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Three Essays on Corruption and Government Finance

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Three Essays on Corruption and Government Finance

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Abstract

There are three chapters in my dissertation. In chapter one I study the impact of government corruption on tax avoidance by corporations with tax liability in China. I begin by developing a model of a firm's choice of tax avoidance based on the level of corruption in the firm's province. I show that a higher level of government corruption and a higher tax rate are predicted to increase a firm's tax avoidance. My empirical estimates show that a one-standard-deviation increase in government corruption corresponds to a 6% increase in tax avoidance by firms, based on data from nearly 600,000 firms from 1998 to 2007. When I separate the sample by type of ownership of firms, I find that domestic private firms tend to avoid a larger portion of their tax liabilities than foreign or state-owned firms. I also find that tax avoidance increases when the effective tax rate increases. The size of the firm, age of the firm, and whether the firm exports from China also influence tax avoidance.

In chapter two, a joint work with Sergey Mityakov, we study the impact of competition on tax avoidance by corporations in Mexico. Using more than 2,000 firm level data, we show that firms tend to avoid more taxes in less competitive markets, that is more concentrated market. A one standard deviation increase in competition leads to a 7.7% increase in tax avoidance. By splitting the sample based on ownership structure, we show that domestic firms avoid more taxes. When we separate the firms according to the plant size, we find that larger firms tend to avoid more taxes. We find robust and consistent results by using different competition measures and other robustness tests.

In chapter three, I theoretically demonstrate how fiscal decentralization affects corruption. The theory predicts that fiscal decentralization reduces corruption. This result is then tested using a panel data set of 31 provincial level government from 1998 to 2007 in China. My estimates suggest that fiscal decentralization in government expenditures and government revenue is negatively corre-

lated with corruption. Using leader and location dummy variables, I find that central government leaders can influence the corruption level in China. I also find that more developed regions in China tend to be less corrupt.

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Chapter 1

Corporate Tax Avoidance and Government Corruption: Evidence from Chinese Firms

1.1 Introduction

The corporate income tax is an increasingly important source of tax revenue in China. During the period 1998 to 2007, for example, corporate income tax revenue increased from RMB 92.6 billion to RMB 877.9 billion, which represents an increase in its share of total tax revenue from about 10% to over 19%. The increasing importance of corporate tax as a tax revenue source naturally raises the question of the severity of tax avoidance, which makes the study of tax avoidance important.

Corporate tax avoidance happens in both developed countries and developing countries. The noncompliance rate for the corporate income tax in the United States is estimated to be more than 13% (Slemrod and Yitzhaki, 2002; Hanlon, Mills, and Slemrod, 2005). According to Global Financial Integrity, China is number one among the developing countries in illicit financial outflow to tax havens, with an outflow of $1.08 trillion from 2002 to 2013.[1] The corporate income tax

[1] http://www.gfintegrity.org/report/2013-global-report-illicit-financial-flows-from-developing-countries-2002-2011/

noncompliance rate was about 30% during the period 1998 to 2007.[2]

In this paper, I address questions on the factors that influence tax avoidance. First, how does government corruption influence tax avoidance? Second, do different types of firms respond to government corruption differently? Corruption and tax avoidance are currently two of the important aspects in most countries. Corrupt governments may give firms an incentive to avoid tax. However, little attention has been paid to the impact of government corruption on corporate tax avoidance. In addition, I study how the effective tax rate and specific firm characteristics influence tax avoidance. Even though the statutory corporate tax rates faced by domestic firm and foreign firms are the same, the effective tax rates faced by them differ because of tax holidays given to foreign firms, tax rebates, and local governments set varies tax credit to compete for firms.

To answer these questions, I first develop a theoretical model of a firm's choice of tax avoidance when considering government corruption and tax rate. Then I use data on a large number of Chinese firms to show the impact of government corruption on tax avoidance using firm-level fixed effect estimation and an instrumental variable method. I also take advantage of a tax policy change, the Tax Sharing Act of 2002. The act instituted a new policy where the national tax bureau collects corporate tax for all firms established in or after 2002, while local tax bureaus collect corporate tax from domestic private firms established before 2002.

In this paper, tax avoidance is measured by profit hiding, which is the difference between imputed profits and reported profits. This measure includes both tax avoidance and tax evasion.[3] An example of tax avoidance is transfer pricing, and I address this by considering whether firms export from China to other countries. The example for tax evasion is that firms evade more tax when dealing with a more corrupt government. Corruption is measured by the number of convictions per thousand government employees in each province.[4]

Using a data set of nearly 600,000 Chinese firms, I empirically examined how government corruption affects the tendency of firms to avoid tax. Using fixed effects regressions, I find that

[2]Twenty-three percent of the corporations having sales of more than RMB 5 million reported a negative profit. The number of tax avoidance was calculated by first obtaining the share of tax revenue collected according to reported profit (RMB 1,438 billion) divided by total corporate income tax revenue from 1998 to 2007 (RMB 3,649 billion), and then comparing the share of profit hiding and reported profit.

[3]It is hard to draw a line between tax avoidance and tax evasion because the difference is not always clear. Tax evasion is illegally paying less tax than the law mandates, and it is subject to a fine and a prison sentence. Tax avoidance is taking advantage of loopholes and paying less tax. It is sometimes hard to tell the difference between the two; there is even a tax court in the United States to deal with disputes. The more complicated the tax law, the more difficult to tell the difference between tax avoidance and tax evasion. Refer to Slemrod and Yitzhaki(2002) and Hanlon and Heitzman(2010) for more detailed information on tax avoidance and tax evasion.

[4]In this paper, the provincial level governments including 22 provinces, 4 municipalities, and 5 autonomous regions.

firms avoid more corporate income tax in a more corrupt province. The effect of corruption on a firm's profit hiding is significant: one standard deviation change in corruption can explain about 6% of the tax avoidance. Besides firm fixed effects regression, I also run two stage least squares estimation using the tie of the province with central political bureau members as an instrument. The instrumental variable method yields the same results with a larger magnitude for corruption coefficients. I find supporting evidence by using a natural experiment, the Tax Sharing Act, to examine the effect of corruption on tax avoidance.

When it comes to tax avoidance decisions, firms respond differently to the level of corruption in a province, based on their ownership structure. This paper examines how the ownership structure of a firm influences tax avoidance. I split the sample into state-owned enterprises, private domestic corporations, and foreign corporations. I find that private domestic firms hide more profits compared with the other two types of firms. The effect of corruption on tax avoidance for private domestic firms is twice the effect of corruption on tax avoidance for foreign firms and state-owned enterprises.

Larger firms tend to hide more profit, and that may be why the tax bureau closely monitors larger firms in China. However, the tax non-compliance rate of larger firms is lower compared with that of smaller firms. It is hard for large firms to successfully hide a large proportion of their profits. When holding other variables constant, firms that export from China avoid more tax and have a lower compliance rate given that it is easier for such firms to use transfer pricing. However, the effects for foreign firms are not significant, because the tax rate for such firms is lower at this time; it is hard for them to make more profit by using transfer pricing. As the age of a foreign firm increases, it tends to hide more profit but at a decreasing rate.

Effective tax rate also plays a role when firms make a tax avoidance decision. I find that firms tend to avoid more tax when facing higher effective tax rates. This result is confirmed when using the natural experiment that foreign firms face different tax rates at different stages of operation in China. Specifically, I compare the first two years after they generate positive profit with the third to fifth years after they generate positive profit, where the tax rate is 0% and 15%, respectively. I find that given the same level of corruption, firms avoid more tax when the tax rate is increased to 15% from 0%. I get the same results when using only the second year as the year with a 0% tax rate compared with the fourth year with a 15% tax rate.

Some additional analyses and robustness tests support my findings that firms avoid more profit in more corrupt provinces. First, I analyze the model by using a balanced panel that includes

only firms that stayed in the sample for all of the 10 years. Second, using the balanced panel, I use a new way to calculate tax avoidance by using weighted imputed profit to correct for the influence of different accounting rules for output and depreciation. Third, because the results may potentially be influenced by outliers, I estimate the model using the sample by dropping the top and bottom 0.5% of the main variables. Fourth, I include the lagged two years corruption term to deal with the tax avoidance that may be influenced by the level of corruption of a province for more than one year. All of these alternative specifications support the main empirical results.

This paper contributes to the literature in the following ways. To the best of my knowledge, this paper is the first empirical study to investigates how government corruption affects a firm's tax avoidance. There are several studied at corruption and individual income tax evasion. The model of tax avoidance by Allingham and Sandmo (1972) based on the model of crime (Becker, 1968) argues that optimal tax evasion depends on the probability of getting caught, the level of the penalty for evasion and the degree of risk aversion. Akdede (2006) shows that if the size of bribes and tax evasion are negatively correlated, taxpayers will prefer to pay taxes if the necessary bribe is too large. There is not much empirical work on corporate tax avoidance, because it is hard to qualify firm behavior. Goerke (2008) shows that at the firm level, tax evasion does not influence corruption, and he found there is no obvious relationship between the two. This paper is related to that of Johnson, Kaufmann, McMillan, and Woodruff (2000), which shows, using several East European countries' firm level data, that bureaucratic corruption is connected with hiding output. Uslaner (2010) use survey data of transaction countries to show that giving gifts to government officials leads to lower sales reported for tax purposes.

Second, this paper contributes to the literature on the measurement of tax avoidance.[5] Many measures of tax avoidance have been used. The effective tax rate measure is used by Dyreng et al.(2008). Fisman and Wei (2004) estimate the tax evasion by the difference between the value that China reports as imports from Hong Kong and the value that Hong Kong reports as exports to China, using data from 1997 and 1998. Another way to measure tax evasion is to find book-tax differences of publicly traded firms (Desai and Dharmapala, 2006). There is also research based on Internal Revenue Service (IRS) audit data that uses the amount of positive adjustment to a firm's liability after audit as the measure of tax avoidance (Hanlon, Mills, and Slemrod, 2005; DeBacker, Heim, and Tran, 2011). Because most of the firms in my sample are not publicly traded, I cannot use

[5]Hanlon and Heitzman (2010) broadly review the literature on measurements of tax avoidance.

the book-tax difference. To measure the extent of tax avoidance, one must figure out the actual profit from a firm's financial sheets. Cai and Liu (2009) measure tax avoidance by comparing imputed profit and reported profit. In this paper, I improve the Cai and Liu (2009) measure of imputed profits by using weighted output and weighted depreciation to get weighted imputed profit. Because imputed profit is calculated based on national income account system, it may differ from the firm's true profit calculated based on generally accepted accounting standards. For example, profit may be biased because firms may use different rules of depreciation, and not all of the output may be converted to current year revenue. Using weighted imputed profit can mitigate such problems.

Third, this paper is related to the growing literature on the determinants and consequences of tax avoidance. Tax avoidance is not necessarily a good thing, because of the cost of not being transparent. Tax evasion is not simply a money transfer from state to firm, given that there is a principal agent problem (Desai and Dharmapala, 2009). The effects of a principal agent problem on tax avoidance is also tested by Crocker and Slemrod (2005) and Chen and Chu (2005). There is also evidence of tax enforcement on firm value and stock price (Desai, Dyck, and Zingales, 2007; Kim, Li, and Zhang, 2011; and Mironov 2013). Cai and Liu (2009) show that firms in competitive environments tend to engage in more tax avoidance activities. This is consistent with the fact that unethical behavior leads to more tax avoidance. This paper adds to the empirical results on the effects of effective tax rate, size of firm, and transfer pricing on tax avoidance. This paper is also among the first few to empirically examine firm characteristics that influence corporate tax avoidance in the context of China. Determinants of tax avoidance have previously been investigated using data from American firms. Hanlon, Mills, and Slemrod (2005) showed that assets, number of employees, and intangible assets influence tax avoidance. I get consistent results.

The rest of the paper is organized as follows. Section 2 provides a simple analytical framework. Section 3 describes the data and how I construct my measure of corruption and tax avoidance and other variables. Section 4 presents the empirical model and empirical results. Section 5 provides robustness tests. Section 6 concludes the paper.

1.2 A Simple Analytical Framework

This section develops a simple model of a firm's choice of compliance rate where bribery is also a choice. For any firm, expected true profit can be written as

$$\Pi^e(B,\theta) = R - T(\theta) - B - P^e(B,\theta) \tag{1.1}$$

where R is net operation revenue, $T(\theta)$ is corporate income tax payment, B is bribe payments to government officials, and $P^e(B,\theta)$ is the expected penalty for underpayment of taxes. Corporation income tax defined as $T(\theta) = \tau\theta R$, where τ is the effective tax rate that applies to the firm and θ is the degree of tax compliance rate, satisfies $0 \leq \theta \leq 1$. Even though in China the tax rates are set by the central government, different firms may have different tax rates, depending on whether there is a local government tax competition or whether the firms are domestic or international. The tax rates differs for domestic firms and foreign firms, because tax holidays are given to foreign firms. Tax rates vary for foreign firms at different stages of operation. Detailed information will be introduced in Section 4.

Expected penalties with no corruption are defined as $\Phi(\theta)$. The penalties are more severe if firms evade more tax. Therefore, the penalty function Φ satisfies $\frac{\partial\Phi}{\partial\theta} < 0$ and $\frac{\partial^2\Phi}{\partial\theta^2} \geq 0$.[6] Bribery of corrupt officials can reduce $P^e(B,\theta)$ through reduced monitoring or a lower penalty if detected. So the expected penalty with corruption is defined as

$$P^e(B,\theta) = [1 - C_p\Psi(B)]\Phi(\theta) \tag{1.2}$$

where C_p is an index of corruption in province p, defined as $0 \leq C_p \leq 1$. $\Psi(B)$ is a function of bribe and satisfies $\frac{\partial\Psi}{\partial B} > 0$ and $\frac{\partial^2\Psi}{\partial B^2} < 0$. Given the level of corruption in a province C_p, more bribe payments lead to less severe penalties.

Expected profit for a firm is therefore given by

$$\Pi^e(B,\theta) = (1-\tau\theta)R - B - [1 - C_p\Psi(B)]\Phi(\theta) \tag{1.3}$$

[6]The penalties can be 0.5 to 5 times the amount of underpaid tax, according to the severity of underpayment. Penalties range from an additional 0.5 to 5 times the amount of tax evasion; penalty range from 1 to 5 times for defrauding tax refund; penalty range from 0.5 to 3 times for failing to withhold or collect tax. The more you evade, the more severe the penalty. The most severe penalty imposed for tax crimes is life imprisonment. If the amount evaded amounts to more than RMB 100,000 and more than 10% of the total taxes payable, the taxpayer could be criminally charged and subject to criminal sanctions according to Article 201 of the Criminal Law.

The firm chooses a tax compliance rate, θ, to maximize profit, Π^e, so the first order condition is

$$\frac{\partial \Pi^e}{\partial \theta} = -\tau R - [1 - C_p \Psi(B)] \frac{\partial \Phi(\theta)}{\partial \theta} \tag{1.4}$$

A firm's choice of B satisfies

$$\frac{\partial \Pi^e}{\partial B} = -1 + C_p \Phi(\theta) \frac{\partial \Psi(B)}{\partial B} \tag{1.5}$$

Bribe B and compliance rate θ are decided by tax rate τ and C_p, from the two first order conditions, giving

$$\tau R + [1 - C_p \Psi(B(C_p, \tau))] \frac{\partial \Phi(\theta(C_p, \tau))}{\partial \theta} = 0 \tag{1.6}$$

$$-1 + [C_p \Phi(\theta(C_p, \tau))] \frac{\partial \Psi(B(C_p, \tau))}{\partial B} = 0 \tag{1.7}$$

The comparative statics of equation (1.6) and equation (1.7) lead to the following two propositions.

Proposition 1 *All else equal, the tax compliance rate is lower in a more corrupt province.*

Proof: See Appendix A

Intuitively, in a more corrupt province, firms are more likely to establish a relationship with government officials through bribes, so the officials would be less likely to audit the firms or levy less severe penalties once the firms are caught; thus, firms would be more likely to hide more of their profits.

Proposition 2 *All else equal, the tax compliance rate is lower when effective tax rate is higher.*

Proof: See Appendix B

Given the same cost of hiding profit, firms with higher tax rates receive more benefits by hiding profits, so firms facing higher tax rates will try to hide more of their profits.

1.3 Data and Variable Definitions

1.3.1 Data

The data in this paper come from a variety of sources. Firm level data were obtained from the Annual Survey of Industrial Firms conducted by China Bureau of Statistics. This data set includes all firms with annual sales of more than RMB 5 million (about $625,000) during the period 1998 to 2007. Growth in the number of large corporations doing business in China has been driving the nation's economic growth. The number of corporations in this data set more than doubled during the sample period, increasing from 139,521 to 331,500. Information about firm characteristics are drawn from balance sheets, cash flow statements, and income statements.

The number of convictions for the abuse of public office in each province are from the provincial reports in the Chinese Procuratorial Yearbook. The data source for the remaining variables is the China Statistical Yearbook.

To get a clean sample and correct the measurement errors in the data sets, I exclude firm-year observations with zero, negative, or missing values for the following variables: total assets, total sales, gross value of industrial output, paid-in capital, net value of fixed assets, total depreciation, number of employees, wages, and intermediate goods. I also exclude observations when current depreciations are greater than cumulative depreciations, liquid assets are greater than total assets, and fixed assets are greater than total assets.[7] After the data construction, my sample contains 2,068,867 observations representing 595,035 firms.

1.3.2 Measurement of Firm Tax Avoidance

The data contain pre-tax profits reported by each firm. To estimate tax avoidance, the firm's real profit is needed. However, knowing a firm's true profit is a challenge. As mentioned in Section 1, many ways have been used to estimate tax avoidance. In this paper, I follow Cai and Liu (2009) by calculating tax avoidance using the difference between imputed profit and reported profit. Explicitly, imputed profit is generated by using the equation

$$ImputedProfit_{it} = Output_{it} - Inputs_{it} - Depreciation_{it} - FinancialCost_{it} - Wage_{it} - VAT_{it} \quad (1.8)$$

[7] There still may potentially be problems with misreporting, especially in the top and bottom 0.5 percentile of the data. Later I conduct a robustness test by dropping the top and bottom 0.5 percentile for the main variables of the data and find similar results.

where $Output_{it}$ is the value of total output of firm i in year t, $Inputs_{it}$ is total intermediate inputs, $Depreciation_{it}$ is current year depreciation, $FinancialCost_{it}$ is the financial cost of firm taking loans from banks or other costs involved in financial activities, $Wage_{it}$ is total wages paid to workers, and VAT_{it} is the total value added tax paid by firm i in year t.

This imputed profit is calculated on the basis of national income account system and may differ from the firm's true profit calculated on the basis of generally accepted accounting standards, given that firms may have different rules for depreciation and that not all of the output converts into firm revenue in the same year. To deal with this potential problem, I calculate the imputed profit using weighted output and weighted depreciation. I will report the weighted output by using 95% of current year output and 5% of previous year output, the weighted depreciation is using 95% of current year depreciation and 5% of previous year depreciation.[8]

Firms try to hide profit in two ways: by understating output, and by overstating inputs, depreciation, the financial cost, wages, and the tax payment. Even though most of these firms are manufacturing firms, they should have extra revenues besides the total value of output, so the imputed profit here should be approximately a lower bound of the firm's profits.[9]

In this paper, tax avoidance is measured by profit hiding PH_{it}, that is, the difference between imputed profit and reported profit, defined as

$$PH_{it} = ImputedProfit - ReportedProfit \tag{1.9}$$

Besides the level of profit hiding, the noncompliance rate of corporation income tax is an important measure. Noncompliance rate NR_{it} is derived by normalizing profit hiding by a firm's assets and is defined as

$$NR_{it} = \frac{ImputedProfit - ReportedProfit}{Assets} \tag{1.10}$$

Noncompliance rate is normalized by assets instead of profit because profit is a noisy measure; it is harder for firms to lie about their assets than their profits. The correlation between imputed profit and reported profit is 0.63, so there is a strong correlation between imputed profit and reported profit. Figures 1.1 through 1.3 show the histograms of reported and imputed profit, profit hiding,

[8] I get similar results by using 85% of current year and 15% of previous year output and depreciation as well as 90% of current year and 10% of previous year output and depreciation.

[9] Taxable income is total income less deductions. The main total income includes production and operational income and assets resale income. The main deductions includes invest payment, labor wage before tax, and employee welfare.

and profit hiding normalized by assets, respectively.[10] Figures 1.2 and 1.3 show that the distribution of profit hiding and of profit hiding normalized by assets is skewed to the right, which gives evidence that firms tend to hide their profits. Profit hiding is mostly close to zero, which suggests there are firms that report their profit truthfully. As we can see from the graphs, profit hiding sometimes has negative values. One reason is that the imputed profit is possibly the lower bound that can be seen in Figure 1.1 histogram of imputed profit and reported profit. Another potential reason for this is that it happens when firms are not familiar with the tax law and do not use all of the deductions or other items that are deductible.

1.3.3 Measurement of Corruption

Corruption is a widespread phenomenon seen in both developing and developed countries. According to Transparency International's Corruption Perceptions Index, China has been ranked between 72nd and 78th out of 178 countries in recent years.

One of the challenges of this empirical research is finding a measurement of corruption, because corruption is illicit and thus secretive. Many measurements have been used in the literature on corruption. That include the corruption rating data sets provided by Transparency International and the World Bank and by the International Country Risk Guide, which is published by Political Risk Service. These data sets include a corruption perceptions index, a bribe payers index, global corruption report, and more. Fan, Lin, and Treisman (2009) construct two measures of corruption bribe frequency and bribe amount. However, these data sets rely on the aggregated perceptions of businessmen or country experts, many of whom may have formed impressions based on common press depictions.

