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Taxation like Predation -- The Case in China

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Abstract

Can a firm pay less tax by locating in a jurisdiction where government size is smaller or by residing with more neighbouring firms? The answer is yes in China. We study this question by investigating the cross-region correlation between firms' effective tax rates and two variables -- fiscal burden of local governments (a measurement of relative government size) and geographical density of firms. We measure the effective tax rate by the ratio of a firm's total tax liability to its reported sales volumes, the fiscal burden by the number of employees in public sector, and the geographical density of firms by the total number of firms per unit area of a locality. We obtain the following findings: first, the correlation between the effective tax rate and fiscal burden across counties is positive; second, the correlation between the effective tax rate and firms density is robustly negative at the county and street level. These findings are puzzling because the tax codes are supposed to be uniform across the whole country and we have controlled for factors that affect the statutory tax rates. We argue that the paradox can be explained by a simple model of fishing in a lake where the cost of catching a fish is fixed and the number of fishermen is exogenously given. The findings provide a novel mechanism of firm clustering in addition to the Marshallian externalities.

1. Introduction

Firms in developing countries generally face more uncertain business environment than their counterparts in rich economies where rule of law is better respected. The uncertain external environment may originate from various causes, including, but not limited to, corruption of government officials (Shleifer and Vishny, 1993; Fisman and Svensson, 2007), kidnap and assaults by pirates (Besley, Feltzer, and Mueller), theft, robbery, and other crimes targeting firms (Besley, Mueller, 2016), extortions by mafia (Bandiera, 2003), discretionary tax enforcement by rulers in predatory states (Moselle and Polak, 2001), or some kinds of informal taxes (Olken and Singhal, 2011). These predatory activities involve two parties: predator and preys. The predators extract resources from the preys by discretionary power rather than following transparent and fixed rules. Although the causes and consequences of these predatory activities have long been widely studied in the literature, they have not received much attention in the economics literature. In particular, few studies have linked regional difference in effective tax rates with the geographical distribution of predator and preys.

This paper attempts to contribute in this regard by using the cross-regional variation in China. We raise the following question: can a firm pay less tax by locating in a jurisdiction with less public employment or residing with more neighbouring firms? We study this question by investigating the cross-regional correlation between firms' effective tax rates and two variables -- fiscal burden and geographical density of firms. We measure the effective tax rate by the ratio of a firm’s total tax liability to its reported sales volumes, the fiscal burden by the number of employees in public sector, and the geographical density of firms by the total number of firms per unit area of a locality. Tax enforcement is widely discretionary at the local level in China, even for the collection of value added tax (VAT) even though the central tax administration sets up directly administered tax bureaus at the local level (Chen, 2016, 2017a, 2017b).

That provides a good opportunity for us to study the cross-regional variation in the effective tax rate.

We obtain the following findings: first, the correlation between the effective tax rate and fiscal burden across counties is positive; second, the correlation between the effective tax rate and firms density is robustly negative at the county and street level.

The observed patterns are related to China's fiscal and governance structures. The underlying rationale is based on a simple model of fishing in a lake where the cost of catching a fish incurs is rather fixed and the number of fishermen is exogenously given. A firm's effective tax rate can be regarded as the likelihood of a fish being caught. This model has three predictions: first, given the number of fish in a lake, the likelihood of a fish being caught rises with the number of fishermen; second, given the number of fishermen, the likelihood of being caught decreases with the fish density (number of fish normalized by lake size). The two predictions become testable if we regard the fishermen as tax inspectors, fish as firms, and likelihood of fish being caught as firms' effective tax rate.

With regard to the exogeneity of number of fishermen (or tax inspector), following Zhang (2006), we find the China's number of tax inspectors and local government size are proportional to the number of population registered in the early phase of nation-wide economic reform. Government size is rather persistent and not very responsive to the subsequent change in the size of local economy. In regions with a smaller ratio of the number of firms relative to the number of tax inspectors, firms naturally face more scrutiny in tax collection and pay greater effective tax rate. Over time, this leads to fewer firm entries in these regions, consequently enlarging regional disparity in economic and tax performance.

Using the data from the *Economic Census* in 2004 and 2008, the Annual Inspection data in 2008, and the *County Public Finance Statistical Yearbook* in 1995, 2004 and 2008, we find that in a region with higher fiscal burden, firms are subjective to lower

effective tax rate. Dynamically, a lower regional effective tax rate is followed by more firm entries and subsequent increase in firm density, which further lowers effective tax rate. These results are robust to confounding factors such as regional GDP level.

Our finding also contributes to the literature of Marshallian externalities associated with clustering, which emphasize information sharing, market linkage, and labour pooling. Our paper shows that there is an additional tax advantage of clustering, which has not been noticed in the literature. Moreover, the finding provides evidences showing the cross-region variation can serve as a potential source of regional inequality (Zhang, 2006) and misallocation across regions (Chen, 2017b).

The rest of the paper is organized as follows. In Section 2, we propose a conceptual framework and discuss the mechanisms underlying the relationship between geographical distribution of public employment, firm density, and effective tax rate. In Section 3, we describe the relevant institutional background of tax administration at the local level in China. Section 4 introduces datasets and measurement of main variables. In Section 5, we discuss empirical methods and presents results. And Section 6 concludes.

2. Conceptual Framework

This section proposes a conceptual framework that helps to understand the effect of relative size of tax inspectors to tax payers on tax enforcement. It focuses on the trade-off between the benefits of public funds and the cost of taxation. The model follows a standard framework of optimal commodity taxation theory, as summarized by Slemrod and Gillitzer (2014) and Slemrod and Yitzhaki (1996). In addition, it introduces and highlights the two features of tax administration costs. *First*, inspecting a firm on taxation incurs both fixed costs and variable costs. The former is irrelevant to firm size. But it depends on the firm density in the neighbourhood.

Greater firm density implies smaller transportation costs or other fixed costs in inspecting each firm. The marginal variable costs for additional unit of tax revenue is smaller from bigger firms. However, tax collection is subject to the general law of increasing marginal variable costs.

Given the structure of tax administration costs, and following the principle of equalization of marginal costs and marginal benefits, tax inspectors make their decision both at the extensive margin and the intensive margin. The former refers to whether the tax inspectors decide to audit a firm or not. The latter involves the specific time and efforts spent on the auditing.

