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The Lottery Receipt's Effect on Provincial Tax Revenues in China[1]

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Abstract

This paper empirically examines the lottery receipt experiment (LRE)'s effect on provincial tax revenues using data in 1998, 2002, 2006 and 2010 from China by panel estimation of a quasi natural experiment. It is found that the LRE has significantly raised the revenues of sales tax, enterprise income tax as well as the total tax, but has had not significant impact on value added tax and individual tax revenue. It is expected that the LRE would be a instrument for preventing the current risk of the worldwide governmental bankruptcies by increasing the tax revenues. *JEL classification*: H26, D81, D82

Keywords: tax evasion, lottery receipt experiment, sales tax, enterprise income tax, value added tax, individual income tax, total tax revenues, panel estimation, provincial data, China, quasi natural experiment

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1 Introduction

Why are there so many bankruptcies among the governments, banks, firms and households in current world? Wan (2011a, b, c) gives a unique explanation on this question by arguing that the most important reason would be the overconsumption caused by the speculative saving motive. In this paper, we will make a further talk on why are there so many governments are at risk of bankruptcy.

During the recession period after the asset bubble crash, the ``doctrine'' of Economics tells us that the government had better do the following tasks simultaneously: purchases non-performing loans from the private sectors for financial stability; increases the governmental expenditure but makes taxes cuts; performs financially quantity easing, and does some un-anticipated policies. The first and the second tasks mean that the government in the recession time had better issue the debt to simulate the economy. If the recession cannot stopped by the governmental policies but lasted for a long time just like the ``lost two decades of Japan,'' the government would accumulate a huge debt outstanding and then face with the risk of bankruptcy. The another reason is that even the government know the importance of tax revenues but cannot collect enough tax efficiently by the tax evasion problem as argued by Andreoni; Erard and Feinstein (1998) and Wan (2009a, 2012). Consequently, we naturally tend to think of that the current ``doctrine'' of Economics and tax evasion problem would be the main causes of the current risk of governmental bankruptcies especially in the developed economies. Therefore, the solution to tax evasion would contribute a lot to prevent the governmental bankruptcy, even though it is difficult for us to identify which of the ``doctrine'' of Economics and tax evasion is more important

determinant of the bankruptcy.

In ancient China, there is detailed description on tax evasion. For example, Guanzi (BC645, p.452) leaves many stories. ``*I wish,'' said Duke Huan (The King), ``to place a special tax on buildings.'' ``That won't do,'' replied Guanzi (The Prime Minister). ``It will harm construction.'' ``I wish to place a special tax on people.'' ``That won't do. It will lead to concealing their true numbers.'' ``I wish to place a special tax on the six domestic animals.'' ``That won't do. It will lead to killing the living.'' ``I wish to place a special tax on trees.'' ``That won't do. It will lead to chopping down those that are alive.'' ``Then what can I tax that will be right?'' ``I suggest,'' replied Guanzi, ``that you place a special tax on ghosts and spirits.''* Guanzi tells Duke Huan that Yao (The King of China four thousands years ago) collects taxes on the necessaries such as orchids, chrysanthemums and fishes used in the ritual and ceremony while the government monopolies these goods to increase the price hundredfold by means of promoting the ceremony. It is known that the institution of governmental monopoly starts from this era. The idea here is to save cost of tax gathering. If the government cannot do this task well, it means that the government or the state would be collapsed.

Smith (1776) also leaves many talks on the issue of tax evasion. ``*An injudicious tax offers a great temptation to smuggling. But the penalties of smuggling must rise in proportion to the temptation* (vol. 2, p.425)." ``*The temptation to smuggle can be diminished only by the lowering of the tax; and the difficulty of smuggling can be increased only by establishing that system of administration which is most proper for preventing it* (vol. 2, p.500)." ``*The dealers in those particular commodities, either by wholesale or retail,*

to be at all times subject to the visit and examination of the customhouse officer; and to be obliged to justify by proper certificates of the payment of the duty upon the whole quantity contained in their shops or warehouses (vol. 2, p.501)." Note here that the ``proper certificates of the payment'' corresponds to the official receipt or the lottery receipt in current China.