Glaeser and Saks (2006) and Goel and Nelson (2011) use the number of convictions for abuse of public office in 50 states in United States as a measure of corruption. Similarly, I use the number of convictions for abuse of public office normalized by per thousand government employees in a province as a measure of corruption. This measure is used as an indicator for corruption because the People's Procuratorates in each province is guided by the Supreme People's Procuratorate of China. Therefore, the rate of catching corrupt activity is likely to be close given that the inspections are conducted in each province following the same rules from the central bureau.

[10] The imputed profit can be considered as the lower bound of a firm's true profit. Thus profit hiding has a negative number.

Convicted graft, taking bribes, and embezzlement are the main reasons for the conviction numbers in each province. The number of convictions for each province is shown in Figure 1.4. The number of convicted officials in a province varies a lot, from as low as 41 in Tibet to as many as 3,881 in Henan province. The number of convictions for each province normalized by per thousand government employees is shown in Figure 1.5. To get a general sense of the corruption level across the provinces, I generate the average corruption level for each province in Figure 1.6.

According to the criminal law of China, any state functionary who takes advantage of his office to accept bribes shall be sentenced to a fixed-term imprisonment. The funds or articles that he received as bribes shall be confiscated, and public funds or articles shall be recovered.[11] Whoever offers or introduces a bribe to a state functionary shall be sentenced to a fixed-term imprisonment of not more than three years or criminal detention.

1.3.4 Other Variables

Before the reform and opening policy started in 1978, most firms in China were state-owned enterprises. The percentage of state owned firms has changed considerably since then. I separate ownership into state owned enterprise, private domestic firms, and foreign firms according to the share of paid-in capital.[12] If the state share of paid-in capital is the biggest share, it is counted as a state owned enterprise. If the largest share of paid in capital is from Hong Kong, Taiwan, Macao, and other countries, the firm is counted as a foreign firm. The remaining are private firms, including the largest share of paid in capital from collected owner, private owner, or legal person. I construct three dummy variables, D^{state}, $D^{private}$, and $D^{foreign}$, for state-owned, private, and foreign firms, respectively.

For the period 1998 to 2007, the percentage of state-owned enterprises decreased from 33.24% to 3.55%, while that of foreign firms increased by 50%, from about 10% to about 15%. The detailed percentage of each type of firm is shown in Table 1.1. This period reflects the privatization of state-

[11] According to article 383 the Criminal law of China, those accepting bribes of more than RMB 100,000 shall be sentenced to imprisonment of more than 10 years, and funds or articles received shall be confiscated; those accepting bribes between 50,000 and 100,000 shall be sentenced to imprisonment of more than 5 years and funds or articles received shall be confiscated; those accepting bribes between 5,000 and 50,000 shall be sentenced to imprisonment of more than 1 year and no more than 7 years, and funds or articles received shall be confiscated; those accepting bribes less than 50,000 shall be sentenced to imprisonment of no more than 2 years for severity case, and funds or articles received shall be confiscated.

[12] Using paid-in capital instead of registration due to the registered firm type may not accurately reflect their activity. Firms will less likely to lie about their paid-in capital. Therefore, the share of paid-in capital would be a better measure compared with the reported type when they first registered.

owned firms and shutting down of some firms. Usually, private firms are relatively small compared with the state-owned firms in this sample. State-owned enterprises receive favorable policies. For example, they can easily get loans from a bank or get funds from the central government through tax expenditure. During the sample period, foreign firms enjoy tax holidays, and their tax rates are lower compared with domestic firms, both state-owned and private.

According to the corporate income tax in China, the corporate income tax rate for domestic firms, both state-owned and private, is 33%.[13] The corporate income tax rate for foreign firms is 30%.[14] Foreign firms, in general, get favorable policies. For example, foreign enterprise may be entitled to a 0% tax rate in the first two years beginning with the year when it begins making a profit, and 15% through the third to fifth years.[15] Because of tax competition among different subnational governments, a local government may give preferable tax rules to firms so as to attract investments.

Besides the statutory difference in tax rates, the effective tax rate the company paid may be differ because of competition from local government. I use the payable income tax divided by taxable income to get the effective tax rate. Firms with negative taxable income are not subject to pay corporate income tax. The total number of observations with positive payable income tax and taxable income is 963,119.

I create a dummy variable for exports based on whether the firm exports from China, D^{export}. This binary variable takes a value of one if the firm exports output to other countries and zero otherwise. I construct 37 industry dummy variables for each two-digit industry to capture any industry fixed effects. The list of 40 industries can be found in Table 1.2. Table 1.2 also shows the number of firms in each industry and the percentage of firms in each industry. I use 10 year dummy variables to capture time varying effects. Assets and number of employees are included so as to capture firm size. Age of the firm is also considered in the regression so as to reflect the effect of experience in the market on tax avoidance.

[13]The tax rate is 27% for firms with taxable income lower than RMB 100,000 but higher than RMB 30,000. The tax rate is 18% for firms with less than RMB 30,000 taxable income. Since the firms I use have more than RMB 5 million as total sales, the tax rate for small firms would not influence my results.

[14]For a foreign enterprise a local income tax shall be assessed on the taxable income at the rate of 3%, but the local tax may be waived or reduced by local government.

[15]As to eligible for this policy, a foreign invested enterprise should have an estimated operation period of more than 10 years. I only consider the firms in special economics zone.

1.4 Empirical Analysis

1.4.1 Empirical Model

To examine the effect of government corruption on firm profit hiding behavior, I use the empirical regression model

$$PH_{ijpt} = \beta_0 + \beta_1 C_{p(t-1)} + \beta_2 TAX_{ijpt} + \beta_3 EMPLOYEE_{ijpt} + \beta_4 AGE_{ijpt} + \beta_5 AGE^2_{ijpt} + \beta_6 D^{export} + \Sigma_{os}\beta_{os} D^{ownership} + \alpha_t + \alpha_j + \alpha_i + \epsilon_{ijpt} \tag{1.11}$$

In the model, PH_{ijpt} is profit hiding for firm i in industry j in province p in year t. $C_{p(t-1)}$ is the number of officials convicted of abuse of public office, normalized by the number of government employees in province p in year $t-1$. I use the corruption of year $t-1$ is because firms need to know the level of corruption in the province in order to make profit hiding decision and because sometimes firms required to prepay taxes. TAX_{ijpt} is the tax rate faced by firm i in year t. $ASSETS_{ijpt}$ is the assets for firm i in industry j in province p in year t.[16] $EMPLOYEE_{ijpt}$ is the number of employees for firm i in industry j in province p in year t. AGE_{ijpt} is the number of years firm i has been established in industry j in province p in year t, and AGE^2_{ijpt} is the squared term of the age of firm.$D^{ownership}$ is a set of dummy variables for ownership, including state-owned firms, private firms, and foreign firms. α_t is year fixed effect, α_j is industry fixed effect, and α_i is firm fixed effects. Firm fixed effects are included to control for firm characteristics that are not observed. Because 3.9% of the observation change industries, industry fixed effects are included to capture industries characters. ε_{ijpt} is the error term.

From the propositions derived from the theoretical model,[17] I have the following hypotheses:

Hypothesis 1 $\beta_1 > 0$*, that is, a firm's tax noncompliance is higher when facing a more corrupt provincial government.*

Hypothesis 2 $\beta_2 > 0$*, that is, a firm's noncompliance rate is higher when facing a higher effective tax rate.*

[16] When profit hiding is the dependent variable, $ASSETS$ is included in the regression equation. When noncompliance rate is the dependent variable, $ASSETS$ is not included in the regression equation.

[17] Hypothesis 3 is based on the proposition derivative in appendix C. Appendix C also shows the first two hypotheses using profit hiding.

Hypothesis 3 *$\beta_6 > 0$, that is, firms with exports tend to hide more profits.*

Firms with exports have incentives to hide more profits because they can avoid taxes through transfer pricing. Transfer pricing is an important method that accounting companies use to help firms avoid their tax.

1.4.2 Firm Fixed Effect OLS Regressions

Consistent with my first hypothesis, I find that firms tend to hide more profit in more corrupt provinces. I report the regression results for all observations and by ownership in Table 1.5. Columns 1 through column 4 show the results when using the noncompliance rate as the dependent variable. Columns 5 through column 8 show the results when using profit hiding as the dependent variable. The coefficients on corruption for all specifications are positive and significant. The coefficient for corruption is higher for private firms compared with state-owned and foreign firms. This means, all else equal, corruption has more impact on private firms compared with state-owned firms and foreign firms.

Domestic private firms avoid more tax perhaps because the less favorable policy faced such private firms compared with state-owned and foreign firms. State owned firms have different incentives compared with private and foreign firms: they do not try to maximize their profit, while the other two types of firms do. Principal and agent problems may be involved in state-owned enterprises because the managers care relatively less about the profitability but more about their own utility. Such problems are less severe in private and foreign corporations. The state-owned enterprises can easily access credit from state-owned banks and usually face favorable policies. International firms including Hong Kong, Macao, and Taiwan firms could benefit from foreign direct investment policies and tax holidays for foreign firms. Thus for private firms, hiding one dollar of profit would save more compared with state-owned and foreign firms, so private firms would report less profit. This is consistent with the finding by Hanlon, Mills, and Slemrod (2005) that foreign controlled firms have a smaller deficiency than domestic firms. This result is also in line with the deficiency rates of private companies being higher than those of public companies, because privately held firms do not have pressure from the capital market and thus can report low financial earnings (Cloyd, 1995; Cloyd, Pratt, and Stock, 1996; and Hanlon, Mills, and Slemrod, 2005).

Another reason foreign firms hide less profit is because of the culture of the companies. The

multinational firms tend to be more transparent and less corrupt (DeBacker, Heim, and Tran, 2012; Braguinsky and Mityakov, 2013). Firms may face punishment by their home countries, so they would hide less profit. According to a report[18] by Transparency International, out of 39 countries that make foreign bribery a crime, 7 countries actively enforce it and 12 countries moderately enforce it. The countries that are heavily invested in China either actively enforce it (the United States, Germany, and the United Kingdom) or moderately enforce it (Japan, France, and South Korea). Therefore given that firms may face investigation by their own countries, they have an extra incentive to report profit honestly. This is consistent with the result by DeBacker, Heim, and Tran (2012) that firms evade more tax with owners from countries with a higher corruption norm. That means firms that are doing business in other countries are also influenced by the regulations of their home countries.

The estimated coefficient of the export dummy is positive and statistically significant for domestic firms. This is consistent with Hypothesis 3, that firms with exports tend to avoid more tax. It is consistent with the fact that firms with exports from China usually have greater tax planning opportunities. For foreign firms, the tax rate faced by them in China is lower, so the incentive to shift their profit to other countries is not as great.

The estimated coefficients on assets and the number of employees are positive when profit hiding is the dependent variable. That means larger firms hide more profit in the absolute term. The coefficient for the number of employees is negative when using noncompliance rate as the dependent variable, because bigger firms would receive greater attention from the tax bureau, which would reduce their incentive to hide higher percentage of their profits. This can be explained by the policy "grasp the large, control the medium, and let the small go".[19]

Larger firms hide more profit, but the noncompliance rate for larger companies is lower, which is consistent with the IRS report for US corporate income tax. The IRS data show that the noncompliance rate is lower for larger companies, while total noncompliance is higher for larger firms (Hanlon, Mills, and Slemrod, 2005).[20] It is also consistent with Article 201 of the criminal law, which states that if the amount evaded amounts to more than RMB 100,000 and more than 10% of the total of taxes payable, the taxpayer could be criminally charged and subject to criminal

[18] `http://www.transparency.org/whatwedo/pub/exporting_corruption_country_enforcement_of_the_oecd_anti_bribery_conventio`

[19] I also separate the sample into four groups by assets; the coefficients increase as the firm size increase.

[20] From the report of IRS, the noncompliance of corporation income tax is $30 billion; more than 80% of the noncompliance with the corporation income tax is by larger corporations, but the noncompliance rate of larger companies is lower. Larger firms are defined here as firm with $10 million.

sanctions. Therefore, firms would strategically respond to this. Bigger firms would evade less than 10% while small firms would evade a higher percentage but make sure the total amount is less than RMB 100,000.

The estimated coefficient of age of the foreign firms is positive when noncompliance rate is the dependent variable. This means that the more years in business, the more likely the foreign firms will hide higher percentage of their profits, which can be explained as learning by doing. The age of the firm squared is negative, which means foreign firms avoid their profits at a decreasing rate.

1.4.3 Instrumental Variables

The OLS results are consistent with my hypotheses, but the estimates may be biased. Specifically, there may be endogeneity problems because the omitted variables may be correlated with the level of corruption in a province. For example, bribery payments by firms are likely to influence both government corruption and the firm's decision to hide profit. Using year and province fixed effects and lagged terms of corruption helps to an extent. To address the endogeneity problem, I instrument for corruption.

I use the tie of the province with central political bureau members as an excluded instrumental variable for corruption.[21] The tie with the central political bureau members is defined as the connection of the province with central political bureau members. If one of the 25 central political bureau members was born in the province or was the top leader of the province, then that relationship counts as a tie with central government. This number is related to corruption given that the tie with members of the central political bureau can be seen as protection of the local officials from the central government. A firm's decision on whether to avoid tax is influenced by the economic environment and firm characteristics, not by the tie of the province with the central political bureau. I perform two stage least squares estimation using this instrument. I report the second stage regression in Table 1.6 and the first stage regression in Table 1.7. From Table 1.6, we can see that the estimated coefficient for corruption is higher when using the tie with central committee members as an instrument.

Even though the instrument used in this paper is significant, there may still be the problem

[21] The central political bureau, also known as Central Politburo, is the 25 people who oversee the Communist Party of China. It is the most powerful decision-making group in China and has control over personnel appointments.

of weak instruments; because when the endogenous explanatory variables are close to collinear, it is difficult to separate the results (Stock and Yogo, 2005). All of the Cragg-Donald Wald F statistics pass the 10% critical value in these results. So the instruments I use in the two stage least squares estimation are not subject to weak identification problem.

1.4.4 A Natural Experiment—Tax Sharing Act

Changes in the tax enforcement administration in China can be used as a natural experiment to test how corruption influences tax avoidance. After the tax reform of 1994, the tax collecting bureau separated into the State Administration of Taxation and local tax bureaus. The State Administration of Taxation has branch offices at each level of government. The local tax bureaus governed by local governments follow the guidance of the State Administration of Taxation. They are responsible for collecting tax revenue for corresponding level local governments. Before 2002 the national tax bureaus collected corporate income tax from foreign firms and the portion of tax from state-owned firms that belongs to the central government. Local tax bureaus collect the corporate income tax on private firms and the portion of state owned firms that belongs to the provincial level government or lower. Starting in 2002, the national tax bureaus collect the corporate income tax for all the firms established starting in 2002 according to the Income Tax Sharing Act. For 2002, the tax revenue was equally shared between the central government and local governments. Starting in 2003, the central government keeps 60%of the total tax revenue, and the local government keeps 40%. The tax structure in China is shown in Figure 1.7.

Taking advantage of this tax sharing act, I use the interaction term of corruption and a dummy variable, $D2002$, to test if there is a significant difference in tax avoidance when the tax is collected by the State Administration of Taxation versus the local tax bureau. I compared the the tax avoidance of private firms in different provinces registered before and after 2002. I use the private firms that were established before 2002 as base group, whose tax was collected by the local tax bureau.

$$PH_{ijpt} = \beta_0 + \beta_1 C_{p(t-1)} + \gamma_1 C_{p(t-1)} * D2002 + \beta_2 D2002 + \beta_3 EMPLOYEE_{ijpt} + \beta_4 AGE_{ijpt} + \beta_5 AGE^2_{ijpt} + \beta_6 D^{export} + \Sigma_{os}\beta_{os} D^{ownership} + \alpha_t + \alpha_j + \alpha_i + \epsilon_{ijpt} \tag{1.12}$$

The coefficient γ_1 on the interaction term of corruption and the established year before or after 2002 measures the average extra effect of corruption on profit hiding when corporate income tax is collected by the national tax bureau. Because the local tax bureaus have relatively more connection with local private firms, they can more easily take bribes from private firms; the central tax bureau is less corrupt compared with local tax bureaus because of the direct governing by the State Administration of Taxation. Table 1.8 shows that the estimated coefficient of the interaction term of corruption and the dummy variable is negative, which means firms dealing with the State Administration of Taxation tend to avoid more taxes. The national tax bureau is less corrupted compared with local tax bureaus; therefore, this natural experiment supports my finding that firms hide more profit in corrupt provinces.

Corrupt governments will lead to more tax avoidance because the firms know they could pay less tax. The national tax bureau, which has less connections with local government, is relatively less corrupt compared with local tax bureaus. It explains why firms established before 2002 hide more profit. The coefficient after the Tax Sharing Act is small in magnitude, meaning it is harder for firms to hide profit, given the less corrupt State Administration of Taxation.

1.4.5 Tax Rates and Tax Avoidance

Table 1.9 shows the results when using all the observations with positive tax liability. The tax rate is derived by dividing taxes paid by reported profit. The average effective tax rate is 26%(the average effective tax rate for foreign firms is 18% while the average effective tax rate for domestic firms is 28%). From the results we can see that the sign for tax rate is positive, which is consistent with Fisman and Wei (2004), who show that a 1% increase in the tax rate leads to a 3% change in tax evasion.

The effective tax rate may be lower than the statutory tax rate for several reasons. First, the tax rates for domestic firms and foreign firms differ. Second, there may be a tax refund for foreign firms with direct investment, according to Article 10 of the Foreign Corporate Income Taxation Law.[22] Third, there may be an implicit tax cut from local governments through favorable tax

[22] "When a foreign investor of an enterprise with foreign investment makes direct investment in the enterprise with the profit obtained from the enterprise, thereby increasing the registered capital thereof or using the profit from the enterprise to establish another enterprise with foreign investment with a schedule operational period of no less than five years, the foreign investor may get a refund of 40% of the income tax already paid on the reinvested portion of income upon approval of application by the tax authorities, or enjoy preferential treatment otherwise prescribed by the State Council. If the reinvestment is withdrawn in less than five years, the refunded tax payment shall be paid back to the tax authorities."

policies. Local government may compete with each other; therefore, the actual tax rate faced by firms may differ.

The results shown in Table 1.9 illustrate the trend that a tax rate increase will lead to higher profit hiding for all specifications. This is consistent with Hypothesis 2, that a higher tax rate positively correlates with more tax avoidance. All other independent variables have results similar to those of the main regression.

1.4.6 A Natural Experiment—Different Tax Rates for Foreign Firms

During my research period, the tax rate for a foreign-invested enterprise is 30% plus a 3% local income tax on taxable income. All foreign invested enterprises except for those located in the special economic zones are subject to this 3% local tax unless it is exempted. Foreign invested enterprises enjoy a five-year tax holiday, which is a two-year exemption and a three-year 50% reduction in the applicable tax rate. That is, for newly established foreign firms the tax rate is 0% for the first two years after generating positive profit, and 15% for third through fifth year after generating positive profit. Firms can also apply to continue having lower tax rates if certain conditions are satisfied. Therefore, tax rates for foreign firms differ from year to year. I separated foreign firms into two groups: firms in the first two years after they generate positive profit, and firms in the third to fifth years after they generate positive profit. According to Hypothesis 2, the tax avoidance would be lower for a firm in the first two years of having positive profit compared with a firm in the third to fifth years.

To show the difference between the two stages, I use an interaction term of government corruption and a dummy for firm operation from the third to fifth years after generating a positive profit.

$$\begin{aligned} PH_{ijpt} = \beta_0 + \beta_1 C_{p(t-1)} + \gamma_1 C_{p(t-1)} * D345 + \beta_2 D345 + \beta_3 EMPLOYEE_{ijpt} + \beta_4 AGE_{ijpt} \\ + \beta_5 AGE^2_{ijpt} + \beta_6 D^{export} + \Sigma_{os} \beta_{os} D^{ownership} + \alpha_t + \alpha_j + \alpha_i + \epsilon_{ijpt} \end{aligned} \tag{1.13}$$

The regression results are shown in Table 1.10. The coefficient for the interaction term is positive, which means that as the level of corruption increases, firms that operate through the third to fifth years after generating profit tend to avoid more tax compared with firms in the first two years after

generating positive profit. The coefficient for the first two years is not significant because the tax rate is zero, so the level of corruption will not influence firm tax avoidance. The estimated coefficient for export is not significant, which means that firms will not take advantage of export for tax planning, given that they enjoy a lower tax rate in China compared with other countries.

Given that some firms may use the first year's profit to cover negative profit in previous years, I do a robustness test using only the second year after generating profit. The fourth year is a good represent for the third to fifth years. Columns 2 and 4 of Table 1.10 show the results using year two as the base year and the interaction term corruption times dummy for the fourth year after a firm generate positive profit. I get the same sign for the interaction term and the magnitude is similar.

1.5 Robustness Tests

I conduct several robustness tests for the main results, and I discuss several aspects that for future research.

1.5.1 Robustness Test: Balanced Sample

It possible that firms in the sample for only a few years hide more profit, which would bias the results upward. Instead of using all the firm-year observations, I use only firms that are in the sample for all 10 years of the sample period. In this way I omit from the sample the firms that had just registered, those about to go bankrupt, and those that did not perform well for all 10 years. Firms in the balanced panel may tend to hide less profit compared with other firms, perhaps because they learned how to hide profit. If the coefficient on corruption is smaller compared with that for the whole sample, that means more successful firms tend to hide less profit than less successful firms. One way to explain this is that the reputation cost of being caught for these firms is high. The regression results for a balanced sample are given in Table 1.11. The results are similar to those for the main regression.

The firms in the balanced sample do relatively well on average, generating more than RMB 5 million in revenue from 1998 to 2007. The estimated coefficient on corruption for private firms is lower compared with that for the main regression. The noncompliance rate is lower than that for the whole sample. This may be because firms that are doing well care more about their reputation,

so they won't hide as much of their profit.

