DEPARTMENT OF ECONOMICS

WORKING PAPER SERIES

2005-01

McMASTER UNIVERSITY

Department of Economics
Kenneth Taylor Hall 426
1280 Main Street West
Hamilton, Ontario, Canada
L8S 4M4

http://socserv.socsci.mcmaster.ca/~econ/

KEEPING IT OFF THE BOOKS: AN EMPIRICAL INVESTIGATION INTO THE CHARACTERISTICS OF FIRMS THAT ENGAGE IN TAX NON-COMPLIANCE[*]

Lindsay M. Tedds

Department of Economics
McMaster University
426 Kenneth Taylor Hall
1280 Main St. West
Hamilton, Ontario, L8S 4M4
Email: teddslm@mcmaster.ca
Phone: (905) 525 9140 ext. 24731
Fax: (905) 521 8232

July 2005

Abstract

We investigate firm tax noncompliance using a survey of firms from around the world. Overall, we find that small firms are less and large firms are more compliant. Foreign owned firms, exporters and firms that have audited finance statements are also more compliant, as found by others, but, quite surprisingly, government ownership is insignificant. Not surprisingly, organized crime, high taxes, and government corruption all result in lower compliance. Finally, we find that firms around the world engage in tax noncompliance but, holding all else constant, compliance in highest in OECD countries and the lowest in Latin American, African & Middle Eastern countries.

Keywords: Underground Economy, Tax Noncompliance, Firm Characteristics, Interval Regression

JEL Classification: C24, D21, O17

---

[*] I would like to thank my supervisor Tom Crossley and Mike Veall and David Bjerk, all of McMaster University, and David Giles, University of Victoria, for their helpful comments and invaluable guidance and Hassan Azziz for his assistance with the literature review. The author would also like to gratefully acknowledge the financial support from the Social Sciences and Humanities Research Council (Doctoral Fellowship #752-2004-1096 and INE grant #501-2002-0107). I am solely responsible for any remaining errors and omissions.

Introduction

It is generally accepted that taxes and tax evasion are intrinsically linked; that one cannot exist without the other. As a result of a great deal of theoretical, experimental, and empirical research conducted over the last twenty years, there exists an extensive knowledgebase regarding tax evasion by individuals. However, research regarding tax evasion[1] by businesses is, by comparison, surprisingly modest. This is startling, given the importance of businesses and their decisions not only in economic models but also in tax system and the economy as a whole.

There is some evidence to suggest that there is cause for concern, and that a substantial share of business income goes unreported to the relevant tax authorities. The United States Internal Revenue Service (IRS) routinely estimates the total amount of under-reported income and overstated deductions, and calculates the total loss of tax revenue, or the "tax gap". The latest data from the IRS (2004) regarding the "tax gap" related to business activities are for the 2001 tax year. These estimates indicate that: (1) the corporate tax gap amounted to $29.9 billion, of which corporations with over $10 million in assets contributed $25.0 billion; (2) the tax gap associated with business income earned by individuals amounted to $81.2 billion; (3) the self-employed evaded $61.2 billion in employment tax; and (4) corporations underpaid the amount of taxes due based on reported income by $2.3 billion. In total, businesses evaded $174.6 billion in taxes, which amounted to almost 10% of total taxes paid voluntarily. This is not an insignificant amount and yet should be considered a lower bound estimate because: it is based on twenty year old compliance rates; it does not include businesses that do not file tax returns (also known as non-filers, the hard-to-tax, ghosts or informal businesses); and/or it does not consider firms that

[1] The focus of this paper is on illegal tax evasion and not legal tax avoidance. Tax evasion or tax non-compliance refers to income tax that is legally owed but is not reported or paid whereas tax avoidance refers to legal actions taken to reduce tax liability. Tax avoidance includes such activities as "…purchasing tax-exempt bonds, which is certainly legal, not at all nefarious, but also certainly done for tax reasons." (Slemrod 2004, 4)

are engaged in illegal activities. While these data are for the United States, it is not unreasonable to assume that firms evade taxes in every country around the world.

Given that there is some evidence which supports the notion that businesses engage in tax non-compliance, several questions arise and require investigation. First, do businesses around the world engage in tax evasion or is it confined to a few countries or regions? Second, does the legal status of the business (e.g. sole proprietorship, partnership, corporation, etc.) affect the incidence and/or intensity of tax evasion? If so, then it may be possible to effect changes in the legal system in order to increase tax compliance. Third, do businesses that engage in tax non-compliance share common and observable characteristics, or is there too wide a variety of shapes and sizes to permit a useful generalization about them? If it were possible to define a typical evader, the tax authority could target their auditing activities more accurately. Finally, while there is considerable agreement internationally about the factors that trigger tax non-compliance (e.g. the tax burden, the degree of regulation, the level of enforcement, confidence in government, labour force characteristics, and morality), how do these features influence the intensity of non-compliance? With this information, policy makers could effect changes to increase the amount of tax revenues collected from businesses.

One of the main constraints to investigating and attempting to provide answers to these and related questions, is the lack of data. Previously, the only data sources available were from tax audits. However, these sources were only available for a very small number of select countries, the data was costly to collect, and access to the data was limited. More recently, however, an alternative data source, that is conducive to investigating issues related to business tax non-compliance, has become available. The World Business Environment Survey (WBES) was launched in 1999 by the World Bank's Investment Climate and Institute Units. The survey

was administered to more than 10,000 firms in eighty countries in late 1999 and early 2000, and provides responses to multiple questions on the investment climate and business environment. In particular, firms were asked several questions that permit an investigation into the linkages between firm characteristics, economic policy, governance, competitive environment, and other factors, as well as the extent and intensity to which firms are hiding output from the tax authority.

Batra *et al.* (2003) also use the WBES to investigate the determinants of under-reporting by firms. They estimate OLS regressions, including country fixed effects, and find that: (1) "…small or medium-size firms that produce for the domestic market (non-exporters), lack foreign investment, and are located in large cities (but not necessarily in the capital) tend to engage more in unofficial activity" (Batra *et al.* 2003, 76); (2) the prevalence, though not the unpredictability, of corruption also significantly affects non-compliance; and (3) "…a firm's age, sector or mode of ownership do not influence [a firm's] under-reporting of revenue." (Batra *et al.* 2003, 78). Unfortunately, the authors do not link their choice of explanatory variables to the existing theoretical or empirical literature regarding firm tax non-compliance. As a result, some potential controls are overlooked and some controls may be mis-specified and/or its inclusion unclear to the reader. For example, the authors include a control for privately owned firms, but do not indicate how this is defined (e.g. does it include private corporations) and also results in the base category including a diverse range of firm organization categories. Both of these issues may result in firms being grouped together that the previous literature indicate may have differing compliance behaviour (e.g. public corporations). This paper surveys the existing theoretical and empirical literature of firm tax non-compliance and use the information from these studies to build the empirical model explored in this paper.

In addition, Batra *et al.* (2003) do not exploit the nature of the dependent variable. The firm's response regarding under-reporting behaviour is grouped into categories. When a quantitative outcome is grouped into known intervals on a continuous scale, the data are said to be "interval-coded".[2] However, Batra *et al.* (2003) define the dependent variable as a binary outcome for each category and estimate the resulting equations by Ordinary Least Squares (OLS). In addition, the equations are not all identically specified. The considerable statistical limitations of such a linear probability model are well known, and it is not clear if the results can be compared across regressions, given the different specifications. There is an estimation technique that has been developed specifically for interval-coded data. This estimation procedure is known as "interval regression" and is undertaken using maximum likelihood techniques. The interval regression technique is utilized in this paper and the extent to which various covariates affect the estimation results is also explored.

Overall, the findings reveal that firms which are sole proprietorships, partnerships or privately owned corporations report a smaller percentage of their sales to the tax authority, though these effects become insignificant when country controls are included in the specification. The previous literature has suggested that: (1) public corporations should be more compliant, but no such effect is found in this paper; and (2) firms in the service and construction sector should be less compliant, but it is found that firms in the service sector are more compliant and that there is no significant effect for the construction sector. There is no consensus in the previous literature about the relationship between firm size and under-reporting, but it is found, unambiguously, that small firms are less compliant than are large firms. Foreign owned firms, exporters, and firms that have audited financial statements are also more compliant, as was also

[2] When the intervals are unknown and have to estimated along with the other parameters, an ordered logit/probit is the preferred estimation framework.

found by other researchers, but, quite surprisingly, government ownership has an insignificant effect. Not surprisingly, organized crime, high taxes, and government corruption all result in lower compliance. Finally, the results indicate that firms around the world engage in tax non-compliance but, holding all else constant, compliance is highest in OECD countries (notably Canada, France and Italy) and the lowest in Latin American (particularly, Haiti, Panama and Peru) and African & Middle Eastern (principally, Tunisia, Egypt, West Bank-Gaza, and Ghana) countries.

The paper begins with a brief review of the relevant tax non-compliance literature. The WBES is then described and the rationale for the empirical techniques is outlined. The results are then summarized and the paper ends with some concluding comments.

Literature Review

In this section, attention is focused on two critical aspects of the literature regarding tax evasion. First, a review the development of the theoretical literature and the associated predictions is provided, commencing with the classical model of an individual's decision to evade taxes and how the model has been modified for firm behaviour. Second, there have been a few empirical papers that explore firm tax non-compliance, and this literature is summarized along with the key findings. This literature will help shape the empirical model utilized in this paper.

Theoretical Studies

As noted above, extensive literature exists on tax evasion by individuals and the seminal contribution was provided by Allingham and Sandmo (1972).[3] Their model was sparse but surprisingly robust in modeling an individual's decision to evade taxes and, if so, how much to evade. The model leads to four propositions about the incidence of tax evasion: (1) the rate of return to evasion is positively related to the incidence of tax evasion; (2) individuals with higher risk aversion tend to evade less; (3) individuals with higher personal income tend to evade more; and (4) and compliance is positively related to the probability of being audited and the size of the penalty if caught.[4] The first and third propositions leads one to conclude that, in the context of business tax non-compliance, the self-employed, sole-proprietors and other small businesses would be less likely to evade taxes than large businesses. The fourth proposition leads to the opposite conclusion, given that large businesses and corporations are normally subjected to audits at a higher rate than are smaller businesses.[5] However, the true effect of these propositions is muddied when the choice is not only the level of evasion but also the level of output, as with most businesses, and when there is no direct link between the owner's income, risk preference, audit probability, and evasion decisions. This is particularly true for businesses where evasion decisions are made by managers and not the owner(s).