Given the model setting, the tax administration is just like a model of optimal decision on fishing in a lake where the number of fishermen are exogenously given. The fishermen can be regarded as tax inspectors; the fish as tax paying firms; the effective tax rate of a firm as the likelihood of a fish being caught; and a lake as a jurisdiction. We can therefore derive the following three **Predictions 1-3** on fish catching.

Prediction 1 (**Number of fisherman)**: *Ceteris paribus, each fish is more likely to be caught if there are more fishermen working in the same lake.*

Prediction 2 (**Fish density**): *Fishermen do not need to catch fish everyday if there are more fish in the lake and one-catch can feed for longer time.*

Prediction 3 (**Big fish**): *(Suppose fish do not eat other) Small fish are safer if there are big fish around.*

In parallel, we can obtain three following testable **Predictions 1'-3'** on tax enforcement.

Prediction 1' (**Number of tax inspectors)**: *Ceteris paribus, each firm is more likely to pay a greater effective tax rate if there are more inspectors working in the same jurisdiction.*

Prediction 2' (**Firm density**): *Tax inspectors do not need to tax very frequently and set a big effective tax rate on each firm if there are firms are more densely populated in the jurisdiction.*

Prediction 3' (**Big firms**): *Small firms pay smaller effective tax rate if there are big firms around.*

3. Institutional Background

Discretionary tax enforcement is prevalent in China mainly for two reasons. First, local governments have incentives and capabilities to intervene the tax administration. Generally, the local governments are incentivized to reduce the tax rate to attract investment and promote local GDP. Second, tax administration is costly. The bureau of taxation takes administrative costs into account in tax collection. Because of these, the effective tax rate in China is generally smaller than the statutory tax rate.

<Insert Figure 1 Here>

As illustrated in Figure 1, the current structure of governments and bureau of taxation in China leaves ample rooms for local governments intervention in tax administration and discretionary tax enforcement. The tax administration in China is conducted by two separate government bodies -- the State Administration of Taxation (*SAT*) and the Local Administration of Taxation (*LAT*). The former is under the direct leadership of the national government, and the latter is under the corresponding sub-national government. Because the national government delegates the task of economic growth and employment to the sub-national government (Li and Zhou, 2005; Xu, 2011), the sub-national governments usually have incentives to reduce the tax burden on local firms by directly intervene the *LAT* or indirectly intervene the *SAT*, unless they are compelled to collection sufficient tax to meet the expenditure needs (Chen, 2017a).

The reasons that the sub-national government can even influence the *SAT* include, but not limited to, the following (Chen, 2017a): *In the first place*, the chief of a local office of the *SAT* is under the direct supervision of the secretary of the Communist Party in the same jurisdiction.[1] For example, the chief/party secretary of a county office of the *SAT* is led by the county secretary of the Communist Party. The latter can considerably affect the promotion and political career of the former. Chen (2015b) studies the role of the prefectural secretary of the Communist Party in selective enforcement of VAT. *In addition*, there are several indirect ways for sub-national governments to intervene in VAT enforcement. *First*, the capability of the *SAT* in tax law enforcement is limited by local departments of Public Security, which are under tight control of local governments. *Second*, the local government can help the *SAT* with issues such as obtaining land for office buildings, schooling for children, local hospitals for health care, and many others. *Third*, it is openly known that the SAT receives a subsidy from the local government in order to improve its working conditions, or for any other reasons. *Fourth*, tax administrators have their own dirty laundry. As a last resort, anti-corruption action can be proposed as a credible threat by local governments against a tax administrator once he/she refuses to cooperate.

At the grassroots level like town or county in many regions in China, the public finance is known as the kind of "hand-to-mouth"(吃饭财政). The greatest and most rigid part of the public expenditure is the salaries of employees in public sectors. Therefore, the public revenue from taxes or other sources are mainly for the minimum requirement on daily operation of the bureau of taxation. Therefore, the pressure on tax enforcement mainly stems from the payroll in public sectors. In the empirical part

[1] For example, the chief/party secretary of a county office of the SAT is led by the county secretary of the Communist Party. The latter can considerably affect the promotion and political career of the former. Chen (2016) studies the role of the prefectural secretary of the Communist Party in selective enforcement of VAT.

of this paper, we are going to use a variable named "Fiscal Burden" to capture this pressure.

4. Data and Measurement of Main Variables

4.1 Data

The dataset we use came from four sources. The first part of data is from the China Economic Census conducted by National Bureau of Statistics in 2004, 2008. The Economic Census includes comprehensive information about firms' basic information, such as their registered names, region codes, 4-digital industry codes as wells operating information, such as firms' annual business sales, and capital stock. The Economic Census include not only big firms but also small ones. However, tax information is missing in the 2008 Economic Census. We fill the missing information using tax information reported in from the Annual Inspection data. The Annual Inspection is conducted by the Industrial and Commercial Administration to all limited liability companies, incorporated companies and other business units which have business license. Major information includes a firm's annual sales, profit, tax payment, asset, and liability. Considering that the taxation for State-Owned-Enterprises (SOEs) can be substantially different from that for non-SOE, we SOEs and keep all non-SOE firms in our sample.

The second part of data come from County Public Financial Statistical Yearbook in 1995, 2004, and 2008. The yearbooks contain information on local revenue and the size of public sector at the county level. Using the yearbooks, we calculate the fiscal burdens for county jurisdiction in different years. There are over 2000 counties in China. Between 1995 and 2008, several hundred counties have changed their names or judiciary boundaries. We match these counties which have changed names based on judiciary boundaries. For merged counties, we summed fiscal revenue, employee on public payroll, and population from two previous separate counties.

Besides the regional difference across counties, our study also pays attention to the difference with county. We focus on the effect of firm density on effective tax rate at the street level. Thus, the third sets of dataset are geographic data for firms and streets in vector form.[2] For the street-level analysis, we for now centre on Guandong Province due to time limitation. We geocoded 238,414 firms in *Guangdong* province through Google API based on the text message of registered firm name in 2008 Economic Census. It enables us to obtain the geographic coordinates for firms under the WGS84 coordinates system which can be used in Geographic Information System (GIS). We join these coordinates for firms with the street shapefiles based on spatial location. The spatial joining is achieved in ArcGIS 10.2 in the following way. If a firm's distance to a street is within 100 meters, we deem the firm belong to the street. If a firm has more than one street to which the distance is within 100 meters, we deem it belong to the nearest one. In this way, we link 169,910 firms to 19,258 streets in *Guangdong* province. For each street, we calculated the total number of firms and the total length of the street. We define firm density as the ratio of the number of firms and the length of street at street level.

