CAES Working Paper Series

The Lottery Receipt and Cashless Payment

Junmin Wan

Fukuoka University, Japan

September 8, 2020

WP-2020-012

Center for Advanced Economic Study
Fukuoka University
(CAES)

8-19-1 Nanakuma, Jonan-ku, Fukuoka,
JAPAN 814-0180
+81-92-871-6631

The revised version of this manuscript entitled ``The Lottery Receipt'' is forthcoming in the International Review of Economics and Finance.

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Junmin Wan*

Faculty of Economics, Fukuoka University

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*This Research utilizes the micro data from the Preference Parameters Study of Osaka University's 21st Century COE Program 'Behavioral Macrodynamics based on Surveys and Experiments and its Global COE project 'Human Behavior and Socioeconomic Dynamics.' The author acknowledges the program project's contributors: Yoshiro Tsutsui, Fumio Ohtake, and Shinsuke Ikeda. The author thanks Hirobumi Akagi, John E. Anderson, Anne Brockmeyer, Takao Fujimoto, Masahiro Fujiwara-Okuno, David F. Hendry, Charles Yuji Horioka, Firouz Gahvari, Carla Marchese, Masao Ogaki, Hikaru Ogawa, Kazuo Ogawa, Shang-Jin Wei, Yaohui Zhao, and the participants for their helpful comments and encouragement when the paper was presented at universities including Fukuoka, Kanazawa, Keio, Maastricht, Osaka, Peking, Pusan, and the 72th IIPF congress at Reno. Finally, the author gives special thanks to an anonymous referee for the constructive comments and beneficial suggestions. Any remaining errors here are the author's responsibility. Correspondence: Nanakuma 8-19-1, Jonan Ward, Fukuoka City, Fukuoka 8140180, Japan; wan@fukuoka-u.ac.jp; (tel) +81-92-871-6631(ext.4208); (fax) +81-92-864-2904.

Abstract

To solicit information about transactions known only to firms and consumers, many governments have set up a lottery receipt experiment (LRE). Field studies and household surveys have shown that LREs in China have significantly improved tax declarations by asking for official receipts. We show that if the government gives a subsidy to a consumer to buy information in a competitive market, the consumer will declare the tax so that the firm cannot cheat the government. Thus, both the cheating and auditing costs can be saved and Pareto-efficient taxation without collusive evasion becomes practicable under specific conditions. A cashless payment system can also work as a lottery receipt system by curbing tax evasion.

JEL classification: D81, D82, H26

Keywords: lottery receipt experiment, tax evasion, subsidy, tax declaration, cashless payment system

1 Introduction

To collect indirect taxes, such as the unit tax, the government needs to obtain private and corporate financial records of transactions. However, unless the government is willing to incur significant costs in monitoring the economic dealings and collection processes, such information will not materialize. Due to the asymmetry of information between the government and taxpayers, taxpayers are tempted to underreport the amount of taxes due.

Since the pioneering work by Allingham and Sandmo (1972) and Yitzhaki (1974), many theoretical and empirical studies have focused on tax evasion. Andreoni et al. (1998) and Slemrod (2007) conducted comprehensive surveys of this body of literature and found that tax enforcement, auditing, tax rates, income levels, and social norms all affect tax evasion. Cowell (1990) focused on empirical studies about the extent of tax evasion and the black economy in 19 countries. Crane and Nourzad (1994), O'Higgins (1989), and Alm et al. (1991) empirically examined the determinants of income tax evasion in the US, UK, and Jamaica. Marion and Muehlegger (2008) examined tax evasion in the diesel fuel market in the US. Gorodnichenko et al. (2009) examined how Russia's 2001 flat-rate income tax reform affected on tax evasion. Marchese (2009) analyzed how rewarding consumers affected the evasion of commodity tax using a competitive tax evasion model. Kleven et al. (2011) found considerable tax evasion among self-reported income taxpayers in Denmark. Pomeranz (2015) used two randomized field experiments in Chile to find that information reporting was crucial for effective tax collection. Based on existing studies, we know that tax evasion is still an unsolved issue worldwide.

As a transitional economy, tax evasion in China seems more serious. Woller (1999) argued that China's shrinking tax burden is partly the result of a nearly endemic level of tax evasion. "The Economist" (1989) noted that in 1989, the

tax authorities of Shanghai seized the books of 10,361 private businesspersons and found that 8,953 of them had evaded tax. Li (1995) estimated tax evasion in China at a loss to the government of around 100 billion Yuan per year.[1] Fisman and Wei (2004) examined the relationship in China between the tariff schedule and the "evasion gap", finding that a one-percentage-point increase in the tariff rate is associated with a three-percent increase in evasion. As shown in Figure 1, the public deficit - partially affected by tax evasion - has become significant.

Due to such serious tax evasion, it is difficult for the Chinese government to capture the real economic activity; a significant part of the economy does not get considered in the national accounting and goes underground. Bajada and Schneider (2005) found that China's underground economy from 1991-1995 and 2000-2001 averaged 10.2% and 13.4% of the official GDP, respectively. Based on the 2005 report of "China Economic Census 2004," the National Bureau of Statistics of China adjusted the national accounting. For example, in 2004 both the GDP and the service industry were undervalued by 14.39% and 13.33%, respectively.[2]

To remedy this situation, mainland China introduced a new system called lottery receipts.[3] These lottery receipts, which are official receipts printed with public lottery numbers, have been used in Taiwan as a means of tax collection since December 12, 1950 (Wan 2014; Hu 2015). Because a lottery ticket number is incorporated into the official receipt, the lottery receipt simultaneously acts as an official receipt and a public lottery ticket. Based on Taiwan's success, many provinces of mainland China have also introduced this system since 1989.

[1] As of February 2016, 1 US dollar = approximately 6.53 Yuan.

[2] The GDP was re-estimated based on information including the number of nationwide employees. In 2004, the GDP was 15.99 trillion Yuan, but as much as 2.3 trillion Yuan was undervalued, of which 2.13 trillion Yuan was in the service industry.

[3] Argentina, Armenia, Austria, Bolivia, Brazil (Naritomi 2015), Bulgaria, Chile, Georgia, Greece, Indonesia, Italy, Malta, Poland, Portugal, Puerto Rico, and Romania also adopted a lottery receipt system, but Georgia and Puerto Rico then eliminated them in April 2012 and October 2015, respectively. The Republic of Korea implemented a similar system called the "Korea Credit Card Tax Deduction System" (Kim 2005; Lee and Swenson 2017).

By 2012, China had introduced the lottery LRE nationwide,[4] but some cities eliminated it due to new taxation.[5]

Some evidence from field studies and empirical analyses indicate that the LRE in China has had a positive effect on tax declarations. Here, we review this evidence. We also assess urban individual data from the "Chinese Household Survey on Consumers' Preference and Satisfaction (CHSCPS) 2006" and suggest that by asking for official receipts, the LRE has promoted tax declarations among consumers in the six biggest cities in China. Furthermore, by introducing incentive constraint for consumers, we demonstrate that the lottery receipt works as an incentive mechanism that can mitigate information asymmetry between the government and taxpayers and that the new system makes Pareto-efficient taxation practicable under some specific conditions without evasion. The key difference between this paper and the existing research, such as that done by Naritomi (2015), is that we focus empirically (by household survey) and theoretically (by incentive compatibility) on the consumer side and while the firm side is frequently analyzed in the literature.

The remainder of the paper is organized as follows. Section 2 reviews evaluation of the LRE through both field studies and empirical analysis. Section 3 empirically analyses an urban household survey in China. Section 4 presents a theoretical explanation of the LRE. Section 5 describes that cashless transaction can function as a lottery receipt system. We close with a conclusion of our results in Section 6.

[4]The LRE has been widely reported by mass media worldwide (Marchese 2007; Chao 2012; Geinttz 2012; and Keng 2013).

[5]The LRE was used only for sales tax. However, due to the replacement of the sales tax by a value-added tax in the service industry in Ningbo, Beijing, and Changsha in October 2013, January 2014, and January 2014, respectively, the LRE was eliminated in those cities.

2 Review of LRE Field Studies

2.1 Experiment in Tangshan

Chen (1990) investigated how lottery receipts affected tax evasion in the city of Tangshan.[6] In June 1989, 2,554 self-employed entrepreneurs at 13 markets in the four districts of the city were assigned to use the lottery receipt system. In a one-year experiment (June 1989 to May 1990), more than two million lottery receipts were issued, and total tax revenues increased by 634 million Yuan compared with the previous year. Tax payments per self-employed entrepreneur increased by an average of 634 Yuan. One of the self-employed entrepreneurs had planned to pay taxes based on 3,000 Yuan, the expected volume of sale, but the realized sales according to the lottery receipts were actually 38,100 Yuan, 12 times more than the expected sales.