In modern times there has been a big literature on tax evasion since the works by Allingham and Sandmo (1972) and Yitzhaki (1974). It is reported that the there are series tax evasion in developing countries (Alm; Bahl and Murray, 1991; Fisman and Wei, 2004). Schneider (2005) reports the big sizes of shadow economies around the world. Recently, Klautke and Weichenrieder (2010) report the evidence on tax evasion of the interest income in the EU countries. It is easy to obtain the major theoretical and empirical findings by the survey papers such as Andreoni; Erard and Feinstein (1998), Slemrod (2007) and Alm (2012).

The main contents of the existing literature argue that the government pay the monitoring cost to audit the taxpayers and then punish the tax evaders. By contrast, Falkinger and Walther (1991) first suggest that the government has choice to use the penalty-reward mix, a penalty of tax evaders and a reward for tax payers, to improve the pure penalty system. Alm; Jackson and McKee (1992) find that the lottery reward mechanism has better compliance than the fixed reward session using laboratory experiments. In lines with this reward system, Marchese (2009) analyzes the impact of rewarding consumers on the evasion of commodity tax using a competitive tax evasion model. Feld; Frey and Torgler (2006) make a survey on the evidence on rewarding honest

taxpayers from the field experiments, and find many evidence on that rewards increase tax compliance. Kirchler; Hoelzl and Wahl (2008) survey the literature on enforced and voluntary tax compliance, and suggest that the slipper slope framework would be an operational tool for solving the tax evasion problem.

Tax evasion is also very serious in current Asia. According to Wan (2010a, 2012), the GDP of mainland China was a little smaller than that of Japan in 2009, but the tax revenues of mainland China was over twice than that of Japan. The consumption tax rate in Japan was 5% in 2009, the expected consumption tax revenue should be 23.8 billion Japanese Yen (=GDP*5%=476 billion Yen*5%), but the realized consumption tax was 9.3 billion Japanese Yen. Thus it is argued that there is a very serious tax evasion problem in Japan. Contrastively, it was reported by the State Bureau of Statistics of China on January 20, 2012, that the increase rates of tax revenues by added value tax, consumption tax, sales tax, enterprise income tax, individual income tax and total tax comparing with previous year was 13.6%, 15.1%, 22.6%, 34.7%, 25.2% and 22.8%, respectively. This result in China may be partly from the fighting against tax evasion by some unique regimes.

Wan (2004, 2006, 2009a,b,c, 2010a,b, 2012) does a series of studies on the solution to tax evasion via the experience in China and other areas. He focuses on the Lottery Receipt Experiment (LRE, hereafter) which has been introduced in many areas such as Amenia, Bolivia, Indonesia, Mainland China, Philippines, South Korea and Taiwan. It is found that the LRE theoretically Pareto improves the economy and helps the government find a Pareto efficient taxation without evasion (Wan, 2009a). Wan (2004, 2006, 2009c, 2010b, 2012) empirically finds that the LRE has significantly positive impact

on tax revenues, and it implies that the LRE has significant effect on fighting tax evasion.

However, there is still no research on the effect of LRE on tax revenues nationwide. Here, we use a unique data set to compensate the existing literature. We use the data in 1998, 2002, 2006 and 2010 from China and the panel estimation of a quasi natural experiment, to identify the effect of LRE on provincial tax revenues by types. It is found that the LRE has significantly raised the revenues of sales tax, enterprise income tax as well as the total tax, but has not significant impacts on value added tax and individual tax revenues.

The left of the paper are organized as follows. The Section 3 briefly introduces the LRE in China. The Section 3 describes the data set and the estimation method as well as the results of estimation. The Section 4 concludes.

2 Lottery Receipt Experiment in China

Wan (2004, 2010b) gives a detailed description on the LRE in China. Wan (2004) argues that the essence of the LRE is that the government gives the consumers, who share the transaction information with the sellers with zero cost, an incentive to voluntarily declare the tax to solve the information asymmetry issue between the government and the tax payers, and then to save the governmental monitoring cost to welfare improve the economy. Based a general equilibrium tax evasion model with complete competition by Cremer and Gahvari (1993), Wan (2009a) thinks of the LRE as an incentive compatible mechanism, and shows that the LRE decreases the monitoring cost to the minimum level and decreases the firm's cheating cost to zero to Pareto improve the economy and makes the

optimal indirect taxation without evasion practicable.