[3] The Allingham-Sandmo (1972) model has been extended in a number of dimensions over the last thirty years (e.g. Watson 1985, Trandel and Snow 1999, Mookherjee and P'ng 1989, Border and Sobel 1987, Scotchmer 1987, Cremer, Marchand and Pestieau 1990, and Sanchez and Sobel (1993)) and this literature is nicely surveyed by Andreoni, Erard, and Feinstein (1998) and Slemrod and Yitzhaki (2002).

[4] The relationship between tax rates and tax evasion, however, is uncertain. A higher tax rate implies less income which, according to the model, implies less evasion. On the other hand, an increase in the tax rate implies that the "return" from evasion increases as well, assuming a constant penalty, which implies more evasion. As a result, the two forces are of opposite tendency which makes the net result uncertain.

[5] For example, in the United States corporations with more than $10 million in assets face an audit rate of nearly 100 percent.

Given the above discussion, the reasons driving many businesses to evade taxes, is likely different from that of individuals and, hence, should be modeled differently. There is a much smaller pool of literature that addresses tax non-compliance by businesses.[6] The majority of this work utilizes the basic framework of the Allingham-Sandmo (1972) model, but the key variation in these models is that they explore how the tax rate, probability of detection, and penalty rate affect the two choices of evasion and output.[7] In these models, it is found that: (1) reported sales decrease as the tax rate increases; (2) a rise in taxes increases the market price of the good, but by less than the amount of the tax, since some of the tax increase is absorbed through increased evasion; and (3) an increased probability of detection or penalty, increases the proportion of sales declared and the market price of the good. As opposed to the propositions of the Allingham-Sandmo (1972) model, there is an unambiguous positive relationship between the tax rate and tax evasion. Further, it should be noted that these results hold, regardless of whether the market, in which the firm is operating, is competitive or monopolistic.

The preceding literature, however, continues to assume that an individual is at the centre of the tax decision. That is, the above noted firm models assume that the firm *owner* makes the tax reporting decision. This assumption, however, likely only applies to small, closely-held businesses and the outcomes predicted by the Allingham-Sandmo (1972) model may not apply to other types of businesses, notably those businesses where financial decisions, including those related to taxes, are not made by the owner/shareholder but, rather, by their agents. With this in mind, Chen and Chu (2002) extend the standard model to include a firm that hires a risk-averse manager. As opposed to the finding of the Allingham-Sandmo (1972) model, that an individual will only evades taxes if the rate of return from evasion is greater than the rate of return from

[6] Cowell (2003) provides an excellent review of this literature.
[7] There is no agreement in this literature if the firm in these models should be modeled as risk-averse or risk neutral.

compliance, Chen and Chu's model implies that a firm will evade tax only when the expected profit from evasion is *significantly* greater than that from reporting honestly. This is because tax evasion by a business actually involves the interaction of many persons and is much more complicated than individual income tax evasion.

Crocker and Slemrod (2003) focus particularly on large, publicly held corporations and propose a model of corporate tax evasion in the context of the contractual relationship between the shareholders of a firm and the chief financial officer (CFO), who determines the firm's deductions from taxable corporate income. The incentives of the CFO to engage in tax evasion are affected by the nature of the compensation arrangement. The model implies that corporate tax evasion is reduced when penalties are imposed on the CFO directly, as opposed to the shareholder; and that tax evasion increases if the CFO's compensation contract optimally adjusts to offset the penalties imposed when evasion is detected.

Previous Empirical Studies of Business Tax Non-Compliance

Unfortunately**,** the empirical analysis of business tax evasion is not extensive, mainly due to a lack of data. There have, however, been a small number of empirical studies that will be summarized here.

One of the first empirical examinations into business tax non-compliance focused on the self-employed. The self-employed are commonly believed to have lower compliance rates than wage and salary earners. Smith *et al.* (1986) obtain estimates that indicate that in 1982 the self-employed in Great Britain understated their income in the range of 30 to 36%. Pissarides and Weber (1989), using the same data, improve on Smith's approach and find that the self-employed under-reported their income by 90%. This modified approach was subsequently

applied by: (1) Apel (1994) who estimates that the self-employed in Sweden under-reported their income by 25% in 1988, though this figure rises to 35% for the self-employed who own firms that are unincorporated (which supports the proposition that the legal organization of the business does effect the tax evasion decision); (2) Mirus and Smith (1997) concentrate their analysis on Canada and obtain an estimate of 12.5% for the year 1990; and (3) Schuetze (2002), who also applies the approach to Canada, finds that the self-employed under-reported their income by between 11 and 23% over the period from 1969 to 1992 and that the construction and service occupations are more likely to be involved in tax non-compliance. Lyssiotou et al. (2004) propose further modifications and conclude that the self-employed in Great Britain in 1993 under-reported their income by 118% if they were in blue collar occupations and 64% if they were in white collar occupations. Finally, Tedds (2005) introduces a nonparametric framework to the approach and found that the gap between true and reported self-employment income is larger for households at the lower end of the self-employment income distribution, a result which runs contrary to the theoretical prediction of the Allingham-Sandmo (1972) model.

A self-employed person, however, can register their business in a variety of forms, including a corporation, which, based on the theoretical literature, likely effects their tax compliance behaviour. Unfortunately, only Apel (1994) explored the relationship between tax non-compliance and the legal form of the business, largely due to the lack of information on the latter in the data employed by these studies.

Smith and Adams (1987) examine the extent of tax non-compliance by informal suppliers in six "at risk" sectors[8] using results from a survey commissioned by the U.S. Internal Revenue Service (IRS) on the expenditures made by consumers on goods and services provided by these

[8] They were: home repairs and additions, domestic services, auto repair, music lessons, appliance repairs, cosmetic services, and catering.

suppliers. For the 1992 tax year, the authors find that unreported income by these informal suppliers amounted to approximately US$59.6 billion and that informal suppliers tend to report only about 20% of their net business income.

Using firm level data from a 1997 survey of private manufacturing firms in Poland, Romania, Russia, Slovakia, and the Ukraine, Johnson *et al.* (2000) investigate the relationship between government corruption, criminal activities, and firm tax compliance. The dependent variable (percentage of sales that are unreported to the tax authority) is similar to that used in this paper from the WBES (discussed below), except that it is a continuous variable (rather than grouped data as in the WBES). The authors found a positive and significant relationship between under-reporting of sales and bribing of corrupt officials, but no relationship between under-reporting of sales and protection payments to the mafia, tax payments, or efficiency of the legal system. Finally, firm tax non-compliance is greater in Russia and the Ukraine than in the other countries.

Several studies have investigated business tax non-compliance using data from tax audits. Probably the most comprehensive tax audit dataset in the world is that available through the U.S. IRS Tax Compliance Measurement Program (TCMP).[9] Rice (1992) used TCMP data from 1980 to investigate tax compliance by small corporations (defined as corporations with assets between $1 and $10 million). His findings suggest four key results. First, compliance is higher among publicly traded corporations, which he attributes to the requirement that publicly traded

[9] The TCMP features data from a random sample of individual and small corporate income tax returns filed in a given year that were subject to intensive audits by experienced examiners. For certain groups, such as non-filers and proprietors who tend to not report a significant amount of their income, the results from special research studies are used to supplement TCMP data. Finally, data for large corporations are obtained from routine operational audits.

corporations must disclose more information to the public about their operations.[10] Second, high profit companies are more likely to under-report their income, and corporations whose profits are below the industry mean tend to resort to non-compliance, perhaps as a means of limiting costs. Third, the marginal tax rate is negatively associated with compliance. Finally, firm size and tax non-compliance are positively related, and corporations engaging in tax non-compliance appear to be geographically bundled. Joulfaian (2000), using TCMP data from 1987, found that non-compliant corporations are three time more likely to be managed by executives who have evaded personal taxes. TCMP data has also been used to explore tax evasion by the self-employed and these studies include Christian (1994), Erard (1992), and Joulfaian and Rider (1998).

Giles (2000) discusses some of the factors that determine the probability of non-compliance among a very large population of New Zealand businesses that were audited by the Inland Revenue Department in that country between the period 1993 and 1995. Contrary to Rice, Giles finds that an increase in the scale of the business, regardless of how this is measured, unambiguously raises the probability of *compliance*, once other characteristics are controlled for. That is, businesses that are relatively small, in terms of sales revenue or before-tax profit, are more likely to evade taxes than are large corporations, all other things being equal. Businesses in the "construction", "wholesale trade", "retail trade", "accommodation", and "cafes and restaurants" sectors exhibited below-average compliance rates over the study period. He also considered several other characteristics that were found to be important in reducing the tax compliance rate among New Zealand businesses. Relatively "inefficient" businesses tended to be less compliant than more efficient ones, where efficiency was defined as either "return on net assets", or "activity ratio" (sales as a percentage of net assets). In addition, businesses which

[10] Tannenbaum (1993), however, disagrees with this statement and instead argues that higher compliance could be the result of managers in these corporations having greater independence from the owners.

were registered off-shore were generally *more* compliant than their on-shore counterparts, again once the analysis controlled for other attributes. Finally, it was found that in general, an aggressive use of legitimate tax-minimization instruments (such as the deduction of interest and depreciation costs, and the writing-off of bad debts) tended to be associated with compliant behaviour.

Many countries use tax holidays to attract foreign investment by providing a limited period of tax exemptions and reductions for qualified investors. Chan and Mo (2000) examine the effect of tax holidays on foreign investors' tax non-compliance behaviour in China. They analyzed 583 tax audit cases, made available by the Chinese tax authorities, on corporate tax non-compliance by foreign investors. Their results indicate that the corporate taxpayers tax holiday position significantly affects non-compliance, notably: (1) companies in the pre-holiday position are least compliant; (2) companies are most compliant in the tax exemption period that has a zero tax rate and a heavy penalty for evasion; (3) domestic market-oriented companies have a higher rate of non-compliance than their export-oriented counterparts; and (4) wholly foreign-owned and manufacturing-oriented companies have higher compliance than joint ventures and service-oriented companies.

This literature makes it clear that a businesses legal organization (private versus public, and owner versus employee managed) likely affects the decision to evade taxes but other factors, such as firm size, have ambiguous effects or, at the very least, vary across countries. Therefore, it seems worthwhile to conduct a worldwide study of firms tax compliance behaviour.

Data

In 1998, the World Bank Group launched its World Business Environment Survey (WBES). The WBES used many of the same questions from the enterprise survey conducted for the *1997 World Development Report*[11] (World Bank 1997) but expanded the number of businesses and countries surveyed and the questions/issues covered. During late 1999 and early 2000, face to face interviews[12] were conducted with either the firm managers or owners of 10,080 firms in eighty countries (plus the West Bank and Gaza).