Since it could be perceived that the above result could be due only to economic growth or other changes, such as population transition, we obtained related data from the period 1988-1991, as shown in Figure 2. It is obvious that there was no other drastic change in per capita GDP and population before and after the experiment, therefore, we can conclude that the experiment had significant impacts on both consumers and self-employed entrepreneurs.

2.2 Experiment in Fuzhou

Tang (2000) investigated how lottery receipts affected tax evasion in the city of Fuzhou City.[7] Use of receipts increased greatly from January to the end

[6] Tangshan is a major city in Hebei Province; in February 2016, its total population was 7.53 million, with urban and rural populations of 4.32 and 3.21 million, respectively. Per capita GDP in 2015 was 81,009 Yuan (12,406 US dollars).

[7] Fuzhou city is located in Jiangxi Province, and had a population of 3.98 million in February 2016, with urban and rural populations of 1.73 and 2.25 million, respectively. Per capita GDP in 2015 was 28,654 Yuan (4,388 US dollars). Fuzhou city was newly established in June 2000, thus for comparability, we used data for Linchuan county, a county of Fuzhou city, in Figure 3.

of February 1999, compared with the same period of the previous year. In the retail sector, receipts increased by 208 percent compared with the previous period, and the value-added tax in the retail sectors increased by 529 million Yuan, a 31.2% increase compared with previous year.

We also obtained data on per capita GDP and population during the period 1998-2001, as shown in Figure 3. It is obvious that there was no drastic change for these two measures before and after the experiment, therefore, we conclude that the experiment had significant impacts on both consumers and retail sellers.

2.3 Experiments in Beijing and Tianjin

Wan (2010) investigated how lottery receipts affected tax evasion in Beijing and Tianjin, based on data about the various timings of the introduction of the LRE in 37 districts and tax revenue data. The results indicated that the LRE significantly raised the sales tax revenue, increased the growth of sales tax revenue, and increased total tax revenues from 1998-2003.

3 Empirical Analysis of LRE Based on Survey Results

3.1 Household Survey on LRE in Six Largest Cities

In February 2006, the 21st Century Center of Excellence Program "Behavioral Macrodynamics based on Surveys and Experiments" of Osaka University conducted a survey of urban households in China's six biggest cities (Shanghai, Beijing, Chengdu, Guangzhou, Shenyang, and Wuhan), where LRE was introduced in 2003, 2001, 2004, 2001, 2002, and 1998, respectively. A total of 250 households were randomly sampled in each city, and data for a total of 1,500 households were obtained by directly interviewing the respondents. Appendix

A presents the related questions and answers.

3.2 Simple Comparison

Figure 4 presents the frequency of asking for and receiving an official receipt before and after the LRE. A total of 225 respondents asked for and received an official receipt per one-time shopping or eating out before the LRE, while the number of respondents increased to 527 after the LRE. Clearly, the frequency increased after the introduction of the LRE. Table 1 lists the number of respondents who asked for and received official receipts before and after the LRE, and Table 2 lists the reasons why respondents asked for and received the lottery receipts after the LRE.

Of the 1,021 respondents who did not ask for and did not receive official receipts before the LRE, 384 respondents (384/1,021=37.6%) asked for and received lottery receipts every 2.039 times they shopped or ate out after the LRE; 331 respondents (331/384=86.2%) said that their reason for this was the fact that the lottery number was printed on the receipt. Therefore, the frequency of receiving receipts was significantly increased by the LRE (p-value = 0.000 by difference test).

Of the 479 respondents who did ask for and receive official receipts before the LRE, they asked for and received official receipts every 2.532 times they shopped or ate out, while after the LRE 450 respondents asked for and received official receipts every 1.620 times they shopped or ate out, and 332 respondents (332/450=73.7%) answered that their reason for this was the fact that the lottery number was printed on the receipt. Therefore, the frequency of receiving the receipts was significantly increased by the LRE (p-value = 0.000 by difference test).

Table 3 lists the reasons why the respondents did not ask for and did not

receive the lottery receipts after the LRE: 37.1% and 63.1% answered "because I thought that it was very difficult to get the lottery prize even I had the lottery receipt" and "because it was very troublesome to ask for and receive the lottery receipt", respectively.

In summary, the above results indicate that the LRE made more respondents ask for and receive an official receipt, and increased the frequency of asking for and receiving an official receipt.

3.3 Empirical Specification

We used the following econometric model to capture the potential impacts of the LRE on asking for and receiving an official receipt. Here, we define a dummy variable as a dependent variable (y_i) for estimation. It equals 1 for respondents who asked for and received an official receipt and 0 when this was not the case.

$$
\begin{aligned}
y_i = & \sum_{j=1}^{k} \gamma_j x_{ji} \ (k \ reasons \ before \ the \ LRE, \ why \ asked \ for \ receipt?) \\
& + \sum_{j=k+1}^{k+m} \gamma_j x_{ji} \ (m \ reasons \ before \ the \ LRE, \ why \ not \ asked \ for \ receipt?) \\
& + \sum_{j=k+m+1}^{k+m+o} \gamma_j x_{ji} \ (o \ reasons \ after \ the \ LRE, \ why \ asked \ for \ lottery \ receipt?) \\
& + \sum_{j=k+m+o+1}^{k+m+o+q} \gamma_j x_{ji} \ (q \ reasons \ after \ the \ LRE, \ why \ not \ asked \ for \ lottery \ receipt?) \\
& + \sum_{j=k+m+o+q+1}^{k+m+o+q+w} \gamma_j x_{ji} \ (w \ factors \ such \ as \ age, \ income, \ career, \ education, \ etc.) \\
& + \sum_{j=k+m+o+q+w+1}^{k+m+o+q+w+z} \gamma_j x_{ji} \ (five \ city \ dummies, \ Shengyang \ excluded) \\
& + u_i.
\end{aligned}
$$

To capture the frequency of asking for and receiving an official receipt, we further define "freq" as a dependent variable (y_i) equal to the reciprocal of the answer of Question 2 ("before the LRE, how often did you ask for and receive an official receipt?" I asked for and received an official receipt per h ($1 \leq h < \infty$) times shopping or eating out") or Question 6 in Appendix A ("after the LRE, how often did you ask for and receive an official receipt? " I asked for and received an official receipt per h ($1 \leq h < \infty$) times shopping or eating out). If the respondent did not receive a receipt, the "freq" was zero. We also define the frequency of receiving receipts before the LRE as "freq_before," while receiving one after the LRE is defined as "freq_after". Thus, the "freq_before" and "freq_after" range from 0 to 1 ($y = 1/h$). Table 4 lists the definitions of other variables and the summary statistics of all variables.

As shown in the above specification, we use the various 'reasons' ($k + m + o + q$ dummies) given by respondents - personal characteristics, such as age or education (w factors), and five (z) city dummies - as independent variables (x_{ji}). Unobservable factors are included in the error term u_i. Among the $k+m+o+q$ 'reasons', variables related to the LRE are expected to have significant impacts. For example, for a respondent who did not ask for a receipt for the 'no lottery' reason, the dummy of 'no lottery' would have a significantly negative impact on the y_i before the LRE while having a significantly positive impact on the y_i after the LRE.

Because Shanghai, Beijing, Chengdu, Guangzhou, Shenyang, and Wuhan introduced an LRE in 2003, 2001, 2004, 2001, 2002, and 1998, respectively, the city dummy would also capture the LRE period. The survey was performed in 2006, hence the LRE period for Shanghai, Beijing, Chengdu, Guangzhou, Shenyang, and Wuhan was 3 years, 5 years, 2 years, 5 years, 4 years, and 8 years, respectively. The LRE period in Beijing (5 years), Guangzhou (5 years),

and Wuhan (8 years) was longer than that in Shenyang (4 years), while in Shanghai (3 years) and Chengdu (2 years) it was shorter than in Shenyang (4 years). Presumably, the shorter the LRE period, the greater the impact of the LRE on asking for receipts. Shengyang is used as a benchmark (excluded), thus the dummies for Shanghai and Chengdu would have significantly positive coefficients, while the dummies for Beijing, Guangzhou, and Wuhan would have significantly negative coefficients.

We used four linear probability models to empirically capture the lottery receipt effect on asking for and receiving receipts.[8] Table 5 summarizes the estimation results based on the ordinary least squares (OLS) method and White robust standard errors. We reported results for four estimations. We were especially interested in which reasons affected asking for and receiving receipts before and after the implementation of the lottery receipt system, as well as the impacts of the LRE period, which would be captured by the city dummies. Model 1 shows the results before the LRE, while Models 2 and 3 show the results after the LRE. Model 3 focuses on the 1021 respondents who did not ask for and receive an official receipt before the LRE, while Model 4 focuses on 479 respondents who asked for and received an official receipt before the LRE. In Model 4, 29 respondents did not ask for and receive an official receipt, while 168 respondents increased the frequency of asking and receiving receipts after the LRE. Thus, we use 'freq_before_after', which is the difference between 'freq_after' and 'freq_before', to capture the lottery receipt effect on the change in frequency of asking for and receiving receipts.