1.5.2 Robustness Test: Weighted Imputed Profit

The way imputed profit was calculated may be problematic, given that different firms may have different depreciation rules and that output may sell in the next year. Therefore, I calculate the weighted imputed profit by using weighted output and depreciation for the current year and the previous year, I do this because the output may be allocated to the next year and will overstate the output for the current year, and because the firms may use different depreciation methods, which may understate or overstate the depreciation for tax avoidance purposes. To deal with this problem, I assigned 90% weight to the current year and 10% weight to the previous year. This would mitigate the problem of accelerated depreciation for tax purposes. The results are shown in Table 1.12.

1.5.3 Robustness Test: Two-Year Lagged Term for Corruption

It is also possible that a firm's profit hiding behavior is influenced not only by the level of corruption one year before but also by the level of corruption two years before. Therefore, the lagged two year corruption is added so as to reflect the lasting impact of corruption. A firm's profit hiding behavior will respond to the level of corruption in the last two years, so the regression function will be

$$\begin{aligned} PH_{ijpt} = \beta_0 + \beta_1 C_{p(t-1)} + \beta_2 C_{p(t-2)} + \beta_3 EMPLOYEE_{ijpt} + \beta_4 AGE_{ijpt} + \beta_5 AGE^2_{ijpt} \\ + \beta_6 D^{export} + \Sigma_{os} \beta_{os} D^{ownership} + \alpha_t + \alpha_j + \alpha_i + \epsilon_{ijpt} \end{aligned} \tag{1.14}$$

where β_1 and β_2 are coefficients for level of corruption $C_{p(t-1)}$ and $C_{p(t-2)}$ in year $t-1$ and year $t-2$ in a province. The results are reported in Table 1.13. The coefficient for lagged two-year corruption in a province shows a positive effective on profit hiding. Compared with the effect of lagged corruption, the effect on profit hiding is lower for lagged two-year corruption. All of the results for the main regression hold for lagged two-year corruption.

1.5.4 Robustness Test: Outliers

For the main regression, I use all of the observations with positive imputed profits. However, outliers may have bias the results either upward or downward. Consequently, I delete observations

for which the number of employees is smaller than 10. Since firms in the sample are manufacturing firms, it is unlikely they have fewer than 10 employees. I also delete the top and bottom 0.5 percentiles of all of the key variables so as to avoid potential misreporting. After trimming the data, I obtained results similar to those for the main regression. The results are reported in Table 1.14.

1.5.5 Robustness Test: With All Observations

In the main regression, I use only the observations with positive imputed profit, given that firms don't need to hide profit when they have negative profit. However, profit hiding is calculated on the basis of imputed profit, which is an estimation of true profit. Moreover, firms may hide profit if they consider they may want consistency with hiding profit in the future. Here I run the main regression using all observations, those with both positive and negative imputed profits. The regression results are shown in Table 1.15. The coefficient of corruption is lower for firms with negative profit compared with firms with positive profits; that is, firms with positive profit tend to hide more profit.

1.6 Conclusions

This study shows the impact of corruption on tax avoidance. The theoretical model shows that higher government corruption levels and higher tax rates lead to higher corporate tax avoidance. Then the theory is tested using firm level data on nearly 600,000 Chinese firms from 1998 to 2007. The empirical results using firm fixed effect estimation, an instrumental variables approach, and a difference-in-difference method provide strong evidence that a corrupt provincial government gives firms an incentive to pay less corporate tax by . In particular, I show that one standard deviation change in government corruption causes a more than 6% increase in tax avoidance. Robust and consistent results are found by conducting several robustness tests.

After separating firms by type of ownership, I find that private firms hide more profit compared with state-owned and foreign firms. Using a firm fixed effect model, I find that a higher tax rate is correlated with higher tax avoidance. This result is confirmed taking advantage of the natural experiment by comparing different periods of tax holidays given to foreign firms. Several firm characteristics are also found to have an impact on a firm's tax avoidance. As their assets increase, firms tend to avoid more profit, but the noncompliance rate is lower for larger firms. Firms

exporting from China tend to avoid more of their corporate income tax. For foreign firms, the age of a firm also plays a role, in that as the age of the firm increases, the tax avoidance increases at a decreasing rate.

These findings add to the literature on the determinants of tax avoidance and the unethical behaviors of governments and firms. Fighting corruption is the top agenda for the current Chinese administration. This paper suggests fighting corruption in local provinces may lead to higher tax collection rates. Further, a lower tax rate will also reduce the amount of tax avoidance, so it is possible that a lower tax rate along with fighting corruption may be optimal both for firms and the government. Additionally, the general trends shown by firm characteristics, emphasized in this paper, include the size of the firm, the age of the firm, and whether the firm exports from China, can be utilized by the tax authorities when deciding what kinds of firms to inspect.

More generally, my estimation framework can be applied to other research questions. The theoretical and empirical approach can be used to test firm level corruption on tax avoidance. One important factor not considered here is the impact corruption has on a firm's growth rate. If corruption impedes growth, fighting local corruption may be even more important than this study indicates. Alternatively, if corruption actually facilitates firm level growth, these results may be diminished. This is a question left for further research.

Table 1.1: Ownership

Year	All Firms	State Owned	Private	Foreign
1998	139,521	33.24	56.38	10.39
1999	148,433	30.67	58.01	11.31
2000	150,136	25.78	62.31	11.91
2001	157,165	20.45	66.55	13.00
2002	169,755	16.87	69.81	13.32
2003	188,485	12.83	73.13	14.04
2004	264,713	8.57	76.42	15.01
2005	263,914	6.65	78.07	15.29
2006	293,823	5.27	79.75	14.98
2007	331,500	3.55	81.67	14.78

This sample contains 2,068,867 observations.

Table 1.2: Two-Digit Industries

Industry	**Freq**	**Percent**	**Cum**
Coal Mining	35,214	1.91	1.91
Petroleum Extraction	926	0.05	1.96
Ferrous Mining	10,941	0.59	2.55
Nonferrous Mining	11,950	0.65	3.20
Nonmetal Mining	17,476	0.95	4.15
Other Mining	156	0.01	4.16
Timber Transportation	2,145	0.12	4.28
Agriculture and By-Product Processing	105,767	5.74	10.02
Food Production	42,802	2.32	12.34
Beverage Manufacturing	29,573	1.60	13.94
Tobacco Product	2,127	0.12	14.06
Textile	143,088	7.76	21.82
Garments Production	83,518	4.53	26.36
Leather Production	40,338	2.19	28.55
Timber Processing	34,532	1.87	30.42
Furniture Manufacturing	19,748	1.07	31.49
Paper Making	50,777	2.76	34.25
Printing	35,655	1.93	36.18
Cultural Education and Sports Product	22,531	1.22	37.40
Petroleum Processing	11,977	0.65	38.05
Raw Chemical Product	126,998	6.89	44.95
Medical Product	34,876	1.89	46.84
Chemical Fiber Product	9,032	0.49	47.33
Rubber Product	20,122	1.09	48.42
Plastic Product	78,932	4.28	52.70
Nonmetal Product	147,079	7.98	60.69
Ferrous Metal Smelting and Pressing	38,288	2.08	62.76
Nonferrous Metal Smelting and Pressing	31,814	1.73	64.49
Metal Production	96,525	5.24	69.73
Ordinary Machine Production	125,956	6.84	76.56
Special Equipment Production	71,179	3.86	80.43
Transportation Equipment Manufacturing	76,162	4.13	84.56
Electric Equipment	61,130	3.32	87.88
Telecom and Electronic Production	73,223	3.97	91.85
Office Instrument and Machine Production	35,638	1.93	93.78
Art Production	29,924	1.62	95.41
Waste Recycle and Production	19,835	1.08	96.48
Electricity Production	41,225	2.24	98.72
Coal and Gas Production and Supply	3,246	0.18	98.90
Water Production and Supply	20,317	1.10	100.00

This sample contains 2,068,867 observations.

Table 1.3: Variables and Description

Variables	**Description**
PH	Profit Hiding
CORRUPTION	The one period lagged term of conviction per thousand employee
CORRUPTIONLAG	The lagged term of CORRUPTION
TIE	The connection between province and central political bureau
TAX	The effective tax rate that firms actually faced for a given year
ASSETS	Assets of the firm
EMPLOYEE	Number of employees for the firm
EXPORT	Dummy variable for whether firms export from China
AGE	The number of years firms have been established
AGE2	Squared the number of years firms have been established
D^{state}	Dummy variable for state owned firms
$D^{private}$	Dummy variable for private firms
$D^{foreign}$	Dummy variable for Hongkong, Macao, Taiwan, and foreign firms
D2002	Dummy variable for firms established in or after 2002
D345	Dummy variable for foreign firms operated in third through fifth year after they generated positive profit
D4	Dummy variable for foreign firms operated in fourth year after they generated positive profit
CORRUPTION*D2002	The interaction term of CORRUPTION and D2002
CORRUPTION*D345	The interaction term of CORRUPTION and D345
CORRUPTION*D4	The interaction term of CORRUPTION and D4

Year dummy variables and industry dummy variables are not included

Table 1.4: Summary Statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Noncompliance Rate	0.291	0.521	-.825	4.521
Profit Hiding	5339.452	14435.5	-112345	987473
Conviction	1662.26	748.126	41	3881
Corruption	0.971	0.245	0.049	2.459
TAX	0.259	0.142	0.003	0.7499787
ASSETS	58780.78	255022.561	201	11925382
EMPLOYEE	236.369	561.711	12	20955
AGE	9.386	10.462	0	100
AGE^2	197.555	502.601	0	10000
D^{export}	0.258	0.438	0	1
D^{state}	0.134	0.341	0	1
$D^{private}$	0.727	0.445	0	1
$D^{foreign}$	0.139	0.345	0	1

The total firm-year observation is 1513565

Table 1.5: Firm Fixed Effect Estimation

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
CORRUPTION	0.0705***	0.0348***	0.0813***	0.0482***	1664.9***	1093.4	2075.7***	949.0
	(0.00684)	(0.0122)	(0.00861)	(0.0147)	(272.3)	(1123.3)	(276.2)	(1151.2)
EMPLOYEE	-0.0391***	-0.00683	-0.0616***	-0.0131***	6.295***	0.135	8.766***	5.333**
	(0.00319)	(0.00581)	(0.00600)	(0.00427)	(1.180)	(2.988)	(1.693)	(2.597)
EXPORT	0.00731**	0.00771	0.00967**	-0.00334	500.3***	3961.1*	484.3***	-250.4
	(0.00356)	(0.0171)	(0.00442)	(0.00686)	(191.7)	(2404.6)	(185.1)	(526.1)
AGE	-0.0558	-0.0685	0.00769	0.430*	-13.35	95.48	-32.56	302.5
	(0.0473)	(0.0971)	(0.0604)	(0.252)	(45.61)	(228.5)	(30.46)	(205.0)
AGE^2	0.0644	0.0331	0.0334	-0.924**	-0.415	-4.672	0.805	-4.323
	(0.0850)	(0.151)	(0.117)	(0.429)	(1.196)	(5.055)	(0.700)	(4.548)
ASSETS					0.0480***	0.0410***	0.0506***	0.0559***
					(0.00376)	(0.00812)	(0.00564)	(0.0111)
_cons	0.434***	0.387***	0.469***	0.198***	2427.4	13785.3**	1678.0	9444.6
	(0.0710)	(0.117)	(0.0840)	(0.0459)	(2048.1)	(5445.6)	(2245.2)	(5768.6)
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
N	1429598	110618	1122355	196625	1429598	110618	1122355	196625
R^2	0.639	0.750	0.645	0.622	0.643	0.754	0.673	0.624

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.6: Effect of Corruption on Profit Hiding—the IV Regression Second Stage

	(1)	(2)
	Noncompliance Rate	Profit Hiding
CORRUPTION	0.105**	22669.6***
	(0.0463)	(2556.0)
EMPLOYEE	-0.0459***	6.242***
	(0.00286)	(1.116)
EXPORT	0.00233	129.5
	(0.00347)	(182.4)
AGE	0.000904	28.76
	(0.0471)	(45.26)
AGE2	-0.0137	-1.187
	(0.0858)	(1.203)
ASSETS		0.0483***
		(0.00339)
Year Fixed Effect	YES	YES
Industry Fixed Effect	YES	YES
Firm Fixed Effect	YES	YES
N	893550	893550
R^2	0.007	0.032

Robust standard errors are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.7: Effect of Corruption on Profit Hiding—the IV Regression First Stage

	(1) CORRUPTION	(2) CORRUPTION
TIE	-0.555***	-0.555***
	(0.00640)	(0.00640)
EMPLOYEE	0.00115	0.00107
	(0.000938)	(0.000981)
EXPORT	0.00141**	0.00141**
	(0.000665)	(0.000664)
AGE	-0.0347***	-0.0346***
	(0.0111)	(0.0111)
AGE2	0.0660***	0.0659***
	(0.0224)	(0.0224)
ASSETS		4.38e-10
		(1.89e-09)
Year Fixed Effect	YES	YES
Industry Fixed Effect	YES	YES
Firm Fixed Effect	YES	YES
N	893550	893550
R^2	0.409	0.409

Robust standard errors are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.8: Natural Experiment 2002

	(1) Noncompliance Rate	(2) Profit Hiding
CORRUPTION	0.100***	3117.3***
	(0.0118)	(417.8)
CORRUPTION*D2002	-0.0673***	-3316.4***
	(0.0192)	(588.4)
D2002	0.0864***	3725.6***
	(0.0216)	(673.7)
EMPLOYEE	-0.0825***	10.81***
	(0.00811)	(2.073)
EXPORT	0.0168***	522.5***
	(0.00529)	(201.9)
AGE	0.244***	-21.77
	(0.0851)	(42.44)
AGE2	-0.355**	0.861
	(0.164)	(0.886)
ASSETS		0.0516***
		(0.00635)
_cons	0.359***	2293.2***
	(0.0134)	(664.0)
Year Fixed Effect	YES	YES
Industry Fixed Effect	YES	YES
Firm Fixed Effect	YES	YES
N	918178	918178
R^2	0.663	0.707

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.9: Firm Fixed Effect Estimation with Effective Tax Rate

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
CORRUPTION	0.0638***	0.0368**	0.0710***	0.0410*	2138.5***	1176.9	2817.4***	-71.61
	(0.00981)	(0.0148)	(0.0118)	(0.0219)	(478.3)	(3068.0)	(469.4)	(2211.7)
TAX	0.0692***	0.0470**	0.0725***	0.0811***	2287.9***	7547.9*	1782.4***	6605.3***
	(0.00941)	(0.0202)	(0.0109)	(0.0289)	(460.8)	(4385.1)	(395.1)	(2394.4)
EMPLOYEE	-0.0287***	-0.00332	-0.0455***	-0.00687	6.551***	3.321	9.094***	5.084
	(0.00359)	(0.00530)	(0.00607)	(0.00623)	(1.771)	(6.202)	(2.442)	(3.864)
EXPORT	0.00189	-0.000502	0.0000364	0.0107	455.4	8922.1	176.5	-234.8
	(0.00451)	(0.0133)	(0.00526)	(0.0105)	(311.6)	(5696.3)	(276.4)	(1136.5)
AGE	0.0210	-0.0342	0.0248	0.490	-39.58	200.1	-67.32	350.8
	(0.0592)	(0.116)	(0.0725)	(0.324)	(73.99)	(450.0)	(50.73)	(394.6)
AGE2	-0.0636	-0.0580	-0.0148	-0.861*	-0.183	-9.560	1.581	-1.883
	(0.107)	(0.185)	(0.142)	(0.506)	(1.943)	(9.446)	(1.224)	(6.824)
ASSETS					0.0431***	0.0403***	0.0465***	0.0344**
					(0.00478)	(0.0111)	(0.00668)	(0.0175)
_cons	0.323***	0.298*	0.343***	-0.433	433.3	19331.9*	-1202.7	270.2
	(0.0585)	(0.157)	(0.0679)	(0.676)	(3516.5)	(11745.0)	(3895.1)	(9486.4)
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
N	794357	42336	666078	85943	794357	42336	666078	85943
R^2	0.716	0.864	0.718	0.711	0.677	0.766	0.700	0.661

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.10: Natural Experiment—Different Tax Rates for Foreign Firms by Firm Age

	Noncompliance Rate		Profit Hiding	
	(1)	(2)	(3)	(4)
	D345	D4	D345	D2
CORRUPTION	0.0177	0.0280	-993.8	-2094.1
	(0.0301)	(0.0911)	(1814.6)	(5296.4)
CORRUPTION*D345	0.172***		4674.8**	
	(0.0281)		(1882.3)	
CORRUPTION*D4		0.145**		6270.8**
		(0.0730)		(3109.2)
D345	-0.160***		-3639.1**	
	(0.0269)		(1851.3)	
D4		-0.0640		-4223.5
		(0.0847)		(7665.5)
EMPLOYEE	-0.0226**	-0.00853	4.730	11.83
	(0.00880)	(0.0220)	(4.771)	(15.00)
EXPORT	0.00386	0.00100	-258.9	1613.2
	(0.0130)	(0.0377)	(722.1)	(2631.5)
AGE	2.09**	-1.32	588.7	-147.4
	(0.997)	(2.82)	(673.2)	(1813.7)
AGE2	-25.4***	12.7	-72.56	-25.74
	(6.62)	(20.6)	(45.38)	(151.7)
ASSETS			0.0468***	0.0367
			(0.0138)	(0.0289)
_cons	0.0743	0.205	5592.7	6040.0
	(0.289)	(0.176)	(4099.4)	(11263.6)
Year Fixed Effect	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES
N	76634	27823	76634	27823
R^2	0.675	0.869	0.702	0.844

The dependent variable for column 1 through column 2 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 3 through column 4 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.11: Robustness Test—OLS Regression of Profit Hiding Using Balanced Sample

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
CORRUPTION	0.0270**	0.0208	0.0303*	0.0389*	2724.9***	407.3	4153.7***	2269.0
	(0.0120)	(0.0138)	(0.0179)	(0.0232)	(801.5)	(1916.6)	(951.3)	(2242.1)
EMPLOYEE	-0.0234***	0.00431	-0.0379***	-0.0137**	5.618***	2.250	7.112***	4.382
	(0.00398)	(0.00439)	(0.00805)	(0.00616)	(1.782)	(4.920)	(2.716)	(3.636)
EXPORT	0.00781	0.00443	0.00840	0.00510	505.1	-316.6	559.0	-862.6
	(0.00729)	(0.0177)	(0.0104)	(0.00984)	(596.9)	(2853.6)	(624.9)	(1439.4)
AGE	-0.139*	0.0472	-0.0406	-0.0699	-0.981	-67.55	-13.26	64.86
	(0.0795)	(0.117)	(0.111)	(0.371)	(83.41)	(283.2)	(77.72)	(424.6)
AGE2	0.297**	-0.113	0.217	0.248	-0.601	-2.652	0.687	1.306
	(0.136)	(0.195)	(0.203)	(0.513)	(1.791)	(5.420)	(1.552)	(7.284)
ASSETS					0.0378***	0.0332***	0.0379***	0.0505***
					(0.00561)	(0.0116)	(0.00840)	(0.0178)
_cons	0.381***	0.126	0.453***	0.240***	-3994.3	4130.6	-6097.9	18056.2**
	(0.0910)	(0.0945)	(0.113)	(0.0607)	(7588.7)	(14837.3)	(9313.7)	(8236.4)
N	160878	21662	102298	36918	160878	21662	102298	36918
R^2	0.513	0.539	0.526	0.489	0.548	0.658	0.589	0.547
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.12: Robustness Test—OLS Regression of Weighted Profit Hiding Using Balanced Sample

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
CORRUPTION	0.0252**	0.0183	0.0285*	0.0375*	2476.5***	48.71	3809.7***	2377.6
	(0.0114)	(0.0134)	(0.0170)	(0.0227)	(796.7)	(1912.7)	(932.9)	(2241.6)
EMPLOYEE	-0.0255***	0.00114	-0.0408***	-0.0151**	3.253*	-0.441	4.340	3.575
	(0.00386)	(0.00406)	(0.00783)	(0.00590)	(1.720)	(5.139)	(2.704)	(3.044)
EXPORT	0.00572	0.00659	0.00514	0.00445	313.4	-885.3	546.8	-1236.5
	(0.00699)	(0.0161)	(0.00993)	(0.00963)	(586.8)	(2845.5)	(615.5)	(1384.8)
AGE	-0.107	0.0408	-0.0175	-0.0388	22.44	-54.60	-11.10	253.3
	(0.0754)	(0.110)	(0.106)	(0.356)	(90.85)	(310.3)	(83.46)	(412.7)
AGE2	0.234*	-0.0975	0.156	0.190	-1.007	-3.455	0.704	-0.384
	(0.128)	(0.183)	(0.193)	(0.481)	(2.055)	(6.157)	(1.818)	(7.258)
ASSETS					0.0238***	0.0228*	0.0232***	0.0333**
					(0.00543)	(0.0117)	(0.00892)	(0.0138)
_cons	0.365***	0.120	0.445***	0.235***	-3132.2	7643.5	-4796.5	16229.6**
	(0.0937)	(0.0920)	(0.116)	(0.0587)	(7908.0)	(15437.3)	(9670.9)	(7236.0)
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
N	160878	21662	102298	36918	160878	21662	102298	36918
R^2	0.512	0.545	0.526	0.486	0.508	0.628	0.556	0.507

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.13: Robustness Test—OLS Regression of Profit Hiding Without Outliers, 1998-2007