In the previous section we mentioned that some studies make focus on the reward or penalty-reward mix mechanism, however, they are off the point of the LRE. The indirect tax such as sales tax needs the information of every transaction, this volume of information is astronomical and is far more than that of direct tax such as income tax. Falkinger and Walther (1991) suggest that the government increases penalty while simultaneously offering a reward to the honest tax payer. In their framework, to increase the penalty will incur additional monitoring cost, thus this system would not be practicable. In Marchese (2009), the information asymmetry is not modeled, and the rewarding consumer is not analyzed in the general equilibrium framework. Also in the experiments of rewarding consumers, the governmental monitoring cost and the taxpayer's cheating cost are not mentioned.

Luckily enough, the LRE has been introduced in many areas in the world since 1950s (Wan, 2004, 2010b). It supplies us invaluable social or natural experiments on solving the tax evasion issue. To the authors' knowledge, the LRE should be the best system of indirect taxation, and will be more and more widely used in the world according to the popularization of information technology just like internet and personal computer.

3 **Empirical Examination**

3.1 The Data Set

We obtained detailed information on tax revenues by type from the China Statistics Yearbook 1999-2011. We construct the variables for estimation as shown in

Table 1. The data by province and by year are shown in the Table 2 (A, B, C).

The information on the LRE is shown in Table 3. We searched the ratio of LRE using Google.com in November, 2011, and reported the figures in the ``2010'' column. The data of the column ``2002'' is from Wan (2004, 2006, 2010), and then we use the average value of the columns ``2002'' and ``2010'' as the one of ``2006.'' The first city where the LRE was performed in 1998 is Haikou City, the capital city of Hainan Province. Here some special notes are needed because these data are not statistical but by the author's internet search.

3.2 Empirical Specification and Estimation Method

Also according to Wan (2004, 2006, 2010), we used the following empirical models to capture the effect of the experiments, and obtained a model with trends,

$$y_{it} = c_i + \beta LRE_{it} + \gamma Z_{it} + \theta t + \xi t^2 + u_{it}, \quad (1)$$

where y_{it} is the level value of per capita tax revenue by type in province i, the information on experiment is denoted by LRE_{it}, the controlled variables with level values are expressed by Z_{it} , the trend is denoted by θ and ξ , time is denoted by t and t^2, the specific time-invariant factor is written by c_i, and the white noise is denoted by u_{it}. In Equation (1), c_i and u_{it} are all unobserved.

For a consistent estimator of β, the important condition is that the LRE_{it} is exogenous as argued by Heckman and Hotz (1989). Following Wan (2010), we know that the LRE avoids the self-selection problem quite well because the LRE can be considered as a quasi natural experiment. We use the fixed and random effects within regression to obtain

the estimator of β.

3.3 Summary Statistics

The Table 4 shows the summary statistics on the information on variables used in the estimation models. Note that the data is per four years panel (interval period is four years). Not annually but per four years panel is because that the yearly exact information on the LRE cannot be obtained.

3.4 Estimated Results

Table 5 provides the results of panel estimation based on information for 31 provinces in China during the period 1998-2010. The figures of ``FE" and "RE" columns mean the results of fixed effect and random effect model, respectively. We only adopt the results of fixed effect model, because this model permits the correlation between the LRE the provincial fixed effect.

The dependent variables are log values of tax revenue by type.[3] Thus, the coefficient of the LRE means the growth rate of tax revenues per four years. If we want to know the annual effect of LRE impact, we should divide the coefficient here by 4. From the Table 5, it is found that the LRE has significantly positive impact on the revenues of sales tax, enterprise income tax as well as the total tax, but has not significant impacts on value added tax and individual income tax revenue. Compared with the area where LRE was not introduced, the yearly growth rate of sales tax revenue, enterprise income tax revenue and

[3] We also performed the same type regressions using level data on tax revenues. The results are similar to the ones here. The results by level data are available upon requests.

total tax revenues in the province with LRE is 8.58%, 12.08% and 5.25%, respectively. The results here are consistent with the ones in Wan (2004, 2006, 2009b,c, 2010a,b, 2012).