The purpose of the survey was to assess and compare the business environment in a large number of countries. To achieve this goal, the survey gathered information regarding the firm's characteristics, such as size and ownership structure, as well as responses to multiple questions on the investment climate and the local business environment as shaped by domestic economic policy, governance, regulatory, infrastructural, and financial impediments, as well as assessments of public service quality. A more detailed description of the survey can be found in Batra *et al.* (2003). After eliminating observations with non-response related to key variables (described below), a maximum sample size of 6,025 firms remains.

Dependent Variable

As was indicated above, the intent of this paper is to explore the relationships between firm characteristics and tax compliance using firm-level data collected from around the world. How can the WBES be used to investigate firm tax compliance? The WBES asks each firm the question

[11] Unfortunately, this dataset neither contains detailed information on characteristics of the firms nor the key variable of interest contained in the WBES dataset. As a result, it cannot be appended to the WBES dataset.
[12] With the exception of Africa where interviews were predominantly conducted by mail.

What percentage of total sales would you estimate the typical firm in your area of activity reports for tax purposes? Possible answers: (1) less than 50%; (2) 50-59%; (3) 60-69%; (4) 70-79%; (5) 80-89% (6) 90-99%; and (7) all (100%).[13]

The distribution of answers is given in Table 1. This table shows that 60% of firms worldwide indicate that the typical firm fails to report their sales in full to the tax authority and, of those firms, over 19% of them fail to report more than half their sales. This shows that business tax compliance is a significant issue. Not surprisingly, there appears to be some difference in perceived tax non-compliance across regions, as is shown in Figure 1. In particular, in OECD countries only approximately 40% of firms are perceived to under-report their sales to the tax authority and of those, approximately 50% fail to report only up to 10% of their sales. Further, compared to other regions, firms in Latin America and Asia perceive that significantly more firms fail to report less than 50% of their sales. In addition, there are significant differences in perceived firm tax compliance across countries. Given these differences, the effects of country and region specific dummy variables on the results will be investigated in the empirical analysis.

Explanatory Variables

As was outlined above, previous empirical work using audit data found relationships between tax non-compliance and various firm characteristics, which these relationships will also be explored using this data. The firm characteristics that will be included as explanatory variables include dummies for: industry sector, and firm size, age, ownership, exporter, whether the firm's financial statements are audited, legal ownership, and number of competitors. In the

[13] In the WBES, the dependent variable is actually coded as follows: *What percentage of total sales would you estimate the typical firm in your area of activity reports for tax purposes? Possible answers: (1) all (100%); (2) 90-99%; (3) 80-89%; (4) 70-79%; (5) 60-69%; (6) 50-59%; and (7) less than 50%.* The order of the responses is revered solely for expositional clarity.

secondary analysis, the effect of various perceived business obstacles on tax compliance will be investigated, including access to capital, taxes, and regulations, organized crime, government corruption, inflation, and exchange rates. As the sample size decreases due to non-response with the inclusion of these latter explanatory variables, they are only included in a secondary regression.

Table 2 categorizes the maximum 6,025 observations, sorted by region and displayed by country. Table 3 provides a summary of the key variables. All of the explanatory variables used in the analysis are dummy variables and these are discussed below.

Legal Status

Firms in the WBES are categorized as being either: sole proprietorships, partnerships, cooperatives, private corporations, public corporations, or other. The first two categories (sole proprietorship and partnership) are much more likely to operate with the owner making the tax evasion decisions, so these firms are grouped together for this analysis. The remaining categories are treated individually, particularly as it is unclear if a cooperative would behave more like a private or public corporation. The excluded category is "other". Based on the literature, it is expected that publicly traded corporations will be the most compliant. In most countries, publicly traded corporations have a greater probability of being audited; and are subject to public disclosure requirements and independent financial auditing, which tends to expose any under-reporting behaviour to the authorities. As audit levels and detection probability are greater, compliance should be higher.

Sector

Firms are categorized into one of four possible industry sectors. They are: services, agriculture, construction, and manufacturing. The omitted category is manufacturing and it is expected that, as found previously, firms in the services and construction sector will be less compliant than others.

Size

Rice (1992) and Giles (2000) each investigated the relationship between a firm's size and tax non-compliance. Rice (1992) defined a firm's size according to the dollar amount of assets it held and found a positive relationship between firm size and tax non-compliance. Whereas, Giles (2000) used a firm's sales revenues and before tax-profits, and found a negative relationship between firm size and tax non-compliance. These measures of firm size are not available in the WBES. Instead, this paper investigates a firm's size as defined in terms of the number of employees. A small firm is one with fewer than 50 employees, a medium-sized firm has between 50 and 500 employees and a large firm has over 500 employees: The omitted category is firms with between 50 and 500 employees. The relationship between firm's size and tax compliance remains unclear.

Competition

While not previously investigated, it is possible that there is a positive relationship between the number of competitors in a given market and tax non-compliance. For example, firms in highly competitive markets may resort to tax non-compliance in order to reduce costs and allow the firm to set a lower price for their goods and/or increase the firm's profits. The

WBES asks firms how many competitors they face in their market. Possible answers are; none, between one and three; and more than three. The omitted category is firms with between one and three competitors.

Age

The WBES includes information on the firm's age - specifically, if the firm is less than five years old, between five and fifteen years old, and greater than fifteen years old. The effect of a firm's age on tax compliance is ambiguous. For example, younger firms may be less compliant because they may have more competitors, may be struggling to turn a profit, and/or may view tax evasion as a way to cut costs. On the other hand, young firm may be more reliant on external financing, which could cause them to be more compliant.

Other Characteristics

Other firm characteristics include indicators of whether the firm is foreign or government owned, an exporter, and whether it subjects its financial statements to audits. Based on previous findings, all of these indicators are expected to be negatively related to non-compliance. Dummies controlling for region as well as country (listed in Table 2) are also investigated. The omitted categories are the OECD and the United States respectively.

Perceived Obstacles

In addition to recording information regarding the firm's characteristics, the WBES also asks a number of questions about the firm's perceptions of various constraints in the business environment, which likely influence operational decisions including tax compliance. While

many of these variables have a low response rate, several have a relatively higher response rate. In particular, firms are asked if the following items present an obstacle or are a constraint to conducting business: access to capital[14], inflation, exchange rate, political instability, organized crime, taxes, and regulations. If these issues are perceived by the firm as affecting their ability to conduct business, then they may result in the firm engaging in tax non-compliance in order to reduce costs and be more competitive.

In addition, firms are asked if: (1) it is common to pay some "irregular" additional payments to government officials; and if (2) laws and regulations that affect the firm are interpreted inconsistently by the government or courts. If corruption is common, then among other effects, it will increase the cost of business, reduce morality, and reduce a firm's confidence in government; all of which are likely to have a negative relationship with tax compliance. The relationship between tax compliance and inconsistency in the application of laws and regulations is more ambiguous. If a firm can individually garner the favour of the government(s) and/or courts in the interpretation and application of laws and regulations, then this may reduce tax non-compliance. On the other hand, if the firm does not benefit from this inconsistency, then it may resort to tax non-compliance. Taking account of these explanatory variables reduces the number of available observations to 4,561.

[14] Andreoni (1992) argues that "…individuals facing binding borrowing constraints may use tax evasion to transfer resources from the future to the present. Even if a person finds tax evasion undesirable in the absence of borrowing constraints, it could become desirable if a borrowing constraint is binding. Tax evasion, therefore, may be a high-risk substitute for a loan." (Andreoni 1992, 35-36). The same argument can apply to firms and hence its inclusion in this analysis.

Data Strengths and Weaknesses

Using the WBES dataset to investigate business tax non-compliance has advantages and disadvantages over audit data.[15] The main disadvantage of the WBES is that the questions of interest are asked about the perceived behaviour of other firms, rather than the behaviour of the firm being interviewed, and this may result in response bias. However, there are two things to consider. First, respondents are likely base their response, at least in part if not in whole, on their own behaviour, which would minimize the bias. Second, as the firms are being asked about the behaviour of other firms rather than their own, they will not feel stigmatized by the interviewer and/or fear possible repercussions when responding to the questions. In addition, the WBES does not explicitly allow for the possibility of over-reporting. Rice (1992) found that about 6% of all corporations overstate their taxable income to some extent. Firms may over-report due to a misinterpretation of tax laws, to avoid a tax audit, to secure financing, or particularly for public corporations, to appear more competitive. In the WBES, firms that over-report will likely be included in the full compliance category. Finally, the WBES does not allow for the tax gap to be calculated. The tax gap is the difference between the taxes paid and the taxes that should have been paid. Such a calculation is useful in determining the amount of tax revenues lost to non-compliance. A disadvantage shared by both the WBES and audit data is that neither data source includes "ghosts" (Erard and Ho, 2001), firms that operate solely in cash and avoid normal business obstacles and regulations.

The main advantages of the present dataset include the fact that: (1) audit data are not widely available, unlike the WBES, which covers eighty countries; (2) audit data only include firms that are selected (for diverse reasons) or caught by the tax authorities, while the WBES is a

[15] Audit data also have several disadvantages, which are discussed by Rice (1992).

random sample of firms; and (3) the WBES includes additional information that is not included in tax audits. In particular, factors that firms perceive as business obstacles, such as taxes and regulations, which may effect a firm's decision to under-report, are included.

Empirical Framework

The survey question which forms the basis for our dependent variable and is described above refers to categories. As a result, a firm's perceived reporting behaviour is not directly observed. Rather, firms are categorized on the basis of the percentage of sales that they perceive to be unreported. When a quantitative outcome is grouped into known intervals on a continuous scale, the data is said to be "interval-coded". An ordered probit (or logit) is ideal when the dependent variable is discrete, ordinal in nature, and when the categories or thresholds are unknown.[16] In this case, the thresholds are estimated along with the model's coefficients and the variance of the error term is normalized to be one. It is possible, however, to modify the ordered probit model so that the thresholds are fixed at their known values and only the models' coefficients and the error variance are estimated. This estimation procedure is known as "interval regression" and is undertaken using maximum likelihood techniques. Its key advantage over the ordered probit is that it provides an asymptotically more efficient estimator as it uses the known threshold information and involves estimating fewer parameters. It is also preferred to OLS, as OLS on the grouped dependent variable model is inconsistent.