And we also focus on the basic block of a prefecture in China: *Jiedao* (sub-districts). China has three township-level administrative units: *Jiedao* in the urban area and its counterparts in the rural side (*Xiang*, townships; and *Zhen*, towns). We focus on this basic block to study the heterogeneous effect of firm size on taxation. We position firms at township level. The township-level administrative boundary shapefile is available from the Open Street Map. Due to data restriction, our study at the township level is restricted to *Zhongshan*, a prefecture of *Guangdong* province. For each township unit, we sort the firms by their main business sales and divide the firms into two groups: one group contains firms which is ranked top 10% according to their

[2] When calculate the firm density at street level, we use shapefile of living streets from State Bureau of Surveying and Mapping. We do not use national highway shapefile or street shapefiles for other hierarchy for the reason that the main function for national highways or railways is to link key transportation hub and the majority of firms, especially small and micro enterprises, locate alongside living streets instead of national highways or railways.

main business sales among total firms (represented as BIG firms) and the other group contains the rest (represented as SMALL firms). For BIG firms within each town, we plot them in the map. Using their main business sales as weights, we calculate their weighted geographic centre in *ArcGIS*. For every firms in the town, we measure their distance to the top 10% firms' centre. According to our hypothesis, small firms can pay less tax by neighbouring big firms, we expect to see the coefficient of the distance on effective tax rate be significantly positive for small firms and this effect should be insignificant for big firms.

4.2 Measurement of Main Variables

4.2.1 Effective tax rate

We construct the effective tax rate of firm *i* in year *t* as:

$$Effective\ Tax\ Rate_{it} = \frac{Total\ Tax\ Payment_{it}}{Main\ business\ sales_{it}}$$

In 2004, tax payment information comes from the 2004 Economic Census. There are four main taxes: VAT, Sales Tax and Extra Charge, Corporate Income Tax, and the other taxes and surcharges paid by enterprises. Total tax payment in 2004 = VAT+ Sales Tax and Extra Charge + Corporate Income Tax +the other taxes and surcharges. In 2008, we obtain the total tax payment information directly from the 2008 Annual Inspection Data.

<Insert Figure 2 Here>

4.2.2 Fiscal Burdens

We measure the fiscal burdens for county *c* in year *t* as:

$$Fiscal\ burdens_{ci} = \frac{The\ number\ of\ employees\ on\ public\ payroll_{ct}}{Local\ fiscal\ revenue_{ct}}$$

The number of employees on public payroll in China of each region, i.e. *bianzhi*, is planned in the early stage of the economy reform in proportional to local *hukou*

population size which has much less to do with the economy size. *bianzhi* is highly persistent over time and does not change in sync with local economic development level. As shown in Figure 3, the total number of *bianzhi* in 2008 moderately increased compared to 1995. Despite nearly twenty-year gap, the correlation coefficient of *bianzhi* between the two year is up to 0.999.

<Insert Figure 3 Here>

Figure 4 highlights the correlation between *bianzhi* and local *hukou* population size (per capita GDP). As shown in the left panel of Figure 4, while the relationship between *bianzhi* in 2008 and local *hukou* population size in 2000 is tight, the correlation between *bianzhi* and local GDP per capita is weak. This demonstrate that government size is more closely tied to local registered population size rather than economic development level.

<Insert Figure 4 Here>

Figure 5 displays the distribution of fiscal burdens across counties. Apparently, there is large regional variation in fiscal burden.

<Insert Figure 5 Here>

4.2.3 Firm density

We calculate the firm density variable at both county level and street level. Firm density of county c in year t is defined as:

$$Firm\ Density_{c,t} = \frac{The\ num\ of\ firms\ within\ county\ c\ in\ year\ t}{Land\ area\ of\ county\ c}$$

We calculated the firm density at county level in two years: 2004 and 2008. In each year, the total number of firms within county is derived from the Economic Census in 2004 and 2008 respectively.

Similarly, firm density of street s in 2008 is constructed as below:

$$Firm\ Density_{s,2008} = \frac{the\ num\ of\ firms\ along\ street\ s\ in\ year\ 2008}{the\ length\ of\ street\ s}$$

Table 1 describes the summary statistics of key variables.

<Insert Table 1 Here>

5. Empirical Methods and Results

5.1 Stylized Facts

Figure 6 displays the relationship between local fiscal burdens and effective tax rate. We divide over 2000 counties into 100 groups by quantiles based on fiscal burdens in 2004, and within each group, we calculate the mean effective tax rate of the counties in 2008. As Figure 6 demonstrates, the effective tax rate in 2008 is significantly positively correlated with local fiscal burdens in 2004. The *R-squared* between the two series is as high as 0.674.

<Insert Figure 6 Here>

Figure 7 exhibits the association between local firm density and effective tax rate. Mirroring the finding of Figure 6, local effective tax rate is strongly negatively associated with firm density.

<Insert Figure 7 Here>

5.2 Empirical Strategy

5.2.1 Baseline

Our baseline econometric specification is as follows:

$$\tau_{c,p,2008} = \lambda \times F_{c,1995} + \rho \times X_c + \gamma_p + \epsilon_{c,p,2008} \quad (1)$$

Where the dependent variable $\tau_{c,p,2008}$ is the mean effective tax rate of county c in prefecture p in 2008. F_s is the local fiscal burdens of county c in 1995. F_s is the key

explanatory variable and we use the initial value in 1995 to exclude the problem of endogeneity. X_c is a vector of county characteristics, which we add one by one, including logarithm *hukou* population in 2000 and nationally designated poor county status in 1995. γ_p captures the prefecture fixed effect. The parameter of interest is λ, capturing the response of the effective tax rate to the local fiscal burdens.

Replacing the dependent variable, effective tax rate in 2008, by the difference in effective tax rate between 2008 and 2004, we come up with an alternative specification.

$$d_{c,p,2008} = \lambda \times F_{c,1995} + \rho \times X_c + \gamma_p + \epsilon_{c,p,2008} \quad (2)$$

Where the dependent variable $d_{c,p,2008}$ is the difference in effective tax rate of county *c* in prefecture *p* between the year 2008 and 2004. The right-hand variables are the same as in previous specification except that X_c now includes initial tax rate in 2004. The parameter of interest is λ, capturing the response of the difference in effective tax rate across year 2008 and 2004 to the initial local fiscal burdens in 1995.