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
CORRUPTION	0.0413***	0.0254***	0.0462***	0.0343***	1364.0***	496.1	1393.9***	1724.5***
	(0.00442)	(0.00925)	(0.00546)	(0.0108)	(126.8)	(455.3)	(138.3)	(479.7)
EMPLOYEE	-0.0726***	-0.0109	-0.0959***	-0.0278***	3.861***	-0.0641	5.041***	3.573***
	(0.00397)	(0.00791)	(0.00587)	(0.00727)	(0.359)	(1.120)	(0.468)	(0.767)
EXPORT	0.00739***	-0.00128	0.0101***	-0.00256	263.8***	-280.3	230.9***	287.6
	(0.00249)	(0.0103)	(0.00307)	(0.00490)	(80.27)	(586.9)	(87.53)	(214.0)
AGE	-0.0103	0.0651	0.0486	0.292*	0.395	53.38	4.269	134.1*
	(0.0341)	(0.0775)	(0.0430)	(0.169)	(13.35)	(63.18)	(12.47)	(78.56)
AGE2	0.00611	-0.143	-0.0542	-0.850**	-0.220	-1.531	-0.0901	-3.707**
	(0.0648)	(0.127)	(0.0879)	(0.373)	(0.317)	(1.298)	(0.285)	(1.733)
ASSETS					0.0346***	0.0273***	0.0375***	0.0336***
					(0.00161)	(0.00435)	(0.00212)	(0.00370)
_cons	0.354***	0.332***	0.382***	0.200***	3847.9**	5839.6	3793.1**	7722.6**
	(0.0449)	(0.126)	(0.0521)	(0.0328)	(1521.8)	(3798.4)	(1763.2)	(3589.1)
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
N	1387450	103612	1094155	189683	1387450	103612	1094155	189683
R^2	0.654	0.741	0.661	0.643	0.633	0.709	0.666	0.607

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.14: Robustness Test—OLS Regression of Profit Hiding with Two Lagged Terms for Corruption, 1998-2007

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
CORRUPTION	0.0657***	0.0565***	0.0784***	0.0221	2103.1***	2353.7	2750.6***	-1392.0
	(0.00801)	(0.0166)	(0.00985)	(0.0186)	(355.9)	(1711.3)	(351.3)	(1513.5)
CORRUPTIONLAG	0.0705***	-0.00882	0.0784***	0.0751***	1631.6***	939.3	1340.6***	5466.1***
	(0.00683)	(0.0142)	(0.00848)	(0.0158)	(262.5)	(1517.8)	(247.1)	(1237.1)
EMPLOYEE	-0.0430***	-0.0104	-0.0680***	-0.0127***	7.001***	-0.721	10.09***	4.998*
	(0.00357)	(0.00716)	(0.00668)	(0.00450)	(1.319)	(3.679)	(1.847)	(2.885)
EXPORT	0.00860**	0.00744	0.0123***	-0.00392	531.1***	3509.0	547.0***	-170.4
	(0.00378)	(0.0196)	(0.00464)	(0.00746)	(196.8)	(2641.8)	(189.3)	(572.5)
AGE	-0.0114	-0.0825	0.0526	0.450	-16.68	90.53	-43.03	351.0
	(0.0511)	(0.113)	(0.0640)	(0.277)	(48.00)	(248.5)	(33.30)	(218.6)
AGE2	-0.00960	0.0335	-0.0474	-0.923**	-0.280	-4.916	1.110	-4.416
	(0.0926)	(0.172)	(0.125)	(0.452)	(1.249)	(5.379)	(0.777)	(4.727)
ASSETS					0.0480***	0.0380***	0.0515***	0.0564***
					(0.00407)	(0.00920)	(0.00585)	(0.0120)
_cons	0.379***	0.435***	0.409***	0.158***	893.8	16005.4***	351.3	4834.8
	(0.0773)	(0.136)	(0.0897)	(0.0560)	(2088.4)	(5869.9)	(2212.2)	(5508.8)
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
N	1337348	90643	1061218	185487	1337348	90643	1061218	185487
R^2	0.645	0.766	0.652	0.631	0.653	0.764	0.680	0.635

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.15: Firm Fixed Effect Estimation with All Observations

	Noncompliance Rate				Profit Hiding			
	(1) All Firms	(2) State Owned	(3) Private	(4) Foreign	(5) All Firms	(6) State Owned	(7) Private	(8) Foreign
corruptgovtt	0.0403***	0.0104	0.0528***	0.0258**	828.2***	604.8	1258.3***	114.9
	(0.00483)	(0.00637)	(0.00663)	(0.0103)	(200.9)	(570.3)	(217.2)	(794.5)
EMPLOYEE	-0.0257***	-0.00201	-0.0480***	-0.0146***	3.238***	-1.421	5.690***	2.911
	(0.00207)	(0.00200)	(0.00432)	(0.00372)	(0.797)	(1.482)	(1.222)	(1.931)
EXPORT	0.00943***	0.00538	0.0114***	0.00368	682.0***	2429.4**	614.5***	240.2
	(0.00261)	(0.00726)	(0.00340)	(0.00489)	(149.5)	(1232.4)	(147.8)	(374.6)
AGE	0.0212	-0.0608	0.0821**	0.530***	13.25	11.17	-12.88	175.1
	(0.0301)	(0.0443)	(0.0414)	(0.191)	(27.41)	(93.46)	(21.52)	(164.5)
AGE2	-0.0920*	0.0536	-0.155**	-1.12***	-0.928	-1.684	0.261	-2.725
	(0.0507)	(0.0667)	(0.0755)	(0.349)	(0.665)	(2.011)	(0.468)	(3.419)
ASSETS					0.0322***	0.0231***	0.0354***	0.0482***
					(0.00289)	(0.00577)	(0.00434)	(0.00877)
_cons	0.312***	0.167***	0.341***	0.674***	1703.7	12149.2	404.6	2944.3
	(0.0467)	(0.0364)	(0.0606)	(0.0266)	(2479.8)	(12378.6)	(2371.4)	(1976.0)
Year Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
N	1927872	223146	1430776	273950	1927872	223146	1430776	273950
R^2	0.611	0.696	0.622	0.557	0.572	0.666	0.619	0.551

The dependent variable for column 1 through column 4 is noncompliance rate, which is defined as profit hiding normalized by assets. The dependent variable for column 5 through column 8 is profit hiding, which is the measure for tax avoidance. Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 1.1: Reported and Imputed Profit

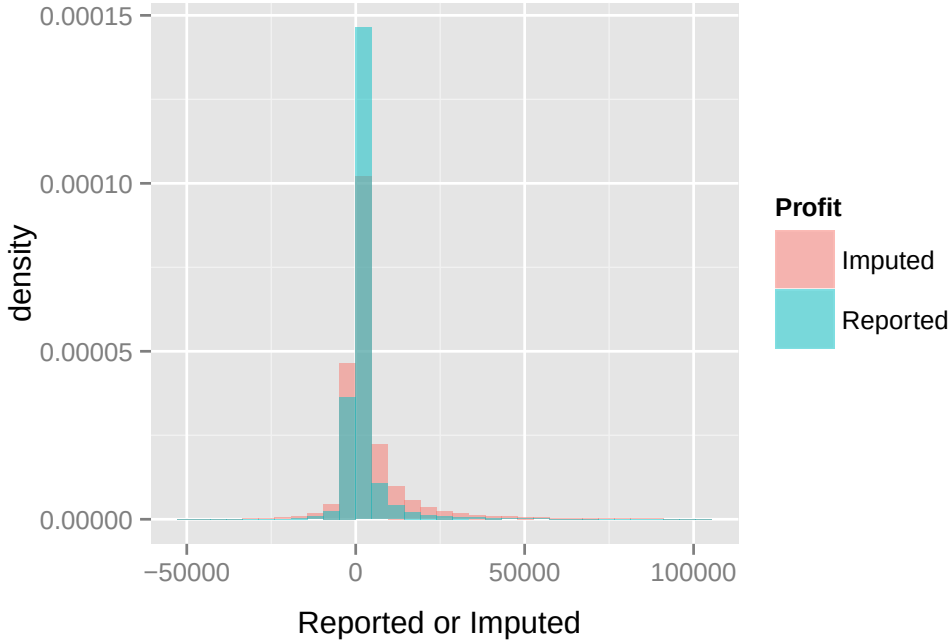
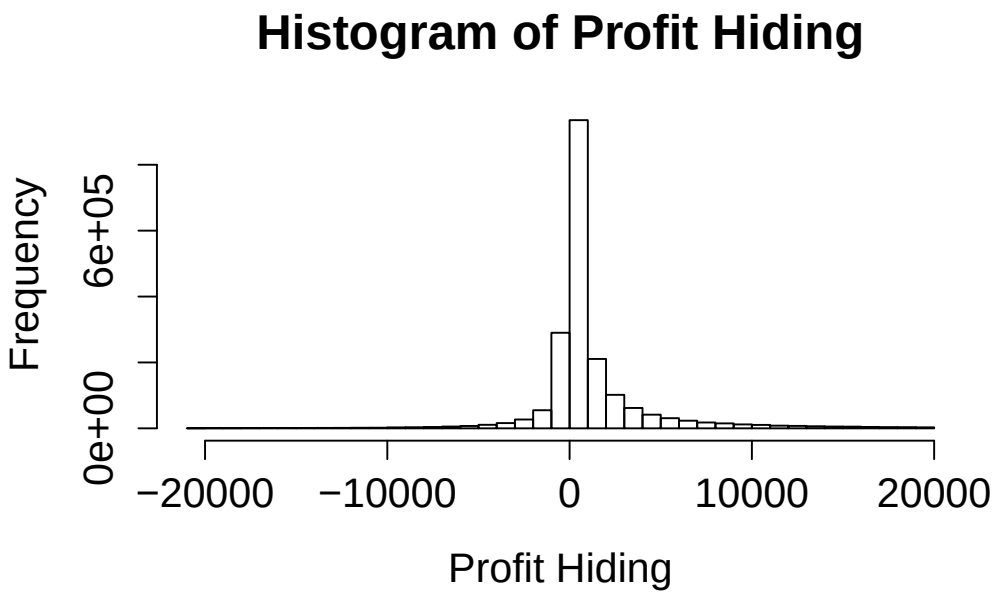
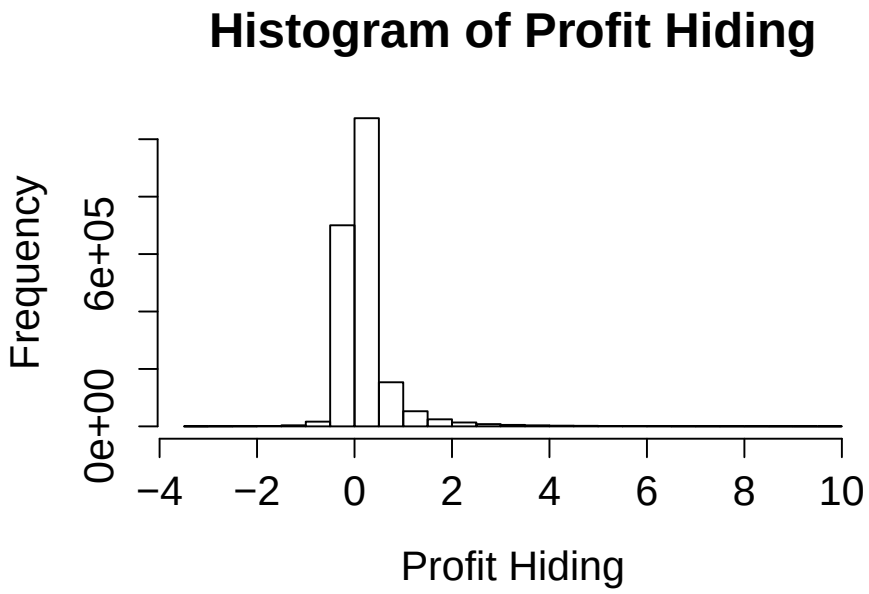


Figure 1.2: Profit Hiding



Hiding Level.pdf

Figure 1.3: Profit Hiding/Assets



Hiding.pdf

Figure 1.4: Number of Convictions for Each Province

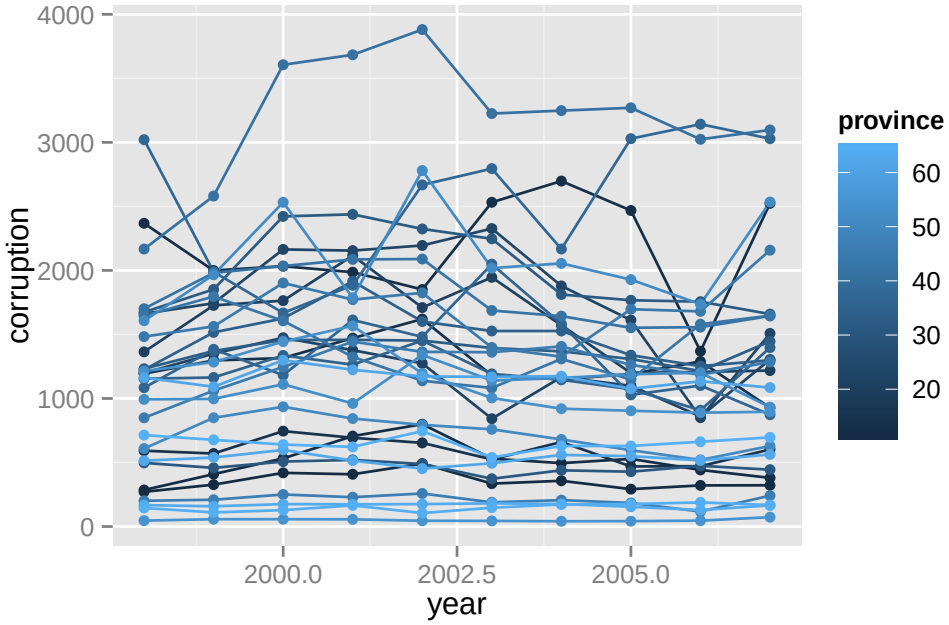


Figure 1.5: Corruption for Each Province

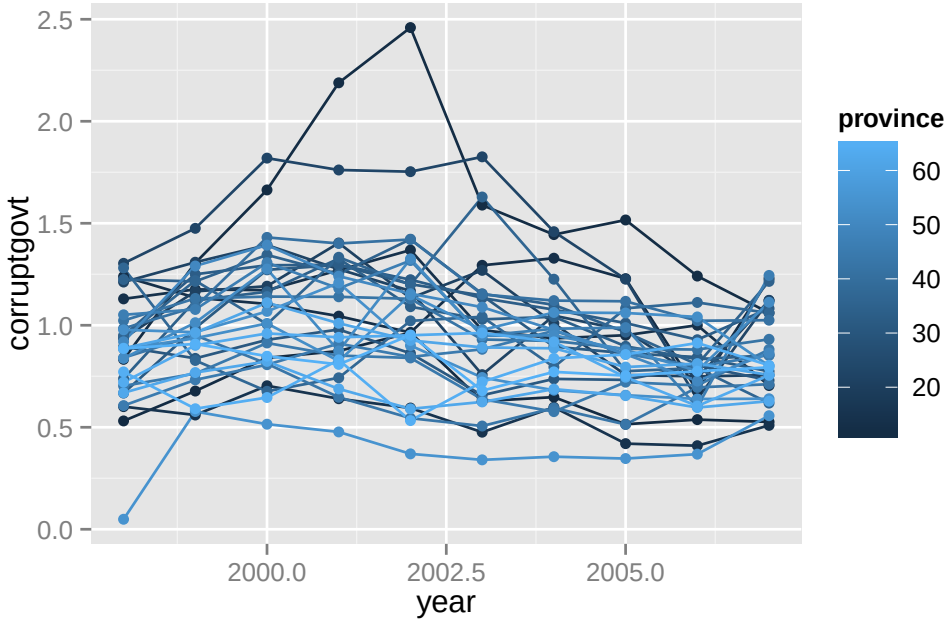


Figure 1.6: Mean Corruption for Each Province

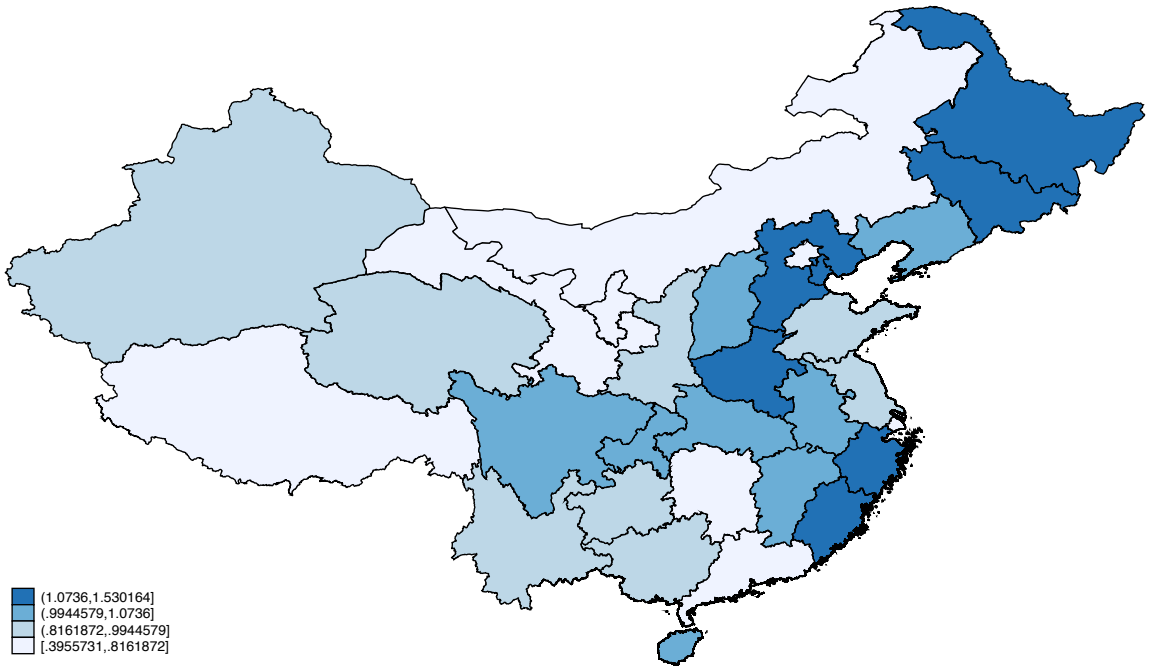


Figure 1.7: Flowchart

Chapter 2

Corporate Tax Avoidance and Competition: Evidence from Mexican Firms

2.1 Introduction

Tax avoidance has long been an interesting topic for academia, accounting firms, and government regulators. There has been a large body of literature on the factors that influence tax avoidance and the consequences of tax avoidance. Several papers have included Mexico in cross country comparisons (Torgler, 2005; Christensen and Kapoor, 2004), but there is little research on tax avoidance using Mexican firm level data. During the research period from 1984 to 1990, Mexico went through trade liberalization and financial liberalization(Gelos and Werner, 2002; Mityakov, 2011), and the concentration of the economy changed significantly during these years. Therefore, it is worthwhile to study the impact of market competition on tax avoidance.

Previous research on competition and tax avoidance using Chinese data shows that firms tend to avoid more tax in more competitive industry (Cai and Liu, 2009). They argue that firms tend to avoid more tax as to have more investment money when facing greater competition. Is competition bad for the economy? Do these results fit other developing countries as well? A firm's

behavior needs to adjust to the economic environment in the country. It can be the case that firms in more concentrated industries will hide more profit given that big firms tend to have better connections with the government. Therefore, the degree of market competition in an economy might influence a firm's incentive to avoid tax. In this paper, we use data on Mexican manufacturing firms to investigate the impact of market competition on tax avoidance.

The corporate tax rate in Mexico decreased over the sample period. The tax rate was 42% for the years 1984-1986, then decreased to 40.6%, 39.2%, 37%, and 36% for 1987, 1988, 1989, and 1990, respectively. Besides the high tax rates, firms also need to share 10% of the profit with their employees, because the high tax rate and profit sharing, firms take home less, they are more willing to take risk, therefore the incentive to hide profit will be fairly strong.

The dataset used in this paper was collected by the Secretary of Trade and Industrial Promotion. It contains annual panel data of Mexican manufacturing plants from 1984 to 1990. This sample covers every Mexican manufacturing firm, excluding new or exiting establishments. After cleaning up the data, we have a panel of 2325 firms over 7 years[1]. The data contain information about the firm characteristics that can be found on balance sheets, cash flow statements, and income statements.

In this paper, tax avoidance is measured by profit hiding, which is the difference between imputed profits and reported profits[2]. Reported profit is generated according to the Mexican 10% profit sharing rule. Imputed profit is calculated based on national income accounts, that is using gross value of output minus intermediate inputs and other costs[3].

We show that firms in more concentrated industries tend to hide more profits. This is different than the results using Chinese data (Cai and Liu, 2009). The effect of market competition is economically and statistically significant for all of the competition measures, that's including total

[1]In the regression, only firms with positive profit will be used due to the fact that reported profit is zero for firm with zero or negative profits. The detailed information can be found in the data section.

[2]As to consider the size of the firm, the profit hiding measure is normalized by assets. Profit hiding, profit hiding normalized by total cost, and profit hiding normalized by number of employee will be used as robustness tests.

[3]There are two ways to calculate imputed profit, I will follow Cai and Liu (2009) as to compare the results. I will use another way used by Gelos and Werner (2002) and Mityakov (2011) as robustness tests. The correlation of the two methods to calculate imputed profit is 0.95

number of firm in the industry, the market share of top three firm, the market share of top four firms, herfindahl index[4], split sample Herfindahl index, and the industry average profit margin. The results also significant when using different methods to calculate imputed profit as robustness tests.

Beside the main results, we also separate the firm into different groups by the size of the firm and the ownership structure of the firm. We show that larger firms tend to avoid more taxes. We find that firms with more than 50% Mexican capital tend to hide more profit compared to firms with foreign capital. Solely Mexican owned firms avoid the most compared with the other three groups. We also show that access to credit and total sales will also impact tax avoidance.

In the mean regression we use the number of firms in each industry and Herfindahl index in each industry to measure concentration. However, using the Herfindahl index might bias the results given that the share of the firm in consideration is used to calculate the Herfindahl index. As to deal with this, we use split sample method along with basic OLS. We separate the firms into two groups randomly and generate Herfindahl index for each group. We will use the Herfindahl index calculated from the other sample as to overcome the endogeneity problem. We obtain similiar results, that tax avoidance increases in more concentrated industries.