The following is the general setup of the model and is based on the discussion contained in Stewart (1983) and Wooldridge (2002, 508-509). The responses for the dependent variable

[16] That is, for an ordered logit model, while it can be said that two is greater than one, it cannot be determined if the difference between two and one is somehow twice as important as the difference between one and zero. The latter is not true of interval coded data.

are coded 1, 2, 3, 4, 5, 6, and 7 to capture seven distinct sales under-reporting categories. Let y_i denote the observable ordinal variable coded in this way and let y_i^* denote the underlying variable that captures the sales under-reporting of the i[th] firm. This can be expressed as a linear function of a vector of explanatory variables x_i using the following relationship:

$$y_i^* = x_i'\beta + u_i, \quad u_i \sim N(0, \sigma^2). \tag{1}$$

It is assumed that y_i^* is related to the observable ordinal variable y_i as follows:

$$\begin{aligned}
y_i &= 1 \text{ if } 0 \le y_i^* < 50\%^{17} \\
y_i &= 2 \text{ if } 50\% \le y_i^* < 60\% \\
y_i &= 3 \text{ if } 60\% \le y_i^* < 70\% \\
y_i &= 4 \text{ if } 70\% \le y_i^* < 80\% \\
y_i &= 5 \text{ if } 80\% \le y_i^* < 90\% \\
y_i &= 6 \text{ if } 90\% \le y_i^* < 100\% \\
y_i &= 7 \text{ if } 100\% \le y_i^* < \infty.
\end{aligned} \tag{2}$$

The last interval is treated as open-ended to account for possible sales over-reporting. If it is further assumed that $y_i^* \mid x_i'\beta \sim N(x_i'\beta, \sigma^2)$, then the seven possible components of the general log likelihood function for the i[th] individual is expressed as:

[17] It could be argued that this interval should be between 1 and 50 because firms that report 0% of their sales would likely be operating completely as "ghosts" and would not have been selected for an interview since there would be no formal record of the firm. Treating the interval in this way, however, does not affect the results.

$$L_i = I[y_i = 1] \times \log_e \{\Phi(\frac{50 - x_i'\beta}{\sigma}) - \Phi(\frac{0 - x_i'\beta}{\sigma})\} + I[y_i = 2] \times \log_e \{\Phi(\frac{60 - x_i'\beta}{\sigma}) - \Phi(\frac{50 - x_i'\beta}{\sigma})\} + I[y_i = 3] \times \log_e \{\Phi(\frac{70 - x_i'\beta}{\sigma}) - \Phi(\frac{60 - x_i'\beta}{\sigma})\} + I[y_i = 4] \times \log_e \{\Phi(\frac{80 - x_i'\beta}{\sigma}) - \Phi(\frac{70 - x_i'\beta}{\sigma})\} + I[y_i = 5] \times \log_e \{\Phi(\frac{90 - x_i'\beta}{\sigma}) - \Phi(\frac{80 - x_i'\beta}{\sigma})\} + I[y_i = 6] \times \log_e \{\Phi(\frac{100 - x_i'\beta}{\sigma}) - \Phi(\frac{90 - x_i'\beta}{\sigma})\} + I[y_i = 7] \times \log_e \{\Phi(\frac{\infty - x_i'\beta}{\sigma}) - \Phi(\frac{100 - x_i'\beta}{\sigma})\} \quad (3)$$

where Φ denotes the cumulative distribution function of the standard normal, $\Phi(\infty) = 1$, $\log_e(\cdot)$ denotes the natural logarithmic operator, and I[·] is an indicator function that takes the value of 1 when the statement in the square brackets is true and 0 when it is false. The relevant part of the log-likelihood is then triggered by the indicator function for whether the individual falls within one of the seven categories in question. The maximum likelihood procedure now involves the estimation of the β parameter vector and the ancillary standard error parameter σ.

Unlike the situation with the ordered probit estimation, the estimated coefficients from an interval regression are interpretable as if y_i^* is observed for each i and estimated $E(y^* \mid x) = x\beta$ by OLS. That is, the estimated coefficients can be interpreted as the marginal effects (i.e. the change in percentage of sales reported given a change in the independent variable, holding all else constant). It should be noted that the estimates contained in the β parameter vector are only interpretable in this way due to the assumption that y* given x, satisfies the classical linear model assumptions. If these assumptions do not hold then the interval regression estimator of β would be inconsistent. As a result, it is important to test the key assumptions of functional form, homoskedasticity, and normality.

Diagnostic Tests

Machin and Stewart (1990) discuss diagnostic tests for (pseudo) functional form for an ordered probit, which is easily modified for the interval regression model, and Chesher and Irish (1987) outline diagnostic tests for normality and homoskedasticity for the grouped data model. These tests are all score (or Lagrange Multiplier) tests for which the test statistics all take the form

$$\xi = 1'F(F'F)^{-1}F'1 \tag{4}$$

where 1 is an n-dimensional vector of ones, and F is a matrix with row order n where each row contains the score contributions for all the parameters of the model. ξ can be easily calculated as n times the non-centered R^2 from a regression of 1 on the columns of F.

The construction of the F matrices for these tests, which are described below, are based on computations of the pseudo-residuals. Usually, residuals are defined as the difference between the observed and estimated values of the dependent variable. However, the estimated values of the dependent variable obtained in the interval regression have no counterpart in the data. Chesher and Irish (1987) provide the computational details for the pseudo-errors for the grouped model, denoted for the i^{th} individual as:

$$u_i = \frac{\phi(\frac{a_{(j-1)i} - x_i'\beta}{\sigma}) - \phi(\frac{a_{ji} - x_i'\beta}{\sigma})}{\sigma[\Phi(\frac{a_{ji} - x_i'\beta}{\sigma}) - \Phi(\frac{a_{(j-1)i} - x_i'\beta}{\sigma})]} \tag{5}$$

where $\phi(\cdot)$ denotes the probability density function for the standard normal, and a_{j-1} and a_j denote the known interval parameters for individual i (e.g. if y_i=2 then a_{j-1}=50 and a_j=60). The pseudo-residuals, e_i, are obtained by replacing the unknown parameters in (5) with their maximum likelihood estimates.

For the homoskedasticity and non-normality tests, higher-order moment residuals are required, specified as:

$$M_{\pi i} = \frac{(\frac{a_{(j-1)i} - x_i'\beta}{\sigma})^{\tau}\phi(\frac{a_{(j-1)i} - x_i'\beta}{\sigma}) - (\frac{a_{ji} - x_i'\beta}{\sigma})^{\tau}\phi(\frac{a_{ji} - x_i'\beta}{\sigma})}{\sigma[\Phi(\frac{a_{ji} - x_i'\beta}{\sigma}) - \Phi(\frac{a_{(j-1)i} - x_i'\beta}{\sigma})]} \tag{6}$$

The higher-order moment residuals are obtained by replacing the unknown parameters in (6) with their maximum likelihood estimates. The first four moment residuals are required for the desired tests and are defined as follows:

$$\begin{aligned} e_i^1 &= e_i \\ e_i^2 &= \hat{M}_{1i} \\ e_i^3 &= 2e_i^1 + \hat{M}_{2i} \\ e_i^4 &= 3e_i^2 + \hat{M}_{3i} \end{aligned} \tag{7}$$

The F matrix, or score contributions, is obtained by multiplying the pseudo-residuals by the various auxiliary variables in question.

Pseudo-Functional Form Test

The (pseudo) functional form test is a modified version of the RESET test (Ramsey 1969). F is given as

$$F = (e^1 x, e^1 \hat{y}^{*2}, ..., e^1 \hat{y}^{*K}, e^2) \tag{8}$$

where x includes a column of 1's if the grouped model contains an intercept and $\hat{y}^{*K}$ is the Kth power of $\hat{y}^* = x'\hat{\beta}$. That test statistic ξ is distributed as $\chi^2(K-1)$.

Test for Homoskedasticity

For the test of heteroskedasticity of unknown form, F is given as

$$F = (e^1 x, e^2 xx') \text{ [18]} \tag{9}$$

That test statistic ξ is distributed as $\chi^2(K)$ where K is the number of columns in x.

Non-Normality Test

Finally, F in the usual $\chi^2(2)$ test for zero skewness and/or excess kurtosis is given by

$$F = (e^1 x, e^2, e^3, e^4) \quad . \tag{10}$$

It should be noted that if either or both of the assumptions of normality and homoskedasticity are rejected, then the Huber (1967) "sandwich" estimator of the variance can be used in place of the conventional Maximum Likelihood variance estimator. This estimator is expressed as:

$$Var(\hat{\beta}) = [I(\hat{\beta})]^{-1} (x_i' u_i^2 x_i) [I(\hat{\beta})]^{-1} \tag{5}$$

where $I(\hat{\beta})$ is the information matrix for the $\hat{\beta}$ vector, computed at the maximum likelihood estimates.

While it is worthwhile considering the results of the aforementioned tests, caution should be exercised when interpreting the associated results. Orme (1990) has questioned the use of such score tests in the context of a simple binary probit and demonstrated their poor finite sample properties in this setting. In particular, he notes that there is upward size-distortion. Assuming that these findings extend to the group model estimated in this study, the tests may indicate that the model does not satisfy the classical linear model assumptions when in fact it does.

18 When an intercept is estimated so that x always contains a unit element, e^2 is redundant in the test for homoskedasticity.

Results

Estimation was undertaken using STATA 8.2 and was conducted using the 'INTREG' command. The command needs two variables, denoted y_1 and y_2, to define the dependent variable. In particular, y_1 and y_2 are used to hold the endpoints of the interval. As our data are right-censored, the upper endpoint of ∞ is represented by a missing value. Table 4 provides the concordances between y_i, the associated interval, y_1, and y_2. The model for the analysis is:

$$
\begin{aligned}
y_i^* = {} & \alpha + \beta_1 PROP_i + \beta_2 COOP_i + \beta_4 CORP_i + \beta_5 PUBCORP_i + \beta_6 SERVICE_i + \\
& \beta_7 AGR_i + \beta_8 CONSTRUC_i + \beta_9 SMALL_i + \beta_{10} LARGE_i + \beta_{11} LESS5_i + \\
& \beta_{12} OVER15_i + \beta_{13} NOCOMPET_i + \beta_{14} MORE3COMPET_i + \beta_{15} FOREIGN_i + \\
& \beta_{16} GOVOWN_i + \beta_{17} EXPORT_i + \beta_{18} AUDIT_i \qquad (4) \\
& [+\beta_{19} FIN_i + \beta_{20} INSTABILE_i + \beta_{21} ORGCRIME_i + \beta_{22} TAX_i + \\
& \beta_{23} CORRUP_i + \beta_{24} INFLAT_i + \beta_{25} EXCHANGE_i + \beta_{26} LAWS_i] \\
& (+ \sum_{t=27}^{32} \beta_t REGION_i, + \sum_{n=27}^{106} \beta_n COUNTRY_i]) + u_i, \qquad i = 1...N
\end{aligned}
$$

Table 3 provides a description of the above noted variables and Table 2 denotes the countries and regions available in the data. The model is estimated with and without the "perception" variables, which are the variables in the square brackets, and with and without either controls for region or country. This produces a total of six possible models.