Our econometric specification at street level is as follows:

$$\tau_{ics} = \lambda \times D_s + \rho \times X_i + \beta_c + \gamma_o + \epsilon_{ics} \quad (3)$$

Where the dependent variable τ_{ics} is the effective tax rate of firm *i*, which along street *s* in county *c*. D_s is firm density of street *s*. X_i is a vector of firm characteristics, including logarithm main business income and logarithm capital. We add X_i step by step. β_c, γ_o captures county fixed effects, and industry fixed effect respectively. The parameter of interest λ measure the response of local effective tax rate to firm density at street level.

5.2.2 Heterogeneity

Our econometric specification for heterogeneity is as follows:

$$\tau_{itc} = \lambda \times D_{i,t} + \rho \times X_i + \alpha \times Z_t + \beta_c + \gamma_o + \epsilon_{itc} \quad (4)$$

Where the dependent variable τ_{itc} is the effective tax rate of firm *i* within town *t*, county *c*. By sorting the firms by their main business sales and divide the firms into two groups: one group contains firms which is ranked top 10% among total firms according to their main business sales (hereafter refer to as top10% firms) and the other group contains the rest (hereafter refer to as non-top10% firms). D_{it} is the distance of firm *i* from the geographic centre of top10% firms within town *t*. X_i is a vector of firm characteristics, including logarithm main business income and logarithm capital. We add X_i step by step. Z_t is characteristics for town *t* , for the main explanatory variable is about geographic distance, we control the total land area of the town. β_c , γ_o captures county fixed effects, and industry fixed effect respectively. We regress the total sample, top10% firms sample and the non-top10% firms respectively. The parameter of interest is λ, capturing the response of the effective tax rate to the distance of firm *i* to big firms.

5.3 Results

5.3.1 Fiscal Burdens and Tax Rate at County Level

Table 2 is the results from regressions of the effective tax rate in 2008 and the difference of effective tax rate between 2008 and 2004 on initial fiscal burdens in 1995 at county level respectively. According to our hypothesis, the local fiscal burdens should have a positive correlation with the mean effective tax rate. And as revealed in column (1) to (3), with standard errors cluster to county level, after controlling prefecture fixed effect, the predetermined fiscal burdens in 1995 has significantly positive-correlation with effective tax rate in 2008 and also the difference of effective rate between 2008 and 2004. Heavier local fiscal burdens make local firms high effective tax rates on average in the later year, and the effective tax rate would incline rather than decline in a region with heavier fiscal burdens.

<Insert Table 2 Here>

5.3.2 Firm Density and Tax Rate at Street Level

Table 3 presents the effect of agglomerative density on effective tax rate at street level. We regress the effective tax rate of each firm instead of the mean tax rate at county level. As revealed in column (1) to (3), after controlling for county fixed effect and industry fixed effective, the firm density along street has a significantly negative correlation with the effective tax rate.

<Insert Table 3 Here>

5.3.3.1 The Role of Big Firms

Table 4 estimates the effect of distance to big firms on a firm's effective tax rate by divide sample into subsamples of top10% firms and non-top10% firms and regress the two groups respectively. Colum S1-S3 list the regression results for non-top10% firms. By controlling for county fixed effect and industry fix effect, firms' distance to big firm centre within each township has a significantly positive correlation with its effective tax rate. And this effect is in-significant for big firms themselves.

<Insert Table 4 Here>

6. Conclusion

As Bird (2010) suggests, tax administration matters -- a lot! In developing countries, tax administration is the *de facto* tax policy (Casanegra de Jantscher, 1990). And it thereafter determines the effective tax rate. In this paper, we study how the effective tax rate can be shaped by the geographical distribution of government size, tax inspectors, and the firms.

In this study, we combine the data from the *Economic Census* in 2004 and 2008, the *Industrial and Commercial Enterprises Registration database* in 2005 and 2009,, the

County Public Finance Statistical Yearbook in 1995, 2004 and 2008, street shape file and township-level administrative boundary shape file. We find that the effective tax rate is negatively correlated with fiscal burden across counties. Additionally, the effective tax rate is robustly negatively correlated with firm density at the county and the street level. Moreover, small firms are more likely to pay lower effective tax rates if there are big firms around in same street.

The findings can shed lights on many other predatory activities prevalent in developing countries, including extortion, corruption, robbery, and theft on firms. Although many researchers have discussed these topics, we still lack a study on how the geographical distribution of predators and preys can play a role in these regards.

The findings also enrich our understanding of clustering in addition to the conventional explanations of Marshallian externality. It suggests that firms can stay together in order to pay lower taxes. The findings also provide more evidences to the related literature on the cross-region disparity in tax rates, which can lead to persistent and enlarging regional income inequality.

In the next step, we plan to do more solid tests on the causal relationship between firm density and effective tax rate using exogenous variations which might affect firm density. Also, it is important to gather more evidence in other countries to check if the findings remain true in other contexts.