This paper contributes to the literature in the following ways. This paper is the first study to investigate how market competition affects a firm's tax avoidance using Mexican manufacturing plants information. It may shed light on how market structure influences tax avoidance in Latin America. We find different results compared to research using Chinese data (Cai and Liu, 2009). Therefore, there should be caution when applying policy suggestions based on the conclusion derived using data from another country. Second, we also investigate more closely by separating the firms into different groups according to plant size and ownership structure. Firms will adjust their strategy according to their size and ownership structures.

The rest of the paper is organized as follows. Section 2 describes the data and how we construct the measure of market competition, tax avoidance and other variables. Section 3 presents

[4]The Herfindahl index calculated in the main regression is using the share of sales, whereas the one calculated using gross value of output is used as a robust test.

the empirical model and empirical results. Section 4 provides robustness tests. Section 5 concludes the paper.

2.2 Data and Variable Definition

2.2.1 Data Description

We use annual panel data of Mexican manufacturing plants from 1984 to 1990 collected by the Secretary of Trade and Industrial Promotion. This data set includes all manufacturing plants operating in Mexico, and as to maintain a balanced panel, new established plants and plants which exit in the sample period are excluded from the sample. After cleaning the data, there are 13,891 plant year observations. Summary statistics of key variables are listed in Table 2.1.

These data provide information at the plant level. However, we cannot identify whether different plants belong to the the same owner. So, we regard each plant as a separate firm in the empirical exercises. The sample includes detailed information on revenue and cost. Some of the variables used in this paper are capital cost, labor costs by types of labor, costs of intermediate inputs, valued of production, sales, ownership structure, inventories, valued added taxes paid, and other firm level variables.

Several cleaning procedures have been applied to the data. Plants with zero or negative profit sharing were dropped due to the fact that if firm has negative reported profit the value of the profit sharing will be zero, but this is not their true profit. Firms with fewer than three workers and plants with zero levels of capital were dropped. Because we will use information on ownership structure, we dropped plants without ownership information. This leaves us with a balanced panel belonging to 126 classes of industrial activity. Still, this amounts to 80% of total value added in the Mexican manufacturing sector. The data employ the Mexican Industrial Classification, which was used before Mexico joined NAFTA in 1994 and adopted NAICS classification. This classification is roughly comparable with the 4-digit ISIC rev. 2.0 industrial classification. We will generate competitions measure based on the 4 digit industry. On average there are 20 plants per industry, although there could be as many as 79 plants and as few as three plants per industry.

2.2.2 Competition Variables

In this paper, we construct several measures for competition. In the main regression, we use Herfindahl index as a measure of market competition. The Herfindahl index is the sum of squares of markets share measured by sales by all firms in each industry[5]. The Herfindahl index is negatively correlated with competition. Similar to Herfindahl index, we also construct the share of top three firms and share of the top four firms. The share of the top three firms and the share of the top four firms will be bigger if the industry is more concentrated, and thus, are highly correlated with the Herfindahl index.

We also construct industry average profit margin, which is defined as the average ratio of profit to total cost in a four digit industry. Average profit margin will fall if competition increases. The number of firms in each industry is also used as an indicator for competition. The market is more competitive as the number of firms increases. The number of firms in each industry is negatively related to other competition measures used in this paper. Competition indices are constructed for each of the 126 four digit manufacturing industries in Mexico. Table 2.2 shows the competition indexes and average profit margin among other measures for 9 one digit industries.

2.2.3 Other Variables

Several other variables are also included in this paper. Natural log of the number of employees is included as a scale of the firm. Sales normalized by assets is also included. Credit measured as the interest payment on debt is included to show the ability to access loans, which can be a measure of financial conditions of the firm.

The ownership dummies are created based on the origin country of the capital. The sources of capital are from Mexico, United States, Canada, Japan, Spain, Germany, and the rest of the world. Dummies will be generated based on each of the there origin countries. The dummies will take the value of one if majority of the social capital is from the above mentioned countries.

[5]Herfindahl index constructed using output will be used as robustness test.

Geographical location may also influence the firm behavior given that states in the north may face completion from United States. The connection with government officials will also be different for firms from different states. Therefore, we include state dummies to reflect location effects. Year dummies are included to control for time varying effects.

2.2.4 Profit Measures

The reported profit is generated using the rule from the mandatory profit sharing in Mexico that employers are required to distribute and pay 10% of their "adjusted" taxable income to employees. Thus, reported profit is 10 times the amount of profit sharing. The reported profit is zero if firm has negative or zero profit[6].

To estimate tax avoidance, the firm's real profit is needed. However, knowing a firm's true profit is a challenge. There are two main ways to calculate imputed profit. In this paper we will follow Cai and Liu (2009) as to compare the results with their Chinese data. Another way used by Gelos and Werner (2002) and Mityakov (2011) will be used as robustness test. Cai and Liu (2009) calculate tax avoidance by using the difference between imputed profit and reported profit. Explicitly, imputed profit is generated by using the equation

$$Imputed\,Profit_{it} = Output_{it} - Inputs_{it} - Depreciation_{it} - Financial\,Cost_{it} - Wage_{it} - VAT_{it} \quad (2.1)$$

where $Output_{it}$ is the value of total output of firm i in year t, $Inputs_{it}$ is total intermediate inputs, $Depreciation_{it}$ is current year depreciation, $FinancialCost_{it}$ is the interest payments on debt, $Wage_{it}$ is total remunerations, and VAT_{it} is the total value added tax paid by firm i in year t.

Profit hiding PH_{it} is the difference between imputed profit and reported profit, defined as

$$Profit\,Hiding_{it} = Imputed\,Profit - Reported\,Profit \quad (2.2)$$

Profit hiding can be viewed as a measure of tax avoidance. The more profit a firm hides, the less

[6]It is impossible to get the amount of profit a firm tries to hide if their reported profit is zero, so the observations with zero or negative profit will be excluded from the analysis.

taxes the firm ultimately pays.

2.3 Empirical Results

2.3.1 Empirical Model

The empirical model used in this paper is

$$Profit\,Hiding_{ijt} = \beta_0 + \beta_1 Competition_{jt} + \Gamma X_{ijt} + \alpha_t + \alpha_o + \alpha_s + \epsilon_{ijt} \tag{2.3}$$

$Profit\,Hiding_{it}$, is profit hiding for firm i in industry j in year t. We normalize profit hiding by assets in the main regression, while other profit hiding measures will be shown as robustness checks. $Competition_{jt}$ is the competition measure for industry j in year t. Competition measures in this paper are Herfindahl index, $Herfindahl$, in each four digit industry and the number of firms in each four digit industry, $\#offirms$[7]. X_{ijt} is a vector of firm characteristics for firm i in industry j in year t. It includes the sales of firms, natural log of number of the firms, the access to credits. α_t is year fixed effect as to reflect the time varying effects., α_o is ownership status, these dummies are based on the origin of the capital. α_s is state fixed effects, which will capture geographical effects.

2.3.2 Baseline Regressions

The results are shown in Table 2.3. The estimated coefficients of all alternative competition measures are significant. Robust standard errors clustered by industry are shown in parentheses. In Column (1), we show the results when using Herfindahl index as a measure for competition. We show that a firm will avoid less tax in a more competitive market. These results are different than the results from Cai and Liu (2009) using Chinese data. These results can be explained in the following way. First, more concentrated industry means the share of several big firms dominates the industry, and in Mexico the top firms tend to have connections with government officials. Therefore, they will likely to bribe the officials as to pay less taxes. Second, in more competitive industries,

[7]Average profit margin in each industry, $Eprofit$, the share of top three firms in the industry, and the share of top four firms in each industry will be used as robustness tests.

firms will likely be similar in size. This would be easier for the tax authorities to compare the tax forms across firms and the avoidance is more likely to be detected.

In Table 2.3 Column (3) and Column (4), we use the share of top three firms and share of top four firms as measures of competition. The results are the same as using the Herfindahl index shown in Column (1). Firms tend to avoid more taxes when several large firms control the majority of the market share. This is consistent with the fact that the correlation between Herfindahl index and share of top three or four firms is 0.9. In Column (5), the coefficient for the average profit margin in the industry is positive, because competition is negatively correlated with average profit margin. Therefore, in more competitive industries firms tend to avoid less profits. The estimated coefficient on the number of firms in each industry is negative, which means firms tend to avoid more taxes when there are less firms in the industriy.

2.3.3 Split Sample Regression

Using Herfindahl index as a measure may face endogeneity problems. The Herfindahl index includes the firm in consideration, thus possibly biasing the results. As to deal with this potential endogeneity problem, we use the split sample method. We separate the sample randomly into two groups. Using the Herfindahl index calculated by the group not including the firm currently in consideration as a measure of competition. The regression results are reported in Table 2.2 Column (2). The estimated coefficient is significant and have same sign as baseline regression, meaning the baseline results hold when we use split sample method.

2.3.4 Ownership and Tax Avoidance

Domestic and foreign firms may act differently when considering tax avoidance. Domestic firms may have more connections with government officials. Multinational firms are also likely to get audited by their home country. Therefore, it is necessary to investigate the impact of ownership structure on tax avoidance. We separate the firms into four groups based on the percentage of capital owned by Mexican capital. The four groups are Solely Mexican controlled firms(100%

Mexican), firms with more than half of Mexican capital(>50% Mexican capital), firms with less than half of Mexican capital(<50% Mexican capital), and sole foreign capital controlled firms(0% Mexican capital).

The regression results when using Herfindahl index as competition measure are shown in Table 2.4. From Table 2.4 we can see that domestically controlled firms, solely Mexican controlled firms, shown in Column (1) and more than half of the capital from Mexican shown in Column (2), avoid more taxes. Market competition has no significant effects on tax avoidance for foreign controlled firms, less than half capital from Mexico or solely foreign controlled firms. Due to the the fact that foreign firms also face the investigation of their own country, and therefore, due to the enforcement from two sides, their incentive to hide profits is weaker.

We also show the results using split sample Herfindahl and the number of firms in each four digits industry as measures of competition. The results are the same as using the Herfindahl index. The results using split sample Herfindahl index are shown in Table 2.5, and the results using the number of firms in each four digits industries are show in Table 2.6. Competition in the market only impacts the tax avoidance of domestic firms, while no pattern shows up for foreign controlled firms.

2.3.5 Firm Size and Tax Avoidance

Large firms tend to have more connections with the government, so they may bribe tax authority and avoid more tax, while it is also possible that larger firms will be a greater target for the tax authority. Therefore, how does the size of the firm influence tax avoidance is one practical question. We measure plant size based on the number of employees. Plants are classified as Large, Medium, Small, and Very small, if total employment is greater than 500 people, between 100 and 500 people, between 40 and 100 people, and less than 40 people, respectively.

The results in Table 2.7 show that larger firms tend to avoid more taxes. Large firms hide more than twice as much profits as medium size firms. Very small firms also avoid tax given the fact that it is hard for tax authority to investigate these firms. As to get detailed information on what the impact of ownership structure and plant size has on tax avoidance, we separate the sample

by both plant size and ownership structure into eight groups: very small solely Mexican controlled firms, very small firm with foreign capital, small solely Mexican controlled firms, small firms with foreign capital, medium solely Mexican controlled firms, medium size firm with foreign capital, large solely Mexican controlled firms, and large firm with foreign capital. The regression results are shown in Table 2.8. We show that both large and very small solely Mexican controlled firms avoid taxes, while medium sized firm with foreign capital avoid taxes. There is no effects on other specifications.

2.4 Robustness Tests

We conduct the following robustness tests for the main results.

2.4.1 Robustness Test: Alternative Way to Compute True Profit

The way to calculate true profit varies. In this section we use the method used by Gelos and Werner (2002) and Mityakov (2011) as a robustness test. The imputed profit is calculated as the gross value of output plus industrial and nonindustrial service income less total cost and value added tax.

$$Imputed\,Profit_{it} = Output_{it} + Industrial\,Service_{it} + Nonindustrial\,Service_{it} - TC_{it} - VAT_{it} \tag{2.4}$$

This way to calculate imputed profit differs from the first method because of the following components: $Output_{it}$ is the value of output plus the value of capital produced for own use. The value of capital produced for own use includes machinery and equipment produced for own use, construction and install assets for own use, transportation equipment for own use, and other assets produced for own use.

Total cost, TC_{it}, is computed as the sum of labor costs, costs of intermediate inputs, value of energy consumed, cost of industrial service, total non-industrial costs and capital costs. Total material costs includes raw materials consumed, packaging materials, fuels, and spare parts. Total cost of industrial services includes repair and maintenance, subcontractors, and other services. Total non-industrial costs includes sales commissions, royalties, advertising costs, and etc. Capital cost is

computed as the sum of rental/leasing costs plus 10% of capital valued at replacement cost.

The regression results are show in Table 2.9, the results for all of the competition measures are consistent with the results in Table 2.3, that means the completion has impact on tax avoidance for the imputed profits calculated using both ways.

2.4.2 Robustness Test: Alternative Measures of Profit Hiding

Profit hiding used in the main regression is normalized by assets of the company. One might argue that other ways to normalize profit hiding may change the results. As to check the robustness of the results, we show the results using profit hiding, profit hiding normalized by the number of employees, and profit hiding normalized by total cost as measures of tax avoidance.

Table 2.10 shows the regression results. The estimated coefficients of all three specifications have the same signs as the baseline regression, lending further evidence that firms tend to avoid more taxes in less competitive markets. All other competition measures are also consistent with the baseline regression. The results also hold when using different ways to calculate imputed profits[8].

2.4.3 Robustness Test: Reported and Imputed Profits

There may be concerns about using the gap between imputed profit and reported profit as profit hiding is not appropriate. As to deal with this, we use the the following regression

$$\begin{aligned} Reported\,Profit_{ijt} = (&\beta_0 + \beta_1 Competition_{jt} + \beta_2 lnlabor + \beta_3 credits + \beta_4 sales \\ &+ \beta_5 D^{year} + \beta_6 D^{ownership} + \beta_7 D^{state}) * Imputed\,Profit_{ijt} \\ &+ \alpha_1 Competition_{jt} + \alpha_2 lnlabor + \alpha_3 credits + \alpha_4 sales \\ &+ \alpha_5 D^{year} + \alpha_6 D^{ownership} + \alpha_7 D^{state} + \epsilon_{ijt} \end{aligned} \tag{2.5}$$

We use interaction terms of imputed profit and competition measures as well as other control variable with imputed profits as explanatory variables. In this setting as long as the imputed profit is positively correlated with true profit, we can get the sensitivity on the impact of competition

[8]The results are available upon request.

measures on reported profit given certain true profit.

In equation (5), the competition measure will be the same as the main regression. Control variables including natural log of the number of employees, financials costs, and sales of the firms. Year dummies, ownership structure dummies, and location dummies are included as well. In this equation we care most about the sign of β_1, which is the interaction term of imputed profits and competition. For example, if we use the Herfindahl index as competition measure, if β_1 is positive that means at a given imputed profit, firms in more competitive industries will report more profit. That is, firm will avoid less taxes.

The regression results are show in Table 2.11. The results when using the Herfindahl index are shown in Column (1), the estimated coefficient for the interaction term of competition and imputed profit is negative, that is, in more concentrated industries, firms tend to report less profits. These results match the results we obtained by using the the gap between imputed profit and are reported in the main regression. Same results are obtained by using split sample Herfindahl index, the market share of top three firm, and the market share of top four firms. The sign for the number of firms in the industry is also consistent with the main regression, that when the number of firms in the industry increase, given imputed profit, firms tend to report more profits.

2.5 Conclusions

In this paper, we show that firms in relatively more competitive industries avoid less taxes. We also find that larger firms tend to avoid more taxes. As for ownership structure, Mexican controlled firms hide more profit, while there is no significant results for foreign controlled firms. Specifically, when we consider both plant size and ownership structure, we show that domestically controlled very small firms and domestically controlled large firms tend to hide more profits.

Contrary to the results using Chinese data by Cai and Liu (2009), we show that competition is good for the market from the perspective of tax collecting. Competitive market will help tax authority to monitor the firms. It is easier for tax authority to regulate similar firms in the industry

by just comparing their financial sheets. While for more concentrated markets, the top firms may collude with each other or more easily bribe government officials to pay less tax.

Our empirical results, along with Cai and Liu (2009), should show that one policy implemented in one country cannot directly used in other countries. The results in this paper illustrate that tax authorities or other government officials need to improve tax enforcement by auditing larger firms. Because our results suggests that larger firms hide more profits. We know that competitive market arguably good for economy, our results suggests additional merit that ensuring stronger competition might lead to higher tax collection rates.

Table 2.1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Gross Output	24653.362	81396.229	20	2311345
Reported Profit Margin	2324.329	9391.5	10	279320
Imputed Profit	3704.995	22078.836	-304273	615874
Total Employment	317.755	490.639	4	10065
Ln Employment	5.127	1.125	1.386	9.217
Value of Output	24638.365	81350.697	20	2311345
Herfindahl Index	0.15	0.131	0.022	0.998
Herfindahl Group1	0.244	0.192	0	1
Herfindahl Group2	0.25	0.195	0	1
Average Profit	0.085	0.167	-5.92	1.615
Share of Top 3 Firms	0.501	0.205	0.129	1
Share of Top 4 Firms	0.575	0.211	0.164	1
# of Firms	28.554	19.129	2	79
N		13,891		

All value data is in millions of pesos

Table 2.2: Herfindahl Index and Average Profit in One-Digit Industry

Sector	Herfindahl	# of firms	Prof Margin	Top 3	Top 4	No. Obs.
1. Food products, beverages and tobacco	0.129	36.184	0.084	0.427	0.493	2740
2. Textiles, clothing and leather	0.18	21.651	0.035	0.55	0.617	2107
3. Manufacture of wood and wood products	0.076	27.119	0.043	0.348	0.425	469
4. Paper, paper products, and printing	0.089	39.637	0.059	0.405	0.479	1086
5. Products and derivatives of oil and coal	0.138	32.009	0.135	0.467	0.539	3206
6. Nonmetal mineral products	0.132	45.591	0.048	0.487	0.565	948
7. Basic metallurgical industries	0.271	13.237	-0.037	0.732	0.807	354
8. Products of metal machinery	0.187	16.752	0.045	0.599	0.687	2714
9. Other manufacturing	0.136	22.281	0.18	0.531	0.605	267

Table 2.3: Competition and Tax Avoidance

	(1) Herfindahl	(2) HHI Split	(3) Top 4 Share	(4) Top 3 Share	(5) Average Profit	(6) # of firm
herfindahl	13.67***					
	(4.476)					
herfindahlc		6.923**				
		(3.343)				
sumtopfour			8.375**			
			(3.375)			
sumtopthree				9.550***		
				(3.232)		
Eprofit					19.22***	
					(6.391)	
numclase						-0.0972*
						(0.0501)
sales	0.0698	0.0698	0.0697	0.0697	0.0697	0.0698
	(0.0945)	(0.0945)	(0.0945)	(0.0945)	(0.0945)	(0.0944)
lnlabor	-0.989	-1.051*	-1.031*	-1.021*	-0.999*	-1.172**
	(0.602)	(0.611)	(0.596)	(0.600)	(0.601)	(0.594)
credit	1.201*	1.201*	1.201*	1.201*	1.201*	1.201*
	(0.680)	(0.680)	(0.680)	(0.680)	(0.680)	(0.680)
_cons	7.411*	7.831*	5.125	5.125	7.485*	13.24***
	(4.448)	(4.438)	(4.756)	(4.563)	(4.484)	(4.906)
N	8377	8377	8377	8377	8377	8377
R^2	0.676	0.676	0.676	0.676	0.676	0.676

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column 1 is Herfindahl index, Column 2 is split smile Herfindahl index, Column 3 is total share of top four firms, Column 4 is total share of top three firms, Column 5 is average profit margin, Column 6 is the number of firms in the industry.

Table 2.4: Ownership and Tax Avoidance

	(1) 100% Mexican	(2) >50% Mexican	(3) >0% Mexican	(4) Foreign	(5) with Foreign
herfindahl	21.18**	7.475*	-1.284	-6.743	9.182
	(8.475)	(4.320)	(11.69)	(42.40)	(12.53)
sales	0.0909***	0.00358	-0.0606***	0.00803	-0.00670
	(0.00284)	(0.00610)	(0.00661)	(0.0128)	(0.00685)
lnlabor	-0.235	1.764***	0.199	-10.21**	-2.137
	(0.959)	(0.620)	(1.549)	(4.822)	(1.626)
credit	1.036***	-0.206	-0.733***	3.904**	-1.512***
	(0.0280)	(0.155)	(0.198)	(1.941)	(0.266)
_cons	2.548	-10.28	3.587	135.3	11.20
	(13.81)	(10.37)	(13.00)	(89.55)	(36.92)
N	6298	1027	344	708	2079
R^2	0.741	0.047	0.852	0.023	0.043

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5: Ownership and Tax Avoidance(Split Sample Method)

	(1) 100% Mexican	(2) >50% Mexican	(3) >0% Mexican	(4) Foreign	(5) with Foreign
herfindahlc	11.31**	7.893***	-3.021	8.951	9.582
	(5.407)	(2.878)	(5.525)	(19.26)	(7.175)
sales	0.0909***	0.00297	-0.0605***	0.00804	-0.00672
	(0.00284)	(0.00610)	(0.00660)	(0.0128)	(0.00685)
lnlabor	-0.303	1.611***	0.148	-10.27**	-2.178
	(0.960)	(0.623)	(1.499)	(4.813)	(1.620)
credit	1.036***	-0.184	-0.733***	3.791*	-1.512***
	(0.0280)	(0.155)	(0.198)	(1.940)	(0.266)
_cons	2.781	-10.08	4.666	46.93	10.60
	(13.81)	(10.34)	(13.15)	(82.53)	(36.91)
N	6298	1027	344	708	2079
R^2	0.741	0.052	0.852	0.023	0.044

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.6: Ownership and Tax Avoidance(# of Firms in the Industry)

	(1) 100% Mexican	(2) >50% Mexican	(3) >0% Mexican	(4) Foreign	(5) with Foreign
numclase	-0.169***	-0.0893**	0.0887	0.234	-0.00232
	(0.0556)	(0.0379)	(0.0656)	(0.250)	(0.0901)
sales	0.0910***	0.00331	-0.0602***	0.00848	-0.00668
	(0.00284)	(0.00610)	(0.00659)	(0.0128)	(0.00685)
lnlabor	-0.557	1.473**	0.386	-9.982**	-2.009
	(0.966)	(0.637)	(1.505)	(4.819)	(1.646)
credit	1.035***	-0.194	-0.742***	4.108**	-1.507***
	(0.0280)	(0.155)	(0.197)	(1.946)	(0.266)
_cons	12.57	-5.805	1.009	53.74	11.58
	(14.04)	(10.50)	(13.11)	(81.99)	(37.11)
N	6298	1027	344	708	2079
R^2	0.741	0.050	0.853	0.024	0.043

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.7: Firm Size and Tax Avoidance

	(1) Very Small	(2) Small	(3) Medium	(4) Large
herfindahl	6.425*	6.684	9.298**	23.88**
	(3.319)	(5.347)	(4.366)	(11.17)
sales	-0.0363	0.0330	-0.0824	0.213***
	(0.0401)	(0.0481)	(0.0714)	(0.0489)
lnlabor	0.226	0.204	1.217	2.374
	(1.069)	(1.920)	(1.116)	(3.271)
credit	-0.855*	-1.076***	-0.531	0.000605
	(0.491)	(0.292)	(0.927)	(0.364)
_cons	-1.498	-0.892	-6.921	-13.21
	(3.615)	(8.456)	(7.180)	(22.40)
N	872	2032	4064	1409
R^2	0.247	0.131	0.243	0.879

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column 2 is for firms with 3-40 works, Column 3 is for firms with 40-100 works , Column 4 is for firms with 100-500 works, and Column 5 is for firms with more than 500 workers.