[8] For robustness, we performed alternative regressions, such as the Probit Model and Count Data Model, which yielded almost unchanged results. These results are available upon request.

3.4 Results by Estimations

In Table 5, the key variables are 'troublesome' and 'no lottery' as 'reasons why have not asked for official receipt before the LRE,' and 'lottery on the receipt' as 'reasons why have asked for the lottery receipt after the LRE'. 'Troublesome' and 'no lottery' before the LRE had significantly negative effects on "ask_before", and had significantly positive effects on "ask_after". 'Lottery on the receipt' after the LRE had a significantly positive effect on both "ask_after" and "ask_before_after". These results suggest that the LRE has a significantly positive effect on asking for and receiving receipts.

When we turn to see 'additional payment', 'troublesome', 'difficult to get the lottery prize', and 'others' as the 'reasons why an official receipt was not asked for after the LRE', we found that all these variables had significantly negative effects on both "ask_after" and "ask_before_after". As of the impacts of the LRE period, the dummies for Shanghai, Chengdu, and Wuhan have significantly positive coefficients from three regressions among totally four ones. In Wuhan, which had the longest period, the dummy effect is not consistent with the prediction that the impacts of the LRE would diminish according to the LRE period.

A consumer is given a lottery receipt, and it is very unlikely that businesses would move to a new district because of the LRE, so the self-selection problem would be considerably controlled and the empirical results here seem plausible. The evidence from the micro-level data suggests that the LRE would encourage consumers to ask for and receive official receipts. These results at the household level support findings from previous field studies (Chen 1990; Tang 2000) as well as empirical analyses at the county level (Wan 2010).

4 A Model of LRE

4.1 The Benchmark

Economic transactions involve three types of agents: firms, consumers, and the government. The government wants to know the volume of transactions between firms and consumers in order to collect taxes, e.g., a unit (or specific) tax. We assume that a large number of homogeneous firms - so large that the product market can be competitive - seek profit maximization within the competitive market. There are N homogeneous consumers, where $N > 1$.[9] When a consumer buys a product from a firm, information about the purchased quantity is shared with it. The government cannot know about this sale unless it incurs a monitoring cost. Each consumer-firm pair in a transaction has a free rider incentive not to pay taxes due to the government's inability to perfectly supervise trading volumes. It is very difficult for a government to monitor a large number of small firms, so there is always a significant tax evasion problem.

Because small firms are always subject to perfect competition, here we consider unit tax evasion in the perfectly competitive market. We use the setting described by Cremer and Gahvari (1993) and, for simplification, consider only one good. The production technology of firms is linear, and the constant average and marginal cost is denoted by c. The output is subject to a per unit (or specific) tax of t and is sold at a consumer price of p. A firm's taxes depend on its reported sales α. The tax administration can confirm α without incurring a cost. The probability that the tax-evading firm will be caught by the tax administration is expressed as β $(0 \leq \beta \leq 1)$, while the penalty rate with an upper bound is denoted by τ $(0 \leq \tau \leq \bar{\tau})$.[10] We assume that $\beta\tau < 1$. The

[9] If N=1, the free rider problem will not arise.

[10] This would be a plausible assumption in China. For example, from 1994-2006, more than 200 individuals who engaged in tax evasion and fraud were condemned to capital punishment, and more than 100 were executed. For details, see http://finance.people.com.cn/GB/1037/4349573.html

social cost incurred by auditing tax evasion, simply called the auditing cost, is given by a function $d(\beta)$, which convexly increases with β. Following Cremer and Gahvari (1997), we assume that the government is benevolent. Social costs incurred by the tax-evading firm (simply called cheating costs) are denoted by a given function $g(1-\alpha)$, $g(0) = 0$, $g(1) = \infty$, and convexly increase with the proportion $(1-\alpha)$ of unreported sales. The representative firm maximizes expected profits, π^e,

$$\pi^e = [p - c - g(1-\alpha) - (\alpha + (1-\alpha)\beta\tau)t]x. \tag{1}$$

Here, x denotes the firm's output. The magnitude α is the proportion reported by the tax-evading firm.

If $x > 0$, eq. (1) implies that the firm chooses α so that

$$q \equiv g(1-\alpha) + (\alpha + (1-\alpha)\beta\tau)t \tag{2}$$

is minimized. The first- and second-order conditions for this problem are

$$\frac{\partial q}{\partial \alpha} = -g'(1-\alpha) + (1-\beta\tau)t = 0, \tag{3}$$

$$g''(1-\alpha) > 0. \tag{4}$$

The solution will then be in the interior. We can use the following definition

$$t^e \equiv (\alpha + (1-\alpha)\beta\tau)t \tag{5}$$

to denote the firm's expected tax payment per unit of output. The market equilibrium occurs at

$$p = c + g + t^e. \tag{6}$$

If $g + t^e < t$, then the tax evasion problem arises for the following reason. If a firm honestly reports sales, then the price of the output will be $p^h = c + t$. Then $g + t^e < t$ makes $p < p^h$, the honest firm will disappear due to market selection, and only tax-evading firms remain in the equilibrium.

The government's problem is how to maximize the utility, Λ, of a representative consumer with a reservation price v.

$$max_{\{t,\beta\}}\Lambda = v - p + ln(R), \tag{7}$$

where $p = c + g + t^e$, and $R \equiv t^e - d(\beta)$ is the net government revenue from per unit private goods. The logarithmic function $ln(R)$ is the utility from the public good. Cremer and Gahvari (1997) demonstrated that the government chooses the "social optimal", and they obtained simulated solutions of $t^*(> 0),\ \beta^*(> 0)$, and $\tau^*(> 0)$ given that the firm optimally chooses $\alpha^*(1 > \alpha^* > 0),\ g(\alpha^*) > 0,\ g(\alpha^*) + t^{e*} < t^*$. This is a state of equilibrium among the government, firms, and consumers. Consequently, honest firms are totally excluded by the cheating firms because of information asymmetry and consumers' search for cheaper goods, with only cheating firms remaining in the market.

4.2 A Solution to Evasion

4.2.1 Cashback for Consumers as Incentives to Declare Tax

In the benchmark model, the positive $d(\beta^*)$ and $g(\alpha^*)$ constitute pure waste of social resources, thus the first best taxation, i.e., $\alpha^* = 1,\ g(\alpha^*) = 0,\ \beta^* = 0,\ d(\beta^*) = 0$, is not realized.

Here, we consider the representative consumer's incentive to declare tax under conditions of a governmental subsidy or cashback program. Assume that the government gives the consumer a subsidy of s based on his/her declaration

of a purchase designed to compel him/her to declare the tax, e.g., report the purchase to the government by asking for an official receipt from the firm, while keeping the auditing, $\beta^* > 0$ and $d(\beta^*) > 0$ as shown in the above section.[11] Figure 5 shows the lottery receipt framework involving consumers, firms, and the government.

Proposition 1. If $t^* - t^{e*} \geq s \geq t^* - t^{e*} - g(\alpha^*) > 0$, where the subsidy s is larger than and sufficiently close to $t^* - t^{e*} - g(\alpha^*)$ and $\alpha^* > 0$, the economy is Pareto improving.

Proof. To make a consumer buy an honest firm's goods (voluntarily and fully declaring tax to the government), the consumer's incentive constraint is $p^s = c + t^* - s \leq p = c + t^{e*} + g(\alpha^*)$.[12] We obtain $s \geq t^* - t^{e*} - g(\alpha^*)$. Also, from the condition on evasion, $p^h = c + t^* > p = c + t^{e*} + g(\alpha^*)$, $t^* - t^{e*} - g(\alpha^*) > 0$. Therefore, we have $s \geq t^* - t^{e*} - g(\alpha^*) > 0$. The government's incentive constraint is $s \leq t^* - t^{e*}$, which means that the additional increase of tax revenue from the subsidy system must cover the budget of the subsidy. If we set $s = t^* - t^{e*} - g(\alpha^*) + \epsilon$, and $\epsilon \to 0^+$, then the net increase of government revenue per unit output will be $(t^* - t^{e*}) - (t^* - t^{e*} - g(\alpha^*) + \epsilon) = g(\alpha^*) - \epsilon > 0$ provided that $\alpha^* > 0$, and the economy is Pareto improving. Q.E.D.