The associated results are presented in Table 5. The first three columns relate to models without the perception variables. Model 1 is the base model, while Model 2 includes regional controls, and Model 3 includes country controls. The last three columns relate to models with the perception variables included. Model 4 is the base model, while Model 5 includes regional controls, and Model 6 includes country controls. The results for the diagnostic tests are presented near the end of the table. In all cases, the null of homoskedasticity is rejected and the Huber (1967) "sandwich" estimator of the variance is used in place of the conventional MLE

variance estimator. The null: (1) of normality for those models that include country controls; and (2) for the pseudo functional form test for all models except 1 and 4 is not rejected. On the basis of these last two test results, Models 1, 2, 4, and 5 should be treated with caution as they fail to meet the necessary assumptions for estimator consistency. These results provide some evidence that Models 3 and 6 meet the necessary assumptions required for consistent estimates, particularly in light of Orme's (1990) finding.

Various goodness of fit measures are also presented at the bottom of Table 5 for the relevant models. Larger (less negative) log-likelihood values are indicative of a better fit. However, only log-likelihood values across models with the same samples can be compared. That is, the log-likelihood values for Models 1, 2 and 3 can be compared and for Models 4, 5, and 6 but not, for example, Models 2 and 5. The R-square, for technical reasons, cannot be computed in the same way in interval regressions as it is in OLS regression. Various pseudo R-square measures, however, have been proposed, but there is no generally accepted measure. Veall and Zimmermann (1996) recommend the measure of McKelvey and Zavoina (1975), which is reported in the various results tables.[19] The log-likelihood function and the R-square measure are larger for those regressions that include the country controls. Tests of the joint significance of the explanatory variables are all significant and the region/country controls are also jointly significant. As a result of the goodness of fit and diagnostic tests, the preferred models are models 3 and 6.

The main results will now be discussed. The coefficients represent the marginal effects and can be interpreted as the impact of the firm's characteristic or perception variable in percentage terms on the share of sales that are reported for tax purposes. A positive (negative)

[19] The McKelvey and Zavoina (1975) R-square is computed in STATA with the 'fitstat' command.

estimate means that the variable is associated with greater tax compliance (non-compliance). In those specifications that do not include country controls, the coefficient associated with firms that are sole proprietorships/partnerships and corporations is negative. The results for Models 1 and 2 indicate that sole proprietorships report approximately 5 to 5.5 percentage points less of their sales to the tax authority, and this rises to between 6 and 7.5 percentage points in Models 4 and 5. These variables, however, are not significant in the models with country controls, the preferred models based on the diagnostic and goodness of fit tests. The other categories for the legal characteristics of the firm are insignificant in all specifications. In particular, it is interesting to note that it is revealed that public corporations are not significantly more compliant than other types of firms as was found by Rice (1992).

Most of the industry sectoral controls are insignificant with the exception of the service sector, which is positive across all specifications. Firms in the service sector report between 2 and 4 percentage points more of their sales to the tax authority. This result is contrary to that of Giles (2000) who found that firms in the service sector are more likely to be non-compliant.

Firm size is a significant indicator of the degree of compliance across all specifications. Small firms (less than 50 employees) report approximately 3.4 to 4.8 percentage points less of their sales while large firms (more than 500 employees) report approximately 3 to 4 percentage points more of their sales. Giles (2000) reports a similar result, whereas Rice (2002) found firm size and tax non-compliance were positively related. Firm age and the number of competitors a firm has, are insignificant in most of the specifications.

Both Giles (2000) and Chan and Mo (2000) found that foreign owned firms are more compliant, and the results in Table 5 provide further support for this result. Foreign owned firms report approximately 4 to 6.2 percentage points more of their sales and this result is significant

across all specifications. Chan and Mo (2000) report that export-oriented firms are more compliant and, at least in those specifications that do not include country controls, similar results are found. The coefficient associated with firms that export is positive and this indicates that exporters report between 2 to 3 percentage points more of their sales to the tax authority. Finally, firms that have their financial statements audited are significantly more tax compliant. These firms report between 5.7 and 10 percentage points more of their sales, and this result is significant across all specifications. The relationship between internal audit controls of the firm and tax compliance has not been investigated in previous empirical work.

Firms that perceive organized crime, the exchange rate, and high taxes and regulations as obstacles to doing businesses and report that government corruption is common, report less of their sales to the tax authority. These results are significant across all specifications. In comparison, Johnson *et al.* (2000) also found a positive relationship between non-compliance and government corruption but failed to find a relationship between compliance and organized crime and tax payments. Our results indicate that government corruption has the largest effect resulting in firms reporting approximately 11.3 to 13.3 percentage points less of their sales followed by organized crime at 5.8 to 10.6 percentage points less. High tax rates and burdensome regulations reduce reporting by between 5.2 and 5.8 percentage points and exchange rates reduce reporting by between 3.2 and 4.4 percentage points. A positive relationship between inconsistency in the interpretation in laws and regulations and tax compliance is found, but only in those specifications that exclude country controls.

The region controls are also highly significant and negative, though of smaller magnitudes in the regression that includes the perception variables (Model 5). This indicates that the perception variables are picking up behaviour previously ascribed to the region controls. The

results for Model 5 will be highlighted, which indicate that firms in Latin America are the least compliant, reporting 12.9 percentage points less of their sales, followed by Africa at 7.3 percentage points, Asia at 5.2 percentage points and Transition Europe at 3.8 percentage points less. The coefficient for the Former Soviet Union dummy variable is statistically insignificant.

Table 5 also includes the coefficients for the country controls, considered in Models 3 and 6. Again, the inclusion of the perception variables leads to changes in the reported coefficients so the results for Model 6 will be presented in detail.

- Africa: firms in Cameroon and Madagascar are the most compliant, reporting 13.4 and 17.6 percentage points more of their sales, while firms in Tunisia, Egypt, the West Bank-Gaza, and Ghana the least compliant.
- Asia: firms in India and Singapore are the most compliant, reporting approximately 20 percentage points more of their sales, while firms in Bangladesh and Cambodia are the least compliant, reporting 15.9 and 13.5 percentage points less of their sales respectively.
- OECD: not surprisingly, firms in the OECD are generally very compliant but firms in Canada, France and Italy are the most compliant, reported in ascending order. However, the result related to Italy is somewhat surprising since Italy is perceived to have a substantial underground economy.
- Transition Europe: Slovakia is the least compliant with firms reporting almost 40 percentage points less of their sales followed by Turkey and Croatia at 10 percentage points while firms in Slovenia are the most compliant reporting 22.8% more of their sales followed by Romania at 10.6 percentage points.
- Latin America: most will be unsurprised that firms in Haiti are the least compliant out of all other Latin American countries, reporting over 40 percentage points less of their sales.

Haiti is followed by Panama, Bolivia, and Trinidad and Tobago where firms report 19.6, 17.2, and 15.3 percentage points less of their sales, respectively. Chile, El Salvador, Nicaragua, and Uruguay are among the most compliant in the region.

— Former Soviet Union: contrary to the findings of Johnson *et al.* (2000), no difference is found in reporting by firms among the various countries in Soviet Union with the exception of Belarus, which is more compliant. All of the other results are statistically insignificant

The regions included in this dataset are quite diverse and it is very plausible that the relationship between firm characteristics, and the perception variables, and tax compliance may be quite different across regions. It would have been interesting to estimate our models separately for each region, but the sample sizes in these models were found to be very low, especially for the specifications that include the perception variables. Consequently, these results are not reported.

Conclusion

Very little is actually known about firm tax compliance due to a lack of detailed and readily available data. The purpose of this paper was to use a unique and recently available dataset that contained information on firms from around the world to investigate the factors that effect business tax compliance. This is one of the first studies to examine firm tax compliance using worldwide data. The majority of previous empirical studies were confined to examining firms within a particular country, using tax audit data.

Overall, evidence is presented that shows that firms in all regions around the world engage in tax non-compliance, but that there is substantial variation within regions. In addition,

while convincing results that the legal organization of a businesses effects tax compliance is not found, large firms, firms in the service sector, and firms that are foreign owned, are exporters and/or have their financial statements audited are found to be more compliant. On the other hand firms that are small and who report that organized crime, high taxes, and government corruption are obstacles for doing business are less compliant.

The findings do suggest a role for public policy, as well as actions to be considered by the tax authority and items for further study. First, the findings suggest that administrations interested in reducing business tax non-compliance should consider reducing taxes, eliminating government corruption, and minimizing organized crime activities. Admittedly, taking action of these issues is complex and involves more than just the tax authority. Second, tax authorities should consider auditing small firms at a higher rate and requiring all firms to have their financial statement audited by a third party. Finally, based on this study, it is not entirely clear why large firms, firms that are foreign owned, and firms that export are more compliant. Further exploration into these relationships appears to be a worthwhile venture.

TABLES

Table 1: Univariate Frequencies of Percentage of Sales Reported to Tax Authorities

	<50%	50-59%	60-69%	70-79%	80-89%	90-99%	100%
Frequency	696	489	365	514	685	826	2,450
Percent	11.55%	8.12%	6.06%	8.53%	11.37%	13.71%	40.66%
Observations	6,025						

Table 2: Countries Surveyed, Categorized by Region, and Number of Observations in Each Country

Country	Observations
Africa and Middle East	
Botswana	57
Cameroon	35
Côte d'Ivoire	36
Egypt	56
Ethiopia	39
Ghana	36
Kenya	55
Madagascar	27
Malawi	25
Namibia	34
Nigeria	41
Senegal	15
South Africa	70
Tanzania	32
Tunisia	36
Uganda	54
West Bank and Gaza	13
Zambia	40
Zimbabwe	59
Total	760
Asia	
Bangladesh	36
Cambodia	216
China	81
India	137
Indonesia	68
Malaysia	41
Pakistan	69
Philippines	89
Singapore	85
Thailand	286
Total	1108
OECD[1]	
Canada	94
France	70
Germany	55
Italy	71
Portugal	80
Spain	85
Sweden	79
United Kingdom	57
United States[1]	77
Total	668
Transition Europe	
Bosnia and Herzegovina	84
Bulgaria	77
Croatia	81
Czech Republic	86
Estonia	96
Hungary	93
Lithuania	27
Poland	178
Romania	97
Slovak Republic	22
Slovenia	96
Turkey	98
Total	1035
Former Soviet Union	
Armenia	82
Azerbaijan	82
Belarus	80
Georgia	73
Kazakhstan	75
Kyrgyzstan	88
Moldova	82
Russia	429
Ukraine	157
Uzbekistan	93
Total	1241
Latin American and Caribbean	
Argentina	76
Belize	21
Bolivia	71
Brazil	72
Chile	79
Colombia	89
Costa Rica	46
Dominican Republic	65
Ecuador	50
El Salvador	60
Guatemala	49
Haiti	67
Honduras	46
Mexico	42
Nicaragua	65
Panama	49
Peru	77
Trinidad and Tobago	64
Uruguay	64
Venezuela	61
Total	1213

Notes: [1]Denotes the omitted category in estimation.

