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Essays in Taxation and International Relations

A dissertation presented

by

Ioana Maria Petrescu

to

The Committee of Economics

in partial fulfillment of the requirements
for the degree of
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in the subject of
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Essays in Taxation and International Relations

Abstract

This thesis consists of three essays on taxation and international relations. The first essay investigates the effects of personal income tax progressivity on the decision to become self-employed. I develop a theoretical model of tax evading self-employed individuals who pay bribes to tax authorities. The model predicts that progressivity affects the decision to become self-employed even if people tax evade. I then test this prediction empirically using three sources of data. I find that increases in progressivity decrease the probability of choosing self-employment and decrease the number of micro enterprises. I also find that in countries with high tax evasion and frequent bribes, self-employment is less responsive to taxes than in the U.S.

In the second essay, I investigate whether sanctions affect future military behavior. I look at the effects of sanctioning a country involved in a militarized dispute on the probability that the sanctioned country or any other country involved in the dispute will be involved in a militarized dispute in the future. I also look at the effects of the sanction on the probability that countries similar to the ones in the sanctioned dispute will participate in another dispute in the future. I find that countries involved in a dispute and countries similar to the ones involved in the dispute are less likely to participate in another dispute in the future if one of the countries involved in the original dispute was sanctioned.

The third essay looks at the ways in which improving the financial sector leads to more revenue. I use a panel of data from 72 countries and from 14 years to test

the relationship between financial sector quality and different types of tax revenue. I construct a financial indicator that encompasses measures from five areas of the financial system and show that an increase in the quality of financial intermediaries increases total tax revenue and income tax revenue as shares of GDP. My findings suggest that the quality of the financial sector does not affect the revenue collected from sales, property or gift taxes.

Contents

Chapter 1: Income Taxation and Self-Employment: The Impact of Progressivity in Countries with Tax Evasion

1.1 Introduction

Estonia was the first transitional economy to adopt a flat income tax, in 1994. Shortly after, Lithuania, Latvia, Russia, Serbia, Slovak Republic, Ukraine, Georgia and Romania also switched to flat tax systems. Table 1.1 provides more information on these tax reforms. The main objectives of these tax reforms were "the creation of a

Table 1.1
TAX REFORMS IN TRANSITIONAL AND DEVELOPING COUNTRIES 1994-2005

country	year	personal income tax rates
Estonia	1993	16, 24, 33
	1994	26
Lithuania	1993	10, 18, 24, 28, 33
	1994	33
Latvia	1996	25, 10
	1997	25
Russia	2000	12, 15, 20, 25, 35, 45
	2001	13
Slovak Republic	2003	10, 20, 28, 35, 38
	2004	19
Ukraine	2003	10, 15, 20, 30, 40
	2004	13
Georgia	2004	12, 15, 17, 20
	2005	12
Romania	2004	18, 23, 28, 34, 40
	2005	16

business and investment friendly environment for both individuals and companies" (Ministry of Finance of the Slovak Republic 2005) and "stimulating entrepreneurship, private investment and job creation" (SEE Monitor 2005). Although the effects of income taxes on entrepreneurship have been studied extensively for developed countries like the U.S., little is known about their effects in developing and transitional countries. How does personal income tax progressivity affect the decision to become self-employed? Do tax effects differ among countries with different levels of tax evasion and corruption? These are the main questions I address in this chapter.

Taxes can have a number of effects on self-employment decisions. Self-employment income is uncertain and, thus, self-employment is often seen as adding one more risky asset to one's portfolio. Income taxation can encourage self-employment through its effects on risk-sharing. The government shares part of the risk of self-employment through progressive taxation. Individuals might wish to offset this by increasing the

riskiness of their portfolio and becoming self-employed. This is an implication of the study on proportional tax and risk-taking by Domar and Musgrave (1944). However, Gentry and Hubbard (2000) argue that progressivity leads to less self-employment because high progressivity reduces the returns of successful self-employed individuals disproportionately relative to the unsuccessful ones and increases the average tax burden for self-employed individuals. Empirical studies find that in the U.S., high progressivity reduces the probability of entry into self-employment (Gentry and Hubbard 2000).

In developing and transitional countries, there are additional implications of taxation for self-employment. In these countries, tax compliance is low, bribes are common and the unofficial economy is large. For example, in 2000, Russia had an unofficial economy of 46.1% of the Russian GDP, while the U.S. had an unofficial economy of only 8.7% of its GDP (Schneider 2005). A self-employed individual from a country with low tax compliance is more likely to tax evade than his U.S. counterpart. Thus, the effects of an increase in tax progressivity are likely to be smaller for a person in a developing country because the increase in average tax burden is smaller due to tax evasion. The possibility of bribes offsets this to some extent. Bribery is generally related to a firm's performance, so an increase in tax progressivity may lead to more taxes and more bribes than in a country with less common bribes. As a result, the effects of progressivity could be larger. In this paper, I focus explicitly on these channels through which taxes affect self-employment in developing and transitional countries.