4.2.2 A Specific Example of Pareto-Efficient Taxation Without Evasion

After a consumer declares tax to the government, the economy will shift to a new equilibrium by the subsidy without evasion. If t^* and $d(\beta^*)$ are kept unchanged, the net increase of government revenue will be $g(\alpha^*) - \epsilon > 0$. The government

[11] In countries where a lottery receipt system is used, the government monitors tax evaders while simultaneously issuing lottery receipts. If the government does not audit, i.e., $\beta = 0$ and $d(\beta) = 0$, t^e may become zero.

[12] The consumer's incentive constraint can also be written by $p^s = c + t^* - ls \leq p = c + t^{e*} + g(\alpha^*)$, while $l > 1$, $l < 1$, and $l = 1$ means lottery lover, averter, and neutral, respectively. For simplicity, and without loss of further generality, here we consider the simplest case of $l = 1$.

can change t^* to find a new social optimal tax t^{**}. In the new equilibrium, the gain from the removal of wasteful resources by tax evasion could be used in private or public sectors,[13] and the tax rate may decrease. From eq. (3), let us assume that the minimum probability $\beta_{min}(0 \leq \beta_{min} < \beta^*)$ with the maximum fine τ_{max} ($\beta_{min}\tau_{max} < 1$) can assure an interior solution of α' for any t in an interval $[0, \bar{t}]$. The government then pays the lowest auditing cost $d(\beta_{min})$, and $0 \leq d(\beta_{min}) < d(\beta^*)$ and has the following problem

$$max_{\{t,s\}}\Lambda = v - p + ln(R), \tag{8}$$

$$s.t. \;\; p = c + t, \tag{9}$$

$$p - s \leq p^e = c + g + t^e, \tag{10}$$

$$R = t - s - d(\beta), \tag{11}$$

where eq. (10) is the consumer's incentive compatibility.

Proposition 2. The government can find an s^{**} to enable the practice of the Pareto efficient taxation t^{**} without evasion through minimum auditing and the maximum fine.

See Appendix B for the proof. Specifically, we assume $g(1-\alpha) = 0.5(1-\alpha)^2$, and $0 \leq d(\beta) < 0.5$. By solving the above problem, we obtain the optimal solutions for tax and subsidy.

$$t^{**} = (1 - \beta\tau)^{-1}(1 - \alpha^{**}), \tag{12}$$

$$s^{**} = t^{**} - [\alpha^{**} + (1 - \alpha^{**})\beta\tau]t^{**} - 0.5(1 - \alpha^{**})^2, \tag{13}$$

[13]This point is indebted to a referee.

where,

$$(14)\quad \alpha^{**} = -\frac{1-\beta\tau+\beta^2\tau^2}{1-\beta\tau} + \frac{\{(1-\beta\tau+\beta^2\tau^2)^2+(1-\beta\tau)[(1-\beta\tau)(1-2d(\beta))+2\beta^2\tau^2]\}^{0.5}}{1-\beta\tau}.$$

In the equilibrium among the government, firms, and consumers, cheating firms are totally excluded by the consumers' tax declaration, leaving only honest firms in the market. These 'honest' firms are not honest by nature but are made passively so by the consumers' tax declaration; these firms would cheat if consumers did not ask for an official receipt. The cheating cost is saved and the auditing cost is partially saved (totally saved in the extreme case of sufficiently small auditing, as discussed in the below section), thus Pareto-efficient taxation without evasion becomes practicable under some strict conditions.

To implement this kind of subsidy system, the government needs detailed information about firms and consumers. Because tax evasion repetitively occurs, and the government repetitively audits taxpayers, it would not be difficult for the government to obtain information on the preferences of related taxpayers.

4.2.3 An Example of Sufficiently Small Auditing

Next, we consider how a firm behaves if the government makes $\beta_{min} \to 0^+$. The firm's best response may be to report nothing to the government, in which case $\alpha = 0$ and $t^e = 0$. But if $\beta_{min} \to 0^+$ (relax fine to be $\tau_{max} \to \infty$) assures that the firm has an interior solution α^{***} $(0 < \alpha^{***} < 1)$ for $t \in [0,\ \bar{t}]$, then the government can find an s^{***} to enable the practice of Pareto-efficient taxation (t^{***}) without evasion and auditing. Certainly, this condition is hardly realistic because the firm reports positive α if and only if the firm meets the positive auditing, $\beta\tau > 0$. The audit cost $d(\beta_{min}) > 0$ is a threat to cheating firms

and makes $\alpha > 0$ and $t^e > 0$. This auditing cost is clearly a waste of social resources caused by information asymmetry, taxpayers' free rider incentive, and the government's inability to force all taxpayers to pay their taxes. We may call this type of cost the "social cost of moral hazard". Because of this cost, the first-best taxation ($\beta^* = 0,\ d(\beta^*) = 0$) is difficult to realize.

Assume that a firm reports positive α when $\beta_{min} \to 0^+$, that is, $g'(1-\alpha) = (1-\beta\tau)t \to t$ of eq. (3) has an interior solution for α. Then, from eqs. (12)-(14), we can obtain the following results,

$$\alpha^{***}_{\beta\to 0^+} = 2^{0.5} - 1 = 0.41, \tag{15}$$

$$t^{***}_{\beta\to 0^+} = 2 - 2^{0.5} = 0.59, \tag{16}$$

$$s^{***}_{\beta\to 0^+} = 3 - 2(2^{0.5}) = 0.17, \tag{17}$$

$$R^{***}_{\beta\to 0^+} = t^{**} - s^{**} = 2^{0.5} - 1 = 0.41, \tag{18}$$

and the ratio of s^{***} to t^{***} is,

$$\frac{s^{***}}{t^{***}} = 1 - \frac{2^{0.5}}{2} = 29.29\%. \tag{19}$$

Figure 6 shows the relationship between subsidy and net tax revenue. Because we assume that the consumer has a linear preference for private goods, the above ratio of subsidy to tax is equivalent to the ratio of lottery prize to tax revenue in Wan (2010), in which the nationwide ratio in China in 2002 was about 3.00%. However, given the very specific assumptions and that we do not consider the stochastic aspect of the lottery or the crowding-out effect of "moral" factors as argued by Frey (1997), we cannot simply conclude that the ratio was too low in the case of China.

4.2.4 Consumer Reporting Cost

Next, we assume that the per-unit cost of the consumer's report is ζ (> 0).

Proposition 3. If $g(\alpha^*) - \zeta > 0$ *and* $t^* - t^{e*} \geq s \geq t^* - t^{e*} - g(\alpha^*) + \zeta > 0$, *then the government can Pareto-improve the economy by giving the consumer a positive subsidy.*

Proof. The consumer's incentive constraint is $p^s = c + t^* + \zeta - s \leq p(= c + t^{e*} + g(\alpha^*))$. From the evasion condition $t^* > t^{e*} - g(\alpha^*)$, we obtain $s \geq t^* - t^{e*} - g(\alpha^*) + \zeta > 0$. The government's incentive constraint is $s \leq t^* - t^{e*}$. If we assume that $s = t^* - t^{e*} - g(\alpha^*) + \zeta + \epsilon,\ \epsilon \to 0^+$, then the net increase of government revenue per unit output will be $(t^* - t^{e*}) - (t^* - t^{e*} - g(\alpha^*) + \zeta + \epsilon) = g(\alpha^*) - \zeta - \epsilon > 0$, provided that $g(\alpha^*) - \zeta > \epsilon$. Q.E.D.

5 Cashless Transaction and the Lottery Receipt System

According to the "Report on Transaction Payments in 2017" issued by The People's Bank of China on March 5, 2018,[14] the number of cashless transactions was 160.88 billion and their volume was 3,759.94 trillion Yuan. For payments by mobile phone, there were 37.55 billion transactions and the volume was 202.93 trillion Yuan, which was about 2.5 times the GDP of 82.71 trillion Yuan. Alipay Inc. and WeChat Pay Inc., the two largest mobile payment companies in China, use a system that is essentially similar to the lottery receipt system described in this paper.[15] If every transaction, especially in the retail sector, were to become cashless, tax evasion would be largely reduced or disappear since the People's

[14] See details from the following official site of The People's Bank of China. http://www.pbc.gov.cn/zhifujiesuansi/128525/128545/128643/3492272/2018030511004961889.pdf

[15] To promote cashless transactions, these companies randomly offer cashback on some transactions. From the author's personal experience, cashback was obtained for some transactions, and the size of cashback was roughly some percent of the total payment.

Bank of China can share information on transactions with the tax bureau at a negligible additional cost.