Table 3: Data Summary

Variable	Acronym	Mean	Standard Deviation	Minimum	Maximum
% of Sales Reported	REPORT	2.962	2.161	1	7
Legal Organization of Company					
Sole Prop. & Partnerships	PROP	0.373	0.484	0	1
Cooperatives	COOP	0.037	0.188	0	1
Corporation	CORP	0.317	0.465	0	1
Public Corp.	PUBCORP	0.116	0.320	0	1
Other Business[1]	OTHER	0.157	0.364	0	1
Industry Sector					
Manufacturing[1]	MANUFAC	0.377	0.485	0	1
Service	SERVICE	0.433	0.496	0	1
Agriculture	AGR	0.026	0.159	0	1
Construction	CONSTRUC	0.070	0.255	0	1
Firm Size					
Small	SMALL	0.410	0.492	0	1
Medium[1]	MED	0.405	0.491	0	1
Large	LARGE	0.185	0.388	0	1
Firm Age					
<5	LESS5	0.262	0.440	0	1
5-15[1]	5TO15	0.378	0.485	0	1
>15	OVER15	0.360	0.480	0	1
Number of Competitors					
No Competitors	NOCOMPET	0.096	0.295	0	1
1-3[1]	1TO3	0.398	0.489	0	1
>3	MORE3COMPET	0.506	0.500	0	1
Other					
Foreign Owned	FOREIGN	0.204	0.403	0	1
Gov. Owned	GOVOWN	0.076	0.265	0	1
Exporter	EXPORT	0.374	0.484	0	1
Fin. Statements Audited	AUDIT	0.634	0.482	0	1
Secondary Parameters – Perception					
Financing	FIN	0.805	0.396	0	1
Political Instability	INSTABILE	0.842	0.365	0	1
Organized Crime	ORGCRIME	0.840	0.367	0	1
High Taxes & Regulations	TAX	0.738	0.440	0	1
Corruption	CORRUP	0.622	0.485	0	1
Inflation	INFLAT	0.896	0.306	0	1
Exchange Rate	EXCHANGE	0.549	0.498	0	1
Laws & Regs In consistent	LAWS	0.422	0.494	0	1

Notes: [1]Denotes the omitted category in estimation.

Table 4: Definition of the Dependent Variable for the Interval Regression Model

y_i	Associated Interval	y_1	y_2
1	(0, 50]	0	50
2	(50, 60]	50	60
3	(60, 70]	60	70
4	(70, 80]	70	80
5	(80, 90]	80	90
6	(90, 100]	90	100
7	(100, ∞]	100	.

Table 5: Estimation Results

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	**88.080**	**101.333**	**94.358**	**108.054**	**114.017**	103.914
	(2.056)* **	**(2.409)*** **	**(4.419)*** **	**(3.165)*** **	**(3.387)*** **	(5.672)***
Legal Organization of Company[1]						
Sole Prop. &	**-5.174**	**-5.410**	-1.782	**-6.128**	**-7.756**	-1.322
Partnerships	**(1.642)*** **	**(1.652)*** **	(1.786)	**(1.755)*** **	**(1.805)*** **	(1.995)
Cooperatives	-0.287	-1.988	1.614	0.347	-2.393	2.201
	(3.035)	(2.958)	(2.915)	(3.245)	(3.248)	(3.391)
Corporation	**-3.008**	**-3.438**	-0.201	**-4.395**	**-7.107**	-1.638
	(1.571)*	**(1.612)** **	(1.778)	**(1.678)*** **	**(1.755)*** **	(1.982)
Public	2.333	-0.664	2.055	0.673	-3.367	1.235
Corporation	(1.931)	(2.019)	(2.074)	(2.119)	(2.250)	(2.346)
Industry Sector[2]						
Service	**4.165**	**2.089**	**2.264**	**3.316**	**2.785**	2.709
	(1.086)* **	**(1.070)***	**(1.023)** **	**(1.195)*** **	**(1.189)** **	(1.151)**
Agriculture	**4.205**	2.007	2.358	1.553	0.494	0.752
	(2.006) **	(1.996)	(1.896)	(2.299)	(2.321)	(2.197)
Construction	1.647	0.346	-0.730	2.498	1.907	0.515
	(1.607)	(1.599)	(1.497)	(1.730)	(1.727)	(1.655)
Firm Size[3]						
Small	**-4.334**	**-3.925**	**-4.762**	**-3.402**	**-3.510**	-3.920
	(1.130)* **	**(1.113)*** **	**(1.066)*** **	**(1.235)*** **	**(1.231)*** **	(1.212)***
Large	1.140	**3.244**	**4.183**	**2.950**	**4.140**	4.545
	(1.467)	**(1.446)** **	**(1.353)*** **	**(1.609)***	**(1.610)** **	(1.517)***
Firm Age[4]						
<5	0.711	1.019	0.971	1.328	1.027	1.147
	(1.167)	(1.166)	(1.086)	(1.286)	(1.310)	(1.234)
>15	1.776	**2.430**	-0.231	-0.053	0.850	-0.162
	(1.186)	**(1.201)** **	(1.162)	(1.301)	(1.336)	(1.310)
Number of Competitors[5]						
No Competitors	1.943	1.9447	**3.381**	-1.670	-1.456	1.110
	(1.859)	(1.812)	**(1.697)** **	(1.949)	(1.926)	(1.868)
>3	**-2.899**	-1.729	-0.881	-0.250	-2.222	-1.057
	(1.061)* **	(1.273)	(1.290)	(1.187)	(1.490)	(1.519)
Other						
Foreign Owned	**4.865**	**6.215**	**5.402**	**4.019**	**4.306**	**3.695**
	(1.324)* **	**(1.308)*** **	**(1.244)*** **	**(1.476)*** **	**(1.476)*** **	**(1.424)*** **
Gov. Owned	0.032	-1.291	1.100	0.205	-0.948	1.519
	(1.931)	(1.879)	(1.761)	(2.201)	(2.170)	(2.095)
Export	**2.395**	**1.973**	0.790	**3.192**	**2.842**	1.855
	(1.096) **	**(1.097)***	(1.062)	**(1.207)*** **	**(1.232)** **	(1.223)
Audits	**7.396**	**10.020**	**6.356**	**7.527**	**8.800**	**5.704**
	(1.136)* **	**(1.171)*** **	**(1.149)*** **	**(1.250)*** **	**(1.297)*** **	**(1.295)*** **
Secondary Parameters – Perception						
Financing	-	-	-	-0.868	-0.192	-0.005
				(1.447)	(1.452)	(1.396)
Political	-	-	-	0.379	0.935	-0.598
Instability				(1.644)	(1.646)	(1.604)

(This table is continued on the next page)

Table 5 Continued

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Organized Crime	-	-	-	**-10.647**	**-9.233**	**-5.796**
				(1.170)* **	**(1.189)*** **	**(1.174)*** **
Taxes & Regs.	-	-	-	**-5.528**	**-5.834**	**-5.175**
				(2.111)* **	**(2.132)*** **	**(2.090)** **
Corruption	-	-	-	**-13.342**	**-13.051**	**-11.358**
				(1.099)* **	**(1.114)*** **	**(1.106)*** **
Inflation	-	-	-	2.678	2.311	1.300
				(1.715)	(1.712)	(1.725)
Exchange Rate	-	-	-	**-3.817**	**-3.222**	**-4.410**
				(1.371)* **	**(1.381)** **	**(1.367)*** **
Laws & Regs.	-	-	-	**2.013**	**2.147**	1.671
In consistent				**(1.036)***	**(1.042)** **	(1.015)
			Region[6]			
Africa & Middle	-	**-21.035**	-	-	**-7.310**	-
East		**(2.020)*** **			**(2.474)*** **	
Transition	-	**-9.554**	-	-	**-3.812**	-
Europe		**(2.081)*** **			**(2.534)***	
Asia	-	**-22.962**	-	-	**-5.207**	-
		(1.954)* **			**(2.312)** **	
Latin America	-	**-19.161**	-	-	**-12.908**	-
		(1.831)* **			**(1.925)*** **	
Former Soviet	-	**-11.068**	-	-	-2.663	-
Union		**(2.132)*** **			(2.375)	
			Country[7]			
			Africa & Middle East			
Botswana	-	-	**-11.448**	-	-	-8.107
			(5.508) **			(7.062)
Cameroon	-	-	-5.014	-	-	**13.364**
			(5.964)			**(7.527)***
Cote d'Ivoire	-	-	-2.481	-	-	6.368
			(5.951)			(7.868)
Egypt	-	-	**-38.744**	-	-	**-30.289**
			(4.723)* **			**(6.739)*** **
Ethiopia	-	-	-6.340	-	-	3.809
			(6.487)			(9.040)
Ghana	-	-	**-13.425**	-	-	**-10.673**
			(6.617) **			**(7.380)**
Kenya	-	-	-6.627	-	-	3.445
			(5.441)			(6.088)
Madagascar	-	-	-1.339	-	-	**17.637**
			(8.618)			**(10.679)***
Malawi	-	-	-9.675	-	-	4.511
			(7.490)			(9.251)
Namibia	-	-	**-12.705**	-	-	1.650
			(7.038)*			(8.335)
Nigeria	-	-	**-10.009**	-	-	10.302
			(5.681)*			(7.455)

(This table is continued on the next page)

