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**COMPETITION AND TAX EVASION:
A CROSS COUNTRY STUDY**

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COMPETITION AND TAX EVASION:
A CROSS COUNTRY STUDY

by
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ABSTRACT

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Master of Philosophy

This paper investigates the determinants of informality (tax evasion in particular) utilizing rich cross-country data of firm-level survey from the World Bank, and hypothesizing that competition is a significant factor determining tax evasion behaviors. Competition pressure is a key stimulus to induce questionable manipulations of tax reporting behaviors. However its effect works at a decreasing speed. It is also hypothesized that business obstacles facing firms such as tax administration and corruption play significant roles in explaining tax evasion. This paper further hypothesizes that firm characteristics such as size, age, ownership are important evasion determinants. Empirical results are found supporting these hypotheses above. The analysis controls for country-level effects, for instance the quality of the legal environment. Industry sectors are also controlled and found significant in explaining corporate tax evasion levels.

Keywords: tax evasion; competition; legal environment.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

(WANG Yiqun)

Aug 30 2009

CERTIFICATE OF APPROVAL OF THESIS





TAX EVASION: THE EFFECTS OF COMPETITION
AND OTHER DETERMINANTS

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COMPETITION AND TAX EVASION:

A CROSS COUNTRY STUDY

Chapter One: Introduction

1. Introduction

“No government can announce a tax system and then rely on taxpayers’ sense of duty to remit what is owed. Some dutiful people will undoubtedly pay what they owe, but many others will not. Over time the ranks of the dutiful will shrink, as they see how they are being taken advantage of by the others. Thus, paying taxes must be made a legal responsibility of citizens, with penalties attendant on noncompliance. But even in the face of those penalties, substantial tax evasion exists—and always has. The history of taxation is replete with episodes of evasion, often notable for their inventiveness. During the third century, many wealthy Romans buried their jewelry or stocks of gold coin to evade the luxury tax, and homeowners in eighteenth-century England temporarily bricked up their fireplaces to escape notice of the hearth tax collector (Webber and Wildavsky, 1986, p. 141).”

By Slemrod

(2007)

Underground or informal economic activity is a fact of life all over the globe. Schneider and Enste (2000) estimated that during 1990-1993 approximately 10% of GDP in the United States was produced by individuals or firms evading taxes or engaging in illegal pursuits, while in Africa the figure is 39%-76%, in Asia countries 13%-70%, and in OECD countries between 13% and 30%. For a quick look at United States, Slemrod and Yitzhaki (2000) cited the Internal Revenue Service (IRS) estimates that about 17% of income tax liability is not paid in 1996, accompanied with the fact that the relative size of federal corporation income tax revenues dropped from 6.4% of GDP in 1951 to less than 1.5% around 2004. Desai (2002) calculated that in 1998, difference between tax and book income (approximately \$154.4 billion or 33.7% of taxable income in U.S.) is consistent with increasing levels of tax sheltering during the late 1990s.

Abundant real-life examples exist in every societal level, for instance illegal child labor in rural districts and unregistered workforce for cost considerations; Under-reporting incomes or profits by individual taxpayers or even well-established corporations; These prevalent phenomenon exist in many economies. Most governments attempt to control these activities by means of punitive measures or through education, rather than tax or social security system reforms.

1.1. Coverage and outline of the study

In this paper, tax evasion issue as a form of corporate tax non-compliance behaviors is carefully examined. After first reviewing existing literature and theories in Chapter Two and Three, three hypotheses in Chapter Four are developed along the line of existing theories, with the most remarking one of competition's effects on tax evasion incentives. After hypotheses developing, Chapter Five utilizes comprehensive cross-country survey data to test the previous hypotheses on competition, firm characteristics and business constraints. Policy implications and limitations of this paper are discussed in Chapter Five.

1.2. Motivations of this thesis

From the seminal paper on tax evasion by Allingham and Sandmo (1972) (A-S henceforth), both theoretical explorations and empirical examinations flourish along the line in a number of directions. Empirical attempts to estimate the size of informal economy has been well surveyed by Cowell (1990), Slemrod and Yitzhaki (2002) and Cowell (2002); Modifications of the original A-S model include the work by Bernasconi (1998)¹, Bordignon (1993)², etc; Tax evasion has also been linked with labor market choices, for instance Pestieau and Posseu (1991) studies the connection between tax evasion and occupational choice, Kolm and Larsen (2004) assumed only manual works have access to underground labor market; Optimal taxation has been

¹ Bernasconi (1998) replaced expected utility with rank-dependent expected utility, However this does not change comparative statistics, in a way similar to the introduction of social stigma, renders the results more restrictive than in the A-S model.

² Bordignon (1993) assumes tax evasion is motivated by taxpayer's feeling of being treated unfairly, and sees the evasion of tax as a social phenomenon and moral issues.

also studied by Kolm (1973), Sandmo (1981), Slemrod and Yitzhaki (2002); Evasion by firms have also been developed from 1980s by Marrelli (1984), with the recent trend to introduce the separation of ownership and control.

This paper examines the determinants of tax evasion on firm-level, aside from acknowledged external factors such as tax rates, tax administrations and country-level effects, existing theories and empirical attempts appear to neglect or skip the assumption of market situation and competition status of individual firm when deciding evasion behaviors, which could have played crucial role in the game of evasion.

Based mainly on the Productivity and the Investment Climate Private Enterprise Survey (PICPES thereafter) carried out by the World Bank during 2002 to 2005, especially with the special design of the questionnaire with respect to competition status of the surveyed firms, a unique opportunity for empirical study emerged for combining tax evasion study with respect to competition, which is a rarely covered area for cross-country comparisons.

1.3. Main Methodology and Empirical Results

In the theoretical part of this paper, besides the basic set-up for standard tax evasion incentives from Allingham and Sandmo (1972), I further add realistic assumptions about utility function, derive specific conditions and predictions for comparative static results, especially focusing on competition's effects on optimal tax evasion. It is shown that competition influences evasion incentives (measured by the unreported sales as a percentage of total sales), however in a decreasing speed. The hypotheses development section mainly illustrates the three hypotheses about effects of competition, firm characteristics and business constraints facing firms with intuition and explanations from the previous chapter.

In Chapter Five of empirical findings, cross-country evidence supporting the

hypothesized decreasing effect of competition is presented utilizing a unique measurement of competition (provided in the survey) and its squared term in Maximum Likelihood estimations (MLE). Supplemented by other data sources, the main determinants of tax evasion as divided into categories by the three hypotheses in Chapter Four are examined. Determinants in the three categories all appear to be playing roles according to expected directions. Other factors such as actual tax rates, size of underground economy are also taken into considerations in examinations. However these factors fail to provide credible effects due to reasons to be explained.

The maximum likelihood estimation method in tobit is applied for main regression to back up the previous hypotheses. Marginal effects and predicted effects are also presented with respect to different measurements. Other forms of regression as robustness checks are also performed.

1.4. Contributions to the Existing Literature

Evasion of tax creates inequity problem among social members, and if evasion opportunities are associated with income (of individuals or firms), government's fiscal attempts are further complicated. Economic costs also arise with the fact that evasion activities take resources to operate and conceal evasion, and tax authorities also require resources in tax collecting and administrations.

Besides the declining revenue tax evasion renders on government, evasion of tax makes the burden of tax and social security contributions heavier, also rendering the quality of public good and services unguaranteed or of inadequate quantities than as it should be. The phenomenon of erosion of tax base is severe in many economies, and most governments attempt to control these activities by means of punitive measures or through education, less than by tax or social security system reforms. For instance, government may resort to policies including "sporadic crackdowns on undeclared economic activities, subsidies and tax breaks for firms that agree to

register legally and maintain legitimate tax accounting practices.”³

Existing literature on the issue of tax evasion has covered links with many areas and explored different forms of taxes in empirical studies. For instance abundant literature in management and corporate finance discusses tax evasion with compensation scheme and manager incentives. For instance, Chander (2007) characterized optimal tax function when agent is risk averse and the principle aims at maximizing social welfare; Often examined areas include also value added tax (VAT) and its application with optimal tax design and tax supervision. For instance Fisman and Wei (2004) examined China-Hong Kong imports data with VAT and found tax rates and misclassifications from high to low-taxed categories determined tax evasion. Das-Gupta and Gang (2001) developed a model of tax evasion applied to valued added tax; Corporate income tax as another main stream of investigations, has also been researched intensively in empirical work.

However, due to limitations of data or applications, much empirical work focuses on one specific country, or several countries belonging to a same region or economic development. Johnson *et al.* (2000) for instance, examined tax evasion in two post-communism countries and three other eastern European countries. Few cross-country empirical studies on tax evasion were performed, especially on firm-levels, although theoretical works are more commonly seen. Recent research by Dabla-Norris *et al.* (2007, 2008) are among the exceptions for cross-country evidence of tax evasion, in which rich cross-country firm level data were employed from World Business Environment Survey (WBES thereafter), carried out by the World Bank. Dabla-Norris *et al.* (2008) re-examined previously acknowledged factors such as size of informal sector, tax and regulation burdens, financial development and quality of legal system, and presented empirical evidence supporting these determinant's effect on informality of firms (namely, tax evasion), especially the importance of the quality of legal framework in reducing informality.

³ Cited from Pratap and Quintin (2006).

Based on former studies, this paper explores in detail that competition condition significantly affect firm's tax evasion behaviors. Except the broad coverage of cross country data in this paper's empirical findings, this paper acknowledged the previous determinants for tax evasion, and further presents new empirical evidence on the effect of competition, which distinguishes this paper from previous studies. Previously acknowledged factors such as firm size, business obstacles are also identified, with further presenting other important determinants such as competition and financing channels. As is hypothesized, fierce competition in product market would precipitate firms into unlawful manipulations such as misreporting sales to tax authorities, as an alternative way to ensure a better after-tax profit to compensate the revenue decline. The empirical findings of competition suggests that policies designed to promote competition should also take into account factors such as strengthening supervision and institution infrastructure, in order to prevent from suffering from its possible negative effects and loss of tax revenues.

Besides the evidence found supporting the view that competition plays an important role in tax evasion, other interesting facts were found such that firms financing more from informal sources also significantly evade more tax, comparing to firms those relying more on formal financing channels such as commercial banks or state services. This finding corresponds to Cai, Liu and Xiao (2007)'s empirical findings that firm's access to capital markets affects their evasion/avoidance behaviors. It also signals the supervising role banks may play in lending loans, indicating another policy insight for tax evasion control. Other factors such as corruption, firm-specific characteristics and industry and country-level effects are also accounted for. My results suggest useful directions for policy makers to strengthen tax supervision.

Chapter Two: Literature Review

2. Literature Review

2.1. Background of Informality

Informality has various definitions and controversies have always been existent. I mention here one often cited definition to define it as: All economic activities that contribute to officially calculated (or observed) gross national product but are not currently registered⁴. Economic activities by this definition include relevant categories classified by legitimate nature of transactions as shown in Table 1 below.

Table 1: A Taxonomy of Types of Underground Economic Activities⁵

Type of Activity	Monetary Transactions		Non Monetary Transactions	
Illegal Activities	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud; etc.		Barter of drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.	
	Tax Evasion	Tax Avoidance	Tax Evasion	Tax Avoidance
Legal Activities	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbor help

Tax noncompliance in taxable transactions for this paper's scope can be generally summarized as either tax-evading or tax-avoiding activities. Despite the technical difficulties and controversies in clearly distinguishing between tax avoidance and tax evasion, which are both under the category of tax noncompliance, the often cited distinction between the two is legitimacy. As avoidance is still in the legal side, evasion is at the other. Tax avoidance usually refers to behaviors taking loopholes in tax laws and relevant regulations, avoiding taxation over certain items or reducing tax liabilities

⁴ This definition has been utilized for instance, by Feige (1989, 1994), Schneider (1994a, 2003), Frey and Pommerehne (1984), and Lubell (1991). Do-it-yourself activities (housework, etc) are not included.

⁵ See Schneider, Klinglmaier 2004, p6.

within a legally registered firm or individual. For instance corporations can purchase tax-exempt bonds to reduce taxability; Another often-mentioned tax avoidance refers to the extreme situation that firms per se are informal, unregistered, thus avoid all taxation and other formal regulations (Underground or illegal economic activities, undocumented jobs, to name a few). While avoiding all formal taxations, these firms at the same time face many limitations such as higher cost of capital and other concerns.

Tax avoidance, despite its legitimate nature, has caught much attention recently, especially abusive avoidance activities, for instance tax shelters. The General Accounting Office in the United States defines abusive shelters as "Very complicated transactions promoted to corporations and wealthy individuals to exploit tax loopholes and provide large, unintended⁶ tax benefits"⁷. Slemrod (2003) indicates abusive tax shelters roughly equal more than half of the total corporate tax gap in the United States⁸. Although large in magnitude and raising depletes in tax morale and relating issues, the legality of avoidance tax activities is immune from criminal investigations and not as intriguing in policy implications as tax evasion does, which is the focus of this paper.

This paper focuses on illegal behaviors in corporate tax non-compliance: Tax evasion issue in legal activities (by registered firms in this paper's scope), which is also in the keen interest of governments and tax authorities. Evasion activities take various forms for different taxes (GST⁹, corporate income tax, profit tax, etc) and are becoming increasingly complicated and professionally done over the recent years. Means utilized for evasion purpose varies, including such as under-reporting sales or profits (fake receipts, falsifying cost, hiding away activities or reporting loss, etc) to retain illegal profits within corporation, which is a major concern for most government.

2.1.1. Broader informality: size of informal sector

⁶ The word "unintended" here refers to the intention of legislators, not promoters or tax payers (Slemrod (2003)).

⁷ U.S General Accounting Office, 2003, p.1

⁸ Total corporate tax gap comprises of under-reporting (tax evasion, in other words), non-filing and underpayment. While U.S corporate underreporting in 2001 is estimated at 29.9 billion, however there's no estimate for non-filing, and underpayment is a quite different issue from this paper's concern.

⁹ GST, goods and services tax, as used in Canada, New Zealand, etc.

Most existing theories presume several reasons for informal (or underground, shadow) economies: Heavy tax and/or regulation burden, high entry barriers, poor institutional quality, corruption or mafia distortion, forced reduction of weekly working time, unemployment, decline of civic virtue and tax morale, etc.

Methods used to estimate the size of informal economy include direct approaches, which employ either well-designed surveys and samples or the discrepancy between declared income and that measured by selective checks; And also indirect approaches, which utilize indicators such as discrepancy between national expenditure and income statistics, discrepancy between official and actual labor force, transaction measure, currency demand, physical input (electricity consumption) to trace the informal economy; And model approaches, which absorb multiple causes and effects for informal economy over time by constructing DYMIMIC (dynamic multiple-indicators multiple-causes) models to estimate the size and movement of informal economy.

Schneider and Enste (2000) estimate shadow economies by electricity consumption and currency demand for developing, transition and OECD countries. Empirical attempts like this have been criticized on various grounds. To list a few, not all transactions in the informal economy are paid in cash or require much electricity; Velocity of money differs in formal and informal world; Technical progress may bias the estimates of informal production and output from for the indirect approaches, etc. More recent trend is to employ MIMIC model, sometimes combined with cash-demand model.