4 Conclusions and Implications

The China's government has performed the LRE as an innovation to solve the tax evasion problem. Based on the panel estimation by provincial data in China from 1998 to 2010, we found that the yearly growth rates of sales tax revenue, enterprise income tax revenue and total tax revenues in the province with LRE is significantly higher with 8.58%, 12.08% and 5.25%, respectively, comparing with the area where the LRE was not introduced. We also found that the LRE has not significant impacts on the value added tax revenue and the individual income tax revenue. Therefore, we recommend that the China should go on the LRE and make the system better work according to the proposal by Wan (2009a). We also recommend that the other countries, especially the countries such as PIIGS (Portugal, Italy, Ireland, Greece and Spain) with the risk of governmental bankruptcy in the world, need to introduce the system just like LRE in China as soon as possible.

We also have some issues not solved well but left for future research. For example, we should carefully examine the impact of LRE on tax revenues in the areas out of China.

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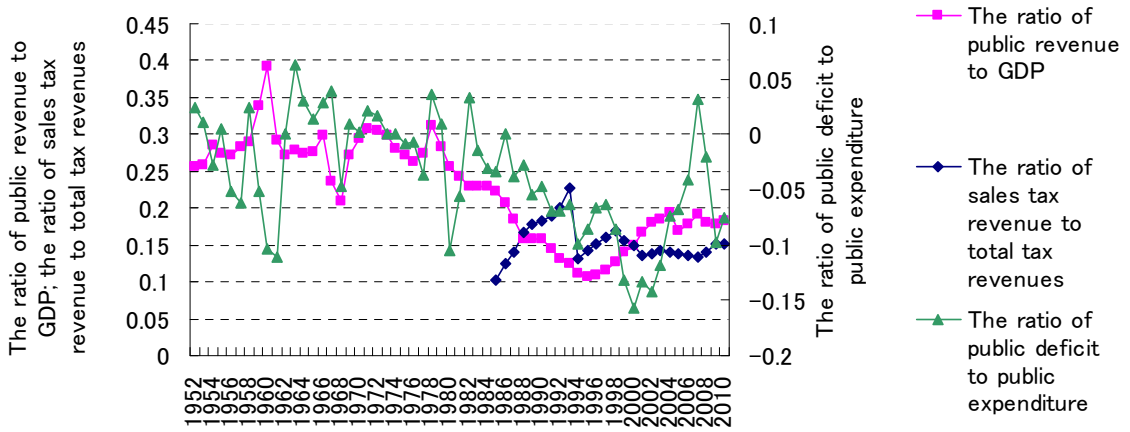
Figure 1: The sales tax revenue, total tax revenue, and public deficit in China, 1952-2010



Source: The author's calculations based on the China Statistics Yearbook (1991–2011)

Table 1: Construction of variables

Variables	Definition (construction of variables)
Sales tax	per capita sales tax revenue (nominal, 10,000 Yuan)
Enterprise income tax	per capita enterprise income tax revenue (nominal, 10,000 Yuan)
Value added tax	per capita value added tax revenue (nominal, 10,000 Yuan)
Individual income tax	per capita individual tax revenue (nominal, 10,000 Yuan)
Total tax	per capita total tax revenue (nominal, 10,000 Yuan)
GDP	per capita GDP (nominal, 10,000 Yuan)
The first sector GDP	per capita GDP by the first sector (nominal, 10,000 Yuan)
The second sector GDP	per capita GDP by the second sector (nominal, 10,000 Yuan)
The third sector GDP	per capita GDP by the third sector (nominal, 10,000 Yuan)
Population	Population by province (10,000 persons)
Urban ratio	The ratio of urban population to total population by province
LRE	The ratio of the Lottery Receipt Experiment by province
Year	=1998, 2002, 2006, 2010
ln(Operation tax)	=log(Operation tax)
ln(Enterprise income tax)	=log(Enterprise income tax)
ln(Value added tax)	=log(Value added tax)
ln(Individual income tax)	=log(Individual income tax)
ln(Total tax)	=log(Total tax)