Table 5 Continued

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Senegal	-	-	-10.772	-	-	10.207
			(8.014)			(21.433)
South Africa	-	-	**-9.270**	-	-	-3.805
			(5.381)*			(6.308)
Tanzania	-	-	-9.189	-	-	3.578
			(7.627)			(9.152)
Tunisia	-	-	**-39.647**	-	-	**-35.614**
			(6.152)***			**(13.499)*****
Uganda	-	-	0.337	-	-	9.972
			(5.499)			(6.841)
West Bank-Gaza	-	-	**-23.098**	-	-	**-21.761**
			(7.896)***			**(9.195)****
Zambia	-	-	-8.855	-	-	2.788
			(5.951)			(7.590)
Zimbabwe	-	-	-8.893	-	-	3.892
			(5.493)			(6.550)
			Asia			
Bangladesh	-	-	**-32.571**	-	-	**-15.863**
			(6.089)			**(7.497)****
Cambodia	-	-	**-23.586**	-	-	**-13.553**
			(4.736)***			**(5.536)****
China	-	-	**-40.528**	-	-	-
			(5.679)***			
India	-	-	6.395	-	-	**20.330**
			(4.701)			**(5.478)*****
Indonesia	-	-	**-10.626**	-	-	1.868
			(5.558)*			(6.435)
Malaysia	-	-	**-16.994**	-	-	-8.228
			(6.830)**			(7.632)
Pakistan	-	-	**-21.470**	-	-	-5.378
			(5.755)***			(6.410)
Philippines	-	-	-7.623	-	-	4.477
			(5.393)			(5.968)
Singapore	-	-	**23.842**	-	-	**20.975**
			(7.003)***			**(7.443)*****
Thailand	-	-	**-21.984**	-	-	-
			(4.339)***			
			OECD			
Canada	-	-	**15.446**	-	-	**14.707**
			(5.336)***			**(5.986)****
France	-	-	**16.509**	-	-	**18.438**
			(5.719)***			**(6.407)*****
Germany	-	-	**-11.642**	-	-	-8.010
			(4.739)**			(5.485)
Italy	-	-	**23.494**	-	-	**25.493**
			(6.122)***			**(6.813)*****

(This table is continued on the next page)

Table 5 Continued

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Portugal	-	-	4.061	-	-	2.805
			(5.199)			(5.878)
Spain	-	-	7.149	-	-	8.441
			(5.400)			(6.075)
Sweden	-	-	8.692	-	-	5.679
			(4.986)*			(5.553)
UK	-	-	8.629	-	-	9.024
			(6.575)			(7.083)
			Transition Europe			
Bosnia	-	-	6.903	-	-	4.532
			(5.558)			(6.442)
Bulgaria	-	-	**-9.983**	-	-	-2.576
			(5.566)*			(6.509)
Croatia	-	-	**-15.271**	-	-	**-10.518**
			(5.120)***			**(5.919)***
Czech Rep	-	-	-0.829	-	-	2.929
			(5.194)			(6.030)
Estonia	-	-	-4.368	-	-	-1.338
			(4.623)			(5.422)
Hungary	-	-	-2.542	-	-	3.777
			(5.115)			(6.022)
Lithuania	-	-	**-55.315**	-	-	-55.428
			(5.251)***			(5.918)***
Poland	-	-	3.663	-	-	6.670
			(4.653)			(5.557)
Romania	-	-	1.097	-	-	**10.553**
			(4.645)			**(5.480)***
Slovakia	-	-	**-52.784**	-	-	**-39.279**
			(5.249)***			**(7.032)*****
Slovenia	-	-	**21.004**	-	-	**22.808**
			(5.369)***			**(6.106)*****
Turkey	-	-	**-20.149**	-	-	**-10.254**
			(4.894)***			**(5.688)***
			Latin America & Caribbean			
Argentina	-	-	**-11.528**	-	-	-8.117
			(5.378)**			(6.037)
Belize	-	-	-9.944	-	-	-9.310
			(8.820)			(8.796)
Bolivia	-	-	**-24.693**	-	-	**-17.154**
			(5.443)***			**(6.066)*****
Brazil	-	-	-8.792	-	-	-2.489
			(6.192)			(6.766)
Chile	-	-	**19.429**	-	-	**19.148**
			(6.132)***			**(6.648)*****
Colombia	-	-	**-13.675**	-	-	-6.950
			(6.218)**			(6.889)

(This table is continued on the next page)

Table 5 Continued

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Costa Rica	-	-	**-13.329**	-	-	-5.413
			(5.868)**			(6.227)
Dominican	-	-	**-15.465**	-	-	6.308
Republic			**(5.401)*****			(5.932)
Ecuador	-	-	**-18.607**	-	-	-5.397
			(6.228)***			(6.960)
El Salvador	-	-	10.334	-	-	**15.846**
			(6.833)			**(7.212)*****
Guatemala	-	-	**-11.383**	-	-	-5.287
			(6.140)*			(6.727)
Haiti	-	-	**-52.132**	-	-	**-40.420**
			(5.659)***			**(6.450)*****
Honduras	-	-	8.990	-	-	6.418
			(7.106)			(8.349)
Mexico	-	-	-5.407	-	-	5.274
			(7.256)			(8.132)
Nicaragua	-	-	3.588	-	-	**10.255**
			(6.693)			**(7.544)**
Panama	-	-	**-26.292**	-	-	**-19.619**
			(7.092)***			**(7.518)*****
Peru	-	-	**-11.063**	-	-	-1.693
			(5.210)**			(5.955)
Trinidad&Tobago	-	-	**-17.070**	-	-	**-15.326**
			(5.311)***			**(5.827)*****
Uruguay	-	-	**13.446**	-	-	**9.722**
			(7.115)*			**(8.158)**
Venezuela	-	-	-7.497	-	-	1.143
			(6.321)			(6.874)
			Former Soviet Union			
Armenia	-	-	-0.933	-	-	5.994
			(5.049)			(5.926)
Azerbaijan	-	-	**-10.216**	-	-	-4.313
			(5.567)*			(6.089)
Belarus	-	-	**10.474**	-	-	**14.198**
			(5.253)**			**(5.917)****
Georgia	-	-	-2.249	-	-	8.774
			(5.865)			(6.513)
Kazakhstan	-	-	-1.343	-	-	9.308
			(5.829)			(7.029)
Kyrgyzstan	-	-	**-8.823**	-	-	-0.243
			(4.488)**			(5.573)
Moldova	-	-	-7.465	-	-	7.238
			(5.453)			(6.432)
Russia	-	-	**-11.948**	-	-	-4.284
			(4.216)***			(5.088)
Ukraine	-	-	-4.037	-	-	3.633
			(4.814)			(5.588)

(This table is continued on the next page)

Table 5 Continued

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Uzbekistan	-	-	**-11.854 (5.145)****	-	-	-5.221 (6.116)
			Diagnostic Tests			
Pseudo Functional Form Test[8] [d.o.f.; P-Value]	14.936 [3; 0.002]	7.798 [3; 0.050]	5.866 [3; 0.118]	16.759 [3; 0.001]	6.870 [3; 0.076]	24.980 [3; 0.00]
Homoskedasticity Test[9] [d.o.f.; P-Value]	108.152 [17; 0.000]	3428.278 [22; 0.000]	5849.945 [96; 0.000]	77.724 [25; 0.000]	2616.940 [30; 0.000]	4429.594 [104; 0.000]
Normality Test [d.o.f.; P-Value]	295.348 [2; 0.000]	135.718 [2; 0.000]	1.174 [2; 0.556]	27.954 [2; 0.000]	11.009 [2; 0.004]	5.332 [0.070]
			Goodness of Fit			
Pseudo Log-Likelihood Value	-10273.028	-10162.527	-9729.695	-7501.096	-7475.952	-7213.586
McKelvey & Zavoina Pseudo R^2	0.035	0.086	0.145	0.082	0.087	0.154
LRT-OS[10] [d.o.f.; P-Value]	321.296 [17; 0.000]	542.299 [22; 0.000]	1407.963 [96; 0.000]	630.514 [17; 0.000]	680.803 [22; 0.000]	1205.532 [96; 0.000]
LRT-AV[11] [d.o.f.; P-Value]	-	221.002 [5; 0.00]	1086.666 [79; 0.00]	-	50.288 [5; 0.00]	575.020 [79; 0.00]
σ (s.e.)	32.994 (0.425)	32.190 (0.415)	29.457 (0.394)	31.072 (0.487)	30.806 (0.482)	28.628 (0.459)
Observations		6025			4561	

Notes: § Robust standard errors (s.e.) corrected for heteroskedasticity are noted in parenthesis.
† ***,** and * denote statistical significance at the 1%, 5% and 10% level respectively.
± d.o.f. denotes degrees of freedom.
‡ Omitted category is [1] "Other", [2] "Manufacturing", [3] "Medium", [4] "Between 5 and 15", [5] "Between 1 and 3", [6] "OECD", [7] "United States".

[8] The functional form test uses as auxiliary variables the fitted values from the interval regression raised to polynomials of up to the fourth order.