Loayza (1996) presents a view that informal economy arises when excessive taxes and regulations are imposed by government that lacks the capability to enforce compliance, and used data in Latin American countries in the early 1990s to back up the view. Friedman *et al.* (2000) investigated into determinants of underground economy in 69 countries, and found higher taxes, more labor restrictions, and poorer quality of institutions (corruption, bureaucracy, legal environment) all playing roles in determining the size of the underground economies.

Shleifer (2002) points out that countries with heavier regulation of entry have higher corruption and larger unofficial economies, but not necessarily better quality of public or private goods. Number of procedures, time and cost of a typical business start-up in 85 countries was employed to back up this point.

As most of us would expect, tax rate as a primary concern of tax burden, is also a key incentive for evasion behaviors in many occasions. Recent work by Fisman and Wei (2004) explore the relationship between tax rates and tax evasion, using export-import data from China and Hong Kong. They find tax evasion (of value added tax) positively related to tax rates, negatively correlated with tax rates on closely related products, suggesting misclassification from higher-taxed categories to lower-taxed ones as a source of evasion, in addition to underreporting the value of imports. However, in the previous work by Friedman *et al.* (2000), empirical evidence shows higher tax rates are associated with less unofficial activity as a percent of GDP, but corruption is associated with more unofficial activity, thus suggesting entrepreneurs going underground not to avoid taxes but to reduce bureaucracy and corruption burden. As one possible yet controversial determinant for tax evasion, this paper also tests the role that actual tax rates play in evasion decisions in the later empirical part and found no evidence supporting its effect in this paper's context.

2.1.2. Narrow informality in our scope: tax noncompliance decisions

Compared with the broader informality, which explains in macro level the size of underground economy (e.g. output from unregistered firms and undocumented jobs, etc), narrower definitions of informality focus on firm or individual level, which mainly focus to the informal tax activities within legally registered firms: “The part of tax liabilities that is legally owned but not reported or paid”¹⁰.

Allingham and Sandmo (1972)'s seminal work on income tax evasion is probably still

¹⁰ Cited from Slemrod (2000)

the most important and irradiative work in the field of tax evasion, in their theoretical analysis, static and dynamic aspects of the decision to evade taxes are examined, with simple and intuition conclusions on the optimal evasion issue, their model structure will be further discussed in the next section. Slemrod and Yitzhaki (2002) have reviewed and expanded the discussion of optimal tax responses and suggested policy implications regarding tax structure changes.

Individual tax noncompliance is a fiscal concern which has caught much public attention, however accurate statistics of individual tax noncompliance is difficult to obtain. Previous efforts have either base on audits of tax returns or from household survey data. Besides these methods of using data from audits and tax authorities (Tax Compliance Measurement Program of the IRS in U.S. is a frequently cited example), Pissarides and Weber (1989) (PW thereafter) developed a pioneering alternative to estimate self-employed taxpayer compliance without relying on audit programs, by assuming same preferences regarding food of self-employed households and regular employees. The differences by employment status in the relationship between reported income and food expenditures are attributed to underreporting¹¹. The PW method has been applied and developed to examine other countries. For instance Feldman and Slemrod (2007) presented new evidence from unaudited tax returns in US using the PW method, taking the differences in the relationship between charitable contributions and the source of income as measurement of individual tax evasion¹².

Regarding corporate tax noncompliance, recent trend in the empirical study is to employ firm-level data to explore its determinants. Aureo and Scheinkman (2007) present two related equilibrium models of determinants for tax noncompliance (tax avoidance in their scope), and test implications utilizing survey data of more than 48,000 small underground firms in Brazil. They find the interaction of manager's education and formality positively correlated with firm size. Their contributions also lie in the role of VAT for transmitting informality, and predict informality of a firm is correlated to the

¹¹ They estimated income tax evasion of self-employed in UK is around 35%.

¹² They found implied amount of noncompliance significant and varying by source of income.

informality of firms from which it buys or sells. However the chain effect of credit system vanishes when VAT is applied only at some stage of production.

Notably among recent empirical works for corporate tax noncompliance, Johnson *et al.* (2000) found bureaucratic corruption significantly associated with tax evasion in five eastern European countries, after controlling for other determinants such as tax rates, incidence of mafia protection and faith in court system; Dabla- Norris *et al.* (2008) review former studies on acknowledged factors such as tax, regulation, financial market and legal system, and show¹³ that the quality of legal framework is crucial in determining the size of informal sector, while firm size, financing constraints, and legal obstacles also playing important roles, concluding that higher tax and regulatory burden reduce firms' formal operations. Empirical results are reported to back up the point that higher tax and regulatory burden reduce firms' formal operations. Their latest IMF working paper extends the line to firm growth, with empirical evidence supporting the role that tax evasion plays as an important channel (together with regulatory and other policy constraints) through which affecting firm growth.

This paper deals exclusively on tax evasion issue, which is regarded as a subcategory of informality, as illustrated in Table 1. Broader definition of informality often refers to the underground economy, which remains in the illegal and shadow side of economic activities, is not in the scope of this paper.

2.2. Competition issue

Competition has been traditionally viewed as a tool for achieving efficiency and greater social welfare. However its negative effects have also been subject to controversies.

Theoretical discussions and analyses have covered topics such as information content on performance measures, role of managerial inputs, probabilities of liquidation and strategic incentive contracting, etc. However generally, these analyses indicate

¹³ They used survey data from WBES (World Business Environment Survey), which is carried out by World Bank.

ambiguous effect of competition on managerial efforts and firm performances. To name a few, Milgrom and Roberts (1992) point that moral hazard could be induced by competition pressure in the savings and loan (S&L) industry in the United States, with managers gambling on risky investment for survival; Schmidt (1997) also illustrates the ambiguous effect of competition, showing increasing competition increases firm's liquidation probability and therefore increase managerial incentives, but also reduces the firm's profit, which makes high efforts unattractive, thus the total effect is ambiguous.

Unethical activities induced by over-competition are also presented by Shleifer (2004): Child labor, corruption, earnings manipulation and excessive executive pay. Shleifer further argues that it's sometimes far from obvious that discouraging these censured activities is efficient. Cummins and Nyman (2005) presented another dark side of competition, when firms know better than customers the benefits of different alternatives, competition pressure may inhibit efficiencies by forcing firms to cater excessively to customer opinions. These works illustrate the point that effects of competition depend on the tools firms reply in order to compete in the market. Therefore when firm use illegal or socially-selfish means to cope with competition pressure, the outcome could be morally controversial or socially undesirable. And as one of the most direct ways to relieve competition pressure, tax evasion to retain profits will equip firms with more resources, financial flexibilities, and thus more advantageous than their competitors, which is under this paper's scrutiny.

Literature on the specific impact of competition on tax evasion issue is quite limited, often exploring broadly but ambiguously on the manager's incentives under competition pressure. For an interesting lab experiment, Schwieren and Weichselbanmer (2008) show that competing for a desired reward does not only affect individual's performance, but also their tendency to cheat. In their experiments, poor performers significantly increase cheating behaviors under competition pressure, due to reasons such as face-saving or attempting to retain a chance of winning.

As a most relevant attempt and a closer look into developing countries, Cai, Liu and Xiao (2007) employ data of more than 20,000 large-and-medium-sized industrial firms in China during 1995 to 2002, and find that firms in more competitive environment and relatively disadvantageous positions hide larger shares of profits. Their paper suggests policies providing equal opportunities for enterprises to avoid firms seeking unlawful means to compensate such disadvantages. Cai, Liu and Xiao (2007) is by far the most relevant empirical work directly supporting the adverse effect that competition could bring to firms: Tax evasion or avoidance (As the two activities are not distinguished in their paper), as underlying incentives to seek compensation for competition pressures. In that paper, a theoretical model is developed and testable hypotheses are presented, that a firm's incentive to hid profits are positively correlated with product market competitiveness, negatively correlated with its accessibility to capital market, and firms with disadvantageous market positions tend to have stronger incentives to hide profits. Their empirical analysis controlled for firm characteristics, and found firms facing higher tax rates, tighter financial constraints and smaller sizes report lower profit for each unit of imputed profit, consistent with their theoretical predictions.

In Cai, Liu and Xiao (2007), three measures of competition are utilized: The number of firms, concentration measure and industry average profit margin. The measure of tax evasion or avoidance¹⁴ comes from the differences between calculated and reported profits. They acknowledge that the calculated profit (from deducting intermediate inputs from gross outputs) could differ from true accounting profit for several reasons¹⁵, and assume that the imputed profit and true accounting profit are positively correlated to guarantee the validness of their findings, as the theoretical predication and empirical findings both deal with sensitivity of tax evasion (which is the reported profits to imputed profits). Robust results are presented with OLS regressions and 2SLS regressions instrumented for imputed profit and competition. In the latest empirical

¹⁴ Their work does not distinguish between evasion and avoidance behaviors.

¹⁵ The difference is mainly due to differences in revenue and expenses recognition rules. For instance, gross output in the current year may convert to revenues in many years; Depreciation rules may also differ; Tax credits and tax loss carry-overs may also enlarge the computing errors.

paper by Cai and Liu (2009), similar results are found that firms in more competitive environments engage in more tax avoidance activities, with robust and consistent results. Except in addition a natural experiment is investigated on competitive environment (lifting of restrictions on foreign investment) for two industries in China. Besides, 3-digit and 4-digit industry classifications are utilized, instead of the 2 and 3-digit classifications in their previous work.

This paper extends the line of argument that competition pressure would have undesirable consequences. As one of many unlawful means to gain relative advantages in market and compensating competition's pressure, firms might engage in illegal activities such as tax evasion, or even ultimate tax avoidance¹⁶: quit.

In comparisons with Cai and Liu (2009), this paper utilizes rich cross country firm-level data from diverse sector and industries, which is providing empirical evidence that applies to broader perspectives, while Cai and Liu (2009) adopts data from manufacturing firms in China only. As to the competition measure used, the number of firms, concentration measures and industry average profit margin are utilized in Cai and Liu (2009), which provides more robustness to their findings; this paper uses mainly a unique measure on price elasticity (or product substitutability) to approximate the competition situation firms face. The measure on tax evasion also differs. Cai and Liu (2009) uses the differences between calculated and reported profits as a measure of tax evasion, this measure also suffers from arguments that calculated profit could differ from true profit for many reasons. The validity of their findings is guaranteed as their paper also deals with the sensitivity of evasion. This paper draws its measure on tax evasion from a survey question asking about a typical firm's reporting behavior in its industry. The validness and possible criticism of this measure are elaborated in section 5.2.

¹⁶ Tax avoidance mentioned here refers to firm's overall behavior/decision to avoid all forms of taxation by not registering and go completely underground.

Chapter 3: Theoretical Setup

3. Theoretical Setup

3.1. Incentives for tax evasion

I develop along the line with Allingham and Sandmo (henceforth A-S)(1972)'s seminal paper on the formulation of economic model for income tax evasion, and focus on the role that competition plays in determining corporate evasion levels.

As in the A-S model, actual taxable income (or profit, sales) Π and corresponding tax rate t (ad valorem tax) are exogenously given and known to the tax payer. Tax authorities cannot observe the real taxable income without cost; Taxpayers choose to report income X to maximize utility¹⁷ under the risk of being caught (with probability p). If evasion behaviors are detected, penalty would be levied on the under-declared income $\Pi - X$ with a penalty rate α (This paper assumes in most cases, penalty rate α is higher than tax rate t), formally as:

$$E(U) = (1 - p)U(\Pi - tX) + pU[\Pi - tX - \alpha(\Pi - X)] \quad (1)$$

For notational convenience, after-tax income is defined as $Y = \Pi - tX$, and after-detection income is defined as $Z = \Pi - tX - \alpha(\Pi - X)$, so the expected utility could be rewritten as: $E(U) = (1 - p)U(Y) + pU(Z)$.

The first-order condition for an interior maximum of the expected utility is as follows:

$$-t(1 - p)U'(Y) + (\alpha - t)pU'(Z) = 0 \quad (2)$$

And the second-order condition is

$$D = t^2(1 - p)U''(Y) + (\alpha - t)^2pU''(Z) \quad (3)$$

The expected utility satisfies the second-order condition by assumption of concavity of utility function.

The existence of interior maximum requires the following corner values of X be discussed:

$$\left. \frac{\partial E(U)}{\partial X} \right|_{X=0} = -t(1 - p)U'(\Pi) - (t - \alpha)pU'(\Pi(1 - \alpha)) > 0 \quad (4)$$

17 Von Neumann-Morgenstern utility function is used here. $U'(W) > 0$, $U''(X) < 0$.

$$\frac{\partial E(U)}{\partial X} \Big|_{X=\Pi} = -t(1-p)U'(\Pi(1-t)) - (t-\alpha)pU'(\Pi(1-t)) < 0 \quad (5)$$

These two conditions could be rewritten into constraints on parameters as

$$t \left[p + (1-p) \frac{U'(\Pi)}{U'(\Pi(1-\alpha))} \right] < p\alpha < t \quad (6)$$

The right hand side of the constraint suggested that when expected tax punishment on under-reported amount is less than formal tax payment, taxpayers would declare less than actual income. In other words, taxpayers will commit tax evasion. This point could be also be seen from another perspective as: Each dollar of evasion will yield a payoff of t with probability $(1-p)$, together with a penalty of α with probability p , so expected payoff of one dollar's evasion would be: $(1-p)t - p\alpha$. While the actual evaded amount would be determined by the values of expected payoff and taxpayer's own risk preferences.

3.2. Comparative Static Results

The impact on optimal evasion from factors such as initial income Π , tax rate t , punishment strength α , and detection possibility p , is of much importance in both theoretical and practical aspects. Comparative static results will be explored into these effects, by first employing Arrow-Pratt risk aversion measures, absolute and relative risk aversion functions are defined respectively as:

$$R_A(W) = -\frac{U''(W)}{U'(W)} \quad \text{and} \quad R_R(Y) = -\frac{U''(W)}{U'(W)}W \quad (7)$$

The above equations (1) to (7) were the same from A-S model, however in A-S model, no specific assumptions about the shape of utility function are carried except the general consensus of utility's properties that $U'(W) > 0$ and $U''(W) < 0$. However even on that simply-set skeleton, following discussions on comparative static impacts by various factors on evasion incentives could not lead to clear-cut conclusions.

In order to explore more specifically into the following effects, this paper assumes a quadratic utility function: $U(W) = aW - bW^2$ (where the parameters $a > 0$ and $b > 0$, W is wealth, same as the initial income Π in previous context). Therefore, the absolute and relative risk aversion from this form of utility function will be:

$$R_A(W) = \frac{2b}{a-2bW} \quad \text{and} \quad R_R(W) = \frac{2b}{\frac{a}{W}-2b} \quad (8)$$

In this case, both absolute and relative risk aversion are increasing in wealth.

3.2.1. Wealth's Effect and Competition

The effects of initial wealth changes on the optimal tax evasion level (which is the evasion incentive) are firstly explored, the following equations (9) to (12) are the same as those in A-S model.