Table 2.8: Firm Size, Ownership, and Tax Avoidance

	(1) Very Small Mexican	(2) Very Small With Foreign	(3) Small Mexican	(4) Small With Foreign	(5) Medium Mexican	(6) Medium With Foreign	(7) Large Mexican	(8) Large With Foreign
herfindahl	7.212**	7.328	3.933	26.32	2.442	7.668*	45.38***	1.637
	(3.475)	(25.94)	(4.265)	(20.22)	(9.118)	(4.471)	(12.48)	(45.56)
sales	-0.0494***	-1.475***	0.00844	0.183***	-0.111***	0.0276***	0.256***	-0.269***
	(0.00557)	(0.201)	(0.00544)	(0.0217)	(0.00299)	(0.00189)	(0.00192)	(0.0345)
lnlabor	-0.118	2.093	-2.827	22.35**	2.257	-2.104*	9.204***	-7.097
	(1.095)	(10.44)	(1.966)	(9.135)	(2.365)	(1.252)	(2.881)	(12.02)
credit	-0.998***	42.19***	-0.928***	-5.723*	-0.596***	-0.811***	-0.344***	4.956***
	(0.117)	(5.648)	(0.0632)	(2.913)	(0.137)	(0.114)	(0.0178)	(1.005)
_cons	-0.884	-23.69	13.06	-94.51*	-11.08	10.32	-63.57***	46.25
	(7.155)	(41.20)	(11.61)	(52.44)	(17.52)	(11.18)	(24.46)	(117.8)
N	809	63	1743	289	2905	1159	841	568
R^2	0.367	0.674	0.169	0.282	0.350	0.178	0.991	0.163

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column 2 is for firms with 3-40 works, Column 3 is for firms with 40-100 works , Column 4 is for firms with 100-500 works, and Column 5 is for firms with more than 500 workers.

Table 2.9: Robustness Test: Alternative Way to Calculate Imputed Profit

	(1) Herfindahl	(2) HHI Split	(3) Top 4 Share	(4) Top 3 Share	(5) Average Profit	(6) # of firm
herfindahl	19.38***					
	(6.080)					
herfindahlc		9.907***				
		(3.079)				
sumtopfour			12.88***			
			(4.377)			
sumtopthree				13.89***		
				(4.504)		
Eprofit					20.86***	
					(7.041)	
numclase						-0.139**
						(0.0596)
salesoutput	-2.796	-2.696	-2.830	-2.844	-3.082*	-2.723
	(2.108)	(2.167)	(2.101)	(2.088)	(1.842)	(2.179)
lnlabor	-0.578	-0.599	-0.650	-0.627	-0.568	-0.841
	(1.055)	(1.076)	(1.047)	(1.046)	(1.056)	(1.111)
credit	2.417***	2.417***	2.417***	2.417***	2.417***	2.417***
	(0.578)	(0.579)	(0.578)	(0.578)	(0.578)	(0.579)
_cons	6.986	7.024	3.376	3.671	7.711	15.25*
	(7.327)	(7.114)	(7.789)	(7.806)	(7.201)	(8.610)
N	8377	8377	8377	8377	8377	8377
R^2	0.671	0.671	0.671	0.671	0.671	0.671

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column 1 is Herfindahl index, Column 2 is split smile Herfindahl index, Column 3 is total share of top four firms, Column 4 is total share of top three firms, Column 5 is average profit margin, Column 6 is the number of firms in the industry.

Table 2.10: Robustness Test: Alternative Ways of Profit Hiding

	(1)	(2)	(3)
	Profit Hiding/Population	Profit Hiding/Costs	Profit Hiding
herfindahl	17.62***	0.123***	4590.9**
	(3.472)	(0.0286)	(1843.1)
sales	0.00275*	0.00000856	2.047*
	(0.00152)	(0.00000752)	(1.152)
lnlabor	-0.121	0.0152***	-73.98
	(0.297)	(0.00323)	(338.9)
credit	-0.0101	-0.0000265	9.165
	(0.0134)	(0.0000670)	(8.391)
_cons	-1.270	-0.0375	-243.7
	(3.788)	(0.0739)	(2131.8)
N	8377	8377	8377
R^2	0.068	0.037	0.092

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column 1 is profit hiding normalized by number of employee, Column 2 is profit hiding normalized by total cost, Column 3 is profit hiding.

Table 2.11: Robustness Test: Alternative Way to Calculate Imputed Profit

	(1) Herfindahl	(2) HHI Split	(3) Top 4 Share	(4) Top 3 Share	(5) Average Profit	(6) # of firm
herfindahl*imputed	-3.862***					
	(0.151)					
herfindahl	7.298***					
	(2.673)					
herfindahlc*imputed		-1.014***				
		(0.0661)				
herfindahlc		2.155				
		(1.704)				
sumtopfour*imputed			-2.321***			
			(0.0781)			
sumtopfour			4.664***			
			(1.608)			
sumtopthree*imputed				-2.150***		
				(0.0801)		
sumtopthree				4.310***		
				(1.664)		
Eprofit2*imputed					1.480***	
					(0.0633)	
Eprofit2					-18.69***	
					(2.605)	
numclase*imputed						0.0247***
						(0.00704)
numclase						-0.0338**
						(0.0151)
credit*imputed	0.000156***	0.000236***	0.000160***	0.000157***	0.000249***	0.000199
	(8.70e-06)	(8.24e-06)	(8.39e-06)	(8.60e-06)	(8.10e-06)	(0.000122)
lnlabor*imputed	-0.168***	-0.256***	-0.152***	-0.192***	-0.0759***	-0.0644
	(0.0130)	(0.0131)	(0.0129)	(0.0128)	(0.0146)	(0.0661)
sales*imputed	2.95e-05***	2.47e-05***	3.02e-05***	3.36e-05***	8.22e-06***	1.22e-05
	(1.86e-06)	(1.89e-06)	(1.83e-06)	(1.87e-06)	(1.99e-06)	(1.62e-05)
profit2a	1.021*	1.113**	1.773***	1.758***	-0.0267	-0.669
	(0.549)	(0.563)	(0.543)	(0.548)	(0.553)	(0.415)
credit	-0.896***	-1.141***	-0.796***	-0.837***	-1.152***	-0.752***
	(0.0630)	(0.0633)	(0.0626)	(0.0631)	(0.0620)	(0.287)
lnlabor	0.525*	0.678**	0.512*	0.575*	0.138	0.355*
	(0.307)	(0.315)	(0.303)	(0.306)	(0.310)	(0.214)
sales	0.153***	0.167***	0.137***	0.144***	0.155***	0.129***
	(0.00254)	(0.00251)	(0.00267)	(0.00263)	(0.00255)	(0.0196)
Constant	-3.402	-3.826	-4.785	-4.709	0.0232	-0.561
	(4.813)	(4.930)	(4.790)	(4.824)	(4.839)	(1.198)
Observations	8,377	8,377	8,377	8,377	8,377	8,377
R-squared	0.841	0.833	0.845	0.842	0.839	0.849

Robust standard errors adjusting for industry clusters are reported in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column 1 is Herfindahl index, Column 2 is split smile Herfindahl index, Column 3 is total share of top four firms, Column 4 is total share of top three firms, Column 5 is average profit margin, Column 6 is the number of firms in the industry.

Figure 2.1: Reported Profit

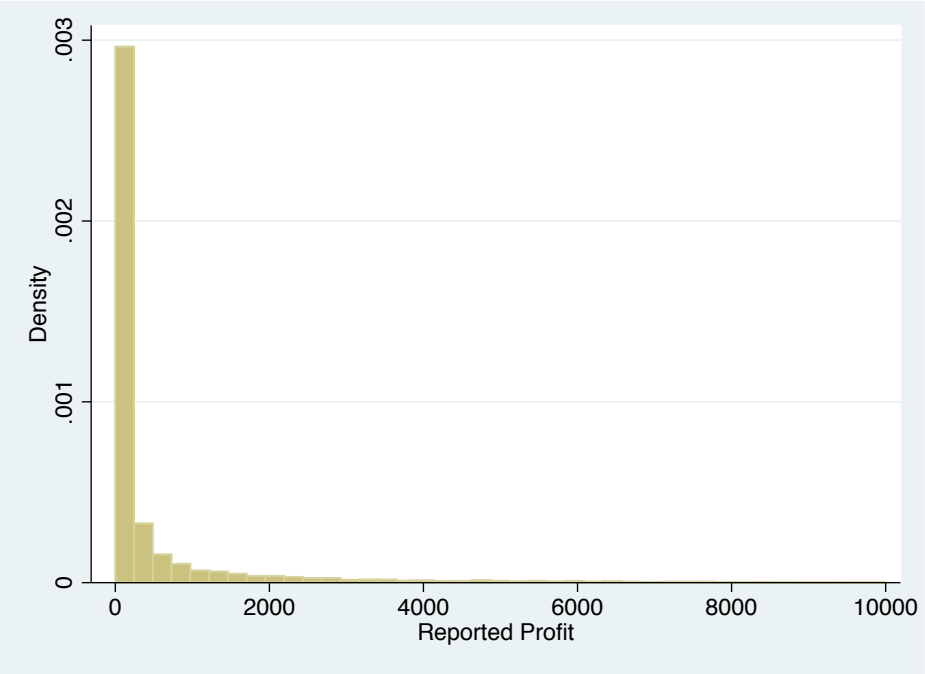
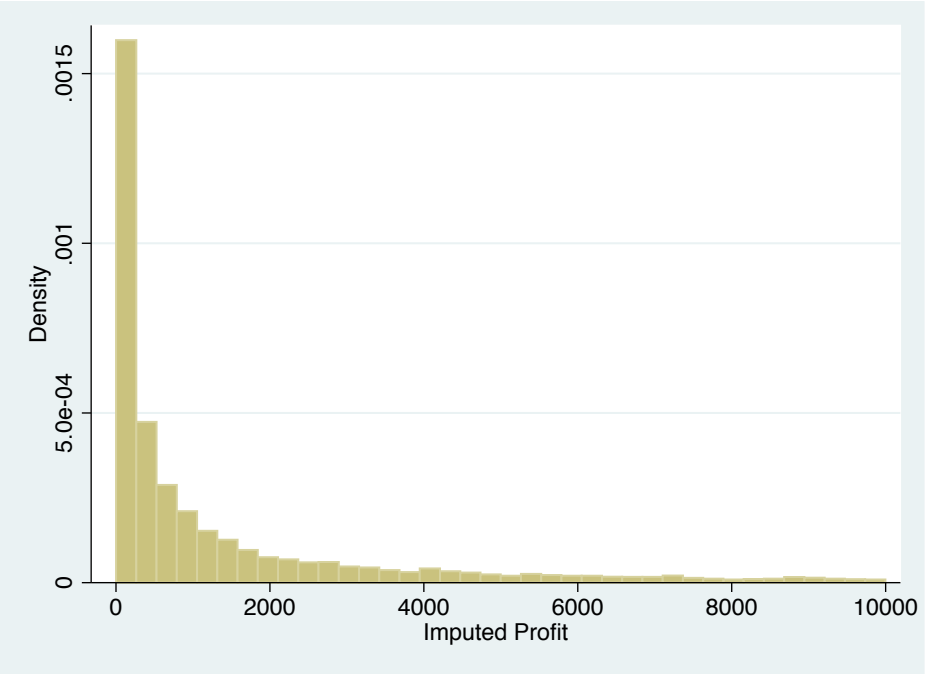


Figure 2.2: Imputed Profit



Chapter 3

Fiscal Decentralization and Corruption: Evidence from China

3.1 Introduction

According to the World Bank, corruption is defined as the abuse of public office for private gain. Corruption is a widespread phenomenon seen in both developing and developed countries. In China corruption exists in nearly every level of government. According to Transparency International's Corruption Perceptions Index, China has been ranked between 72nd and 78th out of 178 countries in recent years. Corruption can have a variety of forms. Graft and rent seeking are the the most common forms in China (Lu, 2000)[1].

Fiscal decentralization, in which the central government relinquishes fiscal controls to provincial level governments, helps to increase economic efficiency. Local governments are better positioned for provincial regulation and providing of public services than the national government because an information advantage (Oates, 1972). In this paper, therefore, I use the number of competing governments as an indicator of fiscal decentralization. The greater the number of jurisdictions, the better the government is positioned for providing public goods and also giving residents more available choices.

[1]Graft involves something of value given to, and accepted by, public officials for dishonest or illegal purposes. Rent-seeking refers to all forms of corrupt behavior by people with monopolistic power (Lu, 2000).

Being able to answer the question what are the causes of corruption is important. Fiscal decentralization as an main feature of economic structure will impact the level of corruption. In this paper I present a theoretical model that shows how fiscal decentralization can prevent corruption in China. I then empirically examine the effects of fiscal decentralization on corruption in local government in China. Unlike previous cross-country research, this paper only focuses on China, thereby reducing concerns about unobservable heterogeneity. I use three proxies for corruption and two fiscal decentralization measurements. The corruption measures are number of convictions in each province, the number of audit reports for each province, and transparency score. I find that fiscal decentralization in government expenditure and government revenue are consistently associated with lower levels of corruption.

Section 2 provides some basic background information on fiscal decentralization in China and the literature on corruption and fiscal decentralization. Section 3 presents a theoretical model that links fiscal decentralization and corruption. Section 4 describes the data and how I construct my measure of corruption and fiscal decentralization and empirical analysis. Section 5 concludes.

3.2 Background and Literature Review

3.2.1 China's Current Fiscal System

From 1994 to the present, a tax sharing system has been used in China. There are five levels of government in China. The central government, and four levels of local governments. The four subnational governments are provincial level governments, prefectural level governments, country level governments, and town level governments. China is fiscally decentralized on both the revenue side and the expenditure side.

The tax sharing system institutes that some taxes belong to central government, some taxes belong to subnational governments, and some taxes are shared by central and subnational governments. Central taxes include tariffs and the consumption tax. Local taxes include resource taxes, urban maintenance and development taxes, urban land-use taxes, agriculture and related

taxes[2], taxes on contracts, taxes on the use of arable land, vehicle purchase taxes and other local taxes. Shared taxes include value-added tax(Central: %75, Local: %25), business tax (Central: %5, Local: %95), stamp tax on security exchange (Central: %97, Local: %3), personal income tax (Central: %60, Local: %40) and corporate income tax (Central: %60, Local: %40). From Table 3.1 we can see that about 50 percent of the entire public revenue was generated at the sub-national level.

The tax sharing system mainly focus on revenue sharing, but didn't change the responsibility of different levels of governments. The assignments of responsibilities as follow: the central government is responsible for national defense, spending on education, health, technology, foreign affairs, and other national service. The subnational governments are responsible for basically the same as central government according but focus more on local levels. Subnational governments delivers local public goods and services, the development of the local economy. We can see from Table 3.2 that the share of public expenditure at the sub-national level increased from 50% to 80% of total government spending from 1980 to 2009.

The difference between subnational governments expenditure and revenue are from intergovernmental transfer program. It is main resources for local governments, especially those less developed provinces. There are two types of intergovernmental grants, one is categorical grant, which should be used for specific projects. Another type is unrestricted grants, which can be used for general purpose.

3.2.2 Literature Review

A number of scholars have estimated the relationship between corruption and decentralization empirically using cross country data produced by Transparency International and the World Bank. Some scholars have used firm-level survey data about firm's concrete experiences with bribery. The findings of these studies have been mixed.

Some scholars argue that fiscal decentralization has helped reduce corruption. Fisman and Gatti (2002a) find that fiscal decentralization in government expenditure is strongly and signifi-

[2]Chinese government abolished agriculture related taxes starting from 2006 for all regions.

cantly associated with lower corruption level by looking at the cross country relationship between fiscal decentralization and corruption, as measured by a number of different indices. Similar results have been found by other researchers (Huther and Shah, 1998; De Mello and Barenstein, 2001)

Some studies, however, have offered evidence suggesting that fiscal decentralization may also lead to poor accountability and governance (Fukasaku and De Mello, 1999). A weak central government allows various governmental agencies and bureaucracies to impose independent bribes on private agents seeking complementary permits from these agencies. When the entry of these agencies into regulation is free, that will increase the cumulative bribe burden or corruption level (Shleifer and Vishny, 1993). Another argument is that lower level governments, although having some degree of autonomy, compete with each other in rent seeking from higher level governments which have the rights of assignments. Governments may compete with each other to attract capital by promising corrupt benefits to local business at the expense of the central government (Cai and Treisman, 2004). The fear of losing mobile capital may worsen the corrupt situation (Cai and Treisman, 2005).

The above mentioned papers use cross country data sets, but when countries have different institutions, maybe they are political decentralized or maybe they have a centralized political system. It is questionable to use cross country data sets to test the effects of fiscal decentralization on corruption. Goel and Nelson (2011) examine the influence of government decentralization on corruption in the United States and they show that government decentralization does not necessarily reduce corruption. Instead they show that the corruption level depends on the type of decentralization. By looking at government transfers, Fisman and Gatti (2002b) find that the rate of prosecutions for the abuse of public office is greater in states with higher transfers. Unlike the former research focus on cross country studies which neglect country specific background or only use the data from a developed country, in this paper I use a data set of Chinese provinces to test the relationship between fiscal decentralization and corruption in a developing country.

3.3 The Theoretical Model

In this section, I present a simple model to help understand the relationship between fiscal decentralization and corruption.

3.3.1 Players and Preference

Players in this model include Chinese provincial level governments, residents and firms.

The Chinese provincial level governments, according to the government officer evaluations system, would like their jurisdiction to have more GDP, which could help them be promoted to a national level government or higher position. They also care about corruption earnings which they could get from rent seeking. Officials care about the number of residents and the number of firms, since more residents can lead to more individual income tax revenue and more firms mean more corporate income tax revenue. According to China's taxation law, provincial level governments receive 40% of both individual income tax revenue and corporate income tax revenue. The provincial government would like to provide more public goods for two reasons. The first is that providing public goods can attract more residents who move into the area. The second is that by deciding who implements public goods projects, they could get bribe money from the procurement of public goods due to incomplete inspections.

According to tax law, the tax rate for residents is the same throughout the whole country. Residents choose the province that can provide them with relatively better public goods and services, i.e. more bang for their buck.

Like residents, firms face the same tax rate throughout the whole country. However, firms can bargain with local governments and try to get more tax deductions or pay lower fees for using land. Note that big firms would get more chances since they could not only provide more tax revenue, but they also bring more work opportunities which attracts more people. For example, when Volkswagen planned to open another plant in China, they first thought about the Jilin province, where they could have gotten more deductions for new investment according to the new tax policy.

However, Shanghai offered a lower Value Added Tax rate via subsidy in order to get Volkswagen to build the plant there.

3.3.2 Timing and Action

First, provincial governments set a spending schedule and decide how to spend their tax revenue. Governments set policies and regulation to try to get more money from residents and private firms. This cannot be too high, or firms would switch to other provinces. They also decide how much the firms need to pay for using land, since the land in China is owned by the government. Because they have monopoly power over land, they can decide how much they will charge to maximize their own utility.

Next, residents decide which province to work and live in according to their utility, which is a function of public goods. Private firms decide where to invest by comparing the price of land and the real tax rate. Firms may pay much less in one province than in another by bribing related government officers. Both firms and residents can bribe government officials to try and bend the rules. This is a bargaining process, decided by the elasticity of the supply, that is the substitutability of governments.