Table 2(A): Per capita tax revenue and GDP by province and by year (unit: 10,000 Yuan)

	per capita sales tax revenue				per capita enterprise income tax revenue			
	1998	2002	2006	2010	1998	2002	2006	2010
Beijing	0.0907	0.1601	0.2916	0.4360	0.0217	0.0720	0.1353	0.2615
Tianjin	0.0321	0.0513	0.1078	0.2185	0.0134	0.0261	0.0498	0.0969
Hebei	0.0062	0.0086	0.0194	0.0504	0.0041	0.0050	0.0096	0.0203
Shanxi	0.0073	0.0095	0.0221	0.0537	0.0028	0.0038	0.0156	0.0329
Neimenggu	0.0073	0.0111	0.0371	0.0949	0.0021	0.0038	0.0114	0.0410
Liaoning	0.0165	0.0253	0.0481	0.1037	0.0061	0.0098	0.0173	0.0398
Jiling	0.0089	0.0113	0.0219	0.0531	0.0027	0.0053	0.0066	0.0221
Heilongjiang	0.0076	0.0105	0.0192	0.0433	0.0019	0.0036	0.0062	0.0161
Shanghai	0.0943	0.1550	0.3078	0.4056	0.0348	0.0858	0.1496	0.2632
Jiangshu	0.0104	0.0201	0.0572	0.1301	0.0044	0.0129	0.0293	0.0705
Zhejiang	0.0148	0.0369	0.0777	0.1499	0.0081	0.0233	0.0410	0.0687
Anhui	0.0046	0.0061	0.0168	0.0490	0.0029	0.0033	0.0067	0.0179
Fujian	0.0145	0.0215	0.0443	0.0866	0.0044	0.0107	0.0200	0.0425
Jiangxi	0.0060	0.0079	0.0174	0.0458	0.0017	0.0025	0.0057	0.0143
Shandong	0.0085	0.0130	0.0292	0.0659	0.0053	0.0086	0.0159	0.0306
Henan	0.0046	0.0066	0.0153	0.0340	0.0024	0.0033	0.0075	0.0145
Huben	0.0058	0.0085	0.0203	0.0436	0.0026	0.0041	0.0084	0.0187
Hunan	0.0048	0.0073	0.0183	0.0391	0.0013	0.0023	0.0047	0.0092
Guangdong	0.0300	0.0477	0.0711	0.1192	0.0099	0.0232	0.0320	0.0650
Guangxi	0.0055	0.0086	0.0172	0.0450	0.0017	0.0030	0.0050	0.0128
Hainan	0.0156	0.0183	0.0344	0.1294	0.0024	0.0041	0.0068	0.0323
Congqing	0.0063	0.0118	0.0306	0.0840	0.0014	0.0030	0.0061	0.0257
Sichuan	0.0059	0.0087	0.0219	0.0591	0.0027	0.0033	0.0067	0.0176
Guizho	0.0038	0.0070	0.0148	0.0393	0.0012	0.0023	0.0057	0.0147
Yunan	0.0072	0.0096	0.0200	0.0516	0.0035	0.0059	0.0092	0.0179
Xizhuang	0.0059	0.0126	0.0182	0.0398	0.0039	0.0027	0.0031	0.0151
Sanxi	0.0072	0.0109	0.0236	0.0712	0.0016	0.0038	0.0091	0.0227
Ganshu	0.0057	0.0081	0.0143	0.0339	0.0018	0.0025	0.0041	0.0078
Qinghai	0.0067	0.0109	0.0206	0.0612	0.0024	0.0025	0.0066	0.0195
Ningxia	0.0093	0.0163	0.0312	0.0888	0.0024	0.0032	0.0053	0.0222
Xinjiang	0.0094	0.0172	0.0269	0.0692	0.0027	0.0038	0.0049	0.0183

Source: The author's calculations based on the China Statistics Yearbook (2003–2011).

Table 2(B): Per capita tax revenue and GDP by province and by year (unit: 10,000 Yuan)