In order to specify the effects of wealth changes on optimal evasion incentives, differentiating the first-order condition in equation (2) with respect to Π , and solve for $\frac{\partial X^*}{\partial \Pi}$ will obtain:

$$\frac{\partial X^*}{\partial \Pi} = \frac{1}{D} [t(1-p)U''(Y) + (t-\alpha)(1-\alpha)pU''(Z)] \quad (9)$$

By utilizing the equivalent relation from the first-order condition in equation (2) and the risk aversion definitions in equation (7), the above equation (9) could be rewritten as:

$$\frac{\partial X^*}{\partial \Pi} = -\frac{1}{D} t(1-p)U'(Y)[R_A(Y) - (1-\alpha)R_A(Z)] \quad (10)$$

With the assumption of a quadratic utility function, absolute risk aversion is increasing in wealth, therefore $R_A(Y) > R_A(Z)$. Since $\alpha \geq t$ and is definitely positive, $(1-\alpha)$ will be less than one, therefore the derivative $\frac{\partial X^*}{\partial \Pi}$ is positive, which means when profit increases, optimal declared income will also increase. In other words, when fierce competition lowers corporate income, optimal reported income for tax purpose will consequently decline. Compared to the same discussion of wealth's effect In A-S model, without any assumptions about utility form and with an assumption of decreasing absolute risk aversion, the above equation (10) could be only unambiguously positive when $\alpha > 1$. The assumption of a penalty rate higher than one implies severe punishment upon detection of tax evasion, and oftentimes fails in reality to guarantee the positive derivative, as tax authorities do not always collect more than the under-reported income $(\Pi - X)$ as penalty, but usually fines comparably to the evaded tax amount $t(\Pi - X)$. In short, $\frac{\partial X^*}{\partial \Pi}$ is positive as long as absolute risk aversion is increasing, or $\alpha > 1$. Any utility function with increasing ARA, for instance the quadratic utility

function used in this paper, or other forms of utility function while $\alpha > 1$, could guarantee the positive sign.

However, the above conclusion considers only the actual amount of evasion, which could be misleading if examined solely, as the evasion horizon is constrained by firm's income. The decline of evasion amount could mean no improvement in the firm's tax morale, but possibly due to the declining profits, that firms have less to evade. Thus the percentage of evasion is also an interest of study. Researchers and tax authorities may need to combine these two aspects in measuring the seriousness of evasion, and check into both measures of tax evasion: On actual amount and on evasion percentage. The percentage measure of tax evasion shows the severity of evasion issue, and controls for the income change. Small firms may have evaded quite limited amount of tax, however compared to its total taxability the percentage could seem substantial; while big established corporations may have evaded huge amount of money, yet the evasion problem seems less serious if compared to its large profits.

The evasion percentage $1 - \frac{X}{\Pi}$ reflects the severity of evasion behaviors, and its derivative with respect to Π , which is $\frac{\partial(1-\frac{X^*}{\Pi})}{\partial\Pi}$, has opposite sign to that of $\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi}$. The sign of $\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi}$ suggests the way how reported percentage will vary when actual taxable income varies. As $\frac{\partial(\frac{X}{\Pi})}{\partial\Pi} = \frac{1}{\Pi^2}(\frac{\partial X}{\partial\Pi}\Pi - X)$, plugging into equation (9) and (3), will obtain:

$$\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi} = \frac{1}{\Pi^2 D} [t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z] \quad (11)$$

Again using the relationship in equation 2, the derivative above could be rewritten into:

$$\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi} = -\frac{1}{\Pi^2 D} t(1-p)U'(Y)[R_R(Y) - R_R(Z)] \quad (12)$$

The above equations (11) and (12) are the same as in A-S, and the property of relative risk aversion will determine the sign of $\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi}$. The fraction declared will increase, decrease, or remain constant if relative risk aversion is increasing, decreasing, or constant. By the previous assumption of a quadratic utility function, the relative risk

aversion is increasing in wealth: $R_R(Y) > R_R(Z)$. Therefore, the above equation will be positive, indicating increasing income renders firms report more and evade less. The sign of wealth's effect suggests mainly an income effect, as if when firms are better-off, they have relatively less incentive to evade. Controversies have always been existent about whether relative risk aversion is increasing or decreasing, and in both directions abundant literature flourishes. The assumption of increasing relative risk aversion adopted in this paper does not guarantee or favor either side of the issue, however the increasing relative risk aversion is supposed in accordance with the empirical findings presented in later content of the paper, that firms with higher corporate income evade less tax, *ceteris paribus*.

As the form of the quadratic utility indicates diminishing marginal utility of wealth, it also suggests the possibility of a diminishing income effect on optimal ratio of tax evasion. Thus this paper takes again the derivative in equation (11) with respect to Π :

$$\frac{\partial^2 \frac{X^*}{\Pi}}{\partial \Pi^2} = -\frac{2}{\Pi^3 D} [t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z] \quad (13)$$

As $-\frac{2}{\Pi^3 D}$ is positive, the sign of the two bracketed terms: $t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z$, will determine the sign of $\frac{\partial^2 \frac{X^*}{\Pi}}{\partial \Pi^2}$. As the negative first term minus the negative second term¹⁸, the absolute value of the two terms will determine the sign. Use equation (2) to rewrite the second term in the middle brackets, the fraction of the two terms is as follows: (Proofs of the equations are attached in the appendix)

$$\frac{t(1-p)U''(Y)Y}{(\alpha-t)pU''(Z)Z} = \frac{\frac{(\alpha-t)U'(Z)}{U'(Y)}U''(Y)Y}{(\alpha-t)pU''(Z)Z} = \frac{R_R(Y)}{R_R(Z)} > 1 \quad (14)$$

With the increasing relative risk aversion of utility functions, $R_R(Y) > R_R(Z)$ so the fraction is larger than one, thus $t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z < 0$. The derivative $\frac{\partial^2 \frac{X^*}{\Pi}}{\partial \Pi^2}$ therefore is negative. The sign of equation (14) supports the diminishing marginal effect of income on the ratio of tax evasion. Combine equation (12) and (13), a positive, yet decreasing effect of wealth appear with respect to the ratio

¹⁸ Again, the assumptions that $t < \alpha < 1$ and $p < 1$ is used here.

of reported percentage $\frac{X^*}{\Pi}$.

3.2.2. The Effect of Tax Rates

Apply the same procedures with respect to tax rate t , again differentiate the first-order condition (equation 2) with respect to t , and then using equation 2 will lead to:

$$\frac{\partial X^*}{\partial t} = \frac{1}{D} X t (1 - p) U'(Y) [R_A(Y) - R_A(Z)] + \frac{1}{D} [(1 - p) U'(Y) + p U'(Z)] \quad (15)$$

The second term is unambiguously negative, while the sign of the first term is positive, negative or zero according as absolute risk aversion is decreasing, increasing, or constant. By the previous assumption of a quadratic utility function, the first term on the right hand side is negative, and the overall effect would be negative. These two terms have been stated in A-S model as compensating effects (when absolute risk aversion is decreasing): The first term as income effect, as higher tax rate leaves taxpayers with less money at hand, thus reduce possible evasion horizon, Y and Z as well for any level of X ; The second term can be regarded as substitute effect, that higher tax rates make evasion more attractive at the margin. Thus the two effects render the actual sign of tax rate's effect hard to determine. However, this point is challenged by Yitzhaki (1974) and will be discussed later on in section 3.2.5.

3.2.3. The Effect of Punishment

Use again the above procedures to explore the effect of penalty rate α on declared income will obtain:

$$\frac{\partial X^*}{\partial \alpha} = -\frac{1}{D} (\Pi - X)(t - \alpha) U''(Z) - \frac{1}{D} p U'(Z) \quad (16)$$

This time, both terms on the right hand side are positive, suggesting more severe punishment leads to an increase in the reported income.

Sometimes the punishing practice regarding small amount evasion is to exert a fixed fine besides the α times evasion amount, denoted by C . In such case the expected utility becomes:

$$E(U) = (1 - p)U(\Pi - tX) + pU[\Pi - tX - \alpha(\Pi - X) - C] \quad (17)$$

Define after-detection income as $Z_1 = \Pi - tX - \alpha(\Pi - X) - C$, then the first-order and

second-order condition will be the same as in equation (2) and (3), after replacing Z for Z_1 . Again solve for the impact of higher fixed fine C on optimal declared X^* will obtain:

$$\frac{\partial X^*}{\partial C} = \frac{1}{D} (\alpha - t)pU''(Z_1) \quad (18)$$

The sign of the derivative above is unambiguously positive, suggesting increasing fixed penalty will deter tax evasion, complementing the predictions as in equation (15).

The consequences of evasion detection do not limit to penalties only, there are many other costs associated with detection, such as reputation loss, trial costs, etc. These costs vary in different firms and can hardly be measured accurately, especially the non-financial costs. The introduction of a fixed fine C also helps to capture and explain the phenomenon. A fixed fine can be interpreted as the general condition of loss a firm would expect to experience besides the penalty exerted, and a higher value of C would signal more serious loss and deters the evasion of tax.

3.2.4. The Effect of Detection Probability

Finally, differentiate the first-order condition with respect to probability of detection p :

$$\frac{\partial X^*}{\partial p} = \frac{1}{D} [-tU'(Y) + (t - \alpha)U'(Z)] \quad (19)$$

The two terms in the brackets are both negative, thus $\frac{\partial X^*}{\partial p} > 0$; A higher probability of detection will lead to a higher reported income, the prediction accords to common intuition that higher risk will terrify taxpayers and deter illegal tax manipulations.

The probability of being detected, p , as representing effectiveness of tax administrations and quality of legal system, despite relatively constant within a given country, could be reasonably assumed as a function of certain factors, such as firm characteristics, which will be further discussed in hypothesis 2.

3.2.5. Relevant Discussions

One important amendment to the previous A-S model is suggested by Yitzhaki (1974),

who claims tax rates become neutral if fines are exposed on the evaded amount, not on the under-reported income. The amended utility function will be:

$$E(U) = (1 - p)U(\Pi - tX) + pU[\Pi - tX - \alpha t(\Pi - X)] \quad (20)$$

In this case, one dollar of tax evasion will generate expected utility as:

$$E(U) = (1 - p)t - p\alpha \quad (21)$$

And the marginal utility of net income in audited world to the marginal utility in unaudited world will be independent of tax rate t as:

$$\frac{MU(W_a)}{MU(W_u)} = \frac{1-p}{p\alpha} \quad (22)$$

As equation (15) shows, the original A-S model presents positive income effect (with assumption of decreasing absolute risk aversion) and negative substitution effect. However the substitution effect disappears when penalty is composed on the evaded tax, leaving only a positive income effect, and therefore it seems that higher tax rates encourage more truthful tax reporting behaviors. This leads to a conclusion that contradicts most people's intuition about the relation between tax rate and evasion, and contrary to much empirical evidence, as Sandmo (2005) also pointed. For instance, Clotfelter (1983) found strong positive association between marginal tax rates and evasion amount. This paper avoids the contradiction by the increasing absolute risk aversion assumed, as income effect of tax rate would be negative, thus the disappearance of substitution effect does not change the direction of tax rate's effect on evasion incentive, which accords to common intuition and much empirical evidence.

However, even by the unambiguous effect of tax rates in this paper, policy implications are not clear-cut on this issue. Tax authorities can not always expect higher levels of tax evasion in presence of high tax rates, as situations are oftentimes complicated when different firms face various marginal tax rates, or firms in certain areas receive tax subsidies or favorable tax policies, thus making the predictions ambiguous.

And possibly, as the evasion amount/percentage goes up, the probability of being caught, which is an increasing function of evasion, also rises. Slemrod and Yitzhaki (2000) presented this possibility and showed evasion will be constrained by the fact that detection probability increases to offset the benefit from hiding. One reason for this

could be that the reported tax accounts appear more dubious to tax authorities or external auditors, arguably for mostly bigger firms, as small firms lack enough disclosure of information and are more effort-taking to investigate.

Chapter Four: Hypotheses Development

4. Hypotheses Development

Base on the simply model above, I develop the following hypotheses.

4.1. Wealth Effect:

4.1.1. The effect of Competition

Hypothesis 1A:

As competition grows more intense, firm's tax evasion incentives are strengthening, however the effect is at a decreasing rate.

It corresponds to common intuition that when firms have more profits and are less constrained by financial circumstances, firms may evade less tax as they probably do not need to undertake the risk. As equation (12) shows, the optimal reported fraction increases with profit (Π), which corresponds to the previous guess that increasing profit reduce tax evasion.

Further, the prevalent assumption of diminishing returns of income in utility functions, is also the case in this paper, where a quadratic utility function with the form $U(W) = aW - bW^2$ has such property¹⁹ as $U''(W) = -2b$. As suggested by the law of diminishing marginal returns, it is reasonable to further explore the marginal effect of profit on its incentive to evade taxes, as equation (13) shows. With $\frac{\partial(x^*)}{\partial\Pi} > 0$ and $\frac{\partial^2(x^*)}{\partial\Pi^2} < 0$, profit displays a decreasing positive effect on evasion incentives.

As market competition grows fiercer, total profits for all firms fall. This paper does not assume any specific market structure, but adopts a reasonable assumption that a firm's profit Π is a decreasing function of the competition degree in its product market, as $\frac{\partial\Pi}{\partial(\text{competition})} < 0$. As competition grows fiercer, not only profit margins fall and corporate incomes shrink, but the benefits derive from tax evasion also gradually lose

¹⁹ And of course, in order to guarantee $U'(W) = a - 2bW > 0$, $a/2b$ needs to be larger than W .

its attractiveness as marginal utility from illegally retained tax is declining.

With the previously explained equation (12) and (13), by the positive sign of $\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi}$ and negative sign of $\frac{\partial^2\frac{X^*}{\Pi}}{\partial\Pi^2}$, optimal declared income fraction $\frac{X^*}{\Pi}$ displays a decreasing effect: When Π increases, optimal declared fraction $\frac{X^*}{\Pi}$ increases at a declining rate (as with a concave shape). As corporate profit Π is a decreasing function of competition, and as evasion ratio $\frac{\partial(1-\frac{X^*}{\Pi})}{\partial\Pi}$ is of the opposite sign as that of $\frac{\partial(\frac{X^*}{\Pi})}{\partial\Pi}$, evasion fraction is thus exhibiting a decreasing effect with respect to competition. More specifically, the decreasing positive effect holds as long as utility function has increasing absolute risk aversion and decreasing risk aversion. The form of quadratic utility used in this paper is one of many possibilities that satisfy the requirements.

This paper uses the measurement of competition and its square term to capture the effect of the negative second derivative as well as the diminishing marginal effect. The practice of putting an explanatory variable and its square term dated back from the influential work of Mincer (1974), where experience and the square of it are put into wage determination equation, and similar results are found that experience has a diminishing effect on wage. This paper also adopts the method to use an explanatory variables and its square term to capture the diminishing contribution of one determinant, which is competition in this paper's context.

However, evasion amount $\frac{\partial X^*}{\partial\Pi} > 0$ and $\frac{\partial^2 X^*}{\partial\Pi^2} = 0$, so there exists only a positive relationship between wealth and optimal declared amount. As mentioned before, evasion amount alone is not comprehensive in judging the seriousness of evasion behaviors, especially for firms of different size and profitability. The evasion ratio is of more emphasis in this paper, and also the key examined part in empirical section later on, which echoes the hypothesis 1.

4.1.2. The Effect of Business Constraints

Hypothesis 1B:

Higher levels of business obstacles induce higher level of tax evasion.