It was proposed that the Japanese government should introduce an official receipt system, with the cashback or subsidy based on the transaction simultaneously coded on the receipt.[16] In line with this view, it was reported by Nihon Keizai Shimbun (October 1, 2018) that the Japanese government was considering "Cashless Transaction and 2 Percent as Cashback" when the consumption tax rate was to be raised from 8

Therefore, internet cashless payment systems, such as those via mobile phone, are expected to be used to curb tax evasion in the future.

6 Conclusions

Previous research about tax evasion has focused on the effects of governmental monitoring, punishment, and consumer attributes of tax evaders. It is an institutional innovation for a government to give taxpayers incentives to declare the tax base voluntarily, by providing a subsidy (i.e., lottery) or cash back instead of inflicting punishment. Evidence from field studies suggests that the LRE has had a positive effect on tax declaration in China. Based on estimates from urban individual household data, we found that the LRE has promoted consumer tax declarations in China's six biggest cities by people asking for and receiving official receipts.

This paper also presented a theoretical examination of what conditions make the LRE work well; the results suggest that if the government gives the consumer an appropriate subsidy to satisfy the incentive compatibility under a competitive market, the consumer will voluntarily and fully declare unit tax

[16] See page 128 of SPA weekly in the following two websites on December 8, 2015, for details.
https://www.fusosha.co.jp/magazines/detail/4910234521256
https://plaza.rakuten.co.jp/bluestone998/diary/201512120000/

so that firms cannot cheat, thereby saving the cheating and auditing costs, resulting in Pareto-improved and efficient taxation without evasion under certain conditions. Using this system, the government can prevent the tax evasion caused by collusion between consumers and firms and can collect unit taxes effectively. This system may also contribute significantly to a national system of accounting, whereby basic information about economic transactions is sent to the government and can thus help mitigate the underground economy worldwide, especially in China.[17] Cashless payment systems can also work as lottery receipt systems.

Future research should focus on the crowding-out effect of monetary subsidies caused by "moral" factors, as well as appropriate policies for fostering tax compliance. It is also important to clarify (both theoretically and more specifically) issues related to optimal policy, consumer and firm behavior in imperfectly competitive markets, non-benevolent governments, political processes, and different purposes between the finance ministry and the tax bureau, etc.

Appendix A

The questions and answers on lottery receipt included in the questionnaire are as follows.

Question 1: Did you ask for and receive an official receipt when you went shopping or eating out before the Lottery Receipt System worked in your residence? 479 respondents answered 'Yes,' while 1,021 respondents answered 'No.'

Question 2: (For the 479 respondents who answered 'Yes' in Question 1) How often did you ask for and receive an official receipt? I asked for and received an official receipt per h ($1 \leq h < \infty$) times of shopping or eating out. On average

[17]This in turn should help fight corruption, because underground economic activity would become a space for bureaucratic discretion.

2.53 times.

Question 3: (For the 479 respondents who answered 'Yes' to Question 1) Why did you ask for and receive an official receipt? (Multiple choices are OK)

3.1) Because I needed an official receipt for accounting; 174 respondents answered 'Yes.'

3.2) Because additional payment was not required when I asked for the official receipt; 74 respondents answered 'Yes.'

3.3) Because tax revenue gives both the country and myself benefits; 316 respondents answered 'Yes.'

3.4) Other; 11 respondents answered 'Yes.'

Question 4: (For all the 1,021 respondents who answered 'No' to Question 1) Why did you not ask for and receive an official receipt? (Multiple choices are OK)

4.1) Because additional payment was required when I asked for the official receipt; 63 respondents answered 'Yes.'

4.2) Because it was very troublesome to ask for and receive the official receipt; 763 respondents answered 'Yes.'

4.3) Because the lottery was not printed on the official receipt; 193 respondents answered 'Yes.'

4.4) Other; 137 respondents answered 'Yes.'

Question 5: Did you ask for and received a lottery receipt when you went shopping or eating out in 2005? 834 respondents answered 'Yes,' while 666 respondents answered 'No.'

Question 6: (For the 834 respondents who answered 'Yes' to Question 5) How often did you ask for and receive a lottery receipt? I asked for and received a lottery receipt per h ($1 \leq h < \infty$) times of shopping or eating out. On average 1.81 times.

Question 7: (for the 834 respondents who answered 'Yes' to Question 5) Why did you ask for and receive a lottery receipt? (Multiple choices are OK)

7.1) Because I needed a receipt for accounting purpose; 153 respondents answered 'Yes.'

7.2) Because additional payment was not required when I asked for the receipt; 57 respondents answered 'Yes.'

7.3) Because tax revenue gives both the country and myself benefits; 373 respondents answered 'Yes.'

7.4) Because the lottery was printed on the receipt; 663 respondents answered 'Yes.'

7.5) Other; 9 respondents answered 'Yes.'

Question 8: (For the 666 respondents who answered 'No' to Question 5) Why did you not ask for and receive a lottery receipt? (Multiple choices are OK)

8.1) Because additional payment was required when I asked for the lottery receipt; 26 respondents answered 'Yes.'

8.2) Because it was very troublesome to ask for and receive the lottery receipt; 420 respondents answered 'Yes.'

8.3) Because I thought that it was very difficult to get the lottery prize even if I had the lottery receipt; 247 respondents answered 'Yes.'

8.4) Other; 89 respondents answered 'Yes.'

Appendix B

Proof of Proposition 2

First, we set the penalty payment τ to be its maximum, and the probability of finding tax evasion β to be its minimum value, and assume that $\beta\tau < 1$ is

satisfied. Then β and τ are parameters. From eqs. (9) and (10), we obtain

$$c + t - s \leq c + g + t^e, \tag{A.1}$$

and subtract c from both sides to have

$$t - s \leq g + t^e. \tag{A.2}$$

Assume that we find the minimum s to make $t - s = g + t^e$, and from eq. (11) we get the net tax revenue,

$$\begin{aligned} R &= t - s - d(\beta), \\ &= g + t^e - d(\beta). \end{aligned} \tag{A.4}$$

Next, to find the solution easily, we transform the problem shown in eqs. (9)-(12) into the following one with only one choice of variable,

$$\begin{aligned} max_{\{t\}}\Lambda &= v - p + ln(R), \\ &= v - (c + t) + ln[g + t^e - d(\beta)]. \end{aligned} \tag{A.5}$$

The first order condition with respect to t is,

$$\frac{\partial \Lambda}{\partial t} = -1 + \frac{1}{g + t^e - d(\beta)}(\frac{\partial R}{\partial t}) = 0, \tag{A.6}$$

where,

$$\frac{\partial R}{\partial t} = \frac{\partial g}{\partial t} + \frac{\partial t^e}{\partial t} = \alpha + (1 - \alpha)\beta\tau, \tag{A.7}$$

because we obtain the following relationships from eq. (3) and eq. (5),

$$\frac{\partial \alpha}{\partial t} = -\frac{1-\beta\tau}{g''}, \tag{A.8}$$

$$\frac{\partial g}{\partial t} = g'(-\frac{\partial \alpha}{\partial t}) = \frac{(1-\beta\tau)^2 t}{g''}, \tag{A.9}$$

$$\frac{\partial t^e}{\partial t} = [\alpha + (1-\alpha)\beta\tau] - \frac{(1-\beta\tau)^2 t}{g''}. \tag{A.10}$$

By rewriting eq. (A.6) with eq. (A.7) and eq. (5), we obtain

$$t = 1 - \frac{g(1-\alpha) - d(\beta)}{\alpha + (1-\alpha)\beta\tau}. \tag{A.11}$$

To obtain concrete solutions, we specify the function $g(1-\alpha)$,

$$g(1-\alpha) = 0.5(1-\alpha)^2, \tag{A.12}$$

$$g'(1-\alpha) = 1-\alpha, \tag{A.13}$$

$$g''(1-\alpha) = 1. \tag{A.14}$$

Recall the eq. (3), $g'(1-\alpha) = (1-\beta\tau)t$, then we solve α with eq. (A.13) and obtain

$$\alpha = 1 - (1-\beta\tau)t, \ \textit{or}$$
$$t = \frac{1-\alpha}{1-\beta\tau}. \tag{A.15}$$

Then we substitute this t in eq. (A.11), and we obtain a equation for α,

$$\frac{1-\alpha}{1-\beta\tau} = 1 - \frac{0.5(1-\alpha)^2 - d(\beta)}{\alpha + (1-\alpha)\beta\tau}, \tag{A.16}$$

and this leads to

(A.17)

$$f(\alpha) \equiv (1-\beta\tau)\alpha^2 + (2-2\beta\tau+2\beta^2\tau^2)\alpha - (1-\beta\tau)(1-2d(\beta)) - 2\beta^2\tau^2 = 0.$$

Corollary 1. If $0 \leq d(\beta) < 0.5$, *the solution of eq. (A.17) will be* $0 < \alpha^{**} < 1$.