	per capita value added tax revenue				per capita individual income tax revenue			
	1998	2002	2006	2010	1998	2002	2006	2010
Beijing	0.0302	0.0469	0.0745	0.1070	0.0293	0.0431	0.0647	0.1098
Tianjin	0.0198	0.0385	0.0750	0.0917	0.0083	0.0131	0.0197	0.0331
Hebei	0.0060	0.0082	0.0204	0.0283	0.0020	0.0032	0.0043	0.0065
Shanxi	0.0078	0.0116	0.0352	0.0555	0.0025	0.0030	0.0047	0.0089
Neimenggu	0.0051	0.0074	0.0248	0.0550	0.0013	0.0024	0.0050	0.0159
Liaoning	0.0117	0.0177	0.0291	0.0432	0.0042	0.0067	0.0083	0.0147
Jiling	0.0069	0.0102	0.0158	0.0285	0.0017	0.0033	0.0043	0.0085
Heilongjiang	0.0098	0.0146	0.0270	0.0322	0.0017	0.0033	0.0042	0.0065
Shanghai	0.0516	0.0842	0.1489	0.1688	0.0264	0.0413	0.0722	0.1134
Jiangshu	0.0110	0.0208	0.0436	0.0715	0.0029	0.0055	0.0108	0.0230
Zhejiang	0.0131	0.0279	0.0499	0.0732	0.0038	0.0094	0.0163	0.0277
Anhui	0.0038	0.0051	0.0113	0.0217	0.0019	0.0015	0.0023	0.0054
Fujian	0.0075	0.0137	0.0247	0.0382	0.0054	0.0068	0.0094	0.0153
Jiangxi	0.0029	0.0044	0.0095	0.0190	0.0008	0.0018	0.0028	0.0045
Shandong	0.0079	0.0122	0.0261	0.0394	0.0019	0.0034	0.0049	0.0084
Henan	0.0039	0.0051	0.0113	0.0166	0.0009	0.0019	0.0026	0.0043
Huben	0.0050	0.0067	0.0137	0.0219	0.0015	0.0022	0.0034	0.0060
Hunan	0.0035	0.0048	0.0109	0.0171	0.0014	0.0021	0.0032	0.0057
Guangdong	0.0130	0.0262	0.0428	0.0630	0.0067	0.0128	0.0169	0.0275
Guangxi	0.0038	0.0055	0.0099	0.0168	0.0015	0.0024	0.0031	0.0056
Hainan	0.0028	0.0049	0.0126	0.0213	0.0044	0.0040	0.0047	0.0093
Congqing	0.0039	0.0067	0.0138	0.0269	0.0014	0.0027	0.0044	0.0091
Sichuan	0.0035	0.0048	0.0104	0.0186	0.0009	0.0018	0.0033	0.0072
Guizho	0.0027	0.0044	0.0102	0.0190	0.0007	0.0014	0.0029	0.0079
Yunan	0.0074	0.0079	0.0151	0.0245	0.0011	0.0022	0.0032	0.0070
Xizhuang	0.0024	0.0032	0.0054	0.0116	0.0009	0.0011	0.0016	0.0066
Sanxi	0.0045	0.0072	0.0196	0.0376	0.0009	0.0020	0.0036	0.0095
Ganshu	0.0043	0.0058	0.0121	0.0172	0.0006	0.0016	0.0022	0.0043
Qinghai	0.0050	0.0087	0.0178	0.0311	0.0009	0.0016	0.0027	0.0061
Ningxia	0.0060	0.0077	0.0183	0.0320	0.0013	0.0025	0.0041	0.0088
Xinjiang	0.0069	0.0111	0.0268	0.0345	0.0029	0.0041	0.0052	0.0125

Source: The author's calculations based on the China Statistics Yearbook (2003-2011).

Table 2(C): Per capita tax revenue and GDP by province and by year (unit: 10,000 Yuan)