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Figures 1 - 7

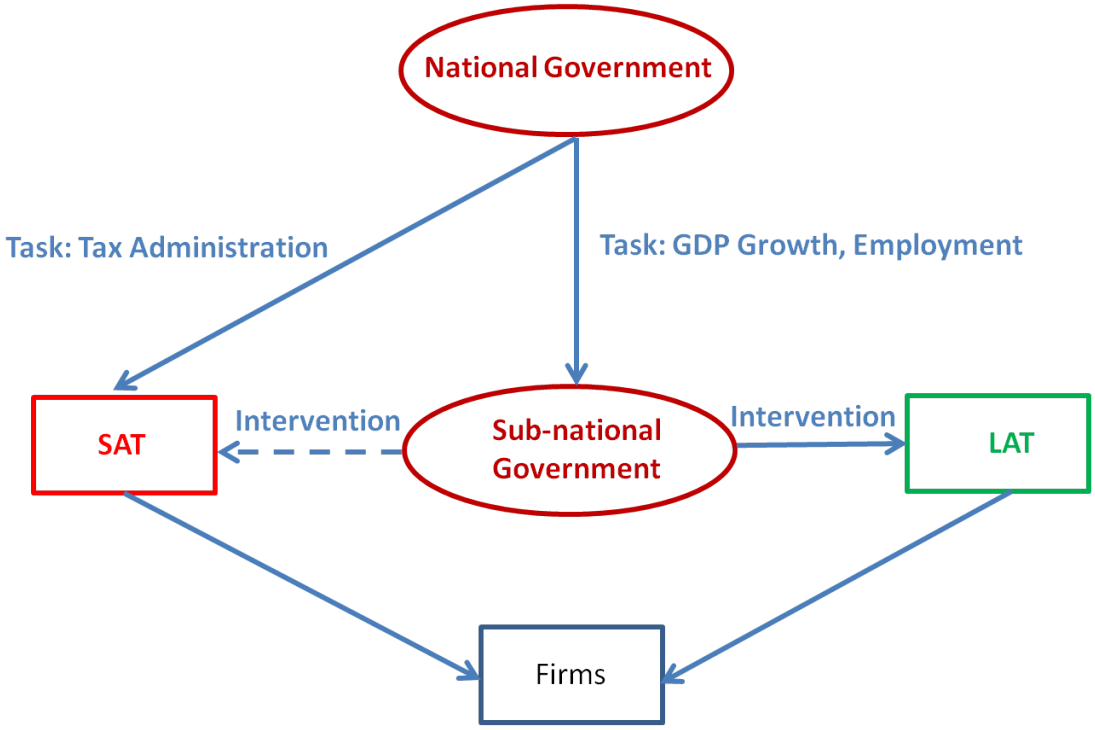

Figure 1. Tax administration in China.

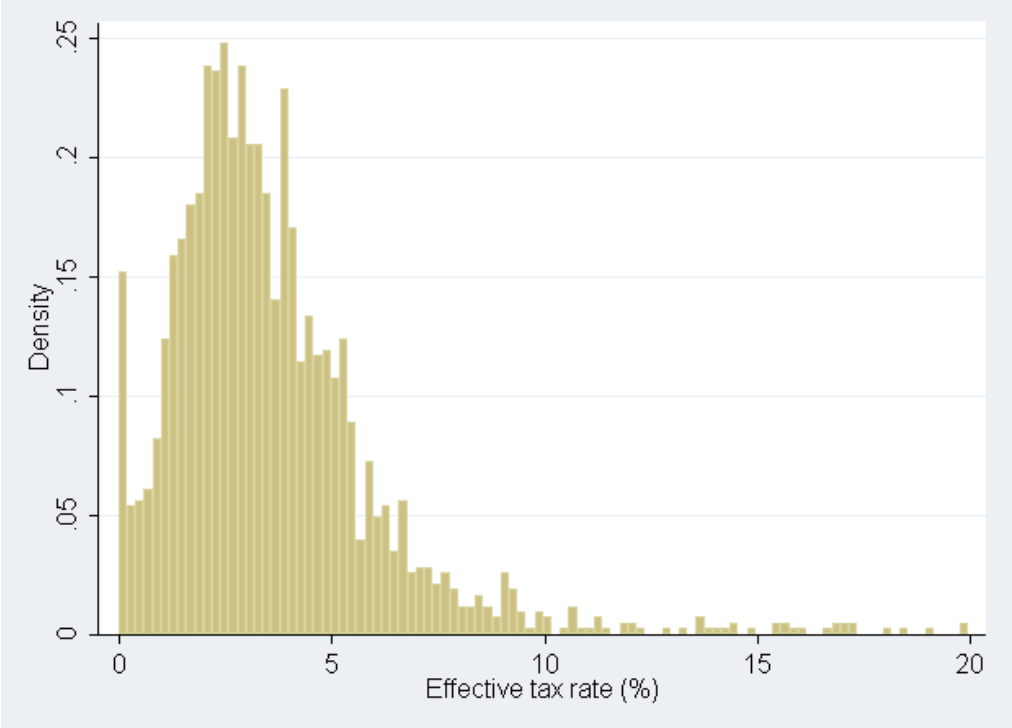

Figure 2. Distribution of effective tax rate across counties (2008).

Note: *Effective tax rate refers to the ratio of the total tax payment and the main business sales. Authors' calculation based on the 2008 Economic Census and annual Inspection Data.*

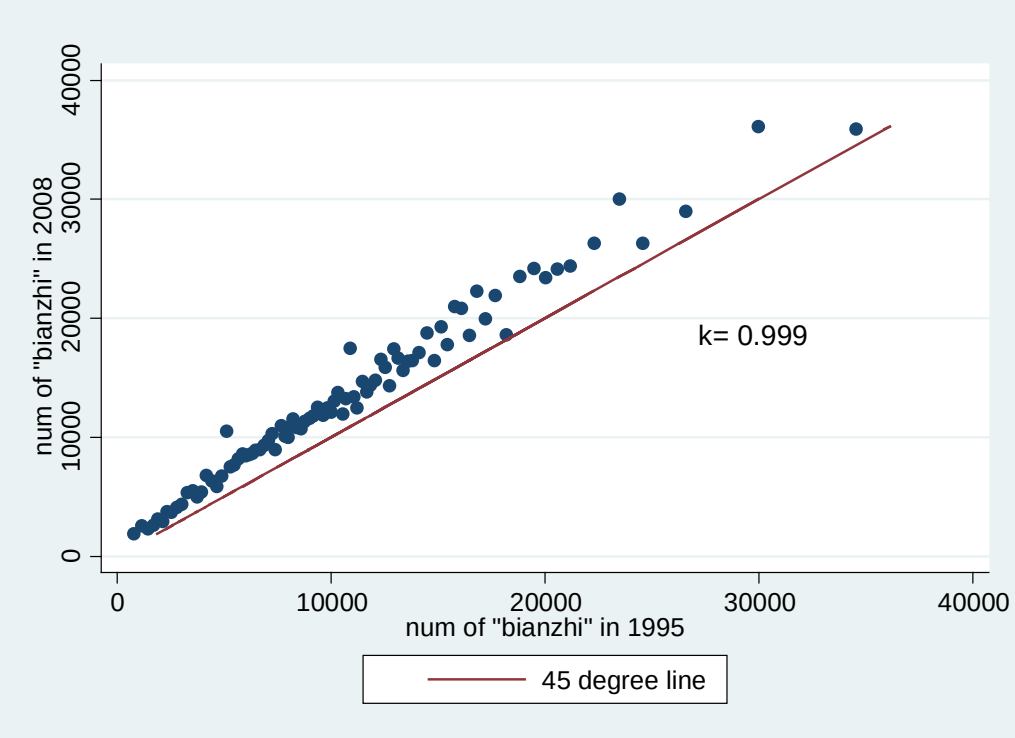

Figure 3. *Bianzhi* is highly persistent over time.