Proof. Because $1-\beta\tau > 0$ and the intercept $-(1-\beta\tau)(1-2d(\beta))-2\beta^2\tau^2 < 0$ provided that $d(\beta) < 0.5$, there are two solutions for eq. (A.17), and the positive one is,

(A.18)

$$\begin{aligned}\alpha^{**} =& -\frac{1-\beta\tau+\beta^2\tau^2}{1-\beta\tau} \\ &+ \frac{\{(1-\beta\tau+\beta^2\tau^2)^2 + (1-\beta\tau)[(1-\beta\tau)(1-2d(\beta)) + 2\beta^2\tau^2]\}^{0.5}}{1-\beta\tau}.\end{aligned}$$

If $f(1) > 0$, i.e.

$$d(\beta) > -1, \tag{A.19}$$

then we obtain $\alpha^{**} < 1$. The condition (A.19) is clearly satisfied. Q.E.D.

The optimal tax is solved by eqs. (A.15) and (A.18),

(A.19)

$$\begin{aligned}t^{**} =& (1-\beta\tau)^{-1}(1-\alpha^{**}), \\ =& \frac{(2-2\beta\tau+\beta^2\tau^2)}{(1-\beta\tau)^2} \\ &- \frac{\{(1-\beta\tau+\beta^2\tau^2)^2 + (1-\beta\tau)[(1-\beta\tau)(1-2d(\beta)) + 2\beta^2\tau^2]\}^{0.5}}{(1-\beta\tau)^2}.\end{aligned}$$

Then the subsidy s is solved by eq. (A.2),

$$\text{(A.20)} \qquad s^{**} \geq t^{**} - t^{e**} - g^{**},$$
$$= t^{**} - [\alpha^{**} + (1-\alpha^{**})\beta\tau]t^{**} - 0.5(1-\alpha^{**})^2,$$

and the net tax revenue is

$$\text{(A.21)} \qquad R^{**} = t^{**} - s^{**} - d(\beta),$$
$$= g(1-\alpha^{**}) + t^{e**} - d(\beta),$$
$$= 0.5(1-\alpha^{**})^2 + [\alpha^{**} + (1-\alpha^{**})\beta\tau]t^{**} - d(\beta).$$

Q.E.D.

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Table 1: The number of respondents who asked for and received an official receipt before and after the LRE.

Did you ask for and receive an official receit before the LRE?	Did you ask for and receive an official receit after the LRE?				Total	
	No		Yes			
	Number of respondens	(Col)	Number of respondens	(Col)	Number of respondens	(Col)
No [Row]	637 [62.4%]	(95.6 %)	384 [37.6%]	(46 %)	1021 [100%]	(68.1 %)
Yes [Row]	29 [6.1%]	(4.4 %)	450 [93.9%]	(54 %)	479 [100%]	(31.9 %)
Total	666 [44.45%]	(100 %)	834 [55.6%]	(100 %)	1,500 [100%]	(100 %)

Note: The figures in the [ ] and ( ) mean the percentages for the numbers in the rows and the columns.

Source: The author's calculations based on the survey.

Table 2: The reasons why you asked for and received a lottery receipt after the LRE.

For the 834 respondents who received an official receipt after the LRE, why did you ask for and receive a lottery receipt? (Multiple choices)		
Reasons	Number of respondents	Percent of the 834 respondents
Because I needed receipt for accounting purpose.	153	18.3
Because additional payment was not required when I asked for the receipt.	57	6.8
Because tax revenue gives both the country and myself benefits.	373	44.7
Because the lottery was printed on the receipt.	663	79.5
Other.	9	1.1
Total	1,255	150.5

Source: The author's calculations based on the survey.

Table 3: The reasons why you did not ask for and receive a lottery receipt after the LRE.

For the 666 respondents who did not ask for and receive an official receipt after the LRE, why did you not ask for and receive a lottery receipt? (Multiple choices)		
Reasons	Number of respondents	Percent of the 666 respondents
Because additional payment was required when I asked for the lottery receipt.	26	3.9
Because it was very troublesome to ask for and receive the lottery receipt.	420	63.1
Because I thought that it was very difficult to get the lottery price even if I had the lottery receipt.	247	37.1
Other.	89	13.4
Total	782	117.4

Source: The author's calculations based on the survey.

Table 4: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
(asking for and receiving receipts)					
ask_before	1500	0.3193	0.4664	0	1
ask_after	1500	0.5560	0.4970	0	1
freq_after	1500	0.4283	0.4476	0	1
freq_before	1500	0.2062	0.3597	0	1
(dummies for reasons before the LRE, why asked for receipt? 1 for `Yes' otherwise 0)					
for accounting	1500	0.1160	0.3203	0	1
no additional payment	1500	0.0493	0.2166	0	1
contribute country and myself	1500	0.2107	0.4079	0	1
others	1500	0.0073	0.0853	0	1
(reasons before the LRE, why not asked for receipt?)					
additional payment	1500	0.0420	0.2007	0	1
troublesom	1500	0.5087	0.5001	0	1
no lottery	1500	0.1287	0.3349	0	1
others	1500	0.0913	0.2882	0	1
(dummies for reasons after the LRE, why asked for the lottery receipt? 1 for `Yes' otherwise 0)					
for accounting	1500	0.1020	0.3027	0	1
no additional payment	1500	0.0380	0.1913	0	1
contribute country and myself	1500	0.2487	0.4324	0	1
lottery on the receipt	1500	0.4420	0.4968	0	1
others	1500	0.0060	0.0773	0	1
(dummies for reasons after the LRE, why not asked for receipt?, 1 for `Yes' otherwise 0)					
additional payment	1500	0.0173	0.1306	0	1
troublesom	1500	0.2800	0.4491	0	1
difficult to get the lottery prize	1500	0.1647	0.3710	0	1
others	1500	0.0593	0.2363	0	1
(respondent's age)					
age	1500	41.7547	13.1913	19	69
age_squared/100	1500	19.1735	11.3054	3.6100	47.6100
(dummies for respondent's carreer)					
company_employee	1500	0.2427	0.4288	0	1
company_manager	1500	0.0093	0.0962	0	1
self_employer	1500	0.1207	0.3258	0	1
public_firm_worker	1500	0.1940	0.3956	0	1
public_employee	1500	0.0107	0.1028	0	1
non_worker	1500	0.4227	0.4941	0	1
(income and asset, unit for personal_income: 10,000 Yuan per month)					
personal_income	1500	0.1383	0.1300	0	2
family_income (unit: million Yuan annually)	1500	0.0559	0.2268	0.0050	5.0000
family_asset (unit: million Yuan)	1500	0.3010	0.4002	0	8
(dummies for respondent's education)					
under_high_school	1500	0.3340	0.4718	0	1
high_school	1500	0.4160	0.4931	0	1
college	1500	0.1507	0.3578	0	1
university	1500	0.0927	0.2901	0	1
graduated	1500	0.0067	0.0814	0	1
(city dummies)					
Shengyang	1500	0.1667	0.3728	0	1
Shanghai	1500	0.1667	0.3728	0	1
Beijing	1500	0.1667	0.3728	0	1
Chengdu	1500	0.1667	0.3728	0	1
Guangzhou	1500	0.1667	0.3728	0	1
Wuhan	1500	0.1667	0.3728	0	1

Table 5: Lottery receipt effect on consumers' receiving receipts by linear probability model
(OLS with robust standard errors)