First, I introduce a theoretical model in which an individual chooses between self-employment and wage employment. I assume that individual can tax evade all or part of his income in self-employment, while he cannot tax evade in wage employment. Self-

employed individuals who choose to tax evade all their income are called unofficially self-employed and those who declare a part of their income are called officially self-employed. Official and unofficial self-employed individuals pay bribes if caught tax evading. The model predicts that an increase in income tax progressivity makes people more likely to choose unofficial self-employment over official self-employment and wage employment over any type of self-employment. It also predicts that an increase in the probability that self-employed individuals pay bribes discourages self-employment. Finally, it predicts that effects of progressivity are higher in countries with high probabilities of paying a bribe.

I test these predictions empirically, first, by exploring the effects of tax changes in one particular country, and second, by exploring the progressivity effects across countries. I start by exploiting tax reforms in Russia in 1993 and 2001. I use individual longitudinal data and explore how individuals took self-employment decisions before and after the tax change in a differences-in-differences model. I show that after progressivity decreased, people were more likely to become officially self-employed and less likely to become wage employed.

Next, I investigate the relationship between the number of official micro enterprises in a country and the progressivity of that country's tax system. I construct a data set of income tax schedules for 76 countries and 12 years and use it to construct a measure of progressivity at the country level. I find that an increase in this measure of progressivity leads to a decrease in the number of official micro enterprises. I also show that the effects of progressivity are larger in countries where bribes are more common.

Finally, I use individual level data from 8 developing and transitional countries to estimate the amount people are tax evading and an individual progressivity measure

on the amount that is not evaded. I estimate a multinominal logit model for official self-employment, unofficial self-employment, and wage employment. I find that low progressivity leads people to choose both official and unofficial self-employment over wage employment.

The rest of this chapter is organized as follows: Section 1.2 introduces a model of self-employment, tax progressivity and tax evasion. Section 1.3 looks at the individual decisions about self-employment before and after two tax reforms in Russia. Section 1.4 investigates the relationship between progressivity and self-employment across countries. Section 1.5 concludes.

1.2 A Theoretical Model of Self-Employment and Tax Evasion

This section describes a theoretical model of individuals who can tax evade if they are self-employed, who can avoid paying taxes by paying bribes and who can operate in the unofficial economy.

The individual in this model chooses between being wage employed and being self-employed. If he is wage employed, then he earns an income $y_e > 0$ that depends on the personal characteristics of the individual. If he is wage employed, he cannot tax evade, so he always declares his full income y_e to the tax authorities, and pays $\tau(y_e)$ in taxes, where $\tau(y) \geq 0$ for any income y and $\tau(0) = 0$. The individual has a utility function U that depends on his after-tax income. So, for a wage employed individual, the utility is

$$U = U(y_e - \tau(y_e)). \tag{1}$$

where $U' > 0$ and $U'' < 0$.

If he is self-employed, he earns an uncertain income. With probability q he earns a large income $\overline{y_s}$, called a successful income, and with probability $(1-q)$ he earns a small income $\underline{y_s}$, called an unsuccessful income. $\overline{y_s} > \underline{y_s} > 0$.

If a person is self-employed, he can also tax evade. He chooses what share k of his self-employed income he declares to tax authorities. He can choose 0 or K, where K is a fixed share of income usually evaded by self-employed individuals in his country. $K \in (0,1)$. With probability p, he gets caught evading and he pays a bribe B to avoid paying the taxes he owns to the government. B depends on the amount evaded,

$$B = B(y(1-k)), \tag{2}$$

where $B(0) = 0$, $B'(y(1-k)) > 0$. If the person pays the bribes, then he doesn't have to pay taxes on $y(1-k)$, the amount he evaded.

If the individual declares at least a part of his self-employed income ($k = K$), then he is considered to operate in the official self-employment sector, and if he declares no income at all ($k = 0$), then he operates in the unofficial self-employment sector.

The individual makes his occupational decision in two steps. First, he chooses the k he is going to report to the tax authorities if he becomes self-employed and earns an income y. I assume he knows the probability of being caught p, the amount he needs to pay in taxes τ, and the bribe he needs to pay if caught B.

He chooses a k that maximizes his expected utility

$$E(U) = pU(y - \tau(ky) - B(y(1-k))) + (1-p)U(y - \tau(ky)). \quad (3)$$

He chooses official self-employment, $k = K$ if the following holds

$$pU(y - B(y)) + (1-p)U(y) \leq pU(y - \tau(Ky) - B(y(1-K))) + (1-p)U(y - \tau(Ky)) \quad (4)$$

If an increase in tax progressivity also involves an increase in the amount paid τ, then this increase in progressivity makes people declare less income and, thus, makes them less likely to choose official self-employment over unofficial self-employment. The intuition is simple: An increase in taxes paid in the official sector makes the unofficial sector in which no taxes are paid more attractive.

The probability p, how common bribes are in the economy, also affects the decision between official self-employment and unofficial self-employment. In order to estimate the effect of p on the decision between the two types of self-employment, I rewrite (4) as,

$$(1-p)(U(y) - U(y - \tau(Ky)) \leq p(U(y - \tau(Ky) - B(y(1-K)) - U(y - B(y))). \quad (5)$$

(5) implies that p has a positive effect on the probability of being officially self-

employed if $\tau(Ky) + B(y(1-K)) < B(y)$ and a negative effect otherwise. In the situation in which the bribe paid if caught evading everything is much larger than the bribe paid if caught evading only a part of the income, more common bribes make people more likely to choose official self-employment. An increase in probability of being caught makes people more likely to choose the alternative for which the amount paid in bribes is lower.

Second, the individual chooses between self-employment and wage employment. He knows his successful income $\overline{y_s}$, and his unsuccessful income $\underline{y_s}$. He has already decided what k he declares for each income. Let $\overline{k_s}$ be the share of income he declares for $\overline{y_s}$ and $\underline{k_s}$ the share for $\underline{y_s}$. He also knows his employment income y_e, the probability of getting caught p, the probability of earning a successful income q, taxes τ, and the bribe B. He chooses the occupation that gives him the larger expected utility, so he chooses self-employment if the following holds

$$\begin{aligned} U(y_e - \tau(y_e)) \leq\ & pqU(\overline{y_s} - \tau(\overline{k}\overline{y_s}) - B(\overline{y_s}(1-\overline{k})))+ \\ & (1-p)qU(\overline{y_s} - \tau(\overline{k}\overline{y_s}))+ \\ & p(1-q)U(\underline{y_s} - \tau(\underline{k}\underline{y_s}) - B(\underline{y_s}(1-\underline{k})))+ \\ & (1-p)(1-q)U(\underline{y_s} - \tau(\underline{k}\underline{y_s})). \end{aligned} \tag{6}$$

(6) implies that a decrease in progressivity encourages the individual to choose self-employment if $y_e \leq \min(\underline{k}\underline{y_s}, \overline{k}\overline{y_s})$, or if $\underline{k}\underline{y_s} \leq y_e \leq \overline{k}\overline{y_s}$ and q is high, or if $\overline{k}\overline{y_s} \leq y_e \leq \underline{k}\underline{y_s}$ and q is low. An increase in progressivity encourages the individual to choose self-employment if bribes don't increase too much as a result of the increase in progressivity and if $y_e \geq \max(\underline{k}\underline{y_s}, \overline{k}\overline{y_s})$, or if $\underline{k}\underline{y_s} \leq y_e \leq \overline{k}\overline{y_s}$ and q is low, or if

Table 1.2
EFFECTS OF PROGRESSIVITY ON CHOOSING AN OCCUPATION

Progressivity increases =>

B	q	$y_e < \min(\overline{ky_s}, \underline{ky_s})$	$\underline{ky_s} < y_e < \overline{kys}$	$\overline{ky_s} < y_e < \underline{ky_s}$	$\max(\overline{ky_s}, \underline{ky_s}) < y_e$
low	high	wage employment	wage employment	self-employment	self-employment
low	low	wage employment	self-employment	wage employment	self-employment
high	high	wage employment			
high	low				

The table describes the effects of an increase in progressivity on choosing an occupation for various values of wage employment y_e, self-employment incomes $\underline{ky_s}$, and ky_s, probability of success q, and amount of paid in bribes B.

$\overline{k}\overline{y_s} \leq y_e \leq \underline{k}\underline{y_s}$ and q is high. Table 1.2 shows the self-employment implications of the model in more detail.

Intuitively, if wage employed income is smaller than all the possible declared self-employed incomes, then a less progressive tax makes the high self-employed incomes more attractive since it reduces the average tax burden. If wage employed income is higher than all the declared self-employed incomes, then a progressive tax makes the low incomes in self-employment more attractive by lowering the average tax burden. When wage employment income is in between the two possible self-employment incomes, then the probability of success determines which type of tax makes self-employment more attractive. If wage employment income is smaller than the more likely income, then a less progressive tax makes this high and likely income more attractive and, thus, makes self-employment more attractive. If the wage employed income is larger than the most likely self-employed income, then a progressive tax makes the low more likely income more attractive, and thus makes self-employment more attractive. But an increase in progressivity has an additional effect of making people tax evade more (follows from 6) and thus, pay more in bribes. Thus, an in-

crease in progressivity leads to more self-employment only if the decrease in average tax burden is higher than the increase in bribes. Since data shows that wage employment income is smaller than self-employment income, I conclude that theoretically progressivity has an adverse effect on the decision to become self-employed.

In order to look at the effects of p on choosing self-employment, I rewrite (6) as

$$\begin{aligned} U(y_e - \tau(y_e)) \leq p[q((U(\overline{y_s} - \tau(\overline{k}\overline{y_s}) - B(\overline{y_s}(1-\overline{k}))- \\ U(\overline{y_s} - \tau(\overline{k}\overline{y_s}))) \\ (1-q)(U(\underline{y_s} - \tau(\underline{k}\underline{y_s}) - B(\underline{y_s}(1-\underline{k}))- \\ U(\underline{y_s} - \tau(\underline{k}\underline{y_s}))]+ \\ qU(\overline{y_s} - \tau(\overline{k}\overline{y_s})) + (1-q)U(\underline{y_s} - \tau(\underline{k}\underline{y_s})). \end{aligned} \tag{7}$$

(7) implies that an increase in probability p leads to less self-employment[1]. If all people in self-employment are tax evading and the probability of being caught increases, then self-employment becomes less attractive compared to wage employment where there is no tax evasion and no bribes are paid.

Also, for the cases in which progressivity negatively affects self-employment, the effects of taxes are higher for higher p's. If an increase in progressivity increases the amount of taxes paid in self-employment and also increases the amount evaded, and thus also the amount of the bribe, then the effects of taxes are higher when it is more likely to pay these high bribes in addition to paying the high taxes.

In conclusion, the major predictions of the model, and the ones that are going to

[1] p's coefficient is always negative. Thus, if p increases, the right hand side of the inequality decreases, and thus self-employment becomes less attractive.

be tested later, are: First, an increase in progressivity makes people more likely to choose unofficial self-employment over official self-employment, second, an increase in progressivity makes people less likely to choose any form of self-employment over wage employment, and third, the effects of progressivity are larger in countries with more common bribes than in countries with less common bribes.

1.3 Analysis of Russian Longitudinal Data

In this section, I explore the effects of taxes on individual decisions regarding official self-employment. I also try to estimate the effects of taxes on self-employed individuals that operate in the unofficial economy. I exploit two large decreases in income tax progressivity in Russia during the 1993 and 2001 tax reforms.

In 1992, the personal income tax system in Russia was very progressive. Income was taxed at 7 distinct marginal tax rates, with the lowest rate at 12%, and the highest rate at 60%. In 1993, the system became far less progressive with only 3 marginal tax rates ranging from 12% to 30%. Table 1.3 shows the personal income tax schedule for Russia between 1992 and 2004.

In the years before and after the 1993 tax reform, Russia faced a decreasing GDP/capita, a decrease in inflation and an increase in unemployment rate. GDP/capita declined every year from 1992 to 1995, from a level of 59,248 constant rubles to a much lower level of 45,517 constant rubles, that is, from a level of 2,106 constant US$ in 1992 to a level of 1,618 constant US$ in 1995. Inflation also declined every year during that period. The inflation rate was 1,490% in 1992 and it reached a much lower rate of 144% in 1995. The unemployment rate increased every year from 5.3% in 1992 to 9.7% in 1995.

Table 1.3
MARGINAL TAX RATES FOR RUSSIA 1992-2004

year	mtr1 (%)	mtr2 (%)	mtr3 (%)	mtr4 (%)	mtr5 (%)	mtr6 (%)	mtr7(%)
1992	12	15	20	30	40	50	60
1993	12	20	30				
1994	12	20	30				
1995	12	20	30				
1996	12	20	25	30	35		
1999	12	15	20	25	35		
2000	12	15	20	25	35	45	
2001	13						
2002	13						
2003	13						
2004	13						

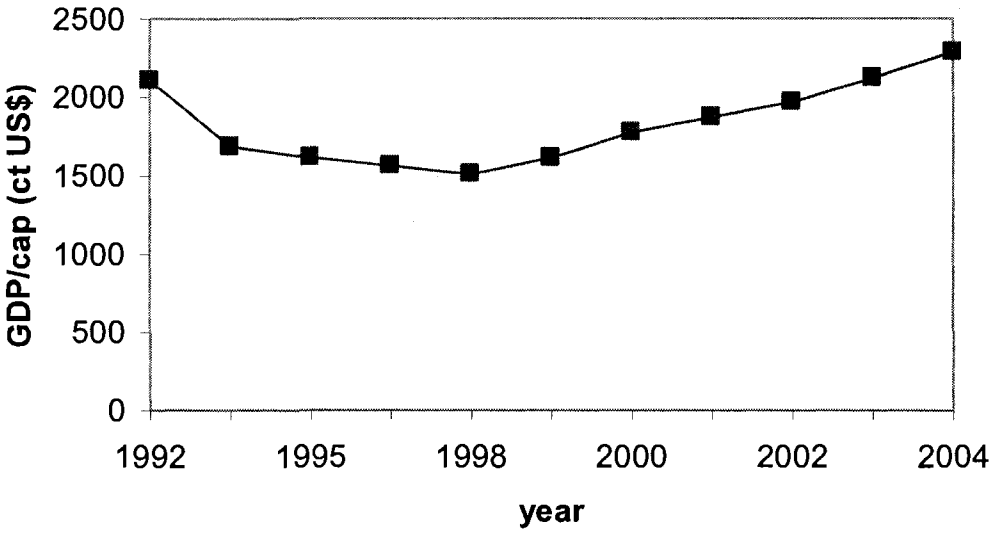
Personal income tax rates at all income tax brackets for Russia between 1992 and 2004. Column 1 reports marginal tax rates paid on an income in the first income tax bracket, column 2 reports marginal tax rates for an income in the second income tax bracket, etc.

In 2000, personal income was taxed at 6 marginal tax rates, ranging from 12% to 45%. In 2001, all taxable income was taxed at 13%. To offset the revenue loss, corporate tax rates increased from 30% to 35% and the tax on dividends doubled from 15% to 30%. At the same time, interest and capital gains tax decreased from 15% to 13%, and VAT and social contributions taxes stayed almost constant.

The economic situation in Russia around this time was quite different from the one in the early 1990s. During this period, GDP/capita increased every year from 49,934 constant rubles in 2000 to 64,282 constant rubles in 2004. That is, GDP/capita was 1,775 constant US$ in 2000 and 2,285 constant US$ in 2004. Inflation decreased every year from 37% in 2000 to 13% in 2003 and then increased the following year to 20%. Unemployment was on a downward trend during this period, decreasing from 9.8% in 2000 to 7.9% in 2004. The macroeconomic situation in Russia is described also in Figures 1.1-1.3.

I analyze the impact of these tax changes on self-employment using longitudinal data from the Russia Longitudinal Monitoring Survey, RLMS. RLMS is a series of

Figure 1.1
GDP/CAPITA FOR RUSSIA 1992-2004

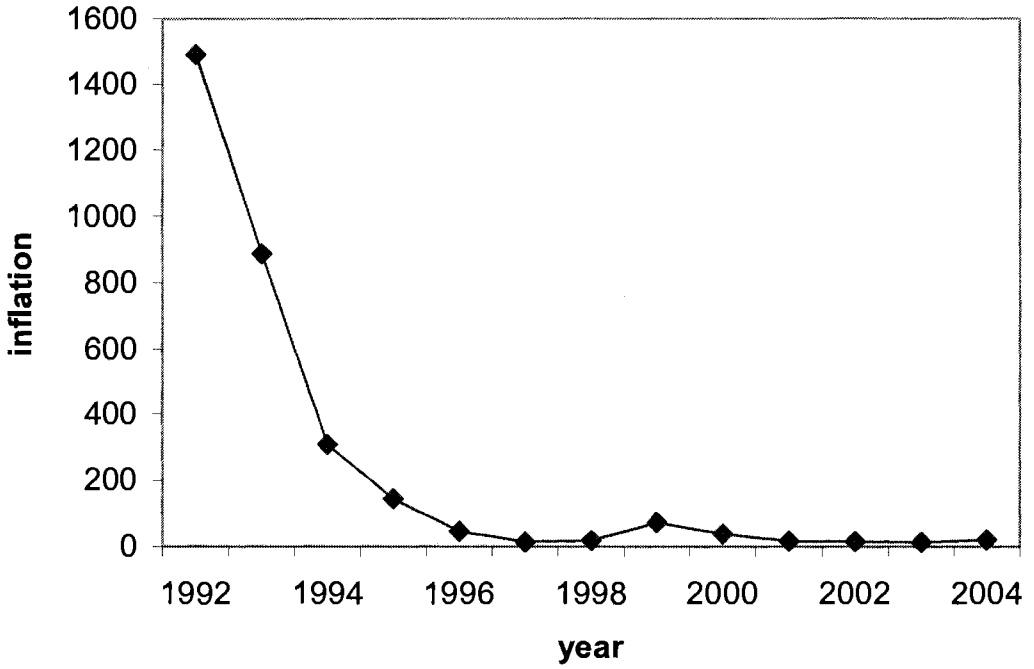


nationally representative surveys that collect data on demographic characteristics, income, occupation, expenditure and health status of its respondents. The survey has been administered 13 times from 1992. I use survey data from 1992 (round 1), 1993 (round 4), 1994 (round 5), 1995 (round 6), 2000 (round 9), 2001(round 10), 2002 (round 11), 2003 (round 12) and 2004 (round 13). One group of individuals was interviewed in 1992 and then most of them were re-interviewed in 1993. A completely different group of people was used for later waves of the survey.

I use data only on heads of households who are between 18 and 60 years old and who are not employed in agriculture. Some information is available only at household level and I include only one person per household in the analysis. I chose the person who has the largest earned income[2] in the household and I call that person head of household. People who work in agriculture and sell/barter the agricultural goods

[2]Other types of income are not reported at individual level, only at household level.

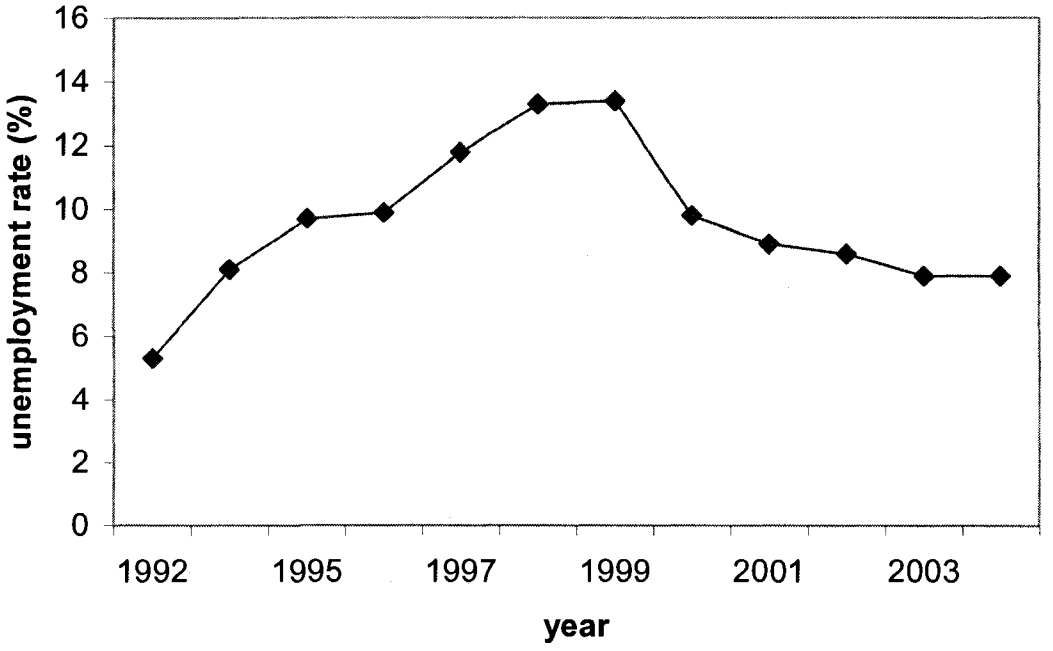
Figure 1.2
INFLATION (%) FOR RUSSIA 1992-2004



they produce are eliminated. Out of the whole sample, I use approximately 37,000 observations.

Using this data, I define 3 occupational dummies. The first one is official self-employment that takes value 1 if the head declares he owns a business or works as a self-employed professional. The second is wage employment that takes value 1 if the head says he works for an employer. The third dummy, other, takes value 1 if the head declares he is out of labor force or unemployed. It is likely that the unofficially self-employed individuals are in this other category. If an individual is unofficially self-employed, then he probably doesn't declare his business in the survey, so he is not in the self-employed category. Also, if this unofficial business is his full time occupation, then he is not working for an employer either. In my sample, 10% of

Figure 1.3
UNEMPLOYMENT RATE (%) FOR RUSSIA 1992-2004



heads are officially self-employed, 12% are in the other category and 77% are wage employed. Table 1.4 shows descriptive statistics for the Russian data.

I also consider personal characteristics of the head of household in the analysis: Age, age squared, male, homeowner, married, family size, and 4 educational dummies, 4 years or less of education, 5-8 years of education, 9-12 years of education and 13 years or more of education. The average age is 40, 66% of heads of household are homeowners, 67% are married, they have an average family size of 4, 45% of them have some high-school education and 46% have some college.

I exploit the 1993 and 2001 tax reforms in a differences-in-differences approach and estimate the effects of decreases in income tax progressivity on choosing an occupation. First, I look at heads of households interviewed in 1992, one year before

Table 1.4
DESCRIPTIVE STATISTICS FOR RUSSIAN LOGITUDINAL DATA 1992-2004

variable	observations	mean	standard deviation
officially self-employed	36167	0.10	0.30
other	36167	0.12	0.33
wage employed	36168	0.77	0.42
age	38778	39.27	11.19
age squared	38778	1667.25	893.55
male	38767	0.51	0.50
homeowner	37744	0.66	0.47
married	38651	0.67	0.47
family size	38777	3.67	2.56
edu4-	37936	0.01	0.09
edu5-8	37936	0.08	0.27
edu9-12	37936	0.45	0.50
edu13+	37936	0.46	0.50

Data reported for 1992-1995 and 2000-2004.

the change, and then again, in 1993, the year of the change. I control for a different group of heads that were interviewed in 1994 and later in 1995 when the tax system remained unchanged. I estimate a multinomial logit model of the form

$$\ln \frac{\Pr(y_{i,t}=o)}{\Pr(y_{i,t}=b)} = \alpha_{0,o|b} + \alpha_{1,o|b} 2nd\ period_{i,t} + \alpha_{2,o|b} cohort_{i,t} + \alpha_{3,o|b} tax\ change_{i,t} + \sum_{j=4}^{9} \alpha_{j,o|b} personal\ characteristics_{j,i,t} + \epsilon_{i,t} \quad (8)$$

where i is the index for individuals, t is the index for year, $y_{i,t}$ is one of the occupational dummies, $o \neq b$, b is the baseline occupation, *2nd period* dummy takes value 1 if the year t is 1993 or 1995 and the individual i in interviewed in both t and $(t-1)$. It takes value 0 if the year t is 1992 or 1994 and i was interviewed in $(t+1)$ as well. The *cohort* dummy takes value 1 if the year t is 1992 or 1993 and the individuals i were interviewed in both years, and value 0 if t is 1994 or 1995 and the individuals were interviewed

in both years. The *tax change* is the variable of interest, the interaction between the *2nd period* effect and the *cohort* effect. I also control for personal characteristics of the head since they are likely to influence the occupational decision.

Next, I estimate a similar model for the 2001 tax change. I define similar dummies to the ones above except that I am using 3 cohorts as controls. Fortunately, the tax system stayed unchanged from 2001 to 2004 and I have data on individuals for each of these years. So this time, the *2nd period* dummy takes value 1 if the year t is 2001, 2002, 2003 or 2004 and the individual i was interviewed in both t and $(t-1)$. It takes value 0 if year t is 2000, 2001, 2002 or 2003 and i was also interviewed in $(t+1)$. The *cohort* dummy takes value 1 if year t is 2000 or 2001 and i was interviewed in both 2000 and 2001, and value 0 if year t is 2001, 2002, 2003 or 2004 and i was interviewed in two consecutive years. The tax change dummy is again the interaction between the *2nd period* effect and the *cohort* effect.

Table 1.5 presents the results from estimating equation (8). The table presents the marginal effects from the multinominal logit model and the robust standard errors clustered by individual. Columns (1)-(3) show the effects of the 1993 experiment and columns (4)-(6) show the effects of the 2001 experiment. Column (1) shows the impact of the *tax change* dummy, *2nd period* dummy, *cohort* dummy and personal characteristics on the officially self-employed dummy. The coefficient estimate for the tax change effect dummy is positive and significant at the 1% level. This means that the decrease in income tax progressivity made individuals more likely to choose official self-employment. The tax change increased the probability of being self-employed by 15% at the mean values of the other control variables.

Column (2) shows the effect of the 1993 tax change on the probability of being wage employed. The tax change coefficient is negative and statistically significant at

Table 1.5
DIFFERENCES-IN-DIFFERENCES FOR RUSSIA

	(1) officially self-employed	(2) wage employed	(3) other	(4) officially self-employed	(5) wage employed	(6) other
		1993 experiment			2001 experiment	
2nd period	.004	-.04	-.04	-.01	.03	-.01
	(.02)	(.03)	(.02)	(.003)***	(.004)***	(.003)***
cohort	-.17	.21	-.04	.02	-.02	-.001
	(.01)***	(.01)***	(.01)***	(.005)***	(.007)***	(.006)
tax change	.15	-.08	-.06	.01	-.02	.006
	(.04)***	(.04)**	(.01)***	(.008)**	(.01)*	(.009)
age	.01	.02	-.03	.01	-.001	-.01
	(.002)***	(.003)***	(.001)***	(.002)***	(.002)	(.001)***
age squared	-.0001	-.0003	.0004	-.0001	-.000008	.0001
	(.00003)***	(.00004)***	(.0002)***	(.00003)***	(.00003)	(.00002)***
male	.05	.02	-.07	.0003	.01	-.01
	(.006)***	(.009)***	(.007)***	(.005)	(.008)**	(.006)***
homeowner	.01	-.05	.04	.009	-.02	.01
	(.01)	(.01)***	(.008)***	(.006)*	(.008)**	(.006)*
married	.02	.04	-.06	.02	.05	-.07
	(.007)***	(.01)***	(.009)***	(.006)***	(.01)***	(.008)***
family size	-.004	.005	-.001	.001	.01	-.01
	(.001)***	(.001)***	(.0009)	(.002)	(.003)***	(.002)***
edu5-8	-.006	.07	-.07	.01	-.04	.02
	(.03)	(.03)**	(.009)***	(.02)	(.04)	(.03)
edu9-12	-.02	.14	-.12	.01	-.02	.009
	(.03)	(.03)***	(.01)***	(.02)	(.03)	(.02)
edu13+	-.01	.16	-.14	.02	.01	-.03
	(.03)	(.03)***	(.01)***	(.02)	(.03)	(.02)
predicted P	.11	.77	.10	.06	.85	.08
observations		8880			15587	
R^2		14.66%			6.37%	

Multinomial logit models; marginal effects reported, robust standard errors in parentheses, clustered by individual. In (1) and (4), the dependent variable is being officially self–employed, in (2) and (5) is being wage employed and (3) and (6) is other. (1)-(3) exploit the 1993 tax change and (4)-(6) exploit the 2001 tax change. The omitted education category is edu4-. *** significant at 1%, ** significant at 5% and * significant at 10%.

the 1% level. It seems that the tax change made people 8% less likely to choose wage employment.

Column (3) shows the effect of the 1993 tax change on the probability of being in the other category, that is, being unofficially self-employed. The tax change coefficient is negative and statistically significant at the 1% level. It seems that the tax change made people 6% less likely to choose unofficial self-employment. Thus, the decrease in progressivity made people move from unofficial self-employed and wage employment to official self-employment. The effects on all three categories are exactly as predicted by the theoretical model.

Column (4) shows the effects of the 2001 tax change on the probability of being officially self-employed, column (5) shows the effects on the probability of being wage employed and finally, column (6) shows the effects on the probability of being in the other category. The effects on official self-employed are positive and significant at the 5% level, the effects on wage employment are negative and significant at the 10% level, and the effects on other are positive and insignificant. It seems that the 2001 tax change made people move from wage employment to official self-employment while the unofficial self-employment stayed unaffected. The magnitude of the effects are much smaller than in the 1992 tax change. One reason why the tax change had a smaller effect on self-employment might be because the 2001 personal income tax change was smaller than the one in 1993, and the 2001 personal income tax reform was accompanied by other tax reforms like increases in corporate tax and dividend tax that usually discourage business activity.

If we define tax progressivity as the difference between the top marginal rate paid at a high income of 10 times the GDP/capita and the top marginal rate paid at a low income of .1 times the GDP/capita, the 2001 tax change led to a decrease of 33% in

tax progressivity. Thus, a decrease of 33% in progressivity increased the probability of official self-employment by 1%; that is an increase in probability of .03 standard deviations.

These results are based on time series analysis; next I use panel and cross-section data for other countries to investigate the effects of progressivity on self-employment.

1.4 Cross-Country Analysis

The rest of the paper investigates cross-country effects of progressivity. First, I estimate the effects of income tax progressivity at the aggregate level on the number of micro enterprises.

I collect data on personal income taxes from PriceWaterhouseCooper's annual summaries of personal income taxes, *Individual taxes, a worldwide summary.* The data set contains information on all marginal tax rates, all income tax brackets, and on special self-employment income tax rates and exemptions. The marginal tax rates are reported for single individuals who are residents of the country. Some countries have one personal income tax schedule for wage income and another for other types of personal income. For such countries, I report the income tax schedule for types of incomes other than wage incomes.

The data set consists of 76 countries over 24 years. It includes 30 OECD countries and 46 non-OECD countries, 31 high income countries, 19 upper middle income countries, 19 lower middle income countries and 7 low income countries[3]. There is

[3]High income countries are countries with an 2006 GNI/capita higher than $11,116, upper middle income countries are countries with 2006 GNI/capita between $3,596 and $11,115, lower middle income countries are countries with 2006 GNI/capita between $906 and $3,595 and lower income countries are countries with 2006 GNI/capita lower than $905. This is the World Development Indicators classification based on income.

a good deal of variation in income tax schedules across countries. Out of the 76 countries, 7 have flat income tax systems and 60 have 2 or more marginal tax rates. Countries like Denmark and Latvia have the least progressive systems, with one single marginal tax rate. Countries like Brazil, Egypt, Hungary, and Indonesia, have slightly more progressive tax systems with 2 or 3 marginal tax rates and top rates as low as 25%. Finally, countries like Belgium, Chile, France are among the most progressive in the data set with at least 7 marginal tax rates and top rates as high as 55%.

There is some time variation as well; the data captures some tax changes in various countries like Slovak Republic, Slovenia and South Korea. Developing countries seem to have more frequent tax reforms than developed countries.

Using this data, I construct a measure of progressivity. Progressivity is the difference between the top marginal tax rate paid on an income 10 times the GDP/capita of that country and the top marginal tax rate paid on an income 1/10 times the GDP/capita,

$$progressivity = MTR(10 \cdot GDP/cap) - MTR(.1 \cdot GDP/cap) \tag{9}$$

There is no relationship between income tax progressivity and the income level in the country. The correlation between GDP/capita and the above measure of progressivity is .03%. However, it seems that countries of Germanic legal origin are more likely to be progressive. The correlation between the Germanic legal origin dummy and progressivity is 33%.

I also use the mean marginal rate in the analysis. I define mean marginal rate as the tax rate paid by an individual who earns an income=GDP/capita,

Table 1.6
DESCRIPTIVE STATISTICS FOR AGGREGATE DATA

variable	observations	mean	standard deviation
micro enterprises/1,000 inhabitants	208	44.07	70.99
progressivity (%)	303	21.08	13.17
marginal tax rate at GDP/capita	306	19.64	11.35
bribe	305	6.80	1.67
gdp/cap (2000 US $)	305	12971.65	12001.93
services/gdp (%)	291	60.79	11.32
manufacturing/gdp (%)	276	18.98	6.30
inflation (%)	299	13.62	120.38
female work force/total work force (%)	307	42.65	5.56
unemployment (%)	274	7.94	4.04

$$mean\ marginal\ tax\ rate = MTR(GDP/cap). \tag{10}$$

The mean marginal tax rate varies between 0%, in countries like Tanzania and Vietnam to 52% in countries like Luxembourg. Table 1.6 summarizes the descriptive statistics for all the aggregate data.

The data on micro enterprises is taken from an International Finance Corporation (IFC) data set. The IFC data set is compiled from multiple sources, mostly from various Census and other country level surveys. This variable is likely to capture small businesses that pay at least some taxes and that operate in the official economy. This section does not address tax evasion or unofficial economy problems.

A micro enterprise is a firm that has few employees. Micro enterprises have 1-4 employees for most countries, except for a small number of countries where micro enterprises can have up to 200 employees. Azerbaijan, Ukraine, Singapore and Hong Kong are the only countries with micro enterprises with more than 50 