High business barriers on one hand, as sunk cost accounted when firms enter the market, pushes firms to seek for more profits to compensate these costs, which might turn into informal tax practices; And on the other hand inhibit normal business operations and growth, drag down the profits horizon, which further encourages the evasion of tax. As the positive sign of $\frac{\partial(x^*)}{\partial\Pi}$ suggested, higher levels of business obstacles reduce Π , therefore enhance evasion incentives. These effects from business barriers serve in the same direction on evasion incentives as competition does, however probably smaller in magnitude.

Cai, Liu and Xiao (2007) hypothesized firm's evasion incentives are negatively correlated with its accessibility to capital market, and empirically tested that financing constraint (as one of many market positions influencing profit reporting behaviors), is significantly reinforcing evasion incentives. Dabla-Norris *et al.* (2007, 2008) also empirically found general constraints such as financing, corruption, taxes and regulations render firms hide more sales; Business constraints such as access to financing, tax rates, crime, unfair practices also play the similar role in encouraging higher level of evasion in their findings.

Main business obstacles tested in this paper include: tax rate, tax administration, corruption, and unfair practices. These obstacles function in a similar way as the competition does in the first hypothesis, in a direction that restrains firm's growth as well as profits. The differential in magnitude of these effects can be presumed smaller than that of competition, since the latter is usually the key determination of firm's profit functions, as firms generally will evolve and adjust according to its competition status in relevant market. It can be seen in empirical results that competition and its square term have a much larger role as well as marginal effects than other business obstacles.

Aureo and Scheinkman (2007) prove theoretically that the informality of a firm is correlated to that of firms from which it buys or sells. This point is tested in this paper by examining whether financing channels affect tax evasion levels, which is illustrated in later context.

Although compared to normal banking-financing, the average informal-channel financing level is quite low in the coverage of data in this paper, it displays a strong positive relationship with the tax evasion levels for surveyed firms. With informal, sometimes private or underground sources of fund, it's often much easier to fake financial figures and make up numbers for its cost, which renders evasion of tax quite easy to implement. However endogeneity issue also arises here, since it could be reasonable argued that firms may seek informal financing from the starting point of trying to evade taxes. Firms may decide to evade taxes at the beginning, and then figure out several ways to achieve the goal, and sometimes arrive at a solution called informal financing, which will be discussed in later context.

4.2. Effect of Firm Characteristics

Hypothesis 2:

Firm characteristics such as size, age, audit condition, influence tax evasion incentives.

As the positive sign of $\frac{\partial X^*}{\partial p}$ in equation (18) implies, higher detection probability renders a higher amount of income reported, therefore deters tax evasion. Firm characteristics significantly influence detection probability as these characteristics alter exposures to tax authorities, or render firms seem dubious in many ways.

Firm size for instance, is a significant determinant of tax evasion. As more often exposed to the supervision of the public and tax authorities, bigger firms relatively have higher probability of being detected of tax manipulations, if any. Therefore, bigger firms tend to evade less, *ceteris paribus*. Dabla-Norris *et al.* (2007, 2008) use dummies of small and big firms and find significant size effect, that small firms display higher

evasion levels while big firms display negative tendency. This paper also tries different measures of size, either by 3 or 5-level size classifications, or by the number of employees, in both cases the empirical results, as shown later on, correspond to the hypothesis that bigger firms evade less tax.

Firm age, as another determinant for evasion incentives, interact with detection probability in the same direction as size. The longer the firm has been operating on the market, the more reputation it has earned over years of service, and it might be more difficult for long-established firms to manipulate on tax, since the loss of loyalty and reputation is more severe for these firms and managers. Besides, compared to newly registered firms, tax authorities probably have been more familiar with the financial situation and performance of long-established ones, which makes detection probability higher, and tax evasion more difficult to operate for these firms.

Having an external auditor also greatly increases the probability of being detected of tax manipulations, especially when firms are publicly listed. As ethical codes and professionalism require integrity, objectivity and independence of external audits, and as maintaining a good reputation is considered to be the single most important ethical principle for external auditors, firms with external auditors have a much higher probability of detection if tax evasion is committed. Thus the higher risk associated with being exposed deters evasion activities.

Ownership and legal status also matter. Compared to domestic firms, foreign firms in many countries are constantly supervised or regulated, and are more often the focus of public attention. Plus the fact that many foreign firms are in the form of subsidiaries or branches of successful MNCs, which usually have well-performing records and considerable profits, which make themselves important tax revenue generators. Therefore, it's generally riskier for foreign firms to evade taxes as they face higher detection probability, therefore rendering these firms evade less. Besides the general classification of domestic and foreign firms, legal status also displays different effects

on evasion levels. Public listed companies appear with the lowest level of evasion, followed by partnership and private-held limited companies, while sole proprietorship appears with the highest evasion levels, which accords to common sense that publicly traded companies are under pressure and supervision from many sources, while sole proprietorship might be the least supervised and investigated form of legal status.

Chapter Five: Data and Empirical Results

5. Data and Empirical Results

5.1. Data Description

This paper mainly employs data from Productivity and the Investment Climate Private Enterprise Survey, which is carried out by the World Bank, covering 72 countries and regions, 48261 surveyed firms during 2002 to 2005. Other sources such as World Governance Indicators, “DoingBusiness” dataset supplements the empirical findings.

Productivity and the Investment Climate Private Enterprise Survey (PICPE thereafter), which a comprehensive survey regarding various business climate, is carried out by the World Bank. “The Surveys use standardized survey instruments and a uniform sampling methodology to minimize measurement error and to yield data that are comparable across the world’s economies. The use of properly designed survey instruments and a uniform sampling methodology enhances the credibility of World Bank analysis and the recommendations that stem from this analysis. The sampling methodology of the World Bank’s Enterprise Survey generates samples sizes appropriate to achieve two main objectives: First, to benchmark the investment climate of individual economies across the world and, Second, to conduct firm performance analyses focusing on determining how investment climate constraints affect productivity and job creation in selected sectors.”²⁰

5.2. Key Variables

This paper draws the measurement of tax evasion (the dependent variable²¹), which is the estimated percentage of total sales kept off for tax purposes, from one of the survey questions: “Recognizing the difficulties many enterprises face in fully complying with taxes and regulations, what percentage of total sales would you estimate the typical establishment in your area of activity reports for tax purposes?”

²⁰ See the Implementation Note for PICPE from World Bank, February 2007.

²¹ See the appendix, Table 11 for detailed variable definitions and sources.

Arguably, the survey question used to measure tax evasion raises some concerns, as the questionnaire asks for a typical firm's tax reporting behavior in the respondent's industry, but not directly for the surveyed firm itself. However, since tax noncompliance (especially illegal tax evasion) is highly confidential and crucial information that could not be easily retrieved from outside the firm, surveyed managers (together with chief financial officer and chief executive) presumably respond according to their own experiences, and the responses could be reasonably interpreted as truly indicating the firm's own behavior. Previous empirical work utilizing similar data sources also acknowledges this issue and proceeds in the same way with caution, as in Dabla-Norris *et al.* (2008). This paper also regards this measure as a proper proxy for tax evasion in firm's reporting behaviors.

Although previous theoretical predictions suggests both evasion amount and percentage will increase when competition increase (firm income decline therefore), this paper only tests the evasion percentage empirically. The measurement of actual evasion amount fails to provide convincing cross-country comparisons as the amounts are listed in local currencies and purchasing powers differ across countries.

One determinant of tax evasion that needs most attention is the unique measurement of competition, which can serve largely as product substitutability. The measure comes from one survey question: "If you were to raise your prices of your main product line or main line of services 10 percent above the current level in the domestic market (after allowing for any inflation), assuming your competitors maintained their current prices, how would your customers react?" Firms were asked to select from four indexes below:

- 1: Continue to buy from us in same quantities as now;
- 2: Continue to buy at slightly lower quantities;
- 3: Continue to buy at much lower quantities;
- 4: Stop buying.

Therefore, large values of the measurement mean more competition. This unique measure of competition absorbs information regarding the surveyed firm's competitive status in its relevant market. Compared to other measures such as the number of competitors, the latter suffers from lack of assumption of the market structure and competition degree. For instance, a monopoly which takes up nearly all domestic market, leaving only narrow survival space for small local competitors, would not experience significant decline in sales if it raises price within acceptable range with inelastic demand. Other utilized measures of market share such as HHI index and CR-N ratio, nevertheless also fail to provide comprehensive information about price elasticity or product substitutability of competing firms. If products are geographically isolated or consumers are mostly very brand-loyal and price insensitive, raising price of products will not be encountered with significant sales decline. In circumstances similar to those listed above, the measures of competition fail to provide insightful information about competition, and firms do not fear the competition pressure, therefore their incentives to evade taxes as an alternative to gain competition advantage are reduced.

The main measurement of competition²² employed by this paper, although not perfect, is nevertheless a unique measure and provides some insights, as it serves the same function as price elasticity or product substitutability. Another possible measurement of competition is the number of competitors faced by individual firm in its product market, supposing that increasing number of competitors would enhance competition, and through some underlying way, enhance firms' incentives to hide profit for tax purpose, in order to gain a relatively advantageous position in market. However in many real-world cases, the number of competitors often fails to describe the market structure and cannot provide insightful information about firm's competition status. For instance, there could be numerous small businesses providing daily groceries in each neighborhood, meanwhile there exists national chain-store supermarkets monopolizing whole domestic market and owns overwhelming market shares. In such case increasing the number of small local firms does not affect the sales of the monopoly and does very

²² See Appendix II for its detailed definition.

little effect on the market.

It is also argued that the relationship between concentration and competition is ambiguous. For instance, fierce competition may not exist if firms in highly concentrated market collude and manipulate prices; Competition may also be very intense in low-concentrated market, where innumerable firms compete on zero profit and in perfect competition. Prior empirical approaches mainly use market concentration as sole measures for competition. For instance, Herfindahl-Hirschman Index (HHI thereafter) and four-firm concentration ratio (CR-4 ratio), which suffer the weakness to describe the actual market structure and competition degree, although much prior research has used a single measure of concentration as measurement of competition, (e.g., Harris, 1998; Engel et al., 2003). These studies inherently assume that market structure is exogenous, that prices decline as concentration falls, and thus that lower concentration reflects higher competition. However, endogenous market structure indicates ambiguous directions from concentration to competition, especially in cross-industry studies (e.g., Demsetz, 1973; Aghion et al., 2001; Raith, 2003). HHI index for instance, is more sensitive to the shares of big firms in the market, but insensitive to shares of smaller firms, which could be the majority in the market. Besides, HHI index requires accurate market shares information of all firms (or at least the biggest 50 firms) in a given relevant market, which remains unfeasible for many cross-country studies. Also, as a possible weakness of this paper, obtaining accurate cross-country data on concentration information in the surveyed industries is difficult to implement, as the names of surveyed firms and respondent are treated strictly anonymously and confidentially, unless the World Bank do this survey again asking respondents about their market shares, which also could be unreliable if SMEs are the majority in surveyed markets.

Measurements of business constraint come from survey questions asking whether the following issues are a problem for the operation and growth of the surveyed business. The severity as an obstacle is based on a four-point scale where 0= No obstacle,

1=Minor obstacle, 2=Moderate obstacles, 3=Major obstacle, 4=Very sever obstacle. Higher values of the measures mean higher levels of business constraints. Selected business constraints include tax rates, tax administration, corruption, unfair practices, etc.

5.3. General Picture of Summary Statistics and Categories

Other determinants for tax evasion are mainly categorized as following:

- Competition measures such as "competition".
- Firm-specific characteristics, including age, size, sector, industry, business and financing constraints.
- Country level controls, including number of starting procedures for a typical business, closing recovery rate of initial capital, quality of legal system, etc.

The following figures provide an overlook about evasion levels and evasion levels by various classifications respectively.