	per capita total tax revenue				per capita GDP			
	1998	2002	2006	2010	1998	2002	2006	2010
Beijing	0.1841	0.3753	0.7066	1.1477	1.6142	2.2577	4.9780	7.1938
Tianjin	0.1060	0.1706	0.3880	0.5977	1.3964	2.0369	4.0550	7.0996
Hebei	0.0315	0.0449	0.0900	0.1493	0.6479	0.9091	1.6904	2.8351
Shanxi	0.0328	0.0458	0.1729	0.1938	0.5048	0.6125	1.4082	2.5743
Neimenggu	0.0331	0.0474	0.1433	0.3045	0.5084	0.7290	1.9989	4.7213
Liaoning	0.0637	0.0951	0.1914	0.3467	0.9338	1.2986	2.1660	4.2189
Jiling	0.0354	0.0487	0.0900	0.1599	0.5892	0.8322	1.5700	3.1557
Heilongjiang	0.0417	0.0608	0.1012	0.1453	0.7508	1.0181	1.6189	2.7048
Shanghai	0.2600	0.4363	0.8684	1.1759	2.5193	3.3285	5.7115	7.4548
Jiangshu	0.0413	0.0872	0.2194	0.4210	1.0025	1.4404	2.8669	5.2642
Zhejiang	0.0445	0.1220	0.2607	0.4526	1.1193	1.6776	3.1611	5.0899
Anhui	0.0257	0.0316	0.0701	0.1455	0.4537	0.5631	1.0063	2.0749
Fujian	0.0570	0.0787	0.1521	0.2616	1.0095	1.3508	2.1401	3.9906
Jiangxi	0.0232	0.0333	0.0704	0.1311	0.4419	0.5804	1.0764	2.1180
Shandong	0.0399	0.0672	0.1457	0.2242	0.8104	1.1619	2.3716	4.0854
Henan	0.0224	0.0309	0.0723	0.1081	0.4677	0.6417	1.3305	2.4552
Huben	0.0286	0.0407	0.0836	0.1358	0.6271	0.8309	1.3317	2.7877
Hunan	0.0241	0.0349	0.0754	0.1112	0.4939	0.6548	1.1935	2.4411
Guangdong	0.0897	0.1529	0.2342	0.3643	1.1087	1.4976	2.8165	4.4070
Guangxi	0.0256	0.0387	0.0726	0.1158	0.4071	0.5092	1.0232	2.0759
Hainan	0.0447	0.0576	0.0979	0.2730	0.5829	0.7523	1.2594	2.3769
Congqing	0.0232	0.0406	0.1131	0.2155	0.4671	0.6345	1.2434	2.7475
Sichuan	0.0232	0.0337	0.0744	0.1467	0.4216	0.5621	1.0574	2.1362
Guizho	0.0179	0.0282	0.0604	0.1137	0.2301	0.3088	0.6074	1.3229
Yunan	0.0406	0.0477	0.0848	0.1526	0.4329	0.5152	0.8938	1.5699
Xizhuang	0.0144	0.0274	0.0518	0.0841	0.3618	0.6046	1.0356	1.6875
Sanxi	0.0260	0.0409	0.0970	0.1902	0.3842	0.5542	1.2112	2.7103
Ganshu	0.0214	0.0294	0.0542	0.0861	0.3453	0.4479	0.8736	1.6097
Qinghai	0.0254	0.0399	0.0771	0.1580	0.4377	0.6448	1.1708	2.3986
Ningxia	0.0330	0.0463	0.1016	0.2003	0.4228	0.5757	1.1768	2.6694
Xinjiang	0.0374	0.0611	0.1071	0.1905	0.6392	0.8390	1.4855	2.4884

Source: The author's calculations based on the China Statistics Yearbook (2003–2011).

Table 3: The ratio of areas with the lottery receipt experiment to total areas by province in China

	1998	2002	2006	2010
Beijing	0.00	1.00	1.00	1.00
Tianjin	0.00	0.00	0.50	1.00
Hebei	0.00	0.09	0.55	1.00
Shanxi	0.00	0.00	0.50	1.00
Neimenggu	0.00	0.00	0.50	1.00
Liaoning	0.00	0.28	0.64	1.00
Jiling	0.00	0.08	0.54	1.00
Heilongjiang	0.00	0.09	0.54	1.00
Shanghai	0.00	1.00	1.00	1.00
Jiangshu	0.00	0.00	0.50	1.00
Zhejiang	0.00	0.00	0.50	1.00
Anhui	0.00	0.04	0.52	1.00
Fujian	0.00	0.16	0.58	1.00
Jiangxi	0.00	0.18	0.59	1.00
Shandong	0.00	0.18	0.59	1.00
Henan	0.00	0.04	0.52	1.00
Huben	0.00	0.13	0.56	1.00
Hunan	0.00	0.07	0.54	1.00
Guangdong	0.00	0.21	0.61	1.00
Guangxi	0.00	0.00	0.50	1.00
Hainan	0.05	0.15	0.58	1.00
Congqing	0.00	0.03	0.51	1.00
Sichuan	0.00	0.00	0.50	1.00
Guizho	0.00	0.06	0.53	1.00
Yunan	0.00	0.03	0.52	1.00
Xizhuang	0.00	0.00	0.00	0.00
Sanxi	0.00	0.00	0.50	1.00
Ganshu	0.00	0.06	0.53	1.00
Qinghai	0.00	0.00	0.50	1.00
Ningxia	0.00	0.00	0.50	1.00
Xinjiang	0.00	0.00	0.50	1.00

Notes: The column ``2002'' of this table is from the Table A1 of Wan (2010). The column ``2006'' of this table is equal to the average of the data of the columns ``2002'' and ``2010;'' This table is derived from the author's data using the search engine Google.com in May 2003 and November 2011;These are not statistical data; some notes are needed.