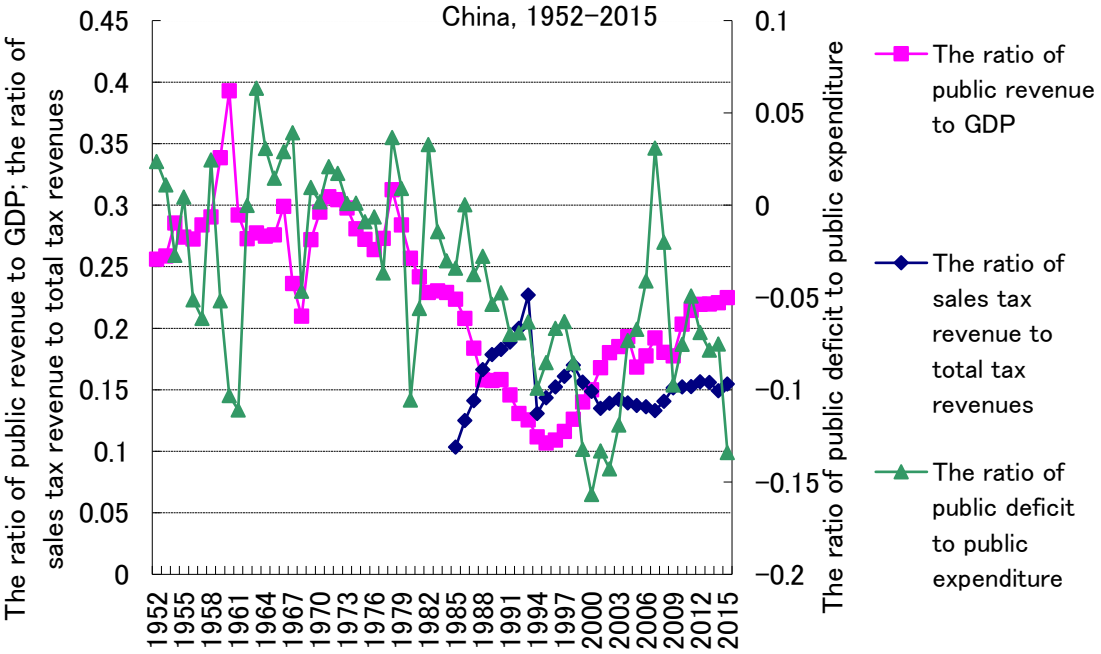
Dependent Variable	ask_before (1 for 479 respondents, 0 for 1021respondents)	ask_after (1 for 864 respondents, 0 for 666 respondents)	ask_after (1021respondents, ask_before=0)	freq_before_after (479 respondents, ask_before=1)
	Model 1	Model 2	Model 3	Model 4
(reasons before the LRE, why asked for receipt?)				
for accounting	0.4328 ***	0.0721 ***		-0.0400
	(0.0271)	(0.0209)		(0.0590)
no additional payment	0.3250 ***	0.0383 *		0.0329
	(0.0344)	(0.0229)		(0.0528)
contribute country and myself	0.5127 ***	0.0690 ***		-0.0720
	(0.0247)	(0.0183)		(0.0530)
others	0.5231 ***	0.0640		-0.0042
	(0.0634)	(0.0398)		(0.1218)
(reasons before the LRE, why not asked for receipt?)				
additional payment	-0.2091 ***	0.0770 ***	0.0851 ***	
	(0.0296)	(0.0293)	(0.0286)	
troublesom	-0.3303 ***	0.0325 *	0.0828 ***	
	(0.0220)	(0.0174)	(0.0202)	
no lottery	-0.2151 ***	0.0475 ***	0.0598 ***	
	(0.0192)	(0.0163)	(0.0175)	
others	-0.3013 ***	0.0296	0.0616 **	
	(0.0252)	(0.0272)	(0.0301)	
(reasons after the LRE, why asked for the lottery receipt?)				
for accounting		0.0658 ***	0.1674 ***	-0.0151
		(0.0188)	(0.0521)	(0.0484)
no additional payment		0.1218 ***	0.0695	-0.0589
		(0.0265)	(0.0510)	(0.0788)
contribute country and myself		0.1179 ***	0.2080 ***	-0.0545
		(0.0120)	(0.0241)	(0.0384)
lottery on the receipt		0.2587 ***	0.5010 ***	0.0880 **
		(0.0195)	(0.0327)	(0.0421)
others		0.3094 ***	0.3811 ***	-0.1335 **
		(0.0344)	(0.1203)	(0.0620)
(reasons after the LRE, why not asked for receipt?)				
additional payment		-0.3533 ***	-0.2439 ***	-0.3149 ***
		(0.0681)	(0.0436)	(0.1097)
troublesom		-0.5050 ***	-0.3281 ***	-0.3874 ***
		(0.0232)	(0.0275)	(0.1390)
difficult to get the lottery prize		-0.4240 ***	-0.2685 ***	-0.4700 ***
		(0.0242)	(0.0249)	(0.1208)
others		-0.4922 ***	-0.2984 ***	-0.2370 ***
		(0.0368)	(0.0361)	(0.0779)

Table 5 (continued)

(respondent's age)				
age	-0.0035 *	-0.0030	0.0005	0.0052
	(0.0019)	(0.0024)	(0.0024)	(0.0081)
age_squared/100	0.0031	0.0034	-0.0001	-0.0065
	(0.0022)	(0.0028)	(0.0027)	(0.0098)
(respondent's carreer dummies, company_employee excluded)				
company_manager	-0.0307	0.0181	0.1232	0.0088
	(0.0562)	(0.0527)	(0.1709)	(0.0791)
self_employer	-0.0303 ***	0.0185	0.0332 *	0.0396
	(0.0126)	(0.0155)	(0.0180)	(0.0531)
public_firm_worker	-0.0327 ***	-0.0065	0.0042	0.0680 *
	(0.0121)	(0.0133)	(0.0162)	(0.0391)
public_employer	-0.0475	0.0141	0.0032	-0.0086
	(0.0433)	(0.0418)	(0.0284)	(0.0982)
non_worker	-0.0295 **	-0.0315 **	-0.0271 *	0.0481
	(0.0115)	(0.0130)	(0.0152)	(0.0415)
(income and asset)				
personal_income	0.0186	-0.0085	-0.0553	-0.0585
	(0.0341)	(0.0399)	(0.0554)	(0.1013)
family_income	0.0070	-0.0482	-0.1118 ***	-0.207 ***
	(0.0211)	(0.0309)	(0.0370)	(0.0694)
family_asset	0.0057	0.0365 *	0.0574 ***	0.1138 **
	(0.0130)	(0.0187)	(0.0199)	(0.0537)
(respondent's education, under_high_school excluded)				
high_school	0.0013	0.0211 **	0.0167	-0.0252
	(0.0084)	(0.0106)	(0.0107)	(0.0381)
college	-0.0158	0.0051	0.0025	-0.0005
	(0.0132)	(0.0162)	(0.0178)	(0.0475)
university	-0.0013	0.0102	0.0079	0.0753
	(0.0145)	(0.0182)	(0.0220)	(0.0565)
graduated	0.0577 *	0.0755	0.0892	0.2204 *
	(0.0321)	(0.0563)	(0.0983)	(0.1303)
(city dummies, Shenyang excluded)				
Shanghai	0.0344 **	0.0501 ***	0.0316 *	0.0374
	(0.0134)	(0.0166)	(0.0191)	(0.0571)
Beijing	-0.0092	0.0110	0.0102	-0.0142
	(0.0120)	(0.0162)	(0.0165)	(0.0676)
Chengdu	0.0547 ***	0.0799 ***	0.0777 ***	0.0499
	(0.0113)	(0.0152)	(0.0203)	(0.0578)
Guangzhou	-0.0105	-0.0395 **	-0.0242	0.0941
	(0.0115)	(0.0156)	(0.0148)	(0.0696)
Wuhan	0.0116	0.0447 ***	0.0289 *	0.1535 **
	(0.0124)	(0.0162)	(0.0164)	(0.0629)
constant	0.4643 ***	0.6216 ***	0.2716 ***	-0.0160
	(0.0474)	(0.0575)	(0.0662)	(0.1709)
N	1500	1500	1021	479
R-squared	0.917	0.902	0.919	0.274

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Sales tax revenue, total tax revenue, and public deficit in China, 1952–2015

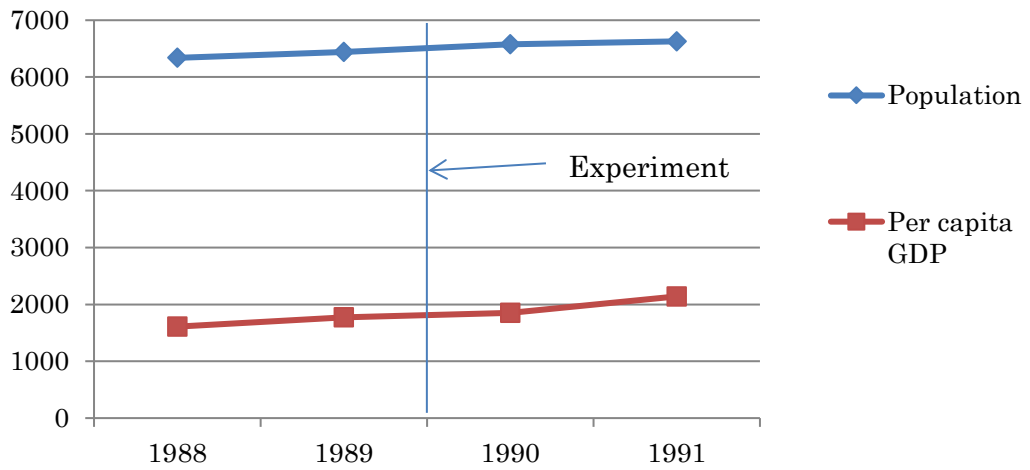


Source: The author's calculations based on the China Statistics Yearbook, 1991–2015.