Note: *The total number of bianzhi in 2008 moderately increased on the basis of the bianzhi in 1995. The number "bianzhi" refers to the number of employees on public payroll at county level, which is inferred from the County Public Financial Statistical Yearbook in 1995 and 2008. k value indicates the correlation coefficient of the number of "bianzhi" between the two years.*

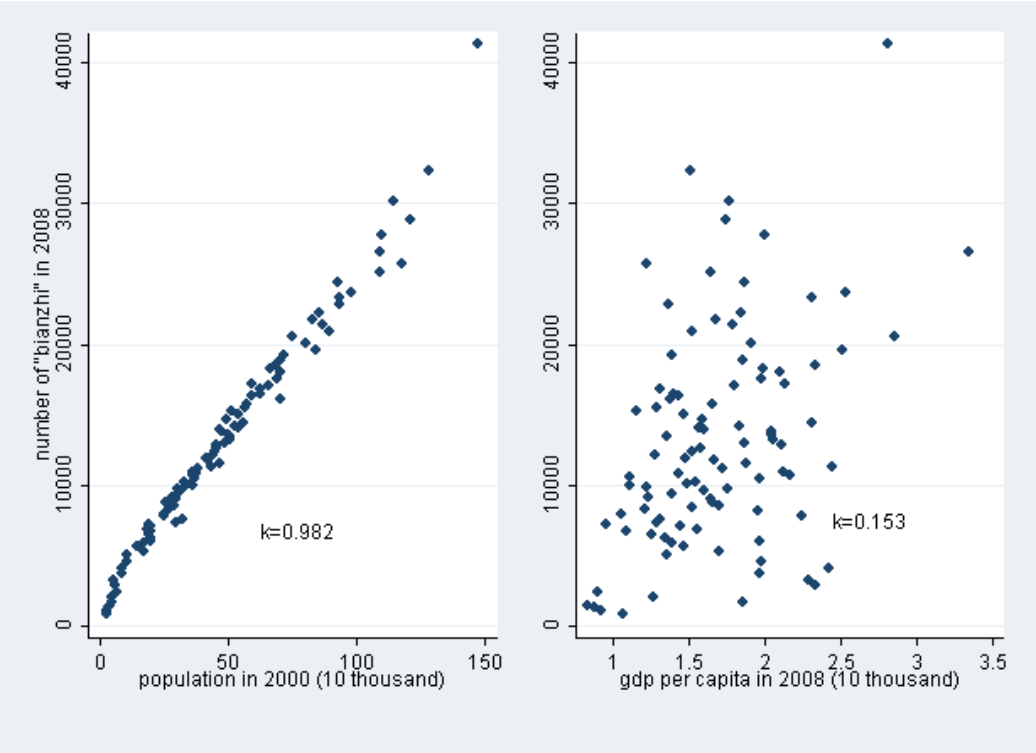

Figure 4. *Bianzhi*, popuation, and economic development level.

Note: *In the left panel, the horizontal axis is the overall population inferred from China Population Census 2000. In the right panel, the horizontal axis is the gross domestic product per capita in 2008, a measure of local economic development level. The vertical axis is number of bianzhi in both panels. k values indicate the overall R-squared values from regressing the number of bianzhi in 2008 on overall population in 2000 and gross domestic product (GDP) per capita in 2008 at county level respectively.*

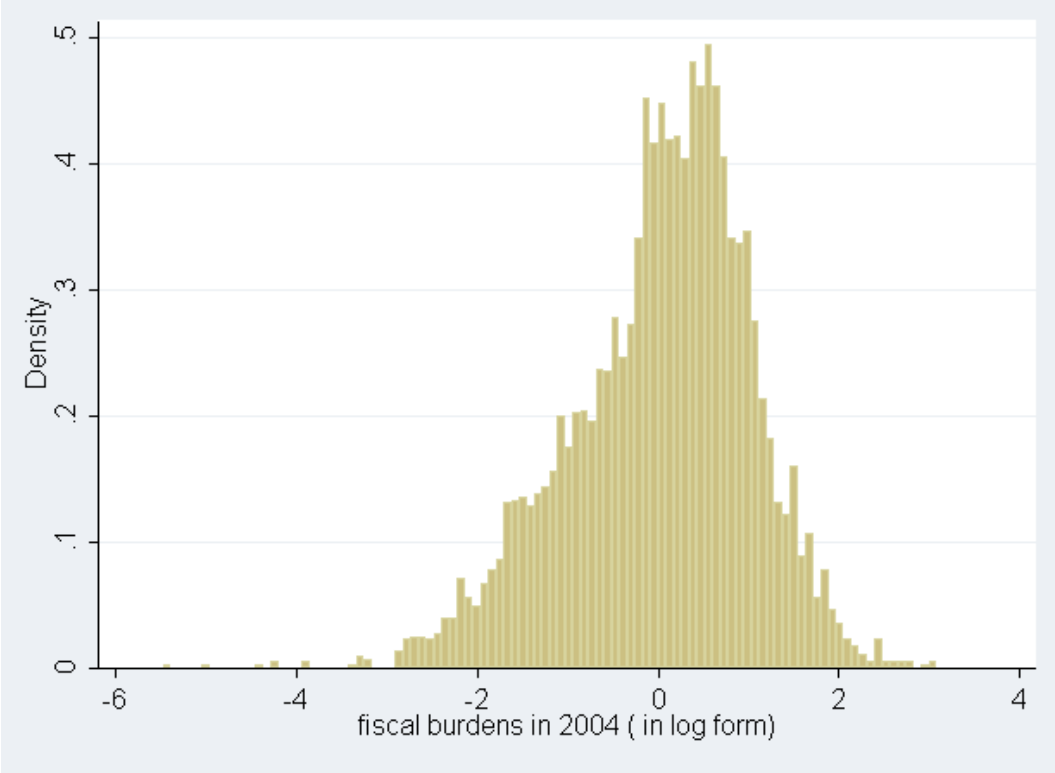

Figure 5. Distribution of fiscal burdens across counties.