Table 4: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Population	124	4139.6430	2643.0540	252.0000	10440.9600
Urban ratio	124	0.4361	0.1648	0.1594	0.8919
Year	124	2004	4.4903	1998	2010
Per capita total tax revenue	124	0.1423	0.1889	0.0144	1.1759
Per capita value added tax revenue	124	0.0231	0.0268	0.0024	0.1688
Per capita sales tax revenue	124	0.0462	0.0700	0.0038	0.4360
Per capita enterprise income tax revenue	124	0.0204	0.0393	0.0012	0.2632
Per capita individual income tax revenue	124	0.0093	0.0172	0.0006	0.1134
Per capita GDP	124	1.7137	1.4903	0.2301	7.4548
The first sector GDP	124	0.1798	0.1029	0.0496	0.6215
The second sector GDP	124	0.8100	0.7238	0.0803	3.7253
The third sector GDP	124	0.7239	0.8130	0.0686	5.4034
ln(Total tax)	124	−2.4489	0.9439	−4.2376	0.1621
ln(Value added tax)	124	−4.2335	0.9516	−6.0466	−1.7792
ln(Sales tax)	124	−3.7296	1.0903	−5.5706	−0.8301
ln(Enterprise income tax)	124	−4.7295	1.1921	−6.7423	−1.3349
ln(Individual income tax)	124	−5.3879	1.0735	−7.4670	−2.1765
LRE	124	0.4102	0.4175	0.0000	1.0000

Note: The variable definition is shown in the Table 1.

Table 5: The lottery receipt's effect on provincial tax revenues by panel estimations (dependent variable: tax revenue by type)

	ln(Sales tax)		ln(Enterprise income tax)		ln(Value added tax)		ln(Individual income tax)		ln(Total tax)	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
Year	0.109	0.072	0.101	0.055	0.122	0.087	0.137	0.066	0.116	0.074
	(0.010)***	(0.012)***	(0.016)***	(0.017)***	(0.010)***	(0.012)***	(0.014)***	(0.017)***	(0.010)***	(0.011)***
The first sector GDP	1.473	0.981	0.963	0.127	0.105	−0.569	−0.133	−0.226	−0.054	−0.193
	(0.390)***	(0.450)**	−0.598	−0.593	−0.401	−0.451	−0.545	−0.612	−0.393	−0.397
The second sector GDP	0.125	0.078	0.068	0.195	0.099	0.182	0.222	0.129	0.136	0.138
	(0.071)*	−0.085	−0.109	(0.115)*	−0.073	(0.085)**	(0.100)**	−0.118	(0.072)*	(0.077)*
The third sector GDP	−0.044	0.123	0.108	0.265	−0.129	−0.052	−0.118	0.189	−0.013	0.14
	−0.054	(0.065)*	−0.084	(0.089)***	(0.056)**	−0.065	−0.076	(0.090)**	−0.055	(0.059)**
Urban ratio	0.316	2.527	0.177	2.657	0.256	2.339	−0.816	2.967	0.159	2.341
	−0.361	(0.313)***	−0.553	(0.389)***	−0.371	(0.313)***	−0.504	(0.407)***	−0.363	(0.262)***
LRE	0.343	0.433	0.483	0.494	0.199	0.249	−0.076	0.044	0.21	0.256
	(0.118)***	(0.147)***	(0.180)***	(0.207)**	−0.121	(0.147)*	−0.164	−0.208	(0.118)*	(0.137)*
Constant	−222.776	−149.963	−207.294	−116.504	−248.724	−180.204	−280.601	−138.172	−235.52	−152.442
	(20.175)***	(23.775)***	(30.918)**	(33.925)***	(20.710)***	(23.848)***	(28.164)***	(33.902)***	(20.300)***	(22.269)***
Observations	124	124	124	124	124	124	124	124	124	124
Number of id	31	31	31	31	31	31	31	31	31	31
R-squared (within)	0.97	0.96	0.94	0.91	0.96	0.93	0.91	0.84	0.96	0.94

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%