Figure 2: Per capita GDP and population in Tangshan before and after the experiment

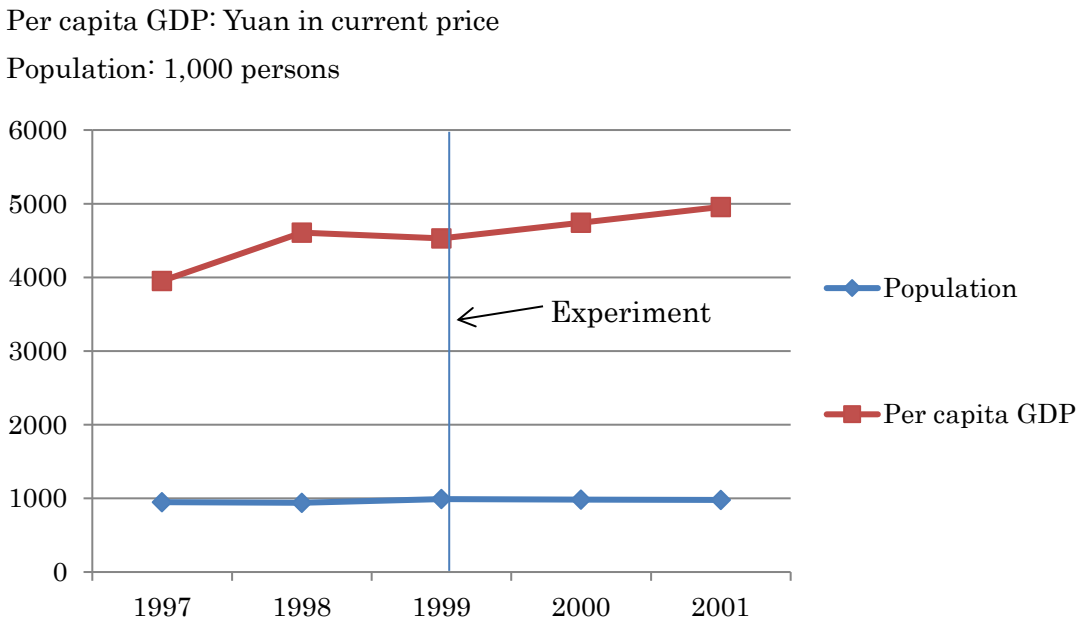
Per capita GDP: Yuan in current price

Population: 1,000 persons



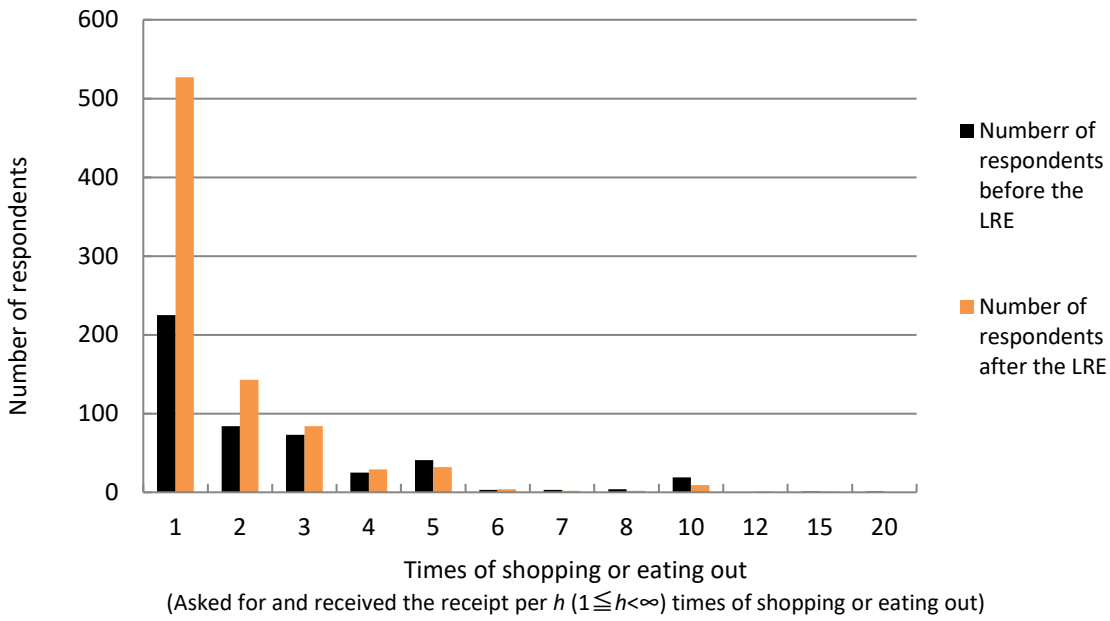
Source: The author's calculations based on the Public Finance Statistics for County and City in China, 1988-1991, and the City Statistic Yearbook in China, 1988-1991.

Figure 3: Per capita GDP and population in Fuzhou before and after the experiment



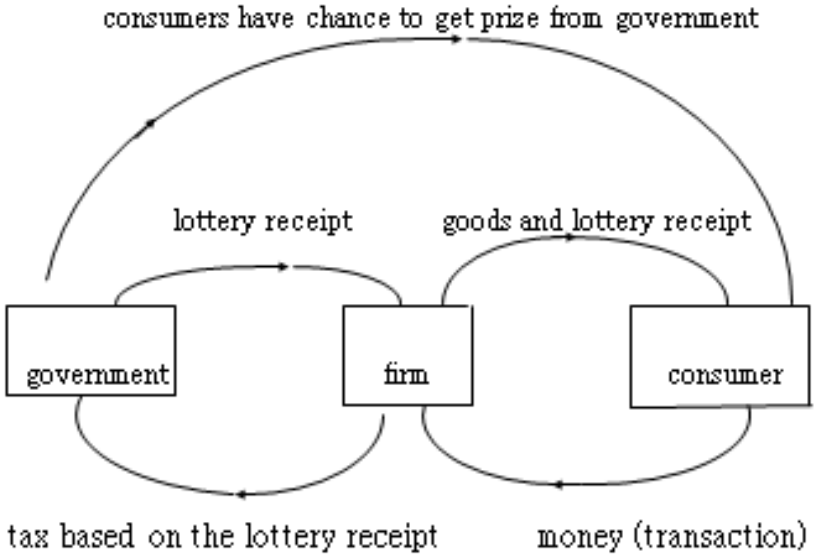
Source: The author's calculations based on the Public Finance Statistics for County and City in China, 1997-2001, and the City Statistic Yearbook in China, 1997-2001.

Figure 4: Frequency of asking for and receiving an official receipt before and after the LRE



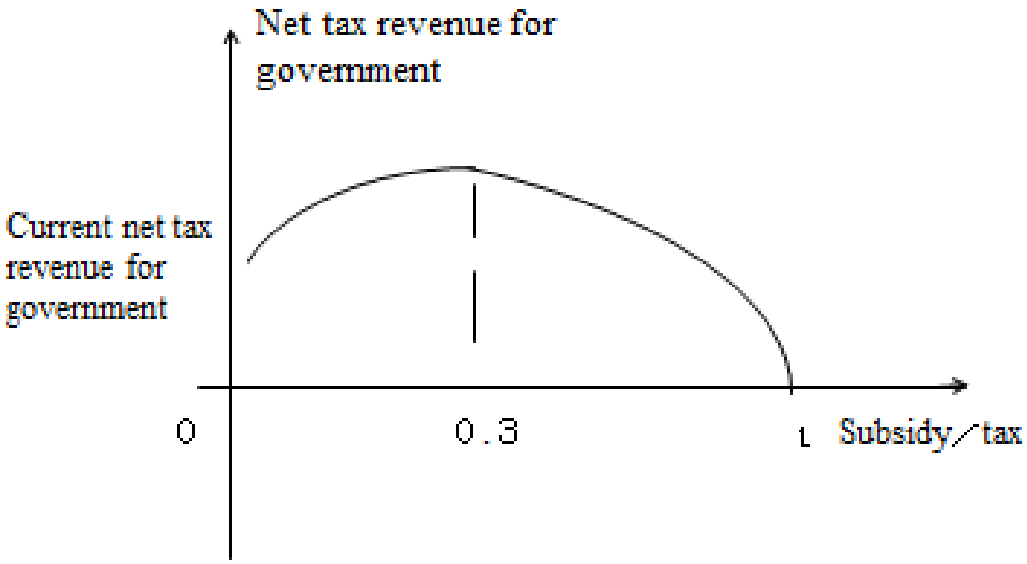
Source: The author's calculations based on Chinese Household Survey on Consumers' Preference and Satisfaction (CHSCPS) 2006.

Figure 5: Lottery Receipt System



Source: Drawn by the author.

Figure 6: Subsidy and Net Tax Revenue



Source: Drawn by the author.