Figure 1: Distribution of dependent variable: tax evasion percentage

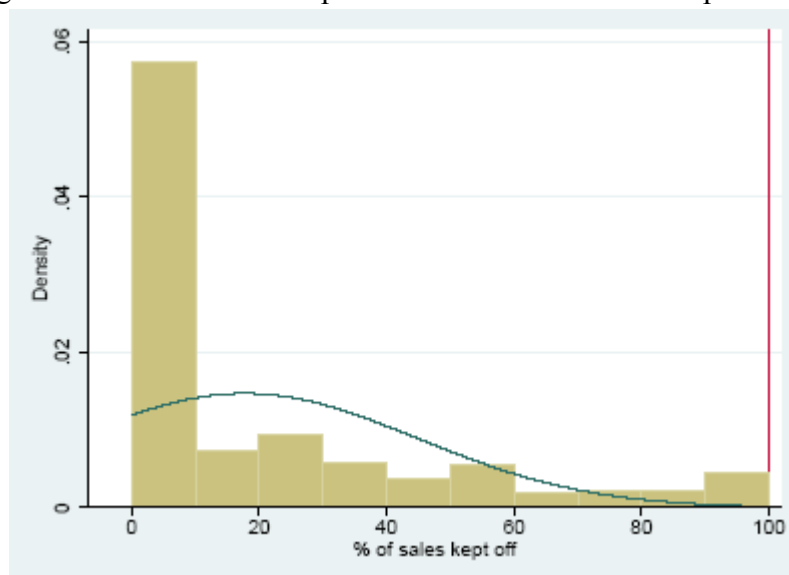


Figure 2: Average evasion levels for firms of different size

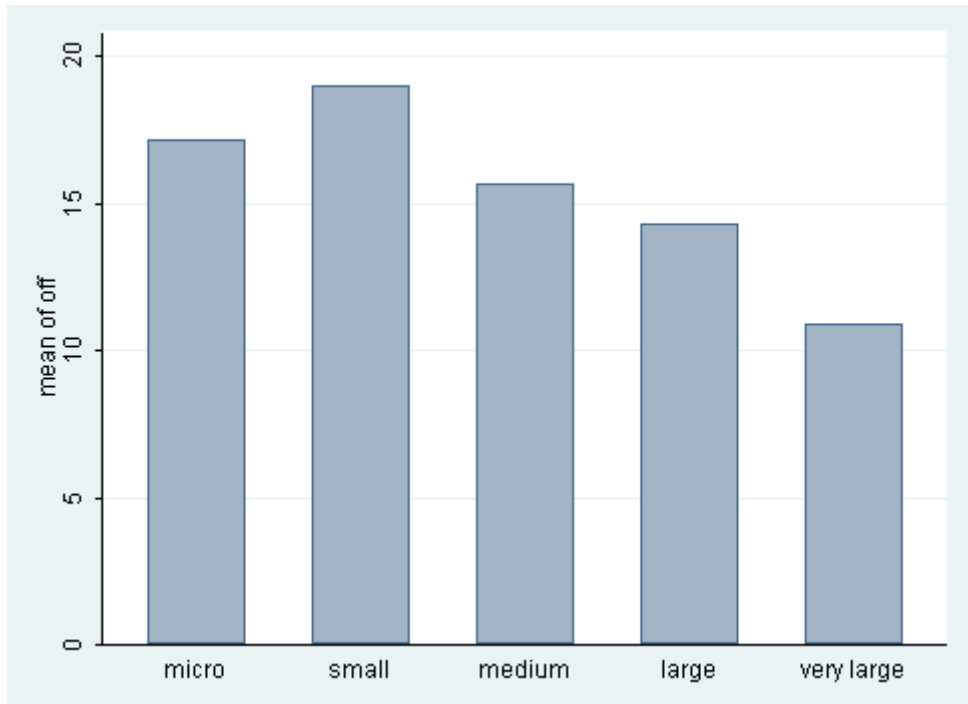


Figure 3: Average evasion levels for firms of different sectors

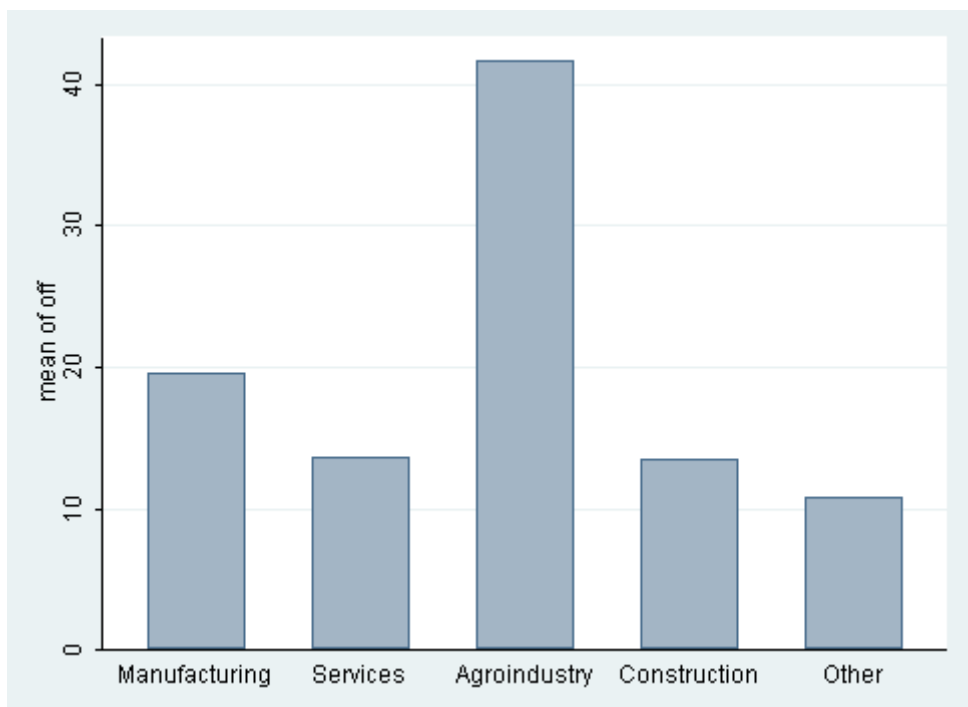


Figure 4: Average evasion levels for different industries

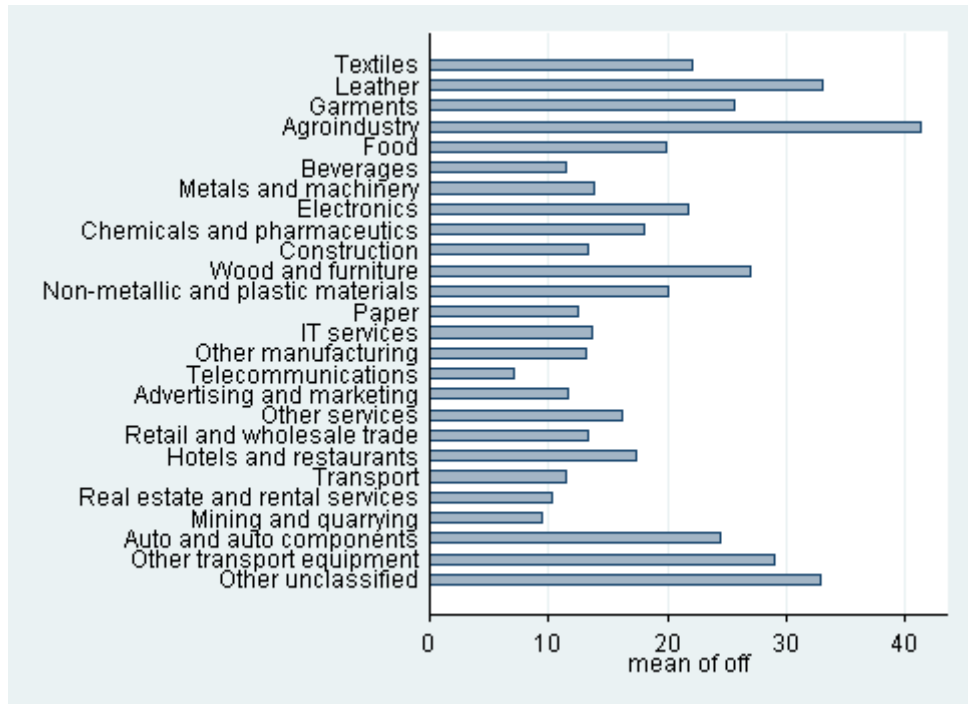
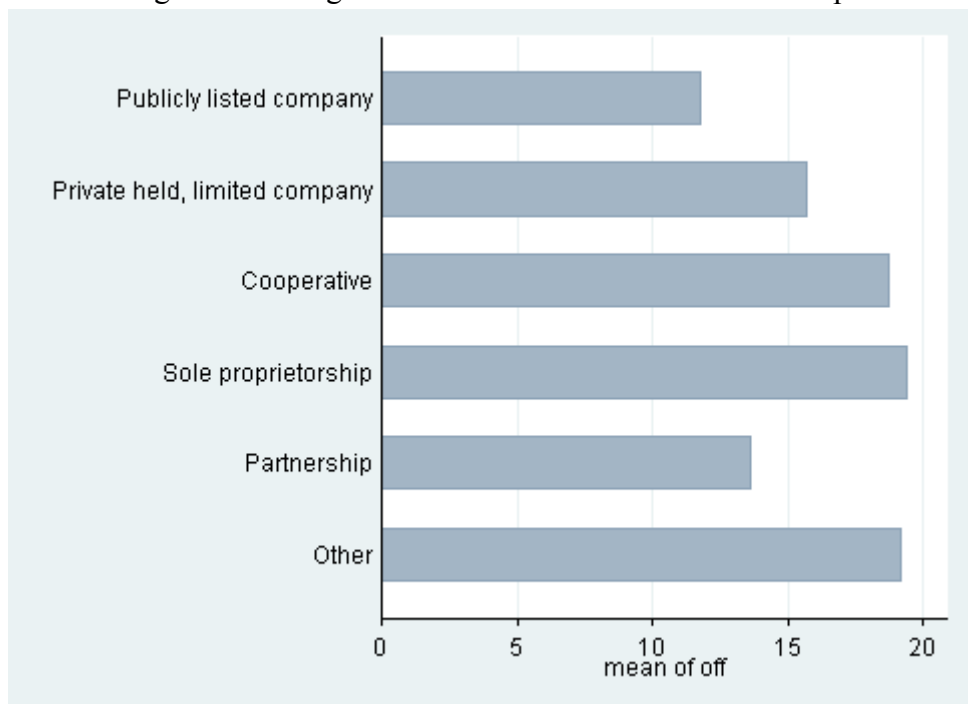


Figure 5: Average evasion levels for different ownership



As seen from the figures above, different sectors, industries and ownerships display divergent levels for tax evasion. For instance, agricultural industry is in the highest category, while telecommunications is at the lowest. It may accord to commonly observed features of these industries. For example, in heavily regulated and supervised

industries such as broadcasting and telecommunications, evasion of tax is difficult to implement and highly risky; And in industries such as Mining and quarrying, output and prices are easily observable and could hardly be faked, which also reduces the chance for tax evasion.

In the following Table 2, summary statistics are presented for a general picture of the variables pool. Definition and sources of these variables are presented in the appendix.

Table 2: Percentage of sales not reported to tax authorities

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent Variable:					
evasion	22261	16.688	25.073	0	100
Competition Measures:					
competition	22261	2.635	1.082	1	4
Business and Financing constraints:					
business constraint: tax rate	22261	1.806	1.247	0	4
business constraint: tax admin	22261	1.546	1.234	0	4
business constraint: corruption	22261	1.381	1.374	0	4
business constraint: access finance	22261	1.394	1.284	0	4
business constraint: unfair practices	22261	1.412	1.265	0	4
informal financing	15787	0.956	6.559	0	100
bank financing	15892	13.462	23.857	0	100
Firm Characteristics:					
audit	22261	0.479	0.500	0	1
log(age)	22261	2.435	0.812	0	5.308
size	22261	2.297	1.310	1	5
foreign	22261	0.123	0.328	0	1
manufacture	22261	0.461	0.498	0	1
service	22261	0.427	0.495	0	1
agriculture	22261	0.012	0.111	0	1
Country level factors:					
start procedures	21222	10.756	3.271	4	17
voice & accountability	22261	0.133	0.896	-1.809	1.644
political stability	22261	-0.084	0.794	-2.033	1.170
rule of law	22261	-0.101	0.837	-1.418	1.738
regulation quality	22261	0.161	0.792	-1.732	1.593
government efficiency	22261	0.082	0.767	-1.210	1.643
corruption	22261	-0.088	0.824	-1.172	1.922
highest marginal tax rate	18667	25.340	5.781	10	35
tax/profit ratio	21539	53.964	24.735	19.4	186.1
Informal economy	19890	34.3201	12.34056	15.6	67.3

Competition's effect on tax evasion could be the most important factor as directly influencing profits and sales, determines firm's evasion level. For other business obstacles like tax administrations or corruption, which might be less important in determining a firm's profitability than competition does, effects of these factors on evasion incentives could be reasonably minor compared to competition.

The following table shows the summary of evasion level classified by each degree of competition and business constraints, respectively.

Table 3: Summarized Evasion levels for different business obstacles

Customer reaction if price increased by 10%					
	Mean	Std.Dev	Min	Max	No. of obs
buy same quantities	14.577	24.387	0	100	4019
slightly lower quantities	17.258	25.300	0	100	6531
much lower quantities	18.617	25.995	0	100	5271
stop buying	15.849	24.353	0	100	6440
Business constraint: tax rates					
	Mean	Std.Dev	Min	Max	No. of obs
No obstacle	13.882	25.776	0	100	4899
Minor obstacle	13.514	22.873	0	100	3809
Moderate obstacle	16.189	24.275	0	100	5642
Major obstacle	17.532	24.107	0	100	6531
Very Severe Obstacle	33.456	28.966	0	100	1380
Business constraint: tax administration					
	Mean	Std.Dev	Min	Max	No. of obs
No obstacle	13.965	25.491	0	100	6341
Minor obstacle	14.179	22.663	0	100	4365
Moderate obstacle	16.941	24.422	0	100	5516
Major obstacle	18.683	24.702	0	100	5133
Very Severe Obstacle	34.990	29.969	0	100	906
Business constraint: corruption					
	Mean	Std.Dev	Min	Max	No. of obs
No obstacle	11.349	22.233	0	100	8751
Minor obstacle	14.842	22.843	0	100	3990
Moderate obstacle	18.023	24.365	0	100	3709
Major obstacle	21.508	26.890	0	100	3899
Very Severe Obstacle	32.558	30.047	0	100	1912
Business constraint: unfair practices					
	Mean	Std.Dev	Min	Max	No. of obs
No obstacle	13.721	24.779	0	100	7484
Minor obstacle	14.913	23.347	0	100	4613
Moderate obstacle	16.216	23.568	0	100	4816
Major obstacle	19.518	25.221	0	100	4204
Very Severe Obstacle	34.846	30.233	0	100	1144
Business constraint: access to finance					
	Mean	Std.Dev	Min	Max	No. of obs
No obstacle	14.148	24.245	0	100	7923
Minor obstacle	14.367	23.292	0	100	4203
Moderate obstacle	16.377	23.842	0	100	4782
Major obstacle	18.978	25.485	0	100	4151
Very Severe Obstacle	34.877	30.949	0	100	1202

In the first panel in the table above, as competition grow fiercer (as customer reactions grow more violate), related evasion levels experience first an increase, from 14.6% to 17.2%, reaches the highest point 18.6% when corresponding category is “buy much lower quantities”, then to 15.8% when customer stop buying. The trend of tax evasion levels displays a decreasing effect if summarized levels, and will be examined controlling for other effects as shown in later context.

For the rest three business obstacles, evasion levels rise monotonously with higher levels of obstacle levels, from around 13% of no obstacle, rise until over 30% when obstacle is very severe. These business obstacles, although also playing roles in shaping the profitability of individual firms, are not the crucial determinants for their competitiveness and tax evasion decisions as competition does, as following regressions indicate.

5.4. Empirical Results and Interpretations

Tobit estimation is applied for Maximum Likelihood Estimation, since many observations are left-censored according to the fact that a majority of firms reported that they evade zero tax. Also, tax evasion as a percentage of the total sales is also naturally right-censored at one hundred. In previous empirical work, for instance Dabla-Norris *et. al* (2007, 2008) used ordered probit model, which is essential the same MLE estimation method, except for the fact that tobit model better captures and estimates the survey data which is censored at both ends. Empirical results are reported with standard errors in parentheses.

As listed below, different business obstacles facing firms are individually tested, and are jointly tested and remain significant in the main estimation (the sixth column). Each individual estimation model is statistically significant, and the fifth model is more so, with larger pseudo R-square²³. Different specifications of models are also tried, for

²³ The standard pseudo R-square calculated in the above regressions are McFadden's pseudo R-square, by calculating the R-square between predicted and observed values, the 5th model has a pseudo R-square of 0.1087, which is of better fit, and much closer to 0.1116 from OLS regression.

instance if column (1) through (5) are estimated in probit model, the coefficients for determinants display the same directions of effects and comparable in magnitudes to tobit coefficients adjusted by the estimated sigma (variance).

Table 4: Determinants of Tax Evasion: Percentage of Total Sales Evaded

	(1)	(2)	(3)	(4)	(5)	(6)
competition	13.88*** (1.767)	15.62*** (1.767)	15.50*** (1.766)	14.06*** (1.753)	15.64*** (1.768)	13.14*** (1.752)
competition^2	-2.591*** (0.334)	-2.884*** (0.335)	-2.844*** (0.335)	-2.629*** (0.332)	-2.867*** (0.335)	-2.507*** (0.332)
<i>Firm characteristics:</i>						
audit	-6.844*** (0.702)	-6.361*** (0.703)	-6.286*** (0.703)	-6.211*** (0.697)	-6.199*** (0.705)	-6.011*** (0.697)
log(age)	-2.931*** (0.441)	-2.807*** (0.441)	-2.630*** (0.441)	-2.757*** (0.438)	-2.721*** (0.441)	-2.754*** (0.437)
size	-4.120*** (0.303)	-4.263*** (0.303)	-4.385*** (0.303)	-4.122*** (0.301)	-4.132*** (0.304)	-4.101*** (0.301)
foreign	-5.780*** (1.080)	-6.100*** (1.082)	-6.375*** (1.081)	-6.256*** (1.073)	-5.363*** (1.084)	-5.702*** (1.074)
<i>Business constraints:</i>						
unfair practices	4.876*** (0.262)					1.756*** (0.297)
tax rate		4.329*** (0.268)				0.592 (0.369)
tax administration			4.507*** (0.267)			1.431*** (0.363)
corruption				6.539*** (0.253)		4.750*** (0.297)
access to finance					3.640*** (0.260)	1.123*** (0.280)
industry	Yes	Yes	Yes	Yes	Yes	Yes
rule of law	-6.698*** (0.432)	-7.117*** (0.432)	-6.866*** (0.432)	-4.460*** (0.442)	-6.970*** (0.433)	-4.820*** (0.442)
constant	20.180 (12.280)	20.76* (12.280)	21.77* (12.260)	18.420 (12.200)	19.370 (12.280)	16.170 (12.150)
Observations	22261	22261	22261	22261	22261	22261

5.4.1. Significant Effect of Competition

As "competition" and its squared term (first two rows in the above table) indicate, as the degree of competition grows, associated tax evasion levels experience increases at decreasing speed. Naturally, it would be best if the question regarding be designed into

how much percentage would the surveyed firm's sales be affected if main product raises price by 1%. However due to the design of the questionnaire for easy-responding, the four-scale measure is the only available source for the elasticity of demand (or as product substitutivity).

More specifically, from estimation(1) through (6) in Table 4, competition and its square term together show significant effect on evasion levels, with the coefficients of “competition” ranging from 13.14 to 15.64, and the square term from -2.507 to -2.884.

5.4.2. Important Firm-specific Characteristics

Firm size, either categorized into four levels (from 1 for micro firms to 4 for large firms), or measured by the natural log of the number of employees, displays opposite direction with tax evasion. This accords to most people’s sense that bigger firms tends to be more formal, while small firms are more likely to have tax manipulations. Firm size could also be proxied by its asset value or sales, however the survey has such data only in terms of local currencies, which makes comparisons less reliable. It is also argued that in sense of business morality, number of employees is more binding than asset value to managers (e.g. High-tech companies might have few employees but huge asset value); As employers develop nice work relationships and emotional connections with employees, managers might not be willing to sacrifice employee’s jobs or confront moral remorse.

Whether the firm has an external auditor makes big differences. Captured by the dummy variable "audit", which equals 1 if the surveyed firm has an external auditor (and 0 otherwise), significantly reduce the evasion levels. This could be explained under the previous context that, being exposed to auditors and public supervision, the probability of being caught and get punished increases, thus reducing the evasion incentives. For instance, Internal Revenue Service (IRS) in U.S routinely examines a high percentage of large companies, while for medium-sized corporations only operational audits are performed. Also, firms usually need external auditors to provide credibility for their

financial reports and accounting operations, oftentimes for IPOs, or annual routines for listed companies. For companies seeking to guarantee their shareholders secured returns, the punishment and reputation loss associated with high detection probability will deter tax evasions.

Ownership structure also affects tax evasion behaviors. For instance, foreign firms significantly evade less than domestic ones. This result corresponds to real-life observations that foreign firms are usually more formal in operations and management compared to local firms, and foreign firms are usually exposed to more supervision power like media, local government and tax authorities, thus their possibility of being detected for of incompliance is relatively higher, therefore discourage the evasion incentives for foreign firms. It's also a common phenomenon that foreign branches or subsidiaries usually belong to formally-regulated and listed companies overseas, again for similar reasons like audited firms, foreign firms generally evade less.

Different industries display diverse evasion levels. In the survey, industries are classified into categories in which the firm is mainly operating in. There are 29 classifications in the survey, such as Food, Metals and machinery, Retail and wholesale trade, etc. After partially out identified determinants for tax evasion and controlled for industry clustering effects, different industries still display significant effects. The nature and practice of a certain industry oftentimes determine largely firm's behaviors. For instance, firms in mining industry face easily observed output and prices, therefore their sales are relatively more difficult to hide; In contrary, firms providing services are much easier to fake financial figures as their output is hard to trace. These effects can also be seen from a rougher classification of sector, including Manufacture, Agriculture, Construction, Service and others. Agricultural firms generally have the highest level of tax evasion: 31.35% kept off sales. Manufacturing comes second with 19.67%, construction and Service firms similarly at 14.53%. The large effect indicated by Agriculture sector is not quite surprising, given the high level of evasion in that industry (either sheltering or the nature of that industry) and around 300 agricultural firms in our

data, and sector dummies remain significant after partially out other determinants.

5.4.3. Financing and Other Business Constraints

Generally, firms facing more severe business constraints evade more tax, as corporate income (or profit margin, ROE, etc), is constrained by these obstacles.

Unfair practices measures how unfair practices are an obstacle to the surveyed firm. Higher values of this variable means firms face higher constraints in competition, which inhibit normal business growth. The unfair practices by government or other competitors therefore serve as stimulus for tax evasion. Also, it's often argued that nonmonetary factors play considerable roles in tax reporting behaviors, for instance the perception of a fair treatment. Firms those perceive themselves as being unfairly treated in competition and hurt by other's mal-practices, might seek alternative measures to make up the disadvantage, for instance evasion of tax.

Empirical results show this variable has the same direction of effect that encourages tax evasion as competition does.

Tax rate as a business obstacle, also inhibits firm's operation and growth and encourage evasion incentives. The measurement is coded as 0 if tax rates is not a problem for the surveyed firm, and then from 1 of minor obstacle until 4 of very severe obstacle. Note all these obstacles are measured conceptually, therefore higher tax rate as business obstacle does not necessarily mean higher tax rates. As firms facing diverse tax rates, and the same rate levels impose lighter or heavier burdens for different firms.

Tax administration, also one business obstacle for firm's growth and profitability, was under the same category with tax rates and following corruption, unfair practices, also coded on a same 0-through-4 scale. And from the same expectation and reasoning, it displayed positive effects towards tax evasion levels, comparable to the effects of tax

rates.

Regarding the effect of corruption on official economy, there are mainly two different views: One is represented by Paul Romer suggesting corruption as a tax on ex-post profits, may stimulate entry of new goods or technology requiring initial fixed investment. Significant negative correlation between corruption and GDP growth rate has been found by Paolo Mauro (1995) and Johnson, Kaufmann, and Zoido-Lobaton (1998); Another viewpoint which emphasis on corruption's substitutive effect, is represented by Bardhan (1997), who claims the progress of economic growth will ultimately generates enough forces to reduce corruption. Empirical work investigating the relationship between corruption and shadow economy has presented strong and consistent relationship that countries with more corruption have higher share of shadow economy, as Johnson et. al (1998) showed. As more corruption is associated with larger informal economy, it also reduces the expected payoff from formal economy, firms might need to compensate through unlawful means such as evasion of tax, for reasons stated above for other business constraints.

Previous mentioned business obstacles are smaller in magnitude, compared to those of competition, and it could be reasonable argued these business obstacles are not the key determinants in market competition, while the product substitutivity (e.g., brand loyalty) and competition could be the main battlefield, that shape the structure and profitability of the market.

Each business obstacle is tested, both separately and jointly significant in our specification, as shown in the regression table.

Notably, firms financing more from informal sources evade more, compared to those relying more on commercial banks. This could be explained by supervising power, formality of firm's running, easiness to fake accounting figures, etc. See in next page the effects of informal financing, compared to bank financing. Most firms in the survey

reply on formal financing sources such as banks, state services or formal financial corporations, and the few firms financing from informal sources (such as money-lenders) significantly evade more tax. However, this interesting result suffers from endogenous issues, as the possibility that firms seek informal financing on the start on tax evasion considerations cannot be removed. And the limited observations of firms with informal financing could not justify the instrument variables approach to eliminate the endogeneity problem.

5.4.4. Other Potential Determinants:

In the empirical results, a wide selection of possible determinants of tax evasion are tried and presented, as this paper try not to be constrained by determinants provided and acknowledged in the survey, and provide more general insights.

As the most observable factor, which may directly comes into most people's minds, that the actual tax rates might be of great importance to tax evasion. It is very natural to assume that when tax rates are too high or unbearable, firms may take measures to reduce or avoid tax burdens. In the survey, tax rates were asked on conceptual basis that whether tax rates are a business obstacle for the surveyed firm. It could be the case that actual tax rates also serve as a determinant for evasion activities, and therefore the true tax rate is also incorporated in empirical test. This paper uses marginal highest corporate income tax rates in the following table, first by testing it alone, then adding other business obstacles into regressions.

From the table below, column (1) shows that when testing alone, marginal tax rate seems to be negatively (which has the smallest determining power on evasion, compared to other determinants) related to evasion levels. However after adding other business obstacles, the effect of actual tax rates turns positively related to tax rate (same direction as most people would predict) as indicated in the column (2), however the effect ceases to be significant. The result is understandable, since the tax rate as a business obstacle has probably already absorbed the effects of actual tax rate. Further,

actual tax rates impose different tax burdens to firms of divergent performances and market status. A high tax rate might be pushing a small firm to the edge of closure, but might be only a light burden for long-established successful businesses.

Another controversial issue is whether the shadow economy within a country affects individual firm's decision to evade tax. It could be argued that shadow economy is another sector with different rules that rarely correlates with most formal firms, especially large and profitable ones; Different voices are also heard claiming the economy is a dynamic entity and will respond to changes on macro levels. The size of shadow economy would signal the benefits from the side and induce formal firms to act accordingly. This paper therefore employs the ratio of informal output to GDP to test its effect on firm's evasion activities, as some marginal firms may choose between going underground or register formally based on expected payoffs from both sides.

In the column (3) of the table below, when shadow economy is added alone with basic determinants, it is positively associated with evasion levels. As to the sign of the effect, as it is reasonably expected countries with large shadow economies have less efficient legal environment, and therefore formal firms would evade more due to lower detection probabilities. After adding other business obstacles, the effect becomes negative and ceases to be significant. It could be the case that added business obstacles better capture unexplained effects in residuals, and make less correlation with previous determinants, thus render the effect of shadow economy not significant.

Further, since countries with larger underground economy already suffer from loss of tax base, the tax revenues from formally registered firms are more important to governments and relatively easier to supervise and collect tax from. Thus governments in these countries might put in more efforts on formal firms. However the detection probabilities differ for different-sized firms. After specifying the impact of shadow economy on firms of different sizes²⁴, column (5) presents a picture that corresponds to

²⁴ Variable "shadow economy for small firms" comes from multiply "shadow rate" with the dummy variable

common sense that smaller firms are more inclined to be affected by the lure from shadow economy, as small firms are closer to the edge of deciding whether to operate formally or going underground. And a larger ratio of shadow economy reflects the situation of many other decision-makers who faced the similar choices and decided to go underground, indicating the attractiveness of shadow sector. Smaller firms might choose to report less to tax authorities, as they nevertheless are not much supervised or often checked. However, bigger firms have higher probability of detection, together with strengthened supervision, evasion incentives are deterred.

“small”, similar for variable “shadow economy for big firms”.

Table 5: Determinants of Tax Evasion (with Shadow Economy)

	(1)	(2)	(3)	(4)	(5)
competition	16.41*** (1.91)	12.69*** (1.89)	14.30*** (1.90)	10.85*** (1.87)	10.93*** (1.87)
competition^2	-2.967*** (0.36)	-2.427*** (0.36)	-2.643*** (0.36)	-2.169*** (0.35)	-2.180*** (0.35)
<i>Firm characteristics:</i>					
audit	-7.247*** (0.76)	-6.358*** (0.75)	-6.755*** (0.75)	-5.966*** (0.74)	-6.061*** (0.74)
log(age)	-2.381*** (0.48)	-2.372*** (0.47)	-2.009*** (0.47)	-1.970*** (0.47)	-1.953*** (0.47)
size	-4.359*** (0.33)	-4.248*** (0.32)	-4.194*** (0.32)	-4.173*** (0.32)	-2.644*** (0.54)
foreign	-4.907*** (1.17)	-4.088*** (1.16)	-5.095*** (1.17)	-4.124*** (1.16)	-4.112*** (1.15)
<i>Business constraints:</i>					
Unfair practices		2.074*** (0.32)		2.050*** (0.32)	2.071*** (0.32)
tax rate		0.719* (0.39)		0.967** (0.39)	0.881** (0.39)
tax administration		1.430*** (0.39)		1.525*** (0.38)	1.586*** (0.38)
corruption		3.920*** (0.32)		3.709*** (0.32)	3.659*** (0.32)
access to finance		1.270*** (0.30)		1.583*** (0.30)	1.557*** (0.30)
marginal highest tax rate	0.144** (0.06)	0.168*** (0.06)			
shadow economy			0.0855** (0.04)	(0.06) (0.04)	
shadow economy * small firms					0.0537** (0.02)
shadow economy * big firms					-0.115*** (0.04)
industry	Yes	Yes	Yes	Yes	Yes
rule of law	-7.910*** (0.47)	-5.568*** (0.49)	-5.656*** (0.63)	-5.099*** (0.64)	-4.312*** (0.50)
Constant	12.43 (13.37)	5.47 (13.15)	-18.86*** (5.47)	13.29 (10.74)	8.78 (10.79)
Observations	18667	18667	17484	17484	17484

In the table below, the predicted levels of tax evasion, which is drawn from the main regression in column (5) of Table 6, are used for prediction according to competition status and various business constraints. For instance in the first row of Panel A, there's 2789 firms who is predicted to evade no tax at all, given that their competition situation is advantageous (Consumers buy same quantities if the product raised its price by 10%); And 877 firms would evade 0 to 20% of total sales given their consumer will buy slightly lower quantities if price raised 10%, etc. As competition grows fiercer, more firms appear to evade more tax.

In Panel B to E, as business constraints grow more serious, more firms engage in larger proportions of tax evasion. The last row of "very severe obstacle" in each of these panels shows uniformly the trend that few firms evade no tax and more firms engage in the last two columns, which are 40-60% or even more.

Table 6: Predicted level of tax evasion from Table 5, column (6)

Panel A: Customer reaction if price increases by 10%		None	0-20	20-40	40-60	>60	No. of obs.
same	quantities	2898	913	193	15	0	4019
slightly	lower	3584	2164	697	83	3	6531
much	lower	2626	1730	806	101	8	5271
stop	buying	3912	1916	564	47	1	6440
Panel B: Tax rates as business constraint		None	0-20	20-40	40-60	>60	No. of obs.
No	obstacle	3821	875	185	17	1	4899
Minor	obstacle	2759	881	155	12	2	3809
Moderate	obstacle	3393	1830	382	31	6	5642
Major	obstacle	2917	2712	827	72	3	6531
Very severe	obstacle	130	425	711	114	0	1380
Panel C: Tax administration as business constraint		None	0-20	20-40	40-60	>60	No. of obs.
No	obstacle	4810	1186	319	25	1	6341
Minor	obstacle	3086	1065	200	12	2	4365
Moderate	obstacle	3068	1904	497	44	3	5516
Major	obstacle	1989	2312	756	71	5	5133
Very severe	obstacle	67	256	488	94	1	906
Panel D: Corruption as business constraint		None	0-20	20-40	40-60	>60	No. of obs.
No	obstacle	7665	1012	73	1	0	8751
Minor	obstacle	2775	1116	91	8	0	3990
Moderate	obstacle	1681	1755	258	15	0	3709
Major	obstacle	861	2290	703	43	2	3899
Very severe	obstacle	38	550	1135	179	10	1912
Panel E: Unfair practices as business constraint		None	0-20	20-40	40-60	>60	No. of obs.
No	obstacle	5865	1360	246	13	0	7484
Minor	obstacle	2986	1365	249	12	1	4613
Moderate	obstacle	2557	1759	460	40	0	4816
Major	obstacle	1534	1907	686	70	7	4204
Very severe	obstacle	78	332	619	111	4	1144
Panel F: Access to finance as business constraint		None	0-20	20-40	40-60	>60	No. of obs.
No	obstacle	5927	1610	364	19	3	7923
Minor	obstacle	2819	1174	199	8	3	4203
Moderate	obstacle	2555	1776	417	32	2	4782
Major	obstacle	1631	1778	666	74	2	4151
Very severe	obstacle	88	385	614	113	2	1202

Again from the main regression of Table 6 Colum (6), I estimate the marginal effects for determinants of tax evasion as shown in the table below.

Table 7: Marginal Effects after Tobit Estimation

variable	dy/dx	Std.Err.	z	P>z	[95% C.I.]	X
competition	13.144	1.752	7.5	0.000	9.711	16.578		2.635
competition^2	-2.507	0.332	-7.56	0.000	-3.157	-1.857		8.114
audit*	-6.011	0.697	-8.62	0.000	-7.377	-4.645		0.479
log(age)	-2.754	0.437	-6.3	0.000	-3.611	-1.898		2.435
size	-4.101	0.301	-13.64	0.000	-4.691	-3.512		2.297
foreign*	-5.702	1.074	-5.31	0.000	-7.807	-3.598		0.123
rule of law	-4.820	0.442	-10.9	0.000	-5.687	-3.953		-0.101
unfair practices	1.756	0.297	5.91	0.000	1.174	2.338		1.412
tax rate	0.592	0.369	1.61	0.108	-0.130	1.315		1.806
tax administration	1.431	0.363	3.95	0.000	0.720	2.142		1.546
corruption	4.750	0.297	16.01	0.000	4.168	5.331		1.381
access to finance	1.123	0.280	4.01	0.000	0.574	1.672		1.394

(*) dy/dx is for discrete change of dummy variable from 0 to 1.

And again, competition and its square term are the most important determinants, as would be expected from tobit estimations, with marginal effects significant and large in magnitude. The expected signs of marginal effects accord to previous estimation. As growing larger and older, firms tend to evade less, dummy variables such as foreign ownership and having an external auditor have clear negative impact on tax evasion. Industrial effects are omitted for concern of brevity, but available upon interest or request.

Table 8: Determinants of informality: effects of informal financing

	(1)	(2)	(3)	(4)
competition	20.30*** (1.997)	12.79*** (1.923)	12.79*** (2.691)	12.75*** (1.924)
competition^2	-3.612*** (0.379)	-2.471*** (0.364)	-2.471*** (0.481)	-2.459*** (0.365)
audit	-7.909*** (0.794)	-5.243*** (0.767)	-5.243*** (1.124)	-5.311*** (0.768)
log(age)	-2.595*** (0.501)	-2.990*** (0.484)	-2.990*** (0.720)	-3.038*** (0.485)
size	-3.625*** (0.332)	-4.118*** (0.328)	-4.118*** (0.480)	-4.178*** (0.330)
foreign	-6.102*** (1.201)	-4.205*** (1.159)	-4.205** (1.778)	-4.190*** (1.160)
unfair practices		2.182*** (0.330)	2.182*** (0.267)	2.155*** (0.330)
tax rate		1.173*** (0.406)	1.173*** (0.344)	1.161*** (0.406)
tax administration		0.805** (0.401)	0.805* (0.429)	0.828** (0.401)
corruption		4.551*** (0.333)	4.551*** (0.443)	4.575*** (0.333)
access to finance		1.115*** (0.310)	1.115*** (0.306)	1.139*** (0.310)
informal financing	0.284*** (0.054)	0.224*** (0.051)	0.224*** (0.044)	
bank financing				0.012 (0.015)
industry	Yes	Yes	Yes	Yes
rule of law	-10.32*** (0.469)	-5.516*** (0.490)	-5.516*** (0.715)	-5.663*** (0.494)
Constant	-6.993*** (2.612)	(5.036) (5.219)	(5.036) (4.692)	(4.745) (5.222)
Observations	15787	15787	15787	15787

As seen in the table above, when added one variable “informal financing”²⁵ alone into the determination of tax evasion, it appears to be positive associated with evasion (column 1), this impact remains significant after other business constraints are added (column 2) and controlled for industry clustering effect (Column 3), although only a

²⁵ This is the percentage of contribution from informal sources (e.g. money lender) as financing to the surveyed establishment (Including working capital and new investments).

very low fraction of surveyed firm have informal financing. However, bank financing does not seem to be correlated with tax evasion as shown in column 4. The variable of bank financing covers financing sources from local commercial banks (loan, overdraft), foreign owned commercial banks, leasing arrangement, investment funds/special development financing or other state services. It is a general measure of formal financing, as these sources all have some access to firm's performances and accounting records, and have supervision power upon.

5.4.5. Country Effects and Robustness Check

As shown in summary statistics in Table 2, the pool of country-level factors contains various measures about the business and legal system environment and the quality of government service, etc. And most of these factors are highly correlated in one given country. Many specifications were tried before reaching the final selection of the rule of law as country effects control (The result is robust to different specifications).

Table 9: Country-Level Factors and tax evasion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
competition	12.99*** (1.755)	13.10*** (1.749)	13.14*** (1.752)	12.93*** (1.756)	13.05*** (1.752)	13.21*** (1.755)	11.37*** (1.806)
competition^2	-2.490*** (0.332)	-2.514*** (0.331)	-2.507*** (0.332)	-2.476*** (0.332)	-2.489*** (0.331)	-2.525*** (0.332)	-2.220*** (0.342)
audit	-6.295*** (0.696)	-6.369*** (0.692)	-6.011*** (0.697)	-6.380*** (0.697)	-6.128*** (0.696)	-6.176*** (0.697)	-6.160*** (0.719)
log(age)	-2.872*** (0.438)	-3.093*** (0.431)	-2.754*** (0.437)	-3.045*** (0.436)	-2.825*** (0.436)	-2.762*** (0.439)	-3.406*** (0.442)
size	-3.958*** (0.300)	-4.046*** (0.299)	-4.101*** (0.301)	-3.916*** (0.300)	-4.021*** (0.299)	-4.019*** (0.300)	-3.976*** (0.306)
foreign	-5.704*** (1.076)	-5.538*** (1.073)	-5.702*** (1.074)	-5.808*** (1.076)	-5.830*** (1.074)	-5.773*** (1.075)	-4.474*** (1.102)
unfair practices	1.826*** (0.298)	1.916*** (0.297)	1.756*** (0.297)	1.798*** (0.298)	1.783*** (0.297)	1.791*** (0.298)	1.795*** (0.305)
tax rate	0.778** (0.371)	0.664* (0.368)	0.592 (0.369)	0.629* (0.370)	0.598 (0.369)	0.621* (0.369)	0.224 (0.378)
tax administration	1.279*** (0.364)	1.268*** (0.363)	1.431*** (0.363)	1.392*** (0.364)	1.449*** (0.363)	1.397*** (0.363)	1.434*** (0.371)
corruption	5.111*** (0.292)	4.873*** (0.292)	4.750*** (0.297)	5.109*** (0.293)	4.827*** (0.295)	4.897*** (0.295)	5.204*** (0.299)
access to finance	1.132*** (0.281)	1.220*** (0.280)	1.123*** (0.280)	1.059*** (0.281)	1.075*** (0.280)	1.144*** (0.281)	0.913*** (0.288)
voice & accountability	-3.775*** (0.394)						
political stability		-5.627*** (0.441)					
rule of law			-4.820*** (0.442)				
regulation quality				-3.873*** (0.453)			
government efficiency					-5.198*** (0.478)		
corruption						-4.432*** (0.448)	
starting procedures							0.976*** (0.114)

constant	9.528 (12.190)	18.050 (12.130)	16.170 (12.150)	15.890 (12.180)	15.410 (12.160)	15.090 (12.170)	8.098 (12.280)
industry	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	22261	22261	22261	22261	21222	20940	

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

Standard errors in parentheses

As shown in the above table, different controls as country-level factors are tried based on the basic set up of determinants from the table 6 column (5), six measures are tried to capture the effect on tax evasion. With higher value in each measure indicating better situation, the empirical results accord to the prediction that, firms in countries with sounder legal systems and more efficient governments evade less.

Specifically, for rule of law, regulation quality and government efficiency, these factors on macro level affect the probability of detection of tax evasion behaviors, and better quality of these situations made evasion a riskier decision. Factors like voice and accountability, political stability, corruption, influence domestic firms' confidence in its business environment, whether their profits are immune from unexpected riots, malice, or even political crises. When firms fear profits could be taken away, evasion would be an alternative to keep money at pocket. Besides, corruption has another indication that firms may be able to bribe officials and get things done without formal costs or channels. Thus with a more corrupt social environment, firms are more likely to seek a privately beneficial way to get things done, and evasion would be easier in such case.

Pigou's public interest theory of regulation states that by means of screening new entrants by governments and denying unqualified entrants, consumers are served by more desirable goods and services, and thus are better off. This argument is examined by Shleifer (2002), who found actually little evidence in favor of it. Here I mainly take the point that lower entry costs reflect greater competition, and thus could be an indicator of competition. However, entry barrier also serves as a sink cost when deciding whether to evade tax and how much. So the higher entry barrier and higher risk

associated with tax evasion will deter firms from doing so, firms those have been detected of severe evasion will suffer reputation loss, and entrepreneurs might have to go through all legal procedures again if they want to start a new business, which will deter evasions. After neutralizing these two effects, in empirical results a positive association is seen of entry barrier with tax evasion levels, thus indicating the latter effect probably dominates firm's decisions.

Robust standard errors were also tried for the main specification. With clustered industry standard errors, all determinants are still significant with expected signs. Industry dummies are also significant after controlled for their possible clustering effects, showing the robustness of industry effects, which remains unchanged under suspicion of correlations within industries.

As in the survey, not all firms choose to respond to the question asking about tax evasion, same phenomenon occurs for many other questions as well. However as our keen interest, it has to be made clear that there's no sample selection problem associated with the missing data for the evasion measure, it has to be tested whether firms intentionally avoid answering this question or not. Based on the basic set up in Table 6 column (5), I employ other factors into the selection model of choosing to answer or not: Unofficial payments to get things done (percentage of annual sales) and gifts expected as percent of contract values. Heckman test shows that no significant selection bias for the dependent variable, indicating that the missing data is properly distributed and no significant system features in choosing to answer the question. Link test probability also shows no significant specification errors²⁶.

²⁶ Linktest Prob > chi2\$=0.0000, p value for _hat:0.000,for _hatsq:0.506

Chapter Six: Policy Implication and Concluding Remarks

6. Policy Implication and Concluding Remarks

6.1. Policy Implications

The erosion of tax base is a fiscal concern of severity in many economies. Effective attempts to control the problem of tax evasion remain an important issue for most governments.

On firm level, business environment and tax policies affect firms in the same industries within a country to the same extent, while individual tax manipulation is a kept-alone fruit enjoyed by the firm itself. For instance, loose tax administrations may encourage tax evading and make new entries attractive, possibly leading to lower prices provided to consumers; However the effect is not symmetric, as illegally-retained tax by one firm would not be faced with pressure from other competitors, and retained profit could probably flow into the pockets of shareholders, and shared by managers through compensation schemes. Although the sharing process remains diverse, abundant real-life examples suggest compensation contracts that reward managerial performances also reward tax misreporting. As principle-agent issue often renders the judgment of performances based on measures such as effective tax rate or net profit comparison, therefore encouraging managers to manipulate tax for better performances.

As shown in theoretical hypothesis and reinforced in the empirical findings, competition pressure is a driving force for firms to engage in tax evasion activities, however the effect is diminishing. Policies designed to promote competition might need to take into considerations its adverse effects on tax evasion incentives. Specifically, given that firms in more competitive markets tend to have a greater incentive to evade tax, additional supervising and detecting measures are needed in such sectors.

Government might take into considerations other factors which encourage tax evasion. Firstly, the importance of industries features is among top cautions for evasion issue. Firms in certain industries apparently evade more tax, even after controlling for other

determinants, for instance leather and transport industry, or agriculture sector.

Firm characteristics may also serve as useful indications for evasion inclinations. General speaking, smaller, younger, domestic private firms significantly evade more tax, due to the detection probability of evasion for these firms. Much resource needs to be put into strengthening administrations for firms in such categories.

Business constraints also provide insights for detecting evasion behaviors and raise tax revenues. As business environment and the quality of legal system are relatively constant within geographical and administrative regions, tax authorities may utilize these observable facts as guidance to predict the tendencies of tax evasion under scrutiny. For sure, evasion of tax is only one of the many possible solutions by firms to seek compensation from these obstacles. And if not dealt properly, evasion activities might evolve into serious social phenomenon and economic crimes.

6.2. Limitations of Study

This paper provides some insights into the determinants of corporate tax evasion, emphasizing on the effect of competition, and its decreasing rate. Yet due to limitation in methodology and data, the paper suffers several weaknesses as following:

6.2.1. Methodology Limitations

This paper mainly discusses the evasion issue of corporate income tax, and does not specify different taxes and weights in firm's tax structure. Lack of considerations for tax structure is a potential weakness of this paper. Indirect taxes for instance value added tax, is quite divergent from the theoretical coverage of this paper, and also, not all countries in this paper's data adopt value added tax, which hinders empirical attempts.

As different types of taxes comprise the total corporate taxability, with diverse determinants for each type of tax, examining into the total effects from one factor might be hard to implement. As the fraction of each tax varies within firms and industries,

different regulations and natures of taxes further produce complications or even contradictions, predictions drawn on comprehensive tax structure may lack conciseness or reliability. Existing literature on tax evasion has empirically estimated specific forms of taxes, while theoretical work mostly analyzes effects of one certain type of tax with respect to corporate finance or management incentives.

As the famous "self-reinforcing penalty system of taxes" by Shoup (1969) suggests, just by auditing one tax return, the extent of tax evasion could be checked comprehensively. Reasons lie in the evident relationships among tax bases of interrelated taxes including: Capital gains tax, income tax, expenditure tax, wealth tax and inheritance and donations tax. Also, taxpayers are aware of the possibilities of self-revealing in presence of cross-checking when evasion activities are committed, thus attention will be paid to conceal true tax bases in related items. Esteller-Moré (2005) examined the theory and proved it holds as long as taxes are administrated by a single tax authority or authorities with high level of collaborations. The congruity within related taxes could to some extent relieve the problem of lacking assumptions of tax structure.

Besides, considering the recent trend to introduce contractual relationship between shareholder and managers into corporate income tax evasion, this paper lacks addressing to this issue. The cross-country background also complicates the attempt to combine theoretical predictions with empirical testing, as many firms in this paper's data are small-sized and do not fit for analyzing agency problems, despite modern corporate theories would suggest. For a quick look, public-listed companies take up only 5% of the total surveyed firms, therefore, it is still reasonable to adopt the A-S model for corporate tax evasion, as Marrelli (1984) also did.

6.2.2. Data Limitations

Constrained by the main data from the Productivity and the Investment Climate Private Enterprise Survey, the measurement of competition lacks preciseness due to the design of questionnaire questions, and the anonymous firm-level data could not be

complemented by other sources once after the survey. It would be desirable if the unique measurement of competition is designed to ask the exact percentage of quantities demanded change if price rise by 10%, or it would be perfect to ask directly for price elasticity or product substitutability. However exact figures could remain unknown even to the surveyed firms. Other possible measures of competition such as the number of competitors, suffers from severe problem of data missing and cannot be utilized.

As to the measure of tax evasion, the design of the question asks namely about a typical firm's evasion information in its industry, but not directly on the survey's firm itself. As discussed already in section 5.2, this measurement serves roughly yet creditably for survey's firm's own tax behaviors as explained in previous section.

Actual tax rates, which could be important factor influencing evasion behaviors, are employed mainly from marginal highest corporate income tax rates in the covered countries. Admitting the fact that firms face difference taxes and diverse marginal rates, the measurement could be rough. Again limited by the survey design, it's not possible to retrieve the information on the main tax or main tax rate level for each surveyed firm, and only rough proxy could be used in this context. Further research focuses on specific country or utilizing surveys with rich information at firm-levels are promising to further explore the effects of actual tax rates.

6.3. Concluding Remarks

In the paper, I re-visited the tax evasion model developed by Allingham and Sandmo (1972), and derived the diminishing positive effect of competition on the incentives to evade tax. More specific form of punishment is also derived, with results according to common intuition that more severe punishment deters evasion incentives.

I empirically tested competition's effect, together with other hypothesized effects from firm characteristics and business constraints, using a comprehensive dataset covering rich cross-country firm-level data (PICPES, carried out by World Bank) during 2002 to

2005. Empirical results confirmed the effects predicted in the hypotheses.

This paper may provide some insights for governments and tax authorities in designing tax policies and enhancing tax administrations. Industry and firm characteristics must be taken into consideration in supervising and reducing tax evasion activities; Policies designed to promote competition must also strengthen infrastructure and supervision to avoid its possible adverse effects on tax evasion incentives.

7. Appendices

7.1. Country List and Variables Definitions

Table 10: Country List and Observations

Country	2002	2003	2004	2005	Obs	Surveyed Year
Albania	170			204	374	2002,2005
Algeria	557				557	2002
Armenia	171			351	522	2002,2005
Azerbaijan	170			350	520	2002,2005
Bangladesh	1,001				1001	2002
Belarus	250			325	575	2002,2005
Benin			197		197	2004
BiH	182			200	382	2002,2005
Brazil		1,642			1642	2003
Bulgaria	250		548	300	1098	2002,2004,2005
Cambodia		503			503	2003
Chile			948		948	2004
China	1,548	2,400			3948	2002,2003
Costa Rica				343	343	2005
Croatia	187			236	423	2002,2005
Czech	268			343	611	2002,2005
Ecuador		453			453	2003
Egypt			977		977	2004
El Salvador		465			465	2003
Eritrea	79				79	2002
Estonia	170			219	389	2002,2005
Ethiopia	427				427	2002
FYROM	170			200	370	2002,2005
Georgia	174			200	374	2002,2005
Germany				1,196	1196	2005
Greece				546	546	2005
Guatemala		455			455	2003
Guyana			163		163	2004
Honduras		450			450	2003
Hungary	250			610	860	2002,2005
India	1,827				1827	2002
Indonesia		713			713	2003
Ireland				501	501	2005
Kazakhstan	250			585	835	2002,2005
Kenya		284			284	2003
Kosovo		329			329	2003
Kyrgyzstan	173	102		202	477	2002,2003,2005
Latvia	176			205	381	2002,2005
Lithuania	200		239	205	644	2002,2004,2005

Table10. Country List and Observations (Cont.d)

Madagascar			293	293	2005
Malawi			160	160	2005
Mali		155		155	2003
Mauritius			212	212	2005
Moldova	174	103	350	627	2002,2003,2005
Montenegro		100		100	2003
Morocco			850	850	2004
Nicaragua		452		452	2003
Oman		337		337	2003
Pakistan	965			965	2002
Peru	576			576	2002
Philippines		716		716	2003
Poland	500	108	975	1583	2002,2003,2005
Portugal			505	505	2005
Romania	255		600	855	2002,2005
Russia	506		601	1107	2002,2005
Senegal		262		262	2002
Serbia		408		408	2002
Serbia & Montenegro	250		300	550	2002,2005
Slovakia	170		220	390	2002,2005
Slovenia	188		223	411	2002,2005
South Africa		603		603	2003
South Korea			598	598	2005
Spain			606	606	2005
Sri Lanka			452	452	2004
Syria		560		560	2002
Tajikistan	176	107	200	483	2002,2003,2005
Tanzania		276		276	2003
Thailand			1,385	1385	2004
Turkey	514		1,880	2394	2002,2005
Uganda		300		300	2003
Ukraine	463		594	1057	2002,2005
Uzbekistan	260	100	300	660	2002,2003,2005
Vietnam			1,650	1650	2005
Zambia	207			207	2002

Table 11: Definitions and Sources of Utilized Variables

Variable	Definition	Source
evasion	Survey question: Recognizing the difficulties many enterprises face in fully complying with taxes and regulations, what percentage of total sales would you estimate the typical establishment in your area of activity reports for tax purposes?	Productivity and the investment climate private enterprise survey(PICPES)
competition	If prices of your main product line or main line of services were raised 10% above current level in the domestic market, which would best describe the result assuming that your competitors maintained their current prices? Our customers would:(1)continue to buy from us in same quantities (2)continue to buy from us, but at slightly lower quantities (3)continue to buy from us, but at much lower quantities (4)stop buying from us.	PICPES
business constraint: unfair practices	Judge if anti-competitive or informal practices is a problem for the operation and growth of your business: (1)No obstacle (2)minor obstacle (3)Major obstacle (4)very severe obstacle	PICPES
business constraint: tax rate	Judge if tax rates is a problem for the operation and growth of your business: (1)No obstacle (2)minor obstacle (3)Major obstacle (4)very severe obstacle	PICPES
business constraint: tax administration	Judge if tax administration is a problem for the operation and growth of your business: (1)No obstacle (2)minor obstacle (3)Major obstacle (4)very severe obstacle	PICPES
business constraint: corruption	Judge if corruption is a problem for the operation and growth of your business: (1)No obstacle (2)minor obstacle (3)Major obstacle (4)very severe obstacle	PICPES
business constraint: access to finance	Judge if access to finance is a problem for the operation and growth of your business: (1)No obstacle (2)minor obstacle (3)Major obstacle (4)very severe obstacle	PICPES
informal financing	Please identify the contribution over the last year of informal sources (eg. money lender) for your establishment	PICPES
bank financing	Please identify the contribution(in percentage) over the last year of banks sources for your establishment	PICPES
audit	Annual financial statement reviewed by external auditor? (1)Yes (2)No	PICPES

age	Number of years since your firm began operations in this country	PICPES
size	Size measurement based on permanent workers plus temps(where duration available): (1)micro (2)small (3)medium (4)large (5)very large	PICPES
foreign	Dummy equals 1 if ownership is foreign, and 0 for domestic firms	PICPES
sector	If firm is in:(1)Manufacture (2)Services (3)Agriculture (4)Construction (5)Other industry	PICPES
Industry	Dummies for categories that the firm is mainly operating in, total 29 classifications, such as Food, Metals and machinery, Retail and wholesale trade, etc.	PICPES
voice & accountability	The extent to which country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	WGI
political stability	The perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including domestic violence and terrorism.	WGI
regulatory quality	The ability of the government to formulate and implement sound Policies and regulations that permit and promote private sector development.	WGI
government efficiency	The quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	WGI
starting procedures	Number of procedures required to start up a typical business in one country.	DoingBusiness, by the World Bank
recovery rate	Recovery rate when closing a business in one country.	DoingBusiness
rule of law	The extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.	World Governness Indicators(WGI)
marginal highest tax rate	Marginal highest corporate income tax rate	World Development Indicators & KPMG International
shadow economy	The ratio of shadow economy output to GDP	Schneider 2004

7.2. Proofs for equation equations (9) to (13):

(9): Differentiate equation (2): $-t(1-p)U'(Y) + (\alpha-t)pU'(Z) = 0$ with respect to Π :

$$\frac{\partial(2)}{\partial\Pi} = -t(1-p)U''(Y) \left(1 - t \frac{\partial X^*}{\partial\Pi}\right) + (\alpha-t)pU''(Z)[1 - \alpha + (\alpha-t) \frac{\partial X^*}{\partial\Pi}] = 0$$

$$\frac{\partial X^*}{\partial\Pi} \left[t^2(1-p)U''(Y)t(\alpha-t)^2 pU''(Z) \right] = t(1-p)U''(Y) - (\alpha-t)(1-\alpha)pU''(Z)$$

$$\text{Therefore, } \frac{\partial X^*}{\partial\Pi} = \frac{1}{D} [t(1-p)U''(Y) - (\alpha-t)(1-\alpha)pU''(Z)]$$

(10): As equation (7): $R_A(Y) = -\frac{U''(Y)}{U'(Y)}$, $R_A(Z) = -\frac{U''(Z)}{U'(Z)}$, use equation(2) to rewrite (9) as

$$\begin{aligned} \frac{\partial X^*}{\partial\Pi} &= -\frac{1}{D} t(1-p)U'(Y) \left[-\frac{U''(Y)}{U'(Y)} - \frac{(\alpha-t)(1-\alpha)pU''(Z)}{t(1-p)U'(Y)} \right] \\ &= -\frac{1}{D} t(1-p)U'(Y) \left[R_A(Y) - \frac{(\alpha-t)(1-\alpha)pU''(Z)}{(\alpha-t)pU'(Z)} \right] \\ &= -\frac{1}{D} t(1-p)U'(Y) [R_A(Y) - (1-\alpha)R_A(Z)] \end{aligned}$$

(11)

$$\begin{aligned} \frac{\partial \left(\frac{X^*}{\Pi} \right)}{\partial\Pi} &= \frac{1}{\Pi^2} \left(\frac{\partial X^*}{\partial\Pi} \Pi - X \right) = \frac{1}{\Pi^2} \left\{ -\frac{1}{D} [t(1-p)U''(Y) - (\alpha-t)(1-\alpha)pU''(Z)] - X \right\} \\ &= \frac{1}{\Pi^2 D} [t(1-p)U''(Y)\Pi - (\alpha-t)(1-\alpha)pU''(Z)\Pi - t^2(1-p)U'(Y)X - (\alpha-t)^2 pU''(Z)X] \\ &= \frac{1}{\Pi^2 D} \{ t(1-p)U''(Y)(\Pi - tX) + (\alpha-t)pU''(Z)[(\alpha-1)\Pi - (\alpha-t)X] \} \\ &= \frac{1}{\Pi^2 D} [t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z] \end{aligned}$$

(12) Use equation (2) and (7) to rewrite equation (11):

$$\begin{aligned} \frac{\partial \left(\frac{X}{\Pi} \right)}{\partial\Pi} &= -\frac{1}{\Pi^2 D} t(1-p)U'(Y) \left[-\frac{U''(Y)}{U'(Y)} Y - \frac{(\alpha-t)pU''(Z)Z}{-t(1-p)U'(Y)} \right] \\ &= -\frac{1}{\Pi^2 D} t(1-p)U'(Y) \left[R_R(Y) - \frac{(\alpha-t)pU''(Z)Z}{-(\alpha-t)pU'(Z)} \right] \\ &= -\frac{1}{\Pi^2 D} t(1-p)U'(Y) [R_R(Y) - R_R(Z)] \end{aligned}$$

(13) Differentiate equation (12) again with respect to Π will obtain:

$$\begin{aligned}
\frac{\partial^2 \left(\frac{X^*}{\Pi}\right)}{\partial \Pi^2} &= \frac{1}{(\Pi^2 D)^2} \{ [t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z]' \Pi^2 D \\
&\quad - [t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z] (2\Pi D + \Pi^2 D') \} \\
&= \frac{1}{(\Pi^2 D)^2} \{ [t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z]' \Pi^2 D \\
&\quad - [t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z] 2\Pi D \} \\
&= \frac{1}{\Pi^3 D} \{ \Pi [t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z]' \\
&\quad - 2[t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z] \}
\end{aligned}$$

As:

$$\begin{aligned}
&[t(1-p)U(Y)Y - (\alpha-t)pU(Z)Z]' \\
&= t(1-p) \left[U'''(Y)(1-tX') \right. \\
&\quad \left. + U(Y)(1-tX') - (\alpha-t)p[U'''(Z)\left(\frac{\partial Z}{\partial \Pi}\right)Z + U(Z)(1-\alpha + (\alpha-t)X')] \right] \\
&= t(1-p)U''(Y)(1-t\frac{\partial X}{\partial \Pi}) - (\alpha-t)pU'''(Z)[(1-\alpha + (\alpha-t)\frac{\partial X}{\partial \Pi})]
\end{aligned}$$

Therefore

$$\begin{aligned}
\frac{\partial^2 \left(\frac{X^*}{\Pi}\right)}{\partial \Pi^2} &= \frac{1}{\Pi^3 D} \{ \Pi [t(1-p)U''(Y)(1-t\frac{\partial X}{\partial \Pi}) - (\alpha-t)pU'''(Z)[1-\alpha + (\alpha-t)\frac{\partial X}{\partial \Pi}]] \\
&\quad - 2[t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z] \} \\
&= \frac{1}{\Pi^3 D} \left\{ t(1-p)\pi \left(1-t\frac{\partial x}{\partial \pi}\right) U''(Y) - 2t(1-p)U''(Y)Y \right. \\
&\quad \left. - (\alpha-t)p\pi U'''(Z) \left[1-\alpha + (\alpha-t)\frac{\partial x}{\partial \pi}\right] + 2(\alpha-t)pU''(Z)Z \right\} \\
&= \frac{1}{\pi^3 D} \left[\frac{(t-\alpha)\alpha p(t-1)U''(z)t(1-p)\pi U''(Y)}{t^2(1-p)U''(Y) + (\alpha-t)^2 p U''(Z)} - 2t(1-p)U''(Y)Y \right. \\
&\quad \left. - \frac{(t-\alpha)\alpha p(t-1)U''(z)t(1-p)\pi U''(Y)}{t^2(1-p)U''(Y) + (\alpha-t)^2 p U''(Z)} + 2(\alpha-t)pU''(Z)Z \right] \\
&= \frac{1}{\pi^3 D} [-2t(1-p)U''(Y)Y + 2(\alpha-t)pU''(Z)Z] \\
&= -\frac{2}{\Pi^3 D} [t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z]
\end{aligned}$$

The form above is exactly equation (13), then rewrite as:

$$\begin{aligned} \frac{\partial^2 \left(\frac{X^*}{\Pi} \right)}{\partial \Pi^2} &= -\frac{2}{\Pi^3 D} [t(1-p)U''(Y)Y - (\alpha-t)pU''(Z)Z] \\ &= \frac{2}{\Pi^2 D} t(1-p)U'(Y)[R_R(Y) - R_R(Z)] < 0 \end{aligned}$$

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