Source: *Authors' calculation based on the County Public Financial Statistical Yearbook in 2004. Note: Fiscal burdens refer to the ratio of the number of employee on public payroll and annual fiscal revenues (10 thousand yuan) at county level.*

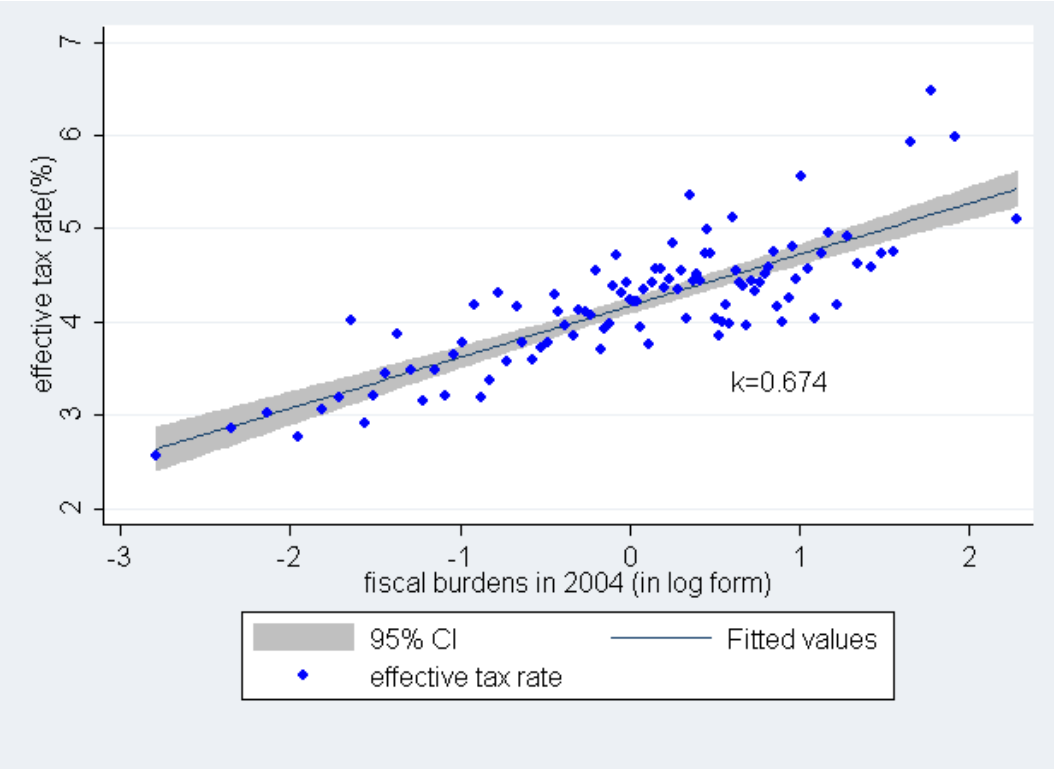

Figure 6. Effective Tax Rate and Fiscal Burdens across Counties.

Note: *On the vertical axis is the mean effective tax rate within counties in 2008. We calculated firm-level effective tax rates by calculating each firm's total tax payment inferred from the Inspection Data in 2008 over its main business sales inferred from 2008 Economic Census. The county-level effective tax rate is the mean value of firm-level effective tax rate. On the horizontal axis is the fiscal burdens based on the County Public Financial Statistical Yearbook in 2004. They refer to the ratio of the number of employee on public payroll and annual fiscal revenues at county level. k value indicates the overall R-squared value from regressing effective tax rate on fiscal burdens in 2004.*

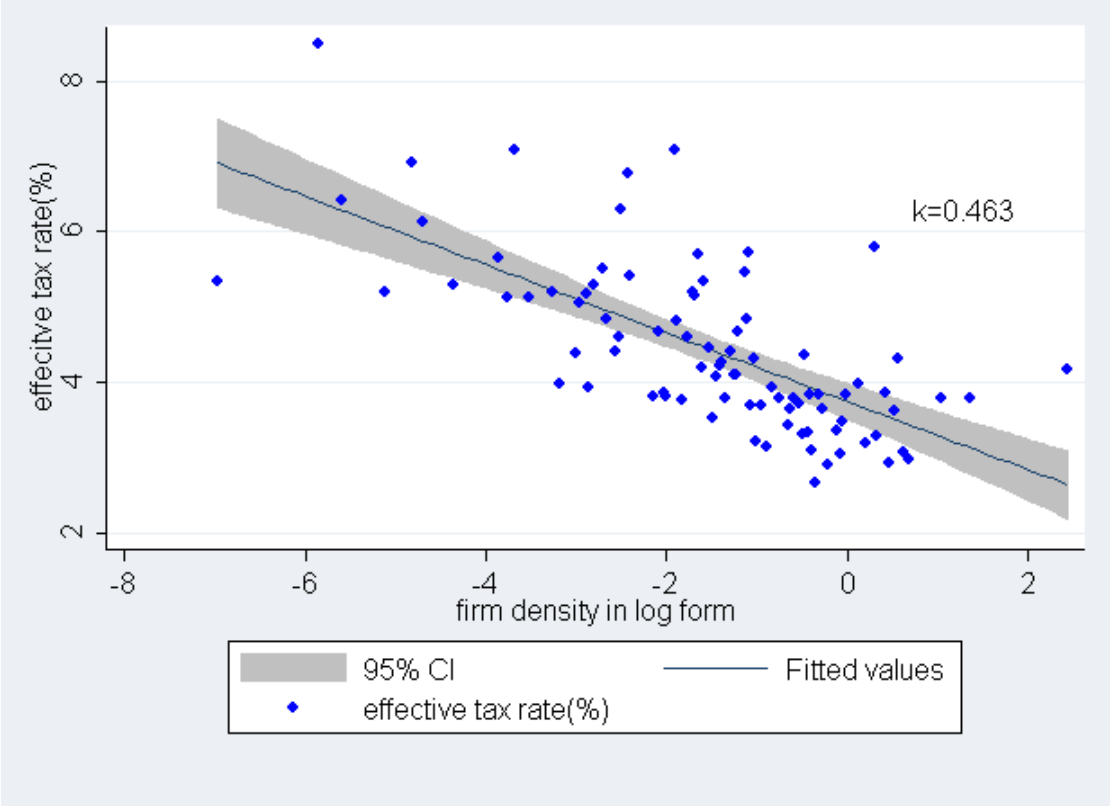

Figure 7. Effective Tax Rate and Firm Density across Counties

Note: *On the vertical axis is the mean effective tax rate within counties in 2008. We calculated firm-level effective tax rates by calculating each firm's total tax payment inferred from the Inspection Data in 2008 over its main business sales inferred from 2008 Economic Census. The county-level effective tax rate is the mean value of firm-level effective tax rate. On the horizontal axis is the total number of firms over land area of each county. The total number of firms within each county is deduced by 2008 Economic Census. k value indicates the overall R-squared value from regressing effective tax rate on firm density.*

Table 1. Summary Statistics

	County Sample			
	Sample Size	Mean	St. Dev.	Median
Effective Tax Rate (%)	2172	4.19	1.78	3.87
LOG (population) in 2000	2172	3.53	0.88	3.62
Fiscal burdens in 1995	1790	3.67	4.53	2.57
Fiscal burdens in 2004	2172	1.6	1.57	1.19
	Street Sample			
Effective Tax Rate (%)	57682	172.97	40539.9	2.17
LOG(main business income)	60845	5.82	2.14	5.82
LOG(capital)	62887	5.63	2.03	5.46
Firm Density along street	64103	2.14	8.8	0.57
	Town Sample			
Effective Tax Rate (%)	9749	3.69	4.13	3.07
Distance to top10% big firms centre	13076	3.03	1.72	2.67
LOG(main business income)	10646	1.2	2.34	1.34
LOG(capital)	10944	1.03	2.04	0.93
LOG (area)	13076	85.23	46.2	84.52

Note: *Effective tax rate, calculated by authors, refers to the ratio of the total tax payment inferred from the Inspection Data in 2008 over its main business sales inferred from 2008 Economic Census. effective tax rate in county sample refers to the mean value of firm-level effective tax rate. Fiscal burdens are based on the County Public Financial Statistical Yearbook in 1995 and 2004. They refer to the ratio of the number of employee on public payroll and annual fiscal revenues at county level. Firm density*

along street (per km) and distance to top 10% big firm centres within township is calculated by authors through ArcGIS 10.2. Population in 2000 (log ten thousand) , main business sales (log million yuan) and capital (log million yuan) are from the Population Census and 2004 Economic Census, respectively.

Table 2. Effects of initial fiscal burdens on effective tax rate

	Effective Tax Rate		
	(1)	(2)	(3)
Fiscal burden in 1995 (in log form)	0.359***	0.251***	0.193***
	(0.066)	(0.068)	(0.074)
Log(population) in 2000		-0.329***	-0.349***
		(0.059)	(0.062)
Nationally designated poor county status in 1999			-0.147
			(0.104)
Observations	1,790	1,790	1,753
R-squared	0.477	0.488	0.486
Regional dummies	Prefecture	Prefecture	Prefecture
	Change in Effective Tax Rate from 2004 to 2008		
	(1)	(2)	(3)
Effective Tax Rate in 2004	-0.997***	-0.997***	-0.997***
	(0.003)	(0.003)	(0.003)
Fiscal burden in 1995 (in log form)	0.347***	0.238***	0.181***
	(0.066)	(0.060)	(0.075)
Log(population) in 2000		-0.331***	-0.351***
		(0.059)	(0.062)
Nationally designated poor county status in 1999			0.133
			(0.104)
Observations	1,769	1,769	1,732
R-squared	0.988	0.988	0.988

Regional dummies	Prefecture	Prefecture	Prefecture

Note: *The sample contains all the counties after match the 2004,2008 Economic Census data, 2008 Annual Inspection Data, 2000 Population Census and data from 1995 County Public Financial Statistical Yearbook. The dependent variable is effective tax rate in 2008 and difference of effective tax rate between 2008 and 2004 according to authors' calculation. The key explanatory variable is predetermined fiscal burdens, the ratio of the number of employee on public payroll and annual fiscal revenues in 1995. After controlling prefecture fixed effect, the predetermined fiscal burdens in 1995 has significantly positive-correlation with effective tax rate in 2008. standard errors cluster to county level. *10% significance level; **5% significance level; ***1% significance level.*

Table 3. Effects of firm density on effective tax rate at street level.

	Dependent variable: Effective Tax Rate		
VARIABLES	(1)	(2)	(3)
Firm density along street (No. of firms over the length of street (100m))	-0.113*	-0.166**	-0.138**
	(0.064)	(0.074)	(0.064)
Log(main business sales)		-0.863***	-1.782***
		(0.146)	(0.360)
Log(capital)			1.286***
			(0.319)
Observations	57,623	57,623	57,623
Adjusted R-squared	0.016	0.021	0.025
Industry FE	YES	YES	YES
County FE	YES	YES	YES

Note: *The sample contains all the geocoded firms in Guangdong based on the matching of the 2008 Economic Census and Annual Inspection Data which can be spatially link to street within 100 meters. Firm density alongside street is based on authors' calculation through ArcGIS. Other variables are from 2008 Economic Census. Standard errors cluster to county level. *10% significance level; **5% significance level; ***1% significance level.*

Table 4. Within town, small firms pay lower tax when neighbouring with big firms.

VARIABLES	Dependent variable: Effective Tax Rate					
	S1	S2	S3	I1	I2	I3
	non-top10% firm (small firms)			top 10% firms (big firm)		
Distance to top10% big firms centre	0.066**	0.064**	0.064**	0.109	0.109	0.068
	(0.027)	(0.027)	(0.027)	(0.070)	(0.070)	(0.067)
Area (hundred km2)	-0.354***	-0.342***	-0.325***	-0.258	-0.258	-0.303
	(0.102)	(0.101)	(0.101)	(0.231)	(0.232)	(0.223)
Log (main business sales)		-0.323***	-0.245***		0.004	-0.958***
		(0.024)	(0.033)		(0.117)	(0.169）
Log (capital)			-0.135***			0.991***
			(0.039)			(0.130)
Observations	8,865	8,865	8,865	884	884	884
Adjusted R-squared	0.081	0.101	0.103	0.253	0.252	0.312
County FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES

Note: *The sample contains all the geocoded firms allocated in the 24 township-level jurisdictions in Zhongshan prefecture, Guangdong Province based on the matching of 2008 Economic Census and Annual Inspection Data. We sort the firms according to their main business sales and divide the firms into top 10% and the non-top 10% by each township unit. The distance of each firm to top 10% firms centre, a measure of the distance of the firm to big firms, and the land area of the towns are calculated through ArcGIS. Controlling county fixed effects and industry fixed effects, the distance of a small firm to top10% big firm centre has a significant positive effect on the firm's effective tax rate. While the distance of a big firms to top 10% big firms centre has no significant effect on the firm's effective tax rate.*