3.3.3 Model Setup

To formalize preferences, timing and action, I follow Arikan (2004) use the following theoretical model to show the relationship between fiscal decentralization and corruption:

There are N local governments that try to compete with each other, and each local area has p residents. The function for producing private goods is $F(k_i)$, where k_i is the investment of a representative firm in region i. The production function is increasing and concave; i.e., $F' > 0$, $F'' < 0$. Each unit of capital is rented on a capital market throughout the whole country at the net return to capital denoted by ρ. Since province i levies a unit tax on capital at rate t_i, after tax

profit of the firm located in province i is

$$\pi_i = F(k_i) - (\rho + t_i)k_i \tag{3.1}$$

The first order condition of profit maximization is

$$F'(k_i) - t_i = \rho \tag{3.2}$$

Residents care about their consumption of private goods and public goods, denoted as $H(x_i, g_i)$, where x and g are private goods and public goods respectively. Marginal utility of one good is increasing in the consumption of the other good. The private good consumption is financed by a resident's capital gains and labor income. Suppose residents have k_0 as their endowment, their gain from capital is the rate of return times endowment, that is $(F'(k_i) - t_i)k_0$. As a worker, residents receive wage income $F(k_i) - k_i F'(k_i)$, thus the private consumption can be expressed as

$$x_i = (F'(k_i) - t_i)k_0 + F(k_i) - k_i F'(k_i) = F(k_i) - (k_i - k_0)F'(k_i) - t_i k_0 \tag{3.3}$$

Government cares about both the utility of residents and what they can get from rent seeking, I use c_i to denote corruption. Thus the objective function of government can be expressed as

$$\alpha H(x_i, g_i) + (1 - \alpha)c_i \tag{3.4}$$

where α is a number between 0 and 1. The tax revenue gathered by government is used for providing public goods as well as corrupt earning, so we have the tax revenue constraint that

$$t_i k_i = g_i + c_i \tag{3.5}$$

Therefore, the government objective function can be expressed as

$$G(t_i, c_i|N) = \alpha H(x_i, g_i) + (1 - \alpha)c_i = \alpha H(F(k_i) - (k_i - k_0)F'(k_i) - t_i k_0, t_i k_i - c_i) + (1 - \alpha)c_i \tag{3.6}$$

The reason why I put N here is because, as mentioned in section 1, N is the number of competing governments, thus an indicator of fiscal decentralization. If I can show that as N increases, corrup-

tion c decreases, then I could conclude that fiscal decentralization reduces the corruption level. Real tax rate and corruption are both functions of N, because these two variables change along with the number of governments. This is another reason why N is in the government objective function.

The first order conditions of government are listed below:

$$\frac{\partial G}{\partial N} = \alpha \frac{\partial H}{\partial x} \frac{\partial x}{\partial t} \frac{\partial t}{\partial N} + \alpha \frac{\partial H}{\partial g} \frac{\partial g}{\partial t} \frac{\partial t}{\partial N} + \alpha \frac{\partial H}{\partial g} \frac{\partial g}{\partial c} \frac{\partial c}{\partial N} + (1-\alpha) \frac{\partial c}{\partial N} \tag{3.7}$$

That is

$$\frac{\partial G}{\partial N} = -\alpha H_x k_0 \frac{\partial t}{\partial N} + \alpha H_g k_i \frac{\partial t}{\partial N} - \alpha H_g \frac{\partial c}{\partial N} + (1-\alpha) \frac{\partial c}{\partial N} \tag{3.8}$$

To maximize the objective function of government, let first order condition equal zero,

$$\frac{\partial G}{\partial N} = -\alpha H_x k_0 \frac{\partial t}{\partial N} + \alpha H_g k_i \frac{\partial t}{\partial N} - \alpha H_g \frac{\partial c}{\partial N} + (1-\alpha) \frac{\partial c}{\partial N} = 0 \tag{3.9}$$

That is:

$$\frac{\partial c}{\partial N} = \frac{\alpha H_x k_0 - \alpha H_g k_i}{(1-\alpha) - \alpha H_g} \frac{\partial t}{\partial N} \tag{3.10}$$

in this equation $\frac{\partial t}{\partial N}$ should be negative, since as the number of governments increase, there will be competition about the tax rate. Thus, what I need to show is that $\frac{\alpha H_x k_0 - \alpha H_g k_i}{(1-\alpha) - \alpha H_g}$ is greater than 0, which means that to get fiscal decentralization to reduce the corruption level the following assumption must be true

$$(1-\alpha) - \alpha H_g > 0 \tag{3.11}$$

This means that the government cares more about corruption revenue than they do about providing public goods.

Also,

$$\alpha H_x k_0 - \alpha H_g k_i > 0 \tag{3.12}$$

which needs $H_x > H_g$, meaning that residents care more about their private consumption than their public good consumption.

Given these reasonable assumptions, it can be proven that fiscal decentralization reduce the level of corruption.

As will be shown in the next section, fiscal decentralization is usually expressed as the

subnational share of total government spending, so fiscal decentralization, FD, can be expressed as following using the model setup.

$$FD_i = \frac{\frac{t_i k_i - c_i}{p_i}}{\frac{t_i k_i - c_i}{p_i} + \frac{\Sigma t_i k_i - \Sigma c_i}{\Sigma p_i}} \tag{3.13}$$

Take the first order derivative with respect to c_i,

$$\frac{\partial FD_i}{\partial c_i} = -\frac{\frac{p_i}{\Sigma p_i}\left(\frac{(\Sigma t_i k_i - \Sigma c_i) - (t_i k_i - c_i)}{(t_i k_i - c_i)^2}\right)}{(1 + \frac{p_i}{\Sigma p_i}\frac{\Sigma t_i k_i - \Sigma c_i}{t_i k_i - c_i})^2} \tag{3.14}$$

This partial derivative is negative, which means fiscal decentralization and corruption are negatively correlated.

3.4 Empirical Analysis

3.4.1 Measurement of Fiscal Decentralization

Because of the complexity of decentralization, namely political centralization and economic decentralization, the way in which to measure fiscal decentralization is a widely debated topic. Lin and Liu (2000) measure the degree of fiscal decentralization by a marginal retention rate, the rate at which revenue increments are retained by provincial governments. Zhang and Zou (1998) use the subnational share of total government spending as a measure of fiscal decentralization. China's decentralization has taken place on both the revenue side and the expenditure side of the budget, so as to fully test how different measurement may affect the results, I use the expenditure side and the revenue side as the measurements of fiscal decentralization.

Fiscal decentralization using expenditures will be defined as the share of provincial fiscal expenditures in total national fiscal expenditure in per capita terms, or

$$FD_{it}^{exp} = \frac{\frac{PE_{it}}{p_{it}}}{\frac{NE_t}{p_t}} \tag{3.15}$$

where FD_{it}^{exp} stands for the measurement of fiscal decentralization using expenditure for province i in year t, PE_{it} stands for fiscal expenditure for province i in year t, NE_t stands for national fiscal expenditure in year t, p_{it} stands for the province population in year t, and p_t stands for national

population in year t.

Fiscal decentralization using revenue will be defined as the share of province fiscal revenue in total national fiscal revenue in per capita terms, or

$$FD_{it}^{rev} = \frac{\frac{PR_{it}}{p_{it}}}{\frac{NR_t}{p_t}} \tag{3.16}$$

where FD_{it}^{rev} stands for the measurement of fiscal decentralization using revenue for province i in year t, PR_{it} stands for fiscal revenue for provine i in year t, and NR_t stands for national fiscal revenue in year t.

3.4.2 Measurement of Corruption

The primary challenge of this empirical research is that the measurement of corruption is illicit and secretive. If we cannot get accurate measurements of corruption, it will be hard to get persuasive results of the effects of fiscal decentralization on corruption. Lots of different measurements have been used. These measurements are the corruption rating data sets provided by Transparency International and the World Bank. International Country Risk Guide, which is published by Political Risk Service, has also been used. These data include corruption perceptions index, bribe payers index, global corruption report and more. Fan (2007) constructed two measure of corruption, bribe frequency and bribe amount. However, these data sets rely on the aggregated perceptions of businessmen or country experts, many of whom may have formed impressions based on common press depictions.

Since there is no consensus about an appropriate indicator of corruption, it is especially hard for researchers to get provincial level data. I will use the following three proxies of corruption to test the effect of fiscal decentralization on corruption. First, the number of convictions for the abuse of public office in a province can be a proxy of corruption (Glaeser and Saks, 2006; Goel and Nelson, 2011). The reason why I use this number as an indicator is that each province is likely to have the same rates of catching corrupt activity given that the inspections are conducted following the same rules in China. Second, the number of auditing reports for provincial governments serves as

a proxy for corruption. More auditing reports means more corruption in the province. Third, I use the level of government transparency score as a proxy for the corruption level. Higher government transparency score means that the provincial level governments share more government expenditures information with the general public. Therefore, higher government transparency scores tend to reflect less corruption.

3.4.3 The Data

The data I use in this paper come from a variety of sources. The number of convictions for the abuse of public office in a province came from the provincial reports in Chinese Procuratorial Yearbook from 2000 to 2009. I collected the number of auditing reports for provincial governments from the Chinese Auditing Yearbook. I found government transparency scores in the Provincial Transparency Report. The data source for remaining variables is the China Statistical Yearbook.

A number of other variables are shown in the regression, besides the proxies for corruption and measurements of fiscal decentralization. I use the share of imports and exports on GDP to proxy for openness (Openness) as suggested by Ades and Di Tella (1997). Per capita GDP (GDP per Capita) is used as the level of economic development. Total provincial government expenditure as a fraction of GDP can be used as an indicator for the size of government (Government Size). I use the ratio of wage of government officials to average provincial wage as a measurement of relative wage (Relative Wage). Summary statistics are shown in Table 3.3.

The data set I use in this paper contains information from 1998 to 2007. During the first five years and second five years China has different central government leaders. Therefore, I included change of leaders (Leader) as a dummy variable. Since China is a big country, geographic and economic conditions usually are not the same, so I include the dummy variables, Costal and Central, if the province is located in the coastal area and the central region respectively. The three regions of China are shown in the graph. Three regions and two dummies specify the west is base case.

3.4.4 Empirical Model

To examine the effect of fiscal decentralization on corruption I use the following empirical regression model.

$$c_{it} = \beta + \gamma FD_{it} + \delta X_{it} + \varepsilon_i + \epsilon_{it} \tag{3.17}$$

where c_{it} is corruption level, FD_{it} is fiscal decentralization, X_{it} is the vector of explanatory variables, that is relative wage, openness, government size, population, GDP per capita and dummy variables. ε_i and ε_{it} are error terms.

3.4.5 Empirical Results

Table 3.4 reports the coefficients and standard errors when the number of convictions for abuse of public office is the dependent variable. My estimation shows that fiscal decentralization and corruption are negatively correlated, indicating that greater decentralization reduces corruption. For example, using expenditure as a measure of fiscal decentralization, 1 percentage point increase in fiscal decentralization in expenditure lowers the total number of corruption crime by 0.3226 percent. The negative sign on openness suggests that the openness of an economy is inversely related to the level of corruption. Because I use the import and export share of GDP as indicator of openness, that means the provinces involved more in international trade are tend to be less corrupted. The sign for relative wage is also negative, which implies that low salaries for public officials gives them an incentive to engage in dishonest activity to try to get extra money.

The result of the dummy variable of leader is particularly interesting. I find that leader is negatively correlated with the corruption and the results are significant. This is reasonable given that the top leader in the first five years was famous for dealing with corruption. That means that even though China has a decentralized fiscal system, the top leader could still influence corruption.

Table 3.5 reports the estimated coefficients and standard errors when using the number of auditing reports as a proxy for corruption. The coefficients for fiscal decentralization in government expenditure and government revenue are all negative and significant. This further supports the view that higher fiscal decentralization leads to a lower level of corruption.

The notable feature of this table is that the signs of the coastal and central dummy variables are negative. The estimated coefficient for coastal is about -0.9 and -0.3 for central. This means that compared with western China, provinces in central China have lower levels of corruption and that the corruption level in the coastal provinces is even lower.

The results when using government transparency scores as a dependent variable are shown in Table 3.6. The coefficients for fiscal decentralization using government expenditures and government revenue show different signs and are not significant. My potential explanation is that government transparency score may not be a good proxy. Because the institution that collects this information only reports a total score, the government officials can give the information they are most comfortable to share. Furthermore, the institution that does this project cannot prove the authenticity of the information.

3.5 Conclusions

In this paper, I show both theoretically and empirically that there is a negative relationship between fiscal decentralization and corruption. The empirical part is tested using a panel data set of 31 provinces from 1998 to 2007 in China. My estimates suggest that fiscal decentralization in government expenditure and government revenue conducive to prevent corruption. By incorporate leader dummy, I find that central government leaders have an impact on the corruption level in China. When location dummy variables are used, my findings suggest that the more developed regions in China tend to be less corrupt. Even though the results is not strong with one of the corruption measure. The results may suggest that give province more revenue and expenditure autonomy may help to lower corruption.

Table 3.1: Government Revenue and Ratio of Central and Local Governments

Year	Revenue	Central	Local	Central	Local
1978	1132.26	175.77	956.49	15.5	84.5
1980	1159.93	284.45	875.48	24.5	75.5
1985	2004.82	769.63	1235.19	38.4	61.6
1990	2937.10	992.42	1944.68	33.8	66.2
1991	3149.48	938.25	2211.23	29.8	70.2
1992	3483.37	979.51	2503.86	28.1	71.9
1993	4348.95	957.51	3391.44	22.0	78.0
1994	5218.10	2906.50	2311.60	55.7	44.3
1995	6242.20	3256.62	2985.58	52.2	47.8
1996	7407.99	3661.07	3746.92	49.4	50.6
1997	8651.14	4226.92	4424.22	48.9	51.1
1998	9875.95	4892.00	4983.95	49.5	50.5
1999	11444.08	5849.21	5594.87	51.1	48.9
2000	13395.23	6989.17	6406.06	52.2	47.8
2001	16386.04	8582.74	7803.30	52.4	47.6
2002	18903.64	10388.64	8515.00	55.0	45.0
2003	21715.25	11865.27	9849.98	54.6	45.4
2004	26396.47	14503.10	11893.37	54.9	45.1
2005	31649.29	16548.53	15100.76	52.3	47.7
2006	38760.20	20456.62	18303.58	52.8	47.2
2007	51321.78	27749.16	23572.62	54.1	45.9
2008	61330.35	32680.56	28649.79	53.3	46.7
2009	68518.30	35915.71	32602.59	52.4	47.6

Notes: Data come from the China Statistical Yearbook.

Table 3.2: Government Expenditure and Ratio of Central and Local Governments

Year	Expenditure	Central	Local	Central	Local
1978	1122.09	532.12	589.97	47.4	52.6
1980	1228.83	666.81	562.02	54.3	45.7
1985	2004.25	795.25	1209.00	39.7	60.3
1990	3083.59	1004.47	2079.12	32.6	67.4
1991	3386.62	1090.81	2295.81	32.2	67.8
1992	3742.20	1170.44	2571.76	31.3	68.7
1993	4642.30	1312.06	3330.24	28.3	71.7
1994	5792.62	1754.43	4038.19	30.3	69.7
1995	6823.72	1995.39	4828.33	29.2	70.8
1996	7937.55	2151.27	5786.28	27.1	72.9
1997	9233.56	2532.50	6701.06	27.4	72.6
1998	10798.18	3125.60	7672.58	28.9	71.1
1999	13187.67	4152.33	9035.34	31.5	68.5
2000	15886.50	5519.85	10366.65	34.7	65.3
2001	18902.58	5768.02	13134.56	30.5	69.5
2002	22053.15	6771.70	15281.45	30.7	69.3
2003	24649.95	7420.10	17229.85	30.1	69.9
2004	28486.89	7894.08	20592.81	27.7	72.3
2005	33930.28	8775.97	25154.31	25.9	74.1
2006	40422.73	9991.40	30431.33	24.7	75.3
2007	49781.35	11442.06	38339.29	23.0	77.0
2008	62592.66	13344.17	49248.49	21.3	78.7
2009	76299.93	15255.79	61044.14	20.0	80.0

Notes: Data come from the China Statistical Yearbook.

Table 3.3: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Corruption(Crime)	310	1199.677	777.8733	41	3881
Corruption(Audit)	310	5341.71	3580.4	402	14358.5
Corruption(Transparency)	310	22.9327	4.7871	16.665	39.03
Fiscal Decentralization(Exp)	310	0.9409	0.6778	0.17973	3.7096
Fiscal Decentralization (Rev)	310	0.5671	0.6251	0.09911	3.2934
Relative Wage	310	1.1564	0.1503	0.6340	1.7901
Openness	310	0.0383	0.0501	0.0039	0.2263
Government Size	310	1660.039	1122.081	467.9092	8539.419
Population	310	4106.719	2616.969	252	9717
GDP per Capita	310	1.2351	0.9942	0.2301	6.7244

Notes: 310 observations are 31 provinces from 1998 to 2007.

Table 3.4: Corruption (Number of Corruption Crime) and Fiscal Decentralization

	Total Number Corruption Crime		Corruption Crime per Capita	
Variable	(1)	(2)	(3)	(4)
FD^{exp}	-0.3226***		-0.1633*	
	(0.1185)		(0.1178)	
FD^{rev}		-0.1270*		-0.0709
		(.0760)		(.0750)
$GDPperCapita$	0.0585	0.0324	0.0071	-0.0057
	(0.0536)	(0.0529)	(0.0533)	(0.0522)
$RelativeWage$	-0.0178	-0.0212	-0.0640	-0.0642
	(0.1193)	(0.1209)	(0.1186)	(0.1194)
$GovernmentSize$	0.3015***	0.1584**	0.2316**	0.1598**
	(0.0945)	(0.0761)	(0.0939)	(0.0752)
$Openness$	-0.0596	-0.0285	-0.0493	-0.0342
	(0.0553)	(0.0539)	(0.0550)	(0.0532)
$Leader$	-0.1294***	-0.1313***	-0.1366***	-0.1381***
	(0.0391)	(0.0398)	(0.0389)	(0.0393)
$Constant$	4.3446***	5.470***	-3.0871***	-2.530***
	(0.8219)	(0.6695)	(0.8167)	(0.6610)
R^2	0.1017	0.1101	0.1405	0.1373
$Hausman$	FE	FE	FE	FE
$Observations$	310	310	310	310

Notes: Columns (1) to (2) are the results when using the number of corruption crime as the dependent variable, columns (3) to (4) are the results when using number of corruption crime per capita as the dependent variable; Standard errors are in the parentheses, *10% significant, **5% significant and ***1% significant.

Table 3.5: Corruption (Number of Auditing Reports) and Fiscal Decentralization

	Total Number Inspection Reprots		Inspection Reports per Capita	
Variable	(1)	(2)	(3)	(4)
FD^{exp}	-0.1870***		-0.1875**	
	(0.1379)		(0.0898)	
FD^{rev}		-0.4028***		-0.0970*
		(0.1084)		(0.0600)
$GDPperCapita$	0.3864***	-0.0854	-0.0874	-0.0130
	(0.1269)	(0.1225)	(0.0769)	(0.0678)
$RelativeWage$	-0.6222**	-0.7146***	-0.0876	-0.1256
	(0.2464)	(0.2718)	(0.1494)	(0.1504)
$GovernmentSize$	-0.7818***	-1.7580***	-0.1447*	-0.1058**
	(0.14123)	(0.0860)	(0.0856)	(0.0673)
$Openness$	0.3564 ***	0.3315***	0.2064***	0.2471***
	(0.0658)	(0.0790)	(0.0399)	(0.0437)
$Leader$	-0.1752*	-0.1889*	-0.0280	-0.1031*
	(0.1043)	(0.1059)	(0.0606)	(0.0586)
$Coastal$	-0.9581***	-0.9971***	-0.8004***	-0.7975***
	(0.1183)	(0.1291)	(0.0689)	(0.0686)
$Central$	-0.2837***	-0.2972***	-0.3533***	-0.3500***
	(0.0862)	(0.0943)	(0.0500)	(0.0499)
$Constant$	15.7155***	22.4919***	4.9517***	5.643***
	(1.0287)	(0.7356)	(0.7413)	(0.7196)
R^2	0.6879	0.6282	0.3538	0.3590
$Observations$	310	310	310	310

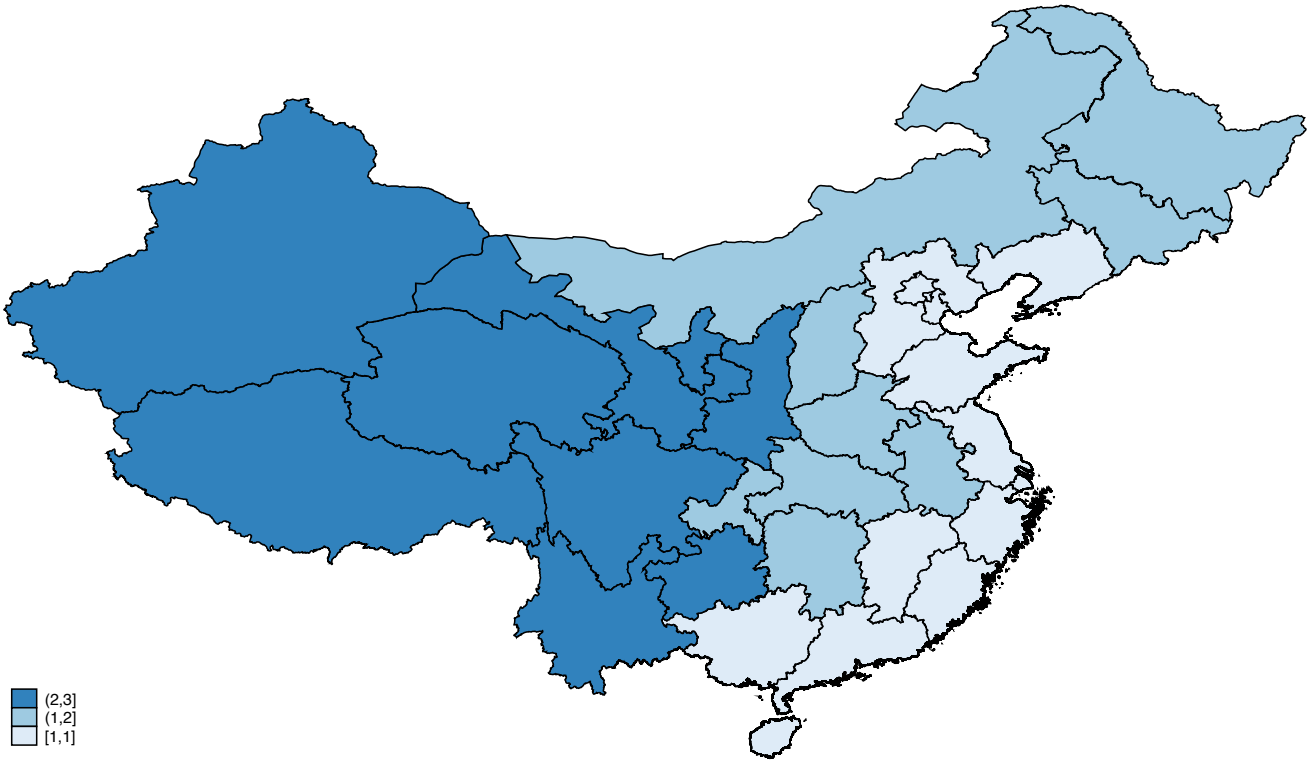
Notes: Columns (1) to (2) are the results when using the number of inspection reports as the dependent variable, columns (3) to (4) are the results when using the number of inspection reports per capita as the dependent variable; Standard errors are in the parentheses, *10% significant, **5% significant and ***1% significant.