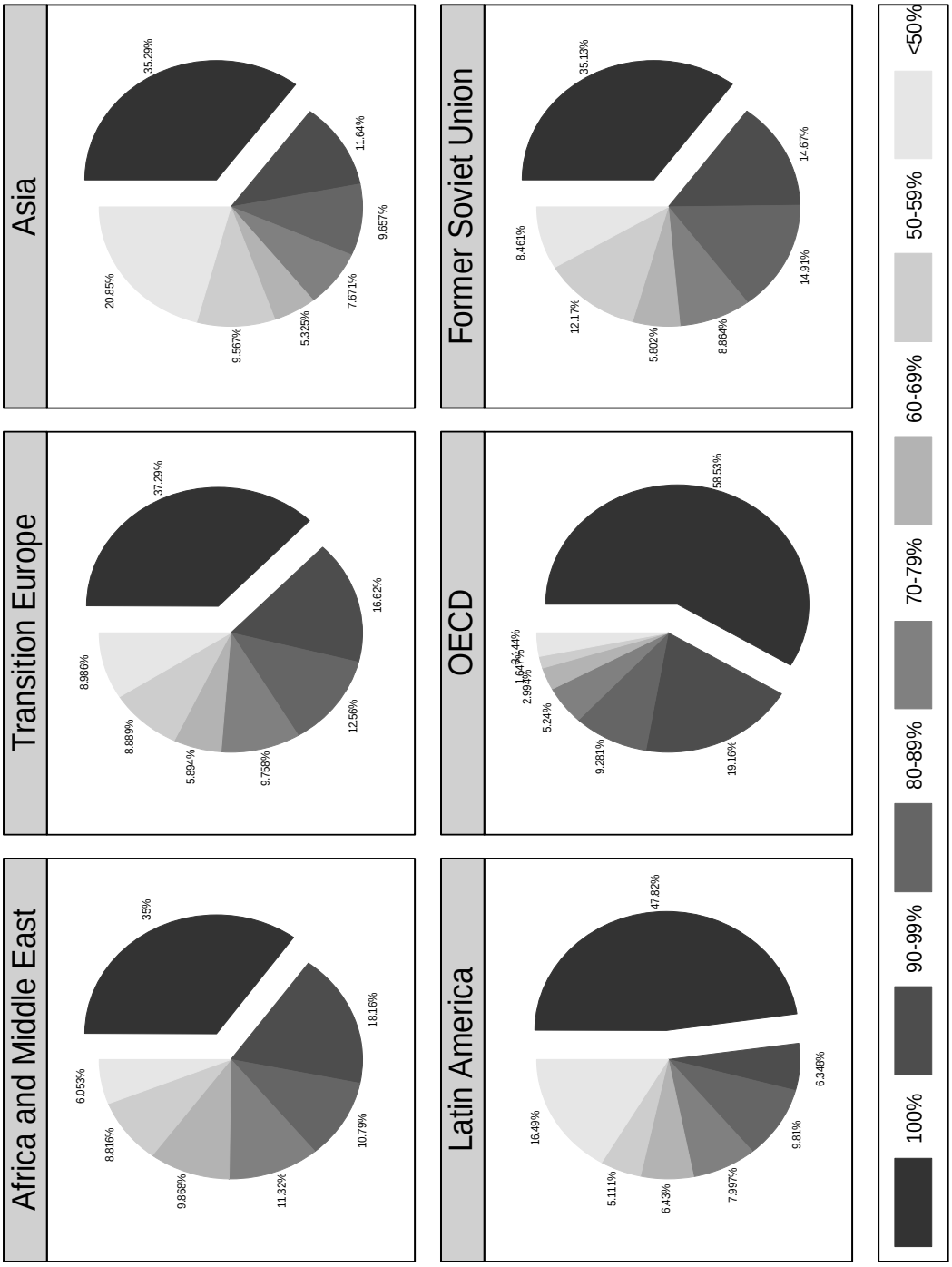
[9] The homoskedasticity test uses all the original regressors as auxiliary regressors.

[10] Likelihood Ratio Test (LRT) of the overall significance (OS) of the model tests the joint significance of the explanatory variables. It is calculated as $LRT=-2(L^R-L^U)$ which is distributed as χ^2 with k degrees of freedom where is the number of dependent variables (not including the constant term) in the unrestricted regressions. The restricted regression includes only a constant.

[11] Likelihood Ratio Test (LRT) of the joint significance of the additional variables (AV) (those added to the Model 1 or 4 specifications). It is calculated as $LRT=-2(L^R-L^U)$ which is distributed as χ^2 with k degrees of freedom where is the number of additional dependent variables (not including the constant term) in the unrestricted regressions. The unrestricted regression is the model specified in the column in which the statistic is calculated. The restricted regression is Model 1 or 4 accordingly.

FIGURES

Figure 1: Percentage of Sales Reported to Tax Authorities



Source: World Business Environment Survey

REFERENCES

Allingham, M. and A. Sandmo. 1972. Income Tax Evasion: A Theoretical Analysis. *Journal of Public Economics* 1:323-338.

Andreoni, James. 1992. IRS as Loan Shark: Tax Compliance with Borrowing Constraints. *Journal of Public Economics* 49:35-46.

_____. Brian Erard, and Jonathan Feinstein. 1998. Tax Compliance. *Journal of Economic Literature* 36:818-860.

Apel, Mikael. 1994. An Expenditure-Based Estimate of Tax Evasion in Sweden. Working Paper, Department of Economics, Uppsala University.

Batra, Geeta, Daniel Kaufmann and Andrew H.W. Stone. 2003. *Investment Climate Around the World: Voices of the Firms from the World Business Environment Survey*. Washington, D.C.: The World Bank.

Border, Kim C. and Joel Sobel. 1987. Samurai Accountant: A Theory of Audit and Plunder. *Review of Economic Studies* 54:525-540.

Chan, K. Hung and Phyllis Lai Lan Mo. 2000. Tax Holidays and Tax Noncompliance: An Empirical Study of Corporate Tax Audits in China's Developing Economy. *The Accounting Review* 75:469-484.

Chen, Kong-Pin and C. Y. Cyrus Chu. 2005. Internal Control and External Manipulation: A Model of Corporate Income Tax Evasion. *RAND Journal of Economics* 26:151-164.

Chesher, A. and M. Irish. 1987. Residual Analysis in the Grouped and Censored Normal Regression Model. *Journal of Econometrics* 34:33–61.

Christian, Charles W. 1994. Voluntary Compliance with Individual Income Tax: Results from the 1988 TCMP study. *The IRS Research Bulletin Publication 1500* 9:35-42.

Cowell, Frank. 2003. Sticks and Carrots. In *The Crises in Tax Administration* , eds. Henry Aaron and Joel Slemrod, 230-258. Washington, D.C.: The Brookings Institution Press.

Cremer, Helmuth, Maurice Marchand and Pierre Pestieau. 1990. Evading, Auditing and Taxing: the Equity-Compliance Tradeoff. *Journal of Public Economics* 43:67-92.

Crocker, Joel and Joel Slemrod. 2005. Corporate Tax Evasion with Agency Costs. *Journal of Public Economics* (forthcoming).

Erard, Brian. 1992. The Influence of Tax Auditing on Reporting Behaviour. In *Why People Pay Taxes*, ed. Joel Slemrod. Ann Arbor: University of Michigan.

_____ and Chih-Chin Ho. 2001. Searching for Ghosts: Who are the Nonfilers and How Much Tax do they Owe? *Journal of Public Economics* 81:25-50.

Giles, David E.A. 2000. Modelling the Tax Compliance Profiles of New Zealand Firms. In *Taxation and the Limits of Government* , eds. Gerald W. Scully and Patrick J. Caragata, 243-270. Boston: Kluwer Academic Publishers.

Huber, P.J. 1967. The Behaviour of Maximum Likelihood Estimates under Non-standard Conditions. In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, 221-223. Berkeley: University of California Press.

Internal Revenue Service. 2004. Interactive Tax Gap Map. National Headquarters Office of Research.

Johnson, Simon, Daniel Kaufmann, John McMillan, and Christopher Woodruff. 2000. Why do firms hide? Bribes and Unofficial Activity After Communism. *Journal of Public Economics* 76:495-520.

Joulfaian, David. 2000. Corporate Tax Evasion and Managerial Preferences. *Review of Economics and Statistics* 82:698-701.

_____ and Mark Rider. 1998. Differential Taxation and Tax Evasion by Small Business. *National Tax Journal* 51:676-87.

Lyssiotou, Panayiota, Panos Pashardes and Thanasis Stengos. 2004. Estimates of the Black Economy Based on Consumer Demand Approaches. *Economic Journal* 114:622-640.

Machin, S., and M. Stewart. 1990. Unions and the Financial Performance of British Private Sector Establishments. *Journal of Applied Econometrics* 5:327–350.

McElvey, W. and Zavoina, R. 1975. A Statistical Model for the Analysis of Ordinal Level Dependent Variables. *Journal of Mathematical Sociology* 4:103-120.

Mirus, Rolf and Roger S. Smith. 1997. Self-Employment, Tax Evasion, and the Underground Economy: Micro-Based Estimates for Canada. Working Paper, International Tax Program, Harvard Law School.

Mookherjee, Dilip and Ivan P.L. P'ng. 1989. Optimal Auditing, Insurance and Redistribution. *Quarterly Journal of Economics* 104:399-415.

Orme, C. 1990. The Small-Sample Performance of the Information Matrix Test. *Journal of Econometrics* 46:309–331.

Pissarides, Christopher A., and Guglielmo Weber. 1989. An Expenditure-based Estimate of Britain's Black Economy. *Journal of Public Economics* 39:17-32.

Ramsey, J.B. 1969. Tests for Specification Errors in Classical Linear Least-Squares Regression Analysis. *Journal of the Royal Statistical Society* 31:350 – 71.

Rice, Eric M. 1992. The Corporate Tax Gap: Evidence on Tax Compliance by Small Corporations. In *Why People Pay Taxes*, ed. Joel Slemrod, 125-166. Ann Arbor: University of Michigan Press: Ann Arbor.

Sanchez, Isabel and Joel Sobel. 1993. Hierarchical Design and Enforcement of Income Tax Policies. *Journal of Public Economics* 50:345-369.

Schuetze, Herb J. 2002. Profiles of Tax Noncompliance Among the Self-Employed in Canada, 1969-1992. *Canadian Public Policy* XXVIII: 219-237.

Scotchmer, Suzanne. 1987. Audit Classes and Tax Enforcement Policy. *American Economic Review* 77:229-233.

Slemrod, Joel. 2004. The Economics of Corporate Tax Selfishness. Working Paper 10858, National Bureau of Economic Research.

_____ and Shlomo Yitzhaki. 1996. The Cost of Taxation and the Marginal Efficiency Cost of Funds. *International Monetary Fund Staff Papers* 43:25-34.

Smith, J. and T. Adams. 1987. The Measurement of Selected Income Flows in Informal Markets, 1981 and 1985-1986. Working Paper, University of Michigan Survey Research Centre.

Smith, Stephen with Christopher A. Pissarides and Guglielmo Weber. 1986. Evidence from Survey Discrepancies. In *Britain's Shadow Economy,* ed. Stephen Smith, 137-153. Oxford: Clarendon Press.

Stewart, M. 1983. On Least Squares Estimation when the Dependent Variable is Grouped. *Review of Economic Studies* 50:737-753.

Tannenbaum, Robert. 1993. Corporate Tax Disclosure: Good or Bad for the Commonwealth? Working Paper, Massachusetts Special Commission on Business Tax Policy.

Tedds, Lindsay M. 2005. Nonparametric Expenditure-based Estimation of Income Under-reporting and the Underground Economy. Working Paper, Department of Economics, McMaster University.

Trandel, Greg and Arthur Snow. 1999. Progressive Income Taxation and the Underground Economy. *Economics Letters* 62:217-222.

Veall, Michael R. and Kurt F. Zimmermann. 1996. Pseudo-R^2 Measures for Some Common Limited Dependent Variable Models. *Journal of Economic Surveys* 10:241-259.

Watson, Harry. 1985. Tax Evasion and Labor Markets. *Journal of Public Economics* 27:231-246.

World Bank. 1997. World Development Report 1997: The State in a Changing World. Washington, D.C.: World Bank Group.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge: The MIT Press.