns	yuan per capita	117.35	198.76	57.11	83.50	71.97	125.14
Fiscal surplus in the previous year	yuan per capita	38.89	91.06	8.75	89.68	16.69	91.00
General economic conditions							
GDP	yuan per capita	17061.58	13780.07	5811.68	4681.98	8776.26	9523.81
Agriculture share	ratio	0.12	0.13	0.33	0.15	0.27	0.17
Manufacture share	ratio	0.43	0.16	0.34	0.15	0.36	0.16
Population characters							
Population	10,000	40.27	29.43	46.35	34.69	44.75	33.49
Government Employees	1 / 100 people	2.35	1.14	3.26	1.61	3.02	1.56
Geographic characters							
Central	ratio	0.42	0.49	0.38	0.49	0.39	0.49
Western	ratio	0.17	0.38	0.35	0.48	0.31	0.46
IV variable							
Local revenues in 1993	yuan per capita in 2002 price			129.31	132.21		

since population structure variables are not available at the county level, we only include population size to meet this requirement. Third, in presence of soft budget constraint, the grantor would take a fiscal deficit as an indicator for urgent need of fiscal support, therefore fiscal surplus in the previous year is used to control for fiscal need associated with deficit traps. Last but not least, China's grant system has a specific concern for wage payments to local government employees, whose pay rates are uniformly preset by the center. Usually, counties with a large number of public employees need more funds to sustain the operation of government offices. Thus, we use the share of government employees in the population to control for the fiscal need associated with administrative operation.

In a multi-tier government system, the governments on the same tier such as provinces may hold different preferences regarding grant redistribution. It might be the case that two counties in different provinces can receive different amount of grant funds even when other conditions being equal. Therefore, we also include provincial and regional indicators to control for the preference difference arising from grantors' location.

3.3.2 Estimation

To estimate the threshold *K* and other parameters simultaneously, we will employ a non-linear least square approach (NLLS), which minimizes the sum of squared errors associated with regression function (3.1). Hansen (1999) suggests that the approach be carried out in three steps: first, the model is estimated by OLS for every possible *K* and the sum of squared errors is saved in accordance with each value of *K*; second, the optimal *K* is determined by searching for the one which corresponds to the lowest sum of squared errors; last, the other parameters in the model are estimated by OLS using the selected value of *K*. We follow his routine closely except that in the second step we exclude the 5 percent highest and lowest values of the threshold variable, R, from the threshold search. In doing so, we ensure that each regime contains at least 5 percent of the population.

3.3.3 Specification tests

We test the single-threshold linear spline model with several alternative specifications: a standard linear model, polynomial models up to the 6th order, a linear-quadratic spline model with a single knot, and a linear spline model with double knots. Among them, a linear –quadratic spline model allows the spline function to be quadratic in the higher-revenue regime and the linear spline model with two knots takes the following form

$$G = \alpha_1 d(K_1)(K_1 - R) + \alpha_2 (d(K_2) - d(K_1))(R - K_1) + \alpha_3 (1 - d(K_2))(R - K_2) + \beta Z + \varepsilon \tag{3.2}$$

where $d(K_i)$ equals 1 if $R<K_i$, otherwise 0, and $K_1<K_2$. In principle, the NLLS approach can be used to search for a pair of (K_1, K_2) yielding the lowest sum of squared errors in OLS. However, such a search may add to computational burdens greatly, especially when the data size is large. An alternative method that can effectively save searching time is a two-step Wald test in which K_1 first takes the estimated value of K in equation (3.1), and then K_2 will be estimated by a search process. According to Hansen (1999), this estimation method, originally proposed and proved by Bai (1997) and Bai and Perron (1998), can produce consistent estimates of (K_1, K_2).

Following Hansen (1999), we implement a least-squares test, in which the hypothesized model is rejected in favor of the alternative model if the F statistic as follows

$$F = n\left(\frac{SSE_h - SSE_a}{SSE_a}\right) \tag{3.3}$$

takes extremely large values. In (3.3), SSE_n and SSE_a are the sum of squared errors in the hypothesized model and the alternative model, respectively, and n indicates the sample size. The distribution of the above F statistic usually attains asymptotic properties of the conventional χ^2 distribution, but it may depart markedly if conditional heteroskedasticity presents; therefore we compute the *p*-value by a bootstrap method[6] in which the *p*-value is approximated by the percentage of 1000 independent draws that exceed the observed value of F.

3.3.4 Testing for endogeneity

Although Chan and Tsay (1998) have proved that the estimation procedure in section 3.3.2 can render efficient and consistent estimates, the estimates in the grant function may not have the desirable properties since revenues usually are not exogenously determined. Intuitively, an endogeneity problem will arise because revenues are correlated with the error terms in the grant function, which reflect counties' unobserved preferences for grants.

We use an IV approach to test and correct for the endogeneity of tax revenues. Since the endogeneity of the threshold variable can bias the LS estimate for *K*, we modify the original three-stage approach as : first, local revenue is regressed on an extended set of regressors including exogenous variables in equation (3.1) and selected instrument variables; second, the estimated revenues, instead of the original local revenues, are used by the NLLS approach in search for the optimal threshold *K*; third, the slope coefficients in equation (3.1) are estimated by using GMM with a threshold value of *K* fixed at the optimal level obtained at the previous stage. The estimators of this procedure, called IV GMM later, are consistent according to Caner and Hansen (2004).

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[6] A more technical discussion about this bootstrap approximation can be found in Hansen (1999).

The instrument variable selected for this purpose is tax revenue in 1993, which is expected to be orthogonal to the grant function residuals and correlated with the revenue of current year. On one hand, this variable is free from the impact of grant incentives, thereby satisfying the first requirement. The intuition, in particular, comes from the perception that the intergovernmental grant before the 1994 fiscal reform had a relatively small size such that the overall influence of grant allocation on recipients' revenue level was negligible. To verify the second requirement, we use the t-test to examine the statistic significance of the instrumental variable coefficient at the first stage regression. The result, as will be shown in the next section, supports the validity of this instrumental variable.

Meanwhile, a Durbin-Wu-Hausman (DWH) test for the endogeneity of revenues will be carried out at the third stage. To be consistent with the routine of DWH tests, we employ a two-stage least squares (2SLS) model, rather than the IV GMM model, to compare with the LS model. Such a test is valid because conditional on a large sample size, the 2SLS model can also produce consistent estimates for a threshold spline model with endogeneity problems (Caner and Hansen 2004). In particular, this test, focused on the consistency of slope estimates, assumes that the threshold used in both comparison models are identical and equal to the value of the consistent estimate obtained from the IV GMM approach.

3.3.5 Testing for sample partition

The above estimation and test procedures all rely heavily on a critical assumption that the threshold value K is exogenous to all the regressors in the grant function. In practice, one may need to relax this assumption if, for example, one believes that the grantor may change his preferences with some perceived characteristics of recipients, such as whether they belong to a rural or urban region. A simple yet informal way to test the null hypothesis that K doesn't vary with a regressor variable is to divide the whole sample by the values of a suspected regressor, then compare the estimated coefficients in split samples with those in the pooled sample.

In a more formal way, we conduct an F (or Wald) specification test, in which revenue variables are multiplied by group dummies in estimation and the revenue coefficient estimates for one group are jointly tested against those for the other group. We partition the population of counties according to urbanization level (whether a county belongs to rural or urban regions), and repeat the sample partition test by using five different specification models. The more often the null is rejected, the more robust is the decision to split the sample according to urban-rural classification.

3.4 Data and empirical results

3.4.1 Data

The data used in this chapter mainly come from the *China Public Finance Statistics Materials for Prefectures, Cities and Counties* (CPFSMPCC), published by the Ministry of Finance. It covers budgetary public finance information as well as basic economic statistics for every jurisdiction at the county level: counties, urban districts located in prefecture-level cities, and county-level cities. In this chapter, we use the data of 2002, mainly because the techniques described in section 3.3 are temporarily not applicable to panel analysis[7]. In addition, the rural budgetary revenues in 1993 are available in the 1993 issue. Because of data limitation, the endogeneity test and the IV NLLS estimation will be performed among rural counties only.

The revenues in 1993 are expressed in terms of the price in 2002 by multiplying the original revenues by the provincial ratio of the Consumer Price Index (CPI) in 2002 to the CPI of 1993. The CPIs are collected from *China Statistics Year Book* of 2003.

[7] Another reason for choosing 2002 is because CPFSMPCC only publishes both rural and urban data for every province since 2002. Prior to this year, most provinces don't have urban data.

Our empirical analysis will be restricted to counties and districts that received net grants in 2002. In doing so, about 33 observations, accounting for only 1.1% of the total number of counties, were left out. The net grant recipients consist of 2755 counties or districts: 2029 rural counties and 726 urban ones, which are spread across all the 31 provinces in China.

Since urban districts are usually able to receive preferential policies due to location advantage, the grant policies faced by rural and urban counties may be substantially different. For comparison purposes, the two groups, as well as the pooled data, will be examined separately. Table 3.1 presents the summary of a set of fiscal, economic and demographic variables by different groups. The rural counties, whose GDP per capita is less than half of the urban GDP per capita, have larger per capita grant receipts, but smaller per capita tax revenues in 2002. In the rural group, grant receipts account for 58.8% of total fiscal income (defined by the total amount of grants, local revenues and tax returns). In the urban group, these receipts only account for 31.2% of total fiscal income.

In this data set, we also find evidence for the existence of fiscal disparity within rural and urban counties. It is surprising to observe that urban counties have greater revenue inequality than rural counties, as the coefficients of variation for revenues among urban and rural counties in 2002 are 1.34 and 1.08 respectively. Meanwhile, the revenue disparity in rural counties slightly increases over the period from 1993 to 2002, as the coefficient of variation rises from 1.02 to 1.08. Such a change throws doubt on the equalizing function of the recent grant policies, thereby motivating us to thoroughly explore the distributional characteristics of grants.

3.4.2 Non-parametric evidence for non-linearity

In the literature, linear models may have been overused to estimate the grant allocation equation. Our concern is that if the relationship between grants and

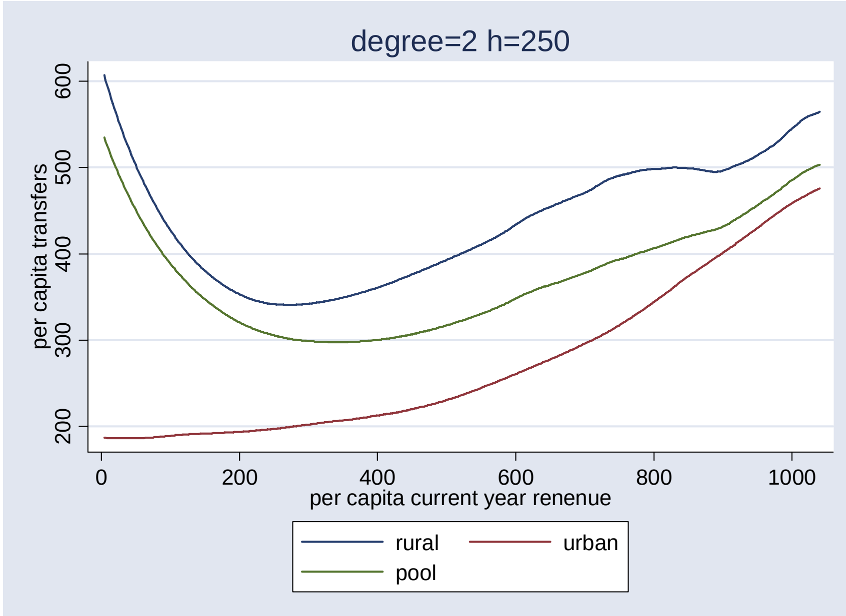

Figure 3.3 Local polynomial regression of grant receipts on tax revenues

revenues is actually non-linear, using a linear model will produce inconsistent coefficient estimates. In comparison with parametric approaches, the advantage of anon-parametric approach lies in its independence of model specification, or assumptions for error term distribution (Hardle, 1990, page 5). Thus, we use a non-parametric approach to explore a general relationship between grant receipts and tax revenues. Figure 3.3 provides the results of using a local polynomial regression procedure with a second order polynomial function and a window width of 250 yuan. This figure shows that the two curves associated with all the counties and rural counties are both in a "U" shape, roughly conforming to our prediction of a non-linear model with a single kink. But for urban counties, the curve doesn't have a significant kink, even though it appears to be non-linear.

3.4.3 Estimation

Estimation results for rural, urban and pooled counties are presented in Table 3.2 , Table 3.3 and Table 3.4 respectively. In each table, the linear spline model with a

Table 3.2 Parametric regressions for rural counties

	(1)		(2)		(3)		(4)		(5)	
	Linear		Polynomial		Linear spline		Linear / Quadratic		Double threshold LS	
Variable	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E
Revenue	-0.027	0.079	-1.809	0.365						
Revenue threshold (K1)					119.717	7.573	99.234	7.196	55.000	13.330
Revenue threshold (K2)									119.717	7.863
Revenue below K1					-2.258	0.406	-3.038	0.620	0.651	1.672
Revenue above K1					0.015	0.073				
Revenue-K1							-0.159	11.845		
(Revenue-K1)^2							0.822	0.362		
Revenue between K1 and K2									-2.408	0.570
Revenue above K2									0.010	0.076
Revenue^2			52.951	12.633						
Revenue^3			-647.562	212.051						
Revenue^4			3662.143	1571.875						
Revenue^5			-9658.088	5048.215						
Revenue^6			9683.441	5778.548						
Surplus_1	0.218	0.136	0.227	0.129	0.200	0.134	0.214	0.134	0.216	0.136
GDP	0.005	0.003	0.007	0.003	0.004	0.003	0.006	0.003	0.006	0.003
Agriculture	-244.566	62.940	-89.669	56.783	-326.385	74.076	-316.556	70.858	-172.344	79.260
Manufacture	-570.818	66.375	-328.563	55.763	-552.057	69.932	-522.736	69.318	-411.099	84.135
Employees	179.830	13.948	187.276	15.702	182.402	14.252	183.803	14.190	185.102	16.353
Central	1.224	14.409	-5.552	15.022	-8.218	14.825	-12.957	14.512	-2.350	12.863
Western	181.547	17.235	167.004	19.616	148.398	18.990	148.500	18.738	157.366	16.895
Observations	2029		2029		2029		2029		2029	
R^2	0.674		0.686		0.685		0.686		0.684	
K1 quantile					0.305		0.209		0.050	
K2 quantile									0.305	

Table 3.3 Parametric regressions for urban counties

	(1) Linear		(2) Polynomial		(3) Linear spline		(4) Linear / Quadratic		(5) Double threshold LS	
Variable	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E
Revenue	0.188	0.027	-0.765	0.182						
Revenue threshold (K1)					529.084	164.099	647.206	157.843	529.084	58.572
Revenue threshold (K2)									1220.254	325.391
Revenue below K1					0.036	0.051	0.061	0.043	-0.199	0.088
Revenue above K1					0.211	0.032				
Revenue-K1							0.277	0.055		
(Revenue-K1)^2							-0.131	0.068		
Revenue between K1 and K2									0.373	0.090
Revenue above K2									0.173	0.034
Revenue^2			14.287	3.044						
Revenue^3			-84.743	21.818						
Revenue^4			228.578	69.405						
Revenue^5			-277.585	97.030						
Revenue^6			122.287	47.802						
surplus_1	0.400	0.163	0.351	0.149	0.382	0.162	0.339	0.165	0.361	0.159
GDP	-0.0001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Agriculture	-24.109	58.880	-39.972	61.024	-36.168	60.084	-2.963	58.515	-65.919	57.823
Manufacture	-37.380	45.802	76.814	43.325	7.307	52.558	29.130	53.292	35.341	42.424
Employees	73.379	14.424	98.038	18.170	83.175	14.000	81.769	14.246	90.389	17.521
Central	31.960	15.147	41.984	14.573	35.008	13.811	40.420	13.489	33.738	14.103
Western	62.601	20.510	87.262	19.482	73.425	19.916	77.704	19.863	80.311	19.504
observations	726		726		726		726		726	
R^2	0.565		0.609		0.584		0.589		0.596	
K1 quantile					0.740		0.784		0.740	
K2 quantile									0.906	

Table 3.4 Parametric regressions on pooled data

	(1)		(2)		(3)		(4)		(5)	
	Linear		Polynomial		Linear spline		Linear / Quadratic		Double threshold LS	
Variable	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E
Revenue	0.124	0.029	-1.019	0.188						
revenue threshold (K1)					130.922	6.109	118.609	5.962	130.922	7.689
revenue threshold (K2)									671.400	134.772
Revenue below K1					-2.027	0.288	-2.421	0.360	-1.809	0.295
Revenue above K1					0.138	0.027				
Revenue-K1							0.072	0.040		
(Revenue-K1)^2							0.152	0.090		
Revenue between K1 and K2									-0.083	0.069
Revenue above K2									0.186	0.034
Revenue^2			17.517	3.544						
Revenue^3			-111.556	27.362						
Revenue^4			326.647	92.582						
Revenue^5			-425.411	134.997						
Revenue^6			197.804	68.213						
surplus_1	0.181	0.052	0.199	0.116	0.163	0.116	0.179	0.115	0.185	0.116
GDP	0.0003	0.0006	0.003	0.001	0.0005	0.001	0.001	0.001	0.002	0.001
Agriculture	-142.303	32.127	-115.261	44.524	-237.620	55.381	-244.898	55.275	-267.281	55.499
Manufacture	-413.631	25.303	-216.727	35.372	-396.392	35.794	-392.445	35.697	-371.161	34.475
Employees	162.379	3.001	174.503	13.307	166.706	11.852	168.416	12.029	170.580	12.138
Central	14.941	10.739	4.567	11.773	0.786	12.058	-1.520	12.307	-9.021	12.437
Western	170.554	11.990	160.934	15.760	137.661	16.052	137.316	16.067	137.154	16.063
Rural	-36.914	15.021	-14.247	13.933	-26.399	14.801	-24.463	14.719	-20.903	14.461
observations	2755		2755		2755		2755		2755	
R^2	0.629		0.653		0.645		0.647		0.650	
K1 quantile					0.321		0.262		0.321	
K2 quantile									0.917	

single threshold, i.e. model 3, is contrasted with four alternatives, which are a standard linear model (model 1), a 6^{th} order polynomial model (model 2), a linear-and-quadratic spline model (model 4), and a linear spline model with two thresholds (model 5). The first three parameters in model 3 are essential to the nonlinear relationship between grants and local revenues. The estimate of the rural revenue threshold is 119.717 yuan per capita, corresponding to the 31^{st} sample quantile. For rural counties whose revenues are below 119.717 yuan per capita, their grant allocation function has a slope of -2.258, indicating that lowering revenues can bring up a remarkable increase in grant supply. For rural counties above the revenue threshold, the slope of their grant function is 0.015, which, however, is not statistically significant. Contrastingly, the urban revenue threshold, 529.084, locates at the 74^{th} sample quantile, below which the slope of the grant function is 0.036 but insignificantly different from zero, and above which the slope becomes 0.211, implying higher revenues can induce more grants. The patterns for estimates using pooled data are quite similar to rural patterns. The threshold, 130.922 yuan per capita, and the slope for the low revenue regime, -2.027, are both much closer to the rural results. The only difference is that counties with revenues above the threshold have a slope of 0.138, which is significantly different from zero. In sum, these results can justify two important features of the grant system: equalization grants are more prevalent in low-revenue rural counties but not operative in high-revenue or urban counties; project grants are effective only in high-revenue urban counties, but hardly available to low-revenue or rural counties.

Besides revenue variables, only two variables in model 3 have estimated coefficients that not only are always statistically significant but also have consistently yielded the same sign in rural, urban and pooled results. One is the number of government employees as a share of the population, which is revealed to be an important factor inducing more grants. In this point, our study agrees with Shih and

Zhang (2007). The other is the dummy variable for counties in the western region, the most economically backward area in China. These counties, indicated by our results, have received more grants than the eastern counties. Therefore, strong evidence suggests that the current grant system has placed great importance on supporting administrative operation and reducing regional disparity.

Some results, however, seem to contradict the traditional expectations. For instance, it is observed that after controlling for other factors, the agriculture and manufacture shares of production significantly and negatively correlate to grant supply to rural counties, implying that the fiscal need for supporting the third industry, namely service industry, prevails in the process of rural grant allocation. Another example is the estimates for the previous year's fiscal surplus, which are positive in all the selected samples, yet only insignificant in the rural sample. In other words, our data don't appear to support the soft-budget hypothesis in which counties with larger budget deficits are supposed to obtain more grants from the government at the upper level.

In Table 3.4, we also notice that the rural dummies always yield a significantly negative impact on the grant supply. That is to say, when other factors being controlled for, a county can expect more grants from the above if it is labeled as urban rather than rural administration. This, therefore, constitutes direct evidence of grantors' preference for urban areas.

3.4.4 Tests of sample partition

It is revealing to notice that the dramatic difference between the rural and urban estimates that has been observed in model 3 is not an occasional phenomenon at all. In fact, the different patterns of rural and urban estimates can be found in each of the five models. For instance, in model 1, the marginal effect of local revenues among rural counties is -0.027, taking the opposite sign to the estimated result for urban

Table 3.5 Wald tests of sample partition by urbanization

(Ho : Revenue coefficients are identical in different sub-groups.)

	Wald statistics	Degree of Freedom	P-value	conclusion
Model 1	8.82	1	0.003	Reject
Model 2	9.37	6	0.154	Don't reject
Model 3	12.48	3	0.006	Reject
Model 4	11.35	4	0.023	Reject
Model 5	10.98	5	0.052	Reject

counties, which is 0.188. The results of contrary signs in rural and urban estimates are also found in model 4 and model 5. Moreover, even though model 2 results in the same sign for all the coefficients of revenue variables in rural and urban samples, their magnitude is strikingly different. Another obvious difference between rural and urban samples is the substantial disparity between threshold values in models 3, 4 and 5. What we have perceived seems to suggest that the grant allocation function faced by rural counties exhibits a pattern different from what suits urban counties.

The hypothesis of no difference between rural and urban samples is formally examined by using a Wald test in which a two-regime model and a single-regime model are estimated and compared. The Wald test statistics associated with model 1 to model 5, as reported in Table 3.5, are 8.82, 9.37, 12.48, 11.35 and 10.98, respectively, four of which are significant at the 5% significance level, suggesting rural and urban counties should be separated to estimate the grant allocation function.

3.4.5 Tests of nonlinearity and specification

The primary concern about the specification of grant function is whether a conventional linear model can appropriately fit the data. We perform a test of the linearity hypothesis against the linear spline hypothesis, which boils down to testing

Table 3.6 Bootstrap tests of polynomial grant functions against spline grant function

Polynomial Order	# of bootstrap replications	Rural (2029)		Urban(726)	
		Wald statistics	P-value	Wald statistics	P-value
1	1000	69.416	0.000	14.982	0.001
2	1000	52.547	0.000	59.434	0.000
3	1000	64.889	0.001	46.096	0.000
4	1000	44.005	0.004	52.714	0.000
5	1000	32.242	0.006	13.905	0.226
6	1000	26.981	0.011	9.342	0.780
7	1000	27.514	0.024	11.333	0.713

whether the regression slopes in high and low revenue regimes are identical. The Wald statistics and their corresponding *p*-values are reported in the first row of Table 3.6. In the rural column, the p-value of 0.000 means that none of the 1000 replications can yield a Wald statistic greater than the observed value of 69.416. Consequently, the linear relationship is rejected in favor of a linear spline. The same conclusion is obtained in the urban column.

Secondly, we are interested in the question whether the linear spline model can do better than polynomial models with second or higher orders. The specification test of a polynomial model against a linear spline model is repeated for all the orders up to 7 and the results are also presented in Table 3.6. Again, for the rural samples, the spline structure is accepted at the 5% significance level by contrasting it with the polynomials of all the orders below 8. But for the urban samples, the acceptance of the spline structure doesn't occur when the order of polynomials rise above 5. Accordingly, we can infer that the grant function for rural counties has a stronger tendency to take the proposed spline specification.

Another concern one may address is whether two regimes are sufficient to capture the nonlinearity of the grant-revenue relationship. In response to this concern, we propose two modified spline models, one of which allows the high-revenue regime

Table 3.7 Bootstrap tests of single knot spline against other splines

	# of bootstrap replications	Rural			Urban		
		Wald statistics	*P*-value	conclusion	Wald statistics	*P*-value	conclusion
Linear-quadratic spline	1000	9.432	0.452	don't reject	13.554	0.223	don't reject
Double-knot spline	1000	-1.368	0.982	don't reject	21.612	0.381	don't reject

to take quadratic form and the other of which imposes two knots, thereby three regimes, to test against the single-knot linear spline. The results are presented in Table 3.7. None of the test statistics can approach the significant level of 5 %, which provides strong evidence for not rejecting the null hypothesis of a single-knot linear spline in favor of a two-knot spline or a linear-quadratic spline.

The statistical test results in this section jointly prove that the linear spline model with a single knot can best fit in the grant allocation function with our data set. This conclusion matches the prediction we have obtained from the theoretical model for grant behaviors.

3.4.6 Endogeneity test

Table 3.8 reports the rural results of model 6 and model 7, which use the IV NLLS approach for estimation of the threshold value. Their difference lies in that model 6 uses GMM to estimate slope coefficients and model 7 uses 2SLS. In spite of this, the results of these two models are quite similar, reflecting the large sample asymptotic property of consistency. For comparison, we also present in Table 3.8 the results of the linear spline model that doesn't use an IV approach (model 3). As Table 3.8 indicates, model 7 (or model 6) and model 3 don't always yield similar coefficient estimates. The threshold revenue predicted by the IV approach is 109.02, which is

Table 3.8 Grant allocation functions for rural counties

Variable	(6) IV GMM		(7) 2SLS		(3) Linear spline	
	Coefficient	Het St E	Coefficient	Het St E	Coefficient	Het St E
Revenue threshold (K1)	109.023	8.604	109.023	8.604	119.717	7.573
Revenue below K1	-5.967	2.190	-5.033	2.869	-2.258	0.406
Revenue above K1	-0.019	0.107	-0.102	0.919	0.015	0.073
Surplus_1	0.180	0.129	0.205	0.121	0.200	0.134
GDP	0.007	0.005	0.005	0.005	0.004	0.003
Agriculture Share	-478.993	140.818	-483.234	139.240	-326.385	74.076
Manufacture Share	-541.576	74.678	-509.353	101.315	-552.057	69.932
Employees	188.658	17.269	187.933	19.329	182.402	14.252
Central	-28.013	21.907	-27.094	23.114	-8.218	14.825
Western	95.812	40.842	100.324	49.948	148.398	18.990
Observations	2029		2029		2029	
R^2	0.671		0.619		0.685	
K1 quantile	0.298		0.298		0.305	

about 10 percent lower than the threshold estimate in model 3. As the revenue variable falls in the low revenue regime, the slope estimate in model 7 is statistically significant and appears about twice as steep as that in model 3. Unfortunately, the slope estimates for local revenues in the high regime, though having different signs, both fail to pass the significance test. In spite of this, the existing disparity can serve as weak evidence for the endogeneity of the tax revenue variable.

Our results of the statistical tests, however, strongly support the endogeneity hypothesis. The Durbin-Wu-Hausman test of the NLLS model against the 2SLS model yields an F statistic of 3.74, whose corresponding p-value is 0.015, suggesting rejection of the null hypothesis of the revenue variable's exogeneity. In order to check the robustness of this test, we further examine the validity of using tax revenues in 1993 as the instrumental variable. At the first stage regression in IV GMM or 2SLS, the coefficient on this instrumental variable turns out to be statistically significant at the 5-percent level, supporting the prediction that tax revenues in 1993 and 2002 are correlated.

Passing the endogeneity test has important empirical meanings. Above all, this lends support to the assumption that budgetary tax revenues are affected by recipients' unobservable preferences for grant funds. This assumption, if true, will imply recipients' grant-seeking behaviors in the budgetary planning process. It is thus reasonable to infer from our endogeneity test results that grant-seeking behaviors are present among rural counties.

Alternatively, the presence of the grant-seeking behaviors can be shown by comparing the reported revenues with the 'true' revenues. Since model 6 uses the predicted revenue, a proxy for the real revenue-generating ability, the estimated revenue slopes in this setting, in fact, reflect the grant responsiveness to the true, or in-absence-of-grants, budgetary revenues. The estimates in model 3, on the other hand, reflect the relationship of grant supply and the actually-reported revenues. These two grant supply curves are displayed in Figure 3.4, in which the grant level corresponds to the sample averaged level of all the variables except for budgetary revenues. Clearly shown on the left side of Figure 3.4, the grant curve associated with the true revenues more steeply lies above that associated with the reported one, implying that a low-revenue county, when its corresponding grant level is set, usually has a reported budgetary revenue level lower than the true one. In the high-revenue regime, both grant supply curves become horizontal and very close to each other, showing no obvious evidence for the gap of reported and true revenues. The divergent pattern, therefore, supports significant grant-seeking behaviors among low-revenue rural counties only. It is, indeed, not surprising to find no grant-seeking behaviors among high-revenue rural counties because the entirely inelastic grant supply leaves no benefit for misreporting.

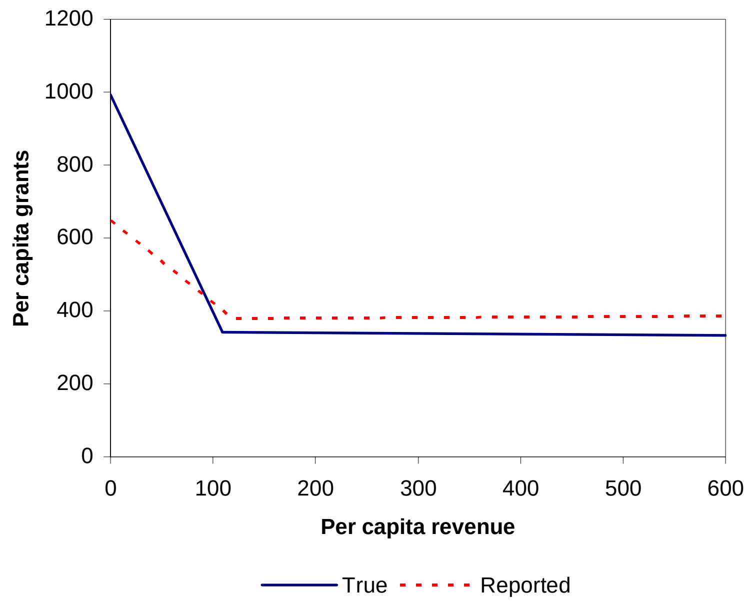

Figure 3.4 Rural grant-revenue relationship

3.5 Conclusion

The primary reason for the surge of interest in the non-linear specification for the grant allocation equation is its implication for the government redistribution policy. Our results indicate that for the rural low-revenue-capacity counties, net grants are generally equalizing, while for the urban high-revenue-capacity counties, net grants have counter-equalization effect. Nevertheless, no significant grant-revenue link can be observed among the 69 percent of rural counties whose revenues are above the rural threshold and the 74 percent of urban counties whose revenues below the urban threshold. In other words, for the majority of counties, the effects of equalizing and disequalizing grant policies sum up to zero.

The estimated grant pattern also suggests that the potential for the crowding out effect on revenues is large for grants to rural counties with small revenue capacity, and the potential for the crowding in effect is large for grants to urban counties with large revenue capacity. With the instrumental variable approach, we further demonstrate that the fiscal equalizing grant policies do lead rural counties with small revenue capacity to purposely reduce tax collection efforts in exchange for more grant funds. Therefore, our study predicts that the inequality of local fiscal capacity among the rural recipients might ironically rise if the current equalizing grants aren't altered to pay due attention to the adverse incentive effect. Moreover, since the project grants to the rich urban recipients can possibly stimulate extra fiscal effort, or crowd in tax revenues, the rural-urban gap in fiscal capacity will definitely be widening over time, resulting in greater social welfare loss.

Until now, most empirical studies of China's fiscal decentralization process (Jin, et al. 2005, Park et al., 1996) claim that fiscal reforms have hardened budget constraints and increased local government accountability. Our study, however, reveals that the budget constraints are not hardened for all the local governments. Because the center attempts to use grants to bailout revenue-scarce rural counties, these counties become more transfer-dependent and less fiscally accountable. Therefore, the efficiency of fiscal (expenditure) decentralization is in part offset by improperly-designed intergovernmental grants.

It is also worth mentioning that we find significant disparity in rural and urban grant policies: the equalizing objective dominates grants to rural areas and, in contrast, the project implementation objective dominates grants to urban areas. Considering that most urban counties can better self-finance local spending, we suggest that the dire rural areas should be rendered priorities in future project grant assignments. That's, the central government needs to design regulations that can ensure the fiscal investments be channeled to places that have urgent financial need, in stead of places that can provide more returns to the grantors.

To conclude this chapter, we underscore the importance for policymakers to take account of the tradeoff of grant transfers and their disincentive effect. Whether an intergovernmental grant can fulfill the original objective largely depends on the allocation criteria, which should best incorporate recipients' grant-seeking incentives. This chapter finds that China's overall grant system doesn't work well in lining up the grantor's equalization objective with recipients' incentives. Solving this problem requires linking grant allocation to desirable expenditure achievements. For instance, Shah (2004) recommends developing countries who attempt to attain national equity objectives to adopt non-matching grants conditional on the attainment of standards in quality, access and level of services and to make sure the grant funds inversely vary with fiscal capacity. This goal may be important to strive for, but not easily attainable in practice. The cost of accurately collecting a large amount of local information can be too high given the current institutional quality in China. Therefore, studies on how to make grant policies both cost-effective and incentive-compatible will be most rewarding in the future.

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Chapter 4

Race to the Top and Race to the Bottom: Tax Competition in Rural China[8]

4.1 Introduction

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

A few studies on tax competition have taken the 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—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 which provides opposite predictions. Their capital competition model has multiple competitors with different size of endowment. They argue that when the endowment difference is large, seeing little hope of winning the capital competition, poorly-endowed units tend to invest less in infrastructure and take part less actively in capital competition, which in turn can widen the gap in initial endowment. Most strikingly, Cai and Treisman's hypothesis seems to justify regional economy polarization in the presence of endowment inequality, in spite of the canonical convergence growth theory.

[8] This chapter is co-authored with Xiaobo Zhang.

While the literature has rich evidence for the presence of tax competition among states or counties in the United States or 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 in large 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 with large regional difference in resource endowment.

China provides a good ground for empirically testing the above question. Since the economic reforms, China has decentralized its fiscal system by devolving a large portion of expenditure responsibilities to the state and local governments but also ensuring local governments' authority over the locally sourced revenues. Jin *et al*. (2005), for example, demonstrate that in the period of 1995-1999 the provincial governments in China faced much stronger fiscal incentives and fiscal decentralization enhances growth. They argue that reform has created self-finance pressure on local officials such that they have to compete with each other to protect the local tax revenue base and attract business investment so as to prompt economic development. However, they assume the effect of fiscal decentralization is the same for all the provinces in their analysis. Considering its sheer size and large regional variation, it is highly likely that the regional fiscal competition behavior and consequence may vary as suggested by the rising regional inequality in the past several 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 tax rate is identical across jurisdictions and the setting of tax tables, no matter 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, however, may vary because of difference in local discretional efforts in collecting taxes. Such discretional activities have been widely observed in China by many case studies (Bahl 1999), indicating that intergovernmental tax competition is a practical issue deserving serious concern.

By making use of a panel data set at the county level covering 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 their underlying endowment. In particular, we develop 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 of the degree of tax competition in different regions. In addition to presenting the pattern, this study empirically relates the endowment heterogeneity to various degrees of tax competition incentives.

In specific, we examine whether poorly endowed units[9] have been disciplined by capital competition in the same way as richly endowed units. For this purpose, we compare the counties in two distinct clusters: each is essentially a spatial cluster of similarly endowed counties, though 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 finding does 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".[10] The negative relationship between the tax rate and the cluster-specific endowment size

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[9] In this chapter, both poor units and poorly endowed units 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.

[10] Many previous studies use "race to the bottom" and "race to the top" to address the welfare concerns of intergovernmental competition. In this chapter, 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 welfare implications of these actions, however, will be discussed separately.

implies richly endowed clusters are more motivated to compete for capital than poorly endowed ones. Initial endowment matters to 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.

The rest of this chapter will continue as follows. Section 4.2 introduces the theoretical background for tax competition behaviors and proposes a new measure to detect tax competition at a local level. Section 4.3 describes the data and presents the spatial and temporal patterns of local tax competition behaviors in China. Section 4.4 applies a regression approach to examine how endowment and other factors affect tax competition choices. Finally, section 4.5 assesses implications of our empirical results and concludes this chapter.

4.2 Rethinking the measure of tax competition

4.2.1 A simple capital-flow model for tax competition

We begin by presenting a simple model of county government behaviors. In this chapter, we focus on a specific type of intergovernmental competition—capital tax competition—where counties with immobile labor impose a tax rate on mobile capital. This type of strategic interaction has been formalized by Zodrow and Mieszkowski (1986), Wilson (1986), Wildasin (1989) and others, and reviewed 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

$$V(t_i, K_i) = U[c_i(K_i), G(t_i, K_i)] + t_i K_i, \quad (4.1)$$

where c_i denotes the representative citizen's private consumption in county i and G the consumption of public good or services. 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 (no government debts), and thereby 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

$$r = f'(k_i) - t_i = f'(k_{-i}) - t_{-i} \quad (4.2)$$

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 (4.2) 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.[11] Similarly, an increase in t_{-i} decreases the level of k_{-i}, thus causing k_i to increase.

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[11] A formal proof for the statement that k_i and t_i are negatively correlated other things being equal, is given as follows. Taking derivatives with respect to *ti* on the first two items in (4.2) gives $\frac{\partial r}{\partial t_i} = f_{kk}^i \cdot \frac{\partial k_i}{\partial t_i} - 1$,

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 [12]

$$\frac{\partial k_i}{\partial t_i} = \frac{1}{f_{kk}^i} \tag{4.3}$$

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: $K_i = n_i \cdot k_i$), 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

$$K_i = K(t_i, t_{-i}, X_i, X_{-i}) \tag{4.4}$$

Substituting equation (4.4) into (4.1) yields

$$V(t_i, t_{-i}, X_i, X_{-i}) = U[c_i(K(t_{i,} t_{-i}, X_i, X_{-i})), G(t_i, K(t_{i,} t_{-i}, X_i, X_{-i}))] + t_i K(t_{i,} t_{-i}, X_i, X_{-i}) \tag{4.5}$$

which indicates that the optimal tax rate, t_i, is an implicit function of t_{-i} The solution to (4.5) reflects a Nash equilibrium in which county *i* chooses the tax rate that maximizes its utility function given a tax rate t_{-i}, which meanwhile is the best choice for its competing county given t_i. Such a solution can be described by a tax reaction function as follows

$$t_i = h(t_{-i}, X_i, X_{-i}) \tag{4.6}$$

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where f_{kk}^i denotes the second derivative of production function $f(k_i)$ with respect to k_i. 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, $\frac{\partial k_i}{\partial t_i} = \frac{1}{f_{kk}^i} < 0$.

12 Same as 11.

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 turn infertile even under the idealistic condition 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). This case clearly suggests that a positive correlation of tax rates should occur for counties with similar endowments. Another prominent feature of this case 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, the empirical studies on the test of heterogeneous tax competition behavior are much rarer.

4.2.2 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 has failed to reflect the intrinsic heterogeneity of competition incentives. Another problem with this method that has yet to be solved is that it tends to reject the hypothesis of competition when it actually should not, especially when only a few of the governments in the sample have significant tax competition behaviors. The approach we adopt for avoiding the specification bias is the local indicators of spatial association (LISA), also called local Moran's I, which was originally developed by Anselin (1995) and studied by Bao and Henry (1996) and many others. In our definition, the localized tax rate correlation coefficient ρ_i is estimated by using an extended version of local Moran's I

$$\hat{\rho}_i = \frac{(t_{1i} - t_1^*)\sum_k w_{ik}(t_{0k} - t_0^*)}{\sum_i (t_{1i} - t_1^*)^2 / n}, \tag{4.7}$$

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 by using a cross-sectional data set. Second, it has direct and rich implications for the spatial distribution of data. A positive value of $\hat{\rho}_i$ 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 $\hat{\rho}_i$ 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. Reasonably speaking, we 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 chapter, we follow the suggestion of Anselin (1995) to take a conditional randomization or permutation approach (as described on page 96, Anselin 1995) to calculate pseudo significance levels.

Another important concern for estimating the tax rate correlation is about how to define competitors. In this chapter, we consider the geographic proximity as the primary standard in the definition of competitors. The study units of this chapter are rural counties in China, which are the smallest administrative unit to have local autonomy of fiscal policies. Its size also makes it vulnerable to the influence of its geographic neighbors. In addition, there are several theoretical arguments to 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 distance could be viewed as good substitutes for such a business. From the information cost point of view, small-sized governments are better informed of the tax policies imposed by their neighbors than by others located at a distance. An extreme case of information-induced tax competition is the yardstick competition, illustrated by Besley and Case (1995), which reveals that local units, even without the constraint of capital mobility, tend to mimic their neighbors' tax policies because officials are disciplined by voters who use neighboring units as benchmarks to judge local achievement.

In the spatial econometrics literature, there is no consensus about how to define geographic neighbors. Several choices, as reviewed by Brett and Pinkse (2000), include the common boundary neighbors, great-circle neighbors and nearest-distance neighbors. Since our results are generally robust to any of these measures, the rest of this chapter will focus on the 'four-nearest' neighbor 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.

4.3 The existence and pattern of tax competition behaviors

4.3.1 Data

To provide a broad view of intergovernmental competition behaviors among grassroots administration units, we construct a panel dataset, consisting of 2094 rural counties and county level municipalities in 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 dataset. 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 geographic data, we create a geocoding 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 CITAS) by utilizing publications on administrative coverage changes posted on the website of the Ministry of Civil Affairs.

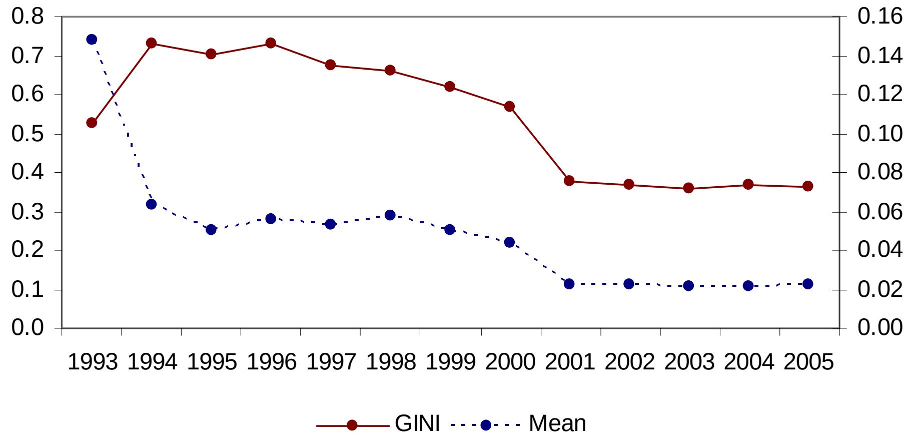

Figure 4.1 Dynamic patterns of county-level tax rates: GINI and mean in the nation

As a measure of tax burdens on capital investment, we follow 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.[13] The numerator includes two types of locally-sourced taxes: VAT and business taxes. For these two tax revenues, shared between the local and the central governments, only the proportion of the actual collection that eventually belong to local control—usually 25 percent— are included in our calculation. Since 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.

As presented in Figure 4.1, 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

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

coefficient stabilized at an even lower level around 0.36. In a similar pattern, the nationwide average effective tax rate has continued decreasing at an annual rate of 9.08% 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 is still likely to disagree with some local trends, in light of the sizable variation in county level tax rates.

4.3.2 Identification of local spatial tax competition

To lessen the impact of autocorrelation at the temporal dimension, we take six discontinued years to examine spatial tax competition: 1994, 1996, 1998, 2000, 2002 and 2004. 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 (4.7), 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', but also enable us to further classify the units with significant correlated tax choices into four tax strategy groups[14]: high-high (the description before the hyphen refers to unit *i* and the one after the hyphen refers to its neighbors), low-low, low-high and high-low tax rate clusters. Among them, 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.

In Figure 4.2, we compare the national distribution of tax competition strategy choices in 1994 and 2004. In both years, the majority of the sample counties, 70.2%

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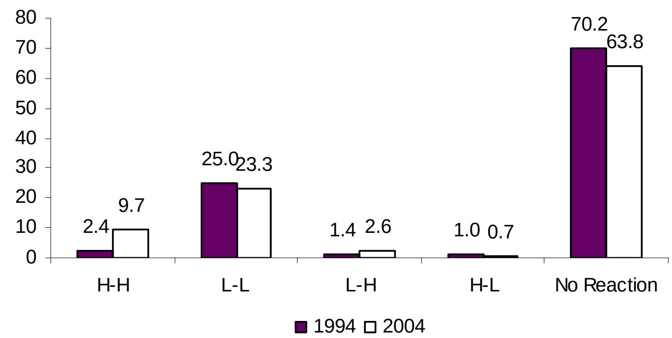
[14] The significance level is 5%. Our results in subsequent sections are robust to other significance levels such as 10%.



Note: relative frequency labeled above the bar and expressed in percentages.

Figure 4.2 Tax strategy distribution among 2094 rural counties in China

and 63.8% for 1994 and 2004 respectively, did not yield 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, there were 25.0% with a significant spatial clustering of low tax rates, 2.4% with a significant clustering of high tax rates and 2.4% 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 9.7%, and the percentage of L-L units decreased to 23.3% in 2004.

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

4.3.3 Spatial and temporal changes

Table 4.1 reports how counties with different tax competition strategies were

Table 4.1 Distribution of tax competition strategies in the nation, regions and endowment clustering groups

	observation		H-H		L-L		L-H		H-L		No response	
	1994	2004	1994	2004	1994	2004	1994	2004	1994	2004	1994	2004
Nation	2094	2094	51	202	524	487	29	55	21	15	1469	1335
Coastal	647	647	2	30	301	233	1	11	10	5	333	368
Inland	1447	1447	49	172	223	254	28	44	11	10	1136	967
E1 (H-H)	175	215	0	27	106	59	0	5	1	1	68	123
E2 (L-L)	484	502	29	71	9	47	7	14	1	3	438	367
E3 (L-H)	33	22	0	2	11	1	0	0	0	1	22	18
E4 (H-L)	10	21	1	2	1	3	0	7	0	0	8	9
E0 (No GDP correlation)	1392	1334	21	100	397	377	22	29	19	10	933	818

Note: numbers indicate frequency.

Table 4.2 The chi-square test of independence for tax competition choices and spatial location variables

Year	(1) Provinces			(2) Regions			(3) Endowment Clusters		
	D.F.	χ2	P value	D.F.	χ2	P value	D.F.	χ2	P value
1994	120	2500	0.000	4	249.8927	0.000	16	292.77	0.000
1996	120	2700	0.000	4	257.4119	0.000	16	382.40	0.000
1998	120	2400	0.000	4	173.1465	0.000	16	539.90	0.000
2000	120	2000	0.000	4	121.6528	0.000	16	332.44	0.000
2002	120	1900	0.000	4	45.2078	0.000	16	154.19	0.000
2004	120	1600	0.000	4	99.9056	0.000	16	174.74	0.000

distributed in coastal and inland areas[15]. It is observed, for instance, that in 1994, 301of 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 in the western inland areas. Generally speaking, Table 4.1suggests that the regional location—for example 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 4.2, suggest that the hypothesis of no provincial and regional effect is not significantly supported by our data. The conclusion is robust across various years.

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

4.3.4 Endowments

Here, the concept of endowment is defined in a general term, which can 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

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[15] Following the convention of China's Statistic Bureau, the coastal region includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi and Hainan. The inland region includes the rest nineteen provinces. As shown in Table 1, our sample includes 647 coastal counties and 1447 inland counties.

competitor have large and closely related GDP, small and closely related GDP, or extremely different GDP level will affect their choice among the five tax competition strategies.

Similar to Section 4.3.2, 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, 2001 and 2003, 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 capital 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 in the rest of this chapter.

It is observed that the clusters of high economic achievements mainly showed up in coastal areas, and clusters of low economic achievements largely concentrated in western and central areas. In 1994, L-L GDP clusters accounted for 23.1% of the population, while H-H GDP clusters only 8.3%. Moreover, 87.4% of H-H clusters were in coastal region, while 85.9% of L-L clusters in inland. The percentages did not change much in 2004. 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 study period, increasing from 31.4% in 1994 to 34.2% by 2004. One implication that we can derive from these results is that these counties, either explicitly or implicitly, should have connections to the neighborhood strong enough to trigger economic convergence at the local level.

The majority, however, does not possess such a strong connection to their neighbors. There are 66.5 and 63.7 percent of the population, in 1994 and 2004 respectively, not significantly correlated to their neighbors' economic development. A small portion, on the other hand, was found to exhibit a significant and negative correlation to their spatial neighbors in terms of economic development. Their share in total population was 2.06% in 1994 and varied little afterward (its standard variation was 0.001 from 1994 to 2004).

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, and apply the chi-square test to see if there is a dependent relationship between the two category variables. The last five rows in Table 4.1 present the frequency tables in 1994 and 2004, 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 column (3) of Table 4.2, also suggest that the hypothesis of independence should be rejected, therefore supporting the presence of a statistically significant endowment cluster effect.

4.4 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 have been identified in section 4.3.2 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

$$\Pr ob(y_i = j) = \pi_{ij} = \frac{\exp(V_{ij})}{\sum_{j=0}^{4} \exp(V_{ij})}, \tag{4.8}$$

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

As for the determinant factors in the choice decisions, Sections 4.3.3 and 4.3.4 provide strong evidence for the regional, temporal, and endowment effects. Although being straightforward, the tests before this section share a common shortcoming in that they do not allow for more than one explainable variable to be taken into account. The regression approach will include all these variables to explain the choices of tax strategies so that it is able to sort out how each factor affects the unit's choice among the five competition behaviors given that other factors have been controlled for. Therefore, to fit in our data, we use the following specification:

$$V_{ij} = \sum_{k=1}^{4} \beta_j^k E_i^k + \gamma_j R_i + \delta_j T + \varphi_j X_i + \varepsilon_{ij} \tag{4.9}$$

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 (4.9) is a vector of other economic variables, X, which comprises agriculture share in GDP (*AGSH*) and share of the population that is employed or financially supported by local governments (*GEPOPSH*), measures for industrial structure and government fiscal burden respectively. Table 4.3 summarizes the means and standard deviations for all the variables to be used in the estimation. In regard to these two new variables, it shows

Table 4.3 Summaries for tax strategy choices and the explanatory variables

	Description	Mean	Std. Dev.
Dependent Variables			
Y=H-H	Dummy for the H-H tax cluster	0.052	0.222
Y=L-L	Dummy for the L-L tax cluster	0.245	0.430
Y=L-H	Dummy for the L-H tax cluster	0.016	0.125
Y=H-L	Dummy for the H-L tax cluster	0.008	0.091
Y=insignificant correlation	No tax rate correlation	0.679	0.467
Explanatory Variables			
E1 (H-H)	Dummy for the H-H endowment cluster	0.106	0.308
E2 (L-L)	Dummy for the L-L endowment cluster	0.236	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	0.009	0.092
E0 (insignificant correlation)	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	0.167	0.373
AGSH	Agricultural share in GDP	0.408	0.225
GEPOPSH	Share of the population that are employed or financially supported by local governments	0.033	0.023

that as an average of the six tax years, the agricultural sector accounted for 40.8 percent of the total GDP in rural counties, and out of every 100 residents, about 3 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 4.4. In each determination equation, we report the exponentiated coefficients, which have an informative interpretation of relative risk ratios (RRR)[16] — 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

[16] Gould (2000) provides a definition for RRR used in the STATA environment. It is expressed as $RRR = \frac{P(y=1/x+1)/P(y=base\ category/x+1)}{P(y=1/x)/P(y=base\ category/x)}$.

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 exactly captured by RRR. For instance, if an explanatory variable came with a RRR greater than one, then a marginal increase in this variable would make the associated choice more preferable than the base category choice.

Table 4.4 includes two models with or without *AGSH* and *GEPOPSH*. Compared with Model (1), which excludes the two variables, Model (2) significantly improves the estimation efficiency by reducing the AIC statistic from 18,559 to 16,270 and increasing the log likelihood ratio from -9,235 to -8,083. This suggests that including these economic variables gives a better fit to our data Even so, there are no extreme changes in the estimated effects for endowments, coastal location and time between these two models. Most variables that are significant in model (1) still have a significant effect in model (2), while a few dummies for years become significant in model (2) though not in model (1). In terms of magnitude, no change as the result of adding the new variables is large enough to convert the implication for influence directions, as it is observed that no RRR estimate above one falls below one or vice versa. For instance, in the H-H tax rate strategy equation, the RRR of the L-L GDP cluster declines from 2.71 in model (1) to 1.63 in model (2). In spite of the magnitude difference, both of them being greater than one suggest that a switch into the L-L GDP cluster generally causes a county to prefer more to the H-H tax rate strategy than the no-response strategy. Because of the above reasons, we focus on model (2) to discuss the implications of tax competition behaviors.

As indicated by the first column in model (2), several variables, H-H, L-L and H-L GDP clusters, *AGSH* and *GEPOPSH*, significantly increase the relative risk

Table 4.4 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)	3.40	1.83	2.56	3.79	7.67	1.23	3.22	4.82
	(0.000**)	(0.000**)	(0.005**)	(0.000**)	(0.000**)	(0.005**)	(0.001**)	(0.000**)
E2 (L-L)	2.71	0.11	2.50	0.27	1.63	0.15	2.40	0.23
	(0.000**)	(0.000**)	(0.000**)	(0.006**)	(0.000**)	(0.000**)	(0.000**)	(0.002**)
E3 (L-H)	1.02	0.75	0.00	2.95	0.67	0.67	0.00	2.96
	(0.98)	(0.14)	(0.000**)	(0.14)	(0.58)	(0.07)	(1.00)	(0.14)
E4 (H-L)	1.98	0.20	8.22	0.00	4.12	0.14	10.58	0.00
	(0.10)	(0.000**)	(0.000**)	(0.000**)	(0.004**)	(0.000**)	(0.000**)	(1.00)
Coastal	0.18	1.85	0.46	1.37	0.31	1.46	0.66	1.30
	(0.000**)	(0.000**)	(0.003**)	(0.23)	(0.000**)	(0.000**)	(0.13)	(0.37)
AGSH					1761.09	0.08	4.71	5.84
					(0.000**)	(0.000**)	(0.000**)	(0.032*)
GEPOPSH					1.2E+11	0.00	1.9E+11	0.00
					(0.000**)	(0.000**)	(0.000**)	(0.41)
Observation	12564				12564			
AIC*n	18559.945				16270.685			
Log Likelihood Ratio	-9235.972				-8083.343			

Notes: (1) year dummies omitted.

(2) p values in parentheses, * significant at 5%; ** significant at 1%

(preference) for the choice of the H-H tax strategy over the base choice. Among them, the estimates for *AGSH* and *GEPOPSH* both take remarkably large values, implying that the change in the relative preference is extremely sensitive to even a marginal change in one of these variables. The only variable significantly depressing the preference for the H-H tax strategy over the no-response strategy is coastal dummy, with an estimated RRR of 0.31.

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 significantly lower the relative preference to the L-L tax strategy except for the H-H GDP cluster. On the other hand, the variables that significantly 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 particularly supports the H-H tax rate competition but does not support L-L tax rate competition; the second group behaves in a converse manner. A noteworthy variable is the H-H GDP cluster, whose RRR estimate is greater than 1 in both H-H and L-L tax strategy functions, suggesting that both tax strategies are preferable over no-response for the counties in this endowment cluster. But which of the two strategies would be more preferable for the H-H GDP cluster?

To make this point clear, we rerun the multinomial logistic regression using the H-H tax competition strategy as the basic choice. Table 4.5 reports the results for three different periods: 1994-2004, 1994-2002, and 2004[17], from which we find a striking difference in behaviors of H-H GDP clusters in the two sub-periods. Unlike in the

[17] Splitting the population into two sub-periods has two reasons. Firstly, in the equation of H-H tax strategy, the estimate for the year dummy of 2004 takes extremely large value but the estimates for other years don't. Secondly, a chi-square test for the hypothesis of identical coefficients in the two periods strongly supports rejection of the hypothesis.

Table 4.5 Tests for factors that support choosing the L-L over H-H tax strategies

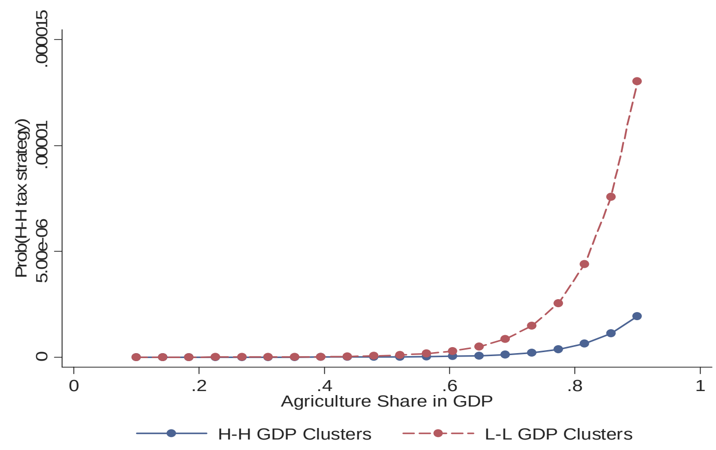
Variable	1994-2004 RRR(L-L vs. H-H)	P-value	1994-2002 RRR(L-L vs. H-H)	P-value	2004 RRR(L-L vs. H-H)	P-value
E1 (H-H)	0.159	0.000	4.412	0.230	0.129	0.000
E2 (L-L)	0.089	0.000	0.051	0.000	0.284	0.000
E3 (L-H)	1.001	0.999	1.024	0.991	0.137	0.117
E4 (H-L)	0.034	0.000	0.015	0.000	0.320	0.229
Coastal	4.707	0.000	3.0E+09	0.000	5.112	0.000
AGSH	0.000	0.000	0.000	0.000	0.054	0.000
GEPOPSH	0.000	0.000	0.000	0.000	0.000	0.000

period between 1994 and 2002, when they preferred L-L tax strategy to H-H tax strategy (as indicated by a RRR estimate of 4.41), the H-H GDP clusters changed to like H-H tax strategy more than L-L tax strategy in 2004 (RRR estimate drops to 0.13).

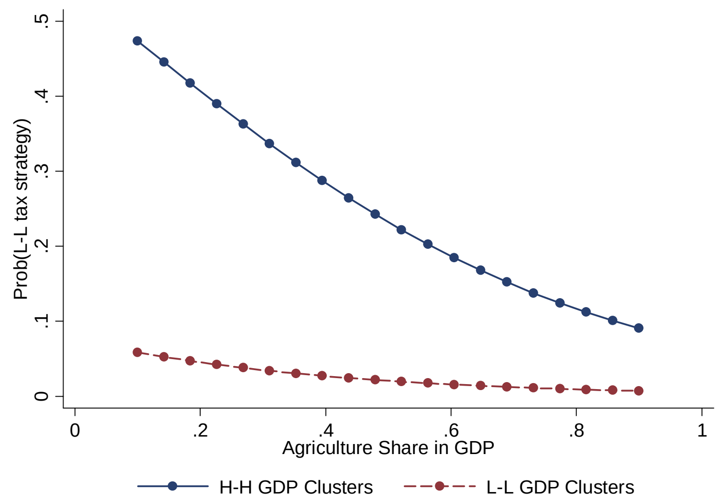
According to Table 4.5, the H-H GDP cluster was a stark contrast to the L-L GDP cluster during 1994-2002: the H-H GDP cluster belongs to the group supporting the L-L competition behaviors, while the L-L GDP cluster belongs to the other. This implies that the racing-to-the-bottom tax behaviors largely 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.

In 2004, however, the H-H GDP cluster fell into the same tax strategy preference as the L-L GDP cluster did. The reason why spatial neighbors with rich endowments would take the risk of losing relatively huge size of tax base by switching to prefer a race to the top, and the reason why the change took place in 2004 are still uncertain. Due to lack of relevant data, we are unable to provide rigorous interpretation for this phenomenon. It is likely "the race to the top" in rich areas to be a short-term response to the implementation of a new fiscal reform "export VAT rebate sharing scheme", which was announced in the early of 2003 and effective since January 1, 2004. As the most important feature of the new scheme, the local government, who used to pay nothing for export VAT rebate, is requested to shoulder a responsibility of 25 percent of the increment above the export VAT rebate in 2003. Considering the fact that most rich rural counties in China are located in coastal area and highly dependent on export-oriented industries, this export rebate reform, therefore, would have affected them much more greatly than the poor ones. From strategic economics' point of view, the policy may distort the rich counties' tax behaviors in two ways. Firstly, as expecting 2003's export VAT would serve as a deductible basis for locally financed rebate in all the years to follow, local governments would intentionally raise effort to enlarge the size of VAT in local export industries. Secondly, the newly-added burden to finance export rebates would constrain local governments with relatively large export industry from engaging in tax reduction competition. As a consequence, rich clusters are likely to raise VAT both in 2003 and 2004, leading to a seemingly changed taste for H-H tax rate competition.

Also shown in Table 4.4 and Table 4.5, both *AGSH* and *GEPOPSH* are in the club of factors that induce the H-H-competition behaviors. Figure 4.3 (a) and (b) depict how the increase in *AGSH* affects the probability of choosing the H-H and L-L tax competition for the H-H and L-L GDP clusters in the period of 1994-2002. In



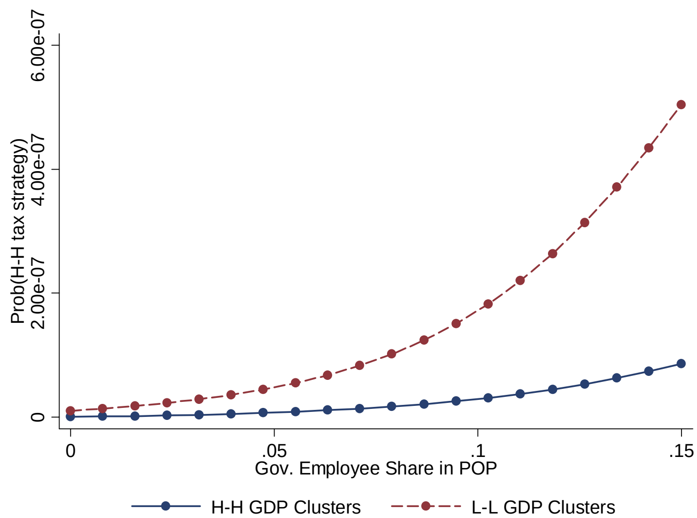
(a) The impact on choosing H-H tax strategy



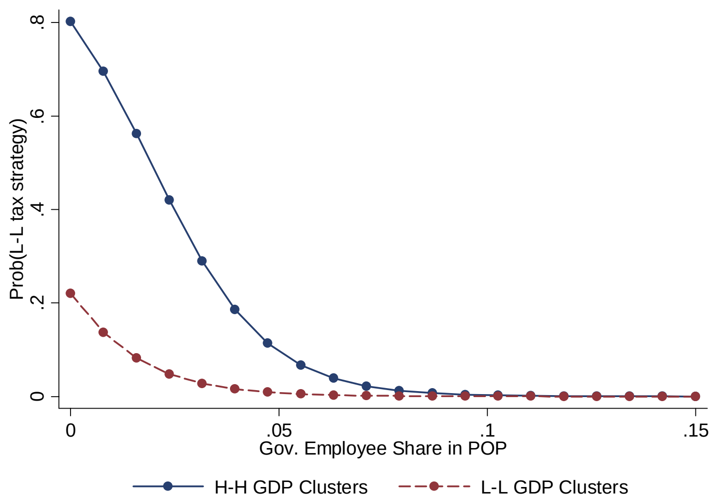
(b) The impact on choosing L-L tax strategy

Note: All the other explanatory variables at means.

Figure 4.3 The impact of agriculture share in GDP on tax competition behaviors



(a) The impact on choosing H-H tax strategy



(b) The impact on choosing L-L tax strategy

Note: All the other explanatory variables at means.

Figure 4.4 The impact of government employment size on tax competition behaviors

general, no matter whether a county belongs to H-H GDP clusters or L-L GDP clusters, a rise in the agriculture 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 the H-H competition probability curves, though remaining flat at zero until the agriculture share in GDP reaches 60%, begin to rise steeply afterward. This suggests that counties that have reached certain industrialization degree 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 Figure 4.3 , the curve for L-L GDP clusters takes a steeper slope than that for H-H GDP clusters in (a), but a less steep slope in (b). This indicates a substantial difference in economic structure effect on different GDP clusters. The impact of *GEPOPSH* on the probability of choosing H-H and L-L tax competition behaviors, as shown in Figure 4.4, is similar to that of *AGSH* except that the probability curves for L-L tax competition behaviors (See Figure 4.4 (b)) exhibit a threshold pattern in which a government employee share greater than 0.09 would prevent both clusters from taking part in L-L tax competition.

Last but not the least, it is surprising to find, in the last two columns in model (2), that the homogeneous GDP clusters also have substantially higher propensity to choose dissimilar tax rates than the base group. 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 in which the observations for heterogeneous tax rate strategies are too few.

4.5 Conclusion

In order to provide explanations for the spatial patterns of localized tax rate correlations, this chapter has developed an empirical approach combining a state-of-the-art geographic statistical method, LISA, and a sequence of rigorous statistical tests. The approach emphasizes the possibility of heterogeneous local behaviors by allowing for an estimation of spatial tax rate correlations at every individual location. As most studies in the empirical literature of 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. In particular, the relationships between neighboring tax rates are found to vary across five distinct groups. These results conform to our intuition that 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. The other factor, probably of greater importance, is the relationship of endowments between competitors. As suggested by theories, the different endowment levels can trigger strategic tax rate settings rather than a unique equilibrium. According to our results, the tax competition behaviors not only differ between symmetrically endowed units and asymmetrically endowed units, but also differ between symmetric units at different endowment levels. In a rather long period of 1994-2002, the clustered rich units were in a competition to reduce tax rates, while the clustered poor units in a competition to raise tax rates.

Although few theoretical studies to date have recognized, let alone interpreted, the ‘race to the top’ behaviors among poor counties, these behaviors can be reasonably explained by several simple intuitions. First of all, in China, poor counties are faced with much tighter budget constraints than rich counties, so the pressure to self-finance the basic spending needs probably has 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 force some local governments in the lagging regions to impose higher average tax rates on capital investment.

Second, it is inevitable that regions comprised of poor counties in clusters are likely to encounter poorly-maintained public facilities, under-educated labors and weak consumption demand. The adverse investment environment in the neighborhood 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 who expect that a rise in tax rate can lead to smaller size of local revenue in the near future.

The divergent behaviors between rich and poor counties might 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 in the coast. At this point, our finding supports the theoretical predictions in Cai and Treisman (2005). In addition to endowment effect, we also find that government fiscal burden also matters to the tax competition behavior. Therefore 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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