Table 3.6: Corruption (Government Transparency Scores) and Fiscal Decentralization

Variable	(1)	(2)
FD^{exp}	0.0205	
	(0.0521)	
FD^{rev}		-0.0498
		(0.0337)
$GDPperCapita$	0.0693	0.1086***
	(0.0431)	(0.0368)
$RelativeWage$	0.2257	0.2039**
	(0.0831)	(0.0836)
$Population$	0.0058*	-0.0015
	(0.0192)	(0.0173)
$GovernmentSize$	-0.1399***	-0.1319***
	(0.0459)	(0.0355)
$Openness$	-0.0100	0.0097
	(0.0189)	(0.0212)
$Leader$	-0.0111	-0.0477
	(0.0352)	(0.0330)
$Constant$	4.0285***	0.0330***
	(0.3898)	(0.3764)
R^2	0.2530	0.2579
$Observations$	310	310

Notes: Standard errors are in the parentheses, *10% significant, **5% significant and ***1% significant.

Figure 3.1: Three Regions in China



Appendices

Appendix A Proof of Proposition 1

Totally differentiating equation (6) and equation (7) w.r.t C_p gives

$$[-\Psi(B(C_p,\tau)) - C_p\frac{\partial\Psi(B(C_p,\tau))}{\partial B}\frac{\partial B}{\partial C_p}]\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta} + \frac{\partial^2\Phi(\theta(C_p,\tau))}{\partial\theta\partial\theta}\frac{\partial\theta}{\partial C_p}[1 - C_p\Psi(B(C_p,\tau))] = 0 \tag{18}$$

$$[\Phi(\theta(C_p,\tau)) + C_p\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta}\frac{\partial\theta}{\partial C_p}]\frac{\partial\Psi(B(C_p,\tau))}{\partial B} + C_p\Phi(\theta(C_p,\tau))\frac{\partial^2\Psi(B(C_p,\tau))}{\partial B\partial B}\frac{\partial B}{\partial C_p} = 0 \tag{19}$$

From equations (A.1) and (A.2), we obtain

$$\begin{bmatrix} \frac{\partial^2\Phi(\theta(C_p,\tau))}{\partial\theta\partial\theta}[1 - C_p\Psi(B(C_p,\tau))] & -C_p\frac{\partial\Psi(B(C_p,\tau))}{\partial B}\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta} \\ C_p\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta}\frac{\partial\Psi(B(C_p,\tau))}{\partial B} & C_p\Phi(\theta(C_p,\tau))\frac{\partial^2\Psi(B(C_p,\tau))}{\partial B\partial B} \end{bmatrix} \times \begin{bmatrix} \frac{\partial\theta}{\partial C_p} \\ \frac{\partial B}{\partial C_p} \end{bmatrix} = \begin{bmatrix} \Psi(B(C_p,\tau))\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta} \\ \Phi(\theta(C_p,\tau))\frac{\partial\Psi(B(C_p,\tau))}{\partial B} \end{bmatrix} \tag{20}$$

Using Cramer's rule, two unknowns $\frac{\partial\theta}{\partial C_p}$, and $\frac{\partial B}{\partial C_p}$ can be resolved. The unknown we care about is $\frac{\partial\theta}{\partial C_p}$, which is

$$\frac{\partial\theta}{\partial C_p} = \frac{C_p\Phi(\theta(C_p,\tau))\frac{\partial^2\Psi(B(C_p,\tau))}{\partial B\partial B}\Psi(B(C_p,\tau))\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta} - C_p\frac{\partial\Psi(B(C_p,\tau))}{\partial B}\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta}\Phi(\theta(C_p,\tau))\frac{\partial\Psi(B(C_p,\tau))}{\partial B}}{C_p\Phi(\theta(C_p,\tau))\frac{\partial^2\Psi(B(C_p,\tau))}{\partial B\partial B}\frac{\partial^2\Phi(\theta(C_p,\tau))}{\partial\theta\partial\theta}[1 - C_p\Psi(B(C_p,\tau))] + [C_p\frac{\partial\Phi(\theta(C_p,\tau))}{\partial\theta}\frac{\partial\Psi(B(C_p,\tau))}{\partial B}]^2} \tag{21}$$

Using the assumption given in section 2, the sign for $\frac{\partial\theta}{\partial C_p}$ is negative. Q.E.D

Appendix B Proof of Proposition 2

Totally differentiating equation (6) and equation (7) w.r.t τ gives

$$R - C_p \frac{\partial \Psi(B(C_p,\tau))}{\partial B} \frac{\partial B}{\partial \tau} \frac{\partial \Phi(\theta(C_p,\tau))}{\partial \theta} + [1 - C_p \Psi(B(C_p,\tau))] \frac{\partial^2 \Phi(\theta(C_p,\tau))}{\partial \theta \partial \theta} \frac{\partial \theta}{\partial \tau} = 0 \tag{22}$$

$$C_p \frac{\partial \Phi(\theta(C_p,\tau))}{\partial \theta} \frac{\partial \theta}{\partial \tau} \frac{\partial \Psi(B(C_p,\tau))}{\partial B} + C_p \Phi(\theta(C_p,\tau)) \frac{\partial^2 \Psi(B(C_p,\tau))}{\partial B \partial B} \frac{\partial B}{\partial \tau} = 0 \tag{23}$$

From equations (A.5) and (A.6), we obtain

$$\begin{bmatrix} \frac{\partial^2 \Phi(\theta(C_p,\tau))}{\partial \theta \partial \theta}[1 - C_p \Psi(B(C_p,\tau))] & -C_p \frac{\partial \Psi(B(C_p,\tau))}{\partial B} \frac{\partial \Phi(\theta(C_p,\tau))}{\partial \theta} \\ C_p \frac{\partial \Phi(\theta(C_p,\tau))}{\partial \theta} \frac{\partial \Psi(B(C_p,\tau))}{\partial B} & C_p \Phi(\theta(C_p,\tau)) \frac{\partial^2 \Psi(B(C_p,\tau))}{\partial B \partial B} \end{bmatrix} \times \begin{bmatrix} \frac{\partial \theta}{\partial \tau} \\ \frac{\partial B}{\partial \tau} \end{bmatrix} = \begin{bmatrix} -R \\ 0 \end{bmatrix} \tag{24}$$

Using Cramer's rule, two unknowns $\frac{\partial \theta}{\partial \tau}$, and $\frac{\partial B}{\partial \tau}$ can be resolved. The unknown we care about is $\frac{\partial \theta}{\partial \tau}$, which is

$$\frac{\partial \theta}{\partial \tau} = \frac{-RC_p \Phi(\theta(C_p,\tau)) \frac{\partial^2 \Psi(B(C_p,\tau))}{\partial B \partial B}}{C_p \Phi(\theta(C_p,\tau)) \frac{\partial^2 \Psi(B(C_p,\tau))}{\partial B \partial B} \frac{\partial^2 \Phi(\theta(C_p,\tau))}{\partial \theta \partial \theta}[1 - C_p \Psi(B(C_p,\tau))] + [C_p \frac{\partial \Phi(\theta(C_p,\tau))}{\partial \theta} \frac{\partial \Psi(B(C_p,\tau))}{\partial B}]^2} \tag{25}$$

Using the assumption given in section 2, the sign for $\frac{\partial \theta}{\partial \tau}$ is negative. Q.E.D

Appendix C Alternative Way to Consider the Firm's Problem

To make the model simple, I assume there are two provinces p 1 and 2. Each province has a corruption level C_{pt} in year t that will be used by the firm when reporting profit in year $t+1$. Provincial level governments and firms play a static game, moving sequentially. First, firms observe the corruption level in year t in province p. Second, firms report year $t+1$ profit. There is a possibility that an untruthful profit report will lead to punishment once the firm is caught. The probability of being caught in a more corrupt province is lower than in a less corrupt province.

Firms try to maximize the following:

$$U_i(\hat{\pi}_i) = \tau_i(\pi_i - \hat{\pi}_i) - (\gamma - \xi_i)(\pi_i - \hat{\pi}_i)^2 - B - [1 - C_p\Psi(B)]A(\pi_i - \hat{\pi}_i) \tag{26}$$

Firms try to maximize their expected gain from tax avoidance by choosing reported profit $\hat{\pi}_i$. The benefit from tax avoidance is $\tau_i(\pi_i - \hat{\pi}_i)$, that is, the difference between true profit π_i and reported profit $\hat{\pi}_i$ times the tax rate τ_i.

$(\gamma - \xi_i)(\pi_i - \hat{\pi}_i)^2$ is the cost of hiding profit. Hiding profit is costly to firms, since they have to spend time studying the tax law or need to hire accounting firms. It is easier to hide profits at first; it would be hard to continue to find loopholes, and the quadratic form is one of the easiest ways to capture this. γ is a positive parameter. ξ_i is a positive parameter if firms export to other countries; otherwise ξ_i is zero. Because it is easy for firms to use transfer pricing if they export to other countries, the cost will be lower for them.

Firms will use B as the bribe to government officials. The expected punishment faced by firms is $[1 - C_p\Psi(B)]A(\pi_i - \hat{\pi}_i)$. C_p is the corruption level in province p. If firms bribe the government, the penalty will be less severe.[3] $A > 1$ means firms will pay more than the profit they try to under report. In China, this A is in the range of 50% to 500% of the tax avoidance.[4]

[3]Suppose the corruption level is observed by firms, and the corruption level is exogenous, then firms behavior won't influence the level of corruption. This is shown in appendix A

[4]Firms that failed to pay the tax would face punishment by regulators. According to article 25 of the corporate income tax law "In the case of tax evasion by concealment or deception, or failure of paying tax within the prescribed

Firms maximize their gain by choosing reported profit $\hat{\pi}_i$. The first order condition is

$$\frac{\partial U_i}{\partial \hat{\pi}_i} = -\tau_i - 2(\gamma - \xi_i)(\pi_i - \hat{\pi}_i) + [1 - C_p\Psi(B)]A = 0 \tag{27}$$

After some algebra, gives

$$\pi_i - \hat{\pi}_i = \frac{\tau_i - [1 - C_p\Psi(B)]A}{2(\gamma - \xi_i)} \tag{28}$$

This leads to the following three Propositions:

Proposition 3 *All else equal, firms in the more corrupt province tend to hide more profits.*

Proof: Take the derivative of hidden profit, $\pi_i - \hat{\pi}_i$, with respect to corruption level C_p, which gives $\frac{\partial(\pi_i - \hat{\pi}_i)}{\partial C_p} = \frac{A\Psi(B)}{2(\gamma - \xi_i)}$. Given that A, $\Psi(B)$, γ, and ξ_i are positive parameters and $\gamma > \xi$, therefore

$$\frac{\partial(\pi_i - \hat{\pi}_i)}{\partial C_p} > 0 \tag{29}$$

which means, all else equal, firms hide more profit if located in a more corrupt province. Intuitively, in the more corrupt province, firms are more likely to establish a relationship with government officials through bribes, so the officials would be less likely to audit the firms; thus, firms would be more likely to hide their profits.

Proposition 4 *All else equal, firms with higher tax rates tend to hide more profits.*

Proof: Taking the derivative of hidden profit, $\pi_i - \hat{\pi}_i$, with respect to the tax rate τ_i for firm i gives $\frac{\partial(\pi_i - \hat{\pi}_i)}{\partial \tau_i} = \frac{1}{2(\gamma - \xi_i)}$. Because $\gamma - \xi_i$ is positive, this gives

$$\frac{\partial(\pi_i - \hat{\pi}_i)}{\partial \tau_i} > 0 \tag{30}$$

That is firms with higher tax rates tend to hide more profit.

Proposition 5 *All else equal, firms that export tend to hide more profits.*

time limit as provided in this law, and payment is still refused within the time limit despite the urge by the tax authorities, the tax authorities shall pursue the payment of tax payable and impose a fine up to five times the tax amount unpaid; and for the severe case, the criminal responsibility of the legal representative and the person with direct responsibility shall be sought in accordance with the provisions of article 121 of the Criminal Law of China."

Proof: Taking the derivative of hidden profit, $\pi_i - \hat{\pi}_i$, with respect to the exportation ξ_i for firm i gives $\frac{\partial(\pi_i - \hat{\pi}_i)}{\partial \xi_i} = \frac{\tau_i - [1 - C_p \Psi(B)]A}{2(\gamma - \xi_i)^2}$. Because $\frac{\tau_i - [1 - C_p \Psi(B)]A}{2(\gamma - \xi_i)}$, which equals $\pi_i - \hat{\pi}_i$, is positive and $\gamma - \xi_i$ is also positive, therefore

$$\frac{\partial(\pi_i - \hat{\pi}_i)}{\partial \xi_i} > 0 \tag{31}$$

This means that when firms have exports, they will hide more profits. Firms that have access to other countries can easily use transfer pricing, so they can hide more profit.

Bibliography

Ades, A., di Tella, R., 1997. National Champions and Corruption: Some Unpleasant Interventionist Arithmetic. *The Economic Journal* 107, 1023-1042.

Akdede, Sacit Hadi (2006). Corruption and tax evasion. *Dogus Universitesi Dergisi* 7 141-149

Alberto Ades, Rafael Di Tella, 1999. Rents, Competition and Corruption. *American Economic Review* 89, 982-993.

Allingham, Maurice, and Agnar Sandmo.1972.Income Tax Evasion: A Theoretical Analysis. *Journal of Public Economics* 1 32338.

Arikan G. Gulsun. 2004 Fiscal Decentralization: A Remedy for Corruption?. *International Tax and Public Finance* 11 175-195.

Bardhan, P., Mookherjee, D., 2000. Capture and Governance at Local and National Levels. *American Economic Review* 90, 135-139.

Bardhan, P., Mookherjee, D., 2000. Corruption and Decentralization of Infrastructure delivery in Developing Countries. Mimeo, Department of Economics, Boston University.

Becker Gary 1968, Crime and Punishment: An Economic Approach. *Journal of Political Economy* 76(2) 169-217.

Braguinsky, Serguey, Sergey, Mityakov, 2013. Foreign Corporations and the Culture of Transparency: Evidence from Russian Administration Data. *Journal of Financial Economics*

Brennan, G. and J. M. Buchanan, 1980. The Power to Tax: Analytical Foundations of a Fiscal Constitution. Cambridge: Cambridge University Press.

Cai, Hongbin., Qiao Liu 2009. Competition and Corporate Tax Avoidance: Evidence from Chinese Industrial Firms. *Economic Journal* 119:764-795.

Cai and Treisman, 2004. State Corroding Federalism. *Journal of Public Economics* 88, 819-843

Cai and Treisman, 2005. Does competition for capital discipline governments? decentralization, globalization, and public policy. *American Economic Review* 95, 817-830.

Chandraa, Piyush., Cheryl Long. 2013. VAT rebates and export performance in China: Firm-level evidence. *Journal of Public Economics* 102:13-22.

Chen, Kong-Ping, and C. Y. Cyrus Chu. 2005. Internal Control vs. External Manipulation: A Model of Corporate Income Tax Evasion. *RAND Journal of Economics* 36, 151164.

Cloyd, Bryan. 1995. The Effects of Financial Accounting Conformity on Recommendations of Tax Preparers. *Journal of the American Taxation Association*. 17(2) 50 70.

Cloyd, Bryan, Jamie Pratt, and Toby Stock.1996. The Use of Financial Accounting Choice to Support Aggressive Tax Positions: Public and Private Firms. *Journal of Accounting Research* 34(1): 23 43.

Crocker, Keith, and Joel Slemrod. 2005. Corporate Tax Evasion with Agency Costs. *Journal of Public Economics* 89, 15931610.

DeBacker, Jason, Bradley, Heim, Anh Tran, 2012 Importing Corruption Culture from Oversees: Evidence from Corporate Tax Evasion in the United States *Journal of Financial Economics*

De Mello Jr., Matias Barenstein, 2001. Fiscal Decentralization and Governance: a Cross-Country Analysis. IMF Working Paper 01/71, IMF, Washington DC.

Desai Mihir and Dhammika Dharmapala, 2006 Corporate Tax Avoidance and High-powered Incentives *Journal of Financial Economics* 79, 145-179.

Desai, Mihir, Alexander Dyck, and Luigi Zingales. 2007 Theft and Taxes *Journal of Financial Economics* 84, 591-623.

Fan, C. Simon, Lin, Chen, Treisman, Daniel, 2009. Political Decentralization and Corruption: Evidence from Around the World. *Journal of Public Economics* 93, 14-34.

Ferraz, Claudio, Finan, Frederico, 2011. Electoral Accountability and Corruption: Evidence from the Audits of Local Governments. *American Economic Review* 101, 1274-1311.

Fisman. R., Robert Gatti, 2002a. Decentralization and Corruption: Evidence from Across Countries. *Journal of Public Economics* 83, 325-345.

Fisman. R., Robert Gatti, 2002b. Decentralization and Corruption: Evidence from U.S. Federal Transfer Programs. *Public Choice* 113, 25-35.

Fisman, Raymond and Shang-Jin Wei, 2004. Tax Rate and Tax Evasion: Evidence from "Missing Imports" in China. *Journal of Political Economics* 112, 471-496.

Fisman, Raymond, Jacob Svensson, 2007. Are corruption and taxation really harmful to growth? Firm Level Evidence. *Journal of Development Economics* 83, 63-75.

Gelos, G. and A. Werner. 2002. Financial liberalization, credit constraints, and collateral: investment in the Mexican manufacturing sector *Journal of Development Economics* 67: 127.

Goel, Rajeev, Michael, Nelson, 2011. Government fragmentation versus fiscal decentralization and corruption. *Public Choice*148(3) 471-490.

Glaeser, Edvard, Raven Saks, 2006. Corruption in America. *Journal of Public Economics* 90 1053-1072.

Goerke, 2008. Bureaucratic Corruption and Profit Tax Evasion. CESifo working paper. No.1666.

Hanlon, Michelle, Shane Heitzman, 2010. A Review of Tax Research. *Journal of Accounting and Economics* 50 127-178.

Hanlon, Michelle, Lillian Mills, and Joel Slemrod 2005. An Empirical Examination of Corporate Tax Noncompliance. working paper

Huther, J., Shah, A., 1998. Applying a Simple Measure of Good Governance to the Debate on Fiscal Decentralization. World Bank Policy Research Working Paper, no. 1894.

Johnson, Simon, Daniel, Kaufmann, John, McMillan, Christopher, Woodruff, 2000. Why do firms hide? Bribes and unofficial activity after communism. *Journal of Public Economics* 76 495-520.

Kim, Jeong-Bon, Yinghua, Li, Liandong, Zhang, 2011. Corporate Tax Avoidance and Stock Price Crash Risk: Firm-level Analysis *Journal of Financial Economics* 100, 639-662.

Lv, Xiaobo, 200. Cadres and Corruption. Stanford University Press.

Mironov, Maxim. 2013 "Taxes, Theft, and Firm Performance." *Journal of Finance* 1411-1762.

Olken, Benjamin A., 2006. Corruption and the Costs of Redistribution: Micro Evidence from Indonesia. *Journal of Public Economics* 90, 853-870.

Pranab, Bardhan, 2002. Decentralization of Governance and Development. *Journal of Economics Perspectives* 16, 185-205.

Qian, Y. and G. Roland, 1998. Federalism and the Soft Budget Constraint. *American Economic Review* 77, 265-284.

Sandmo, Agnar. 2005. "The Theory of Tax Evasion: A Retrospective View." *National Tax Journal* 58, 643663.

Shleifer, A., Vishny, R., 1993. Corruption. *Quarterly Journal of Economics* 108, 599-617.

Slemrod, Joel, 2007. Cheating Ourselves: The Economics of Tax Evasion. *Journal of Economic Perspectives* 20, 25-48.

Slemrod, Joel, Shlomo Yitzhaki, 2002. Tax Avoidance, Evasion, and Administration. *Handbook of Public Economics* 1423-70.

Stock J, Yogo M. 2005. Testing for Weak Instruments in Linear IV Regression. In Andrews DWK Identification and Inference for Econometric Models New York: Cambridge University Press; 80-108.

Svensson, Jakob, 2005. Eight Questions about Corruption. *Journal of Economic Perspectives* 19, 19-42.

Svensson, Jakob, 2003. Who Must Pay Bribes and How Much? Evidence from a Cross Section of Firms. *The Quarterly Journal of Economics* 18, 207-230.

Treisman, D. 2000. The Causes of Corruption: A Cross-National Study. *Journal of Public Economics* 76, 399-457.

Uslaner. E. Tax Evasion, Corruption, and the Social Contract in Transition, in James Alm, Jorge Martinez-Vazquez, and Benno Torgler (eds.), Developing Alternative Frameworks for Explaining Tax Compliance (London: Routledge,2010), pp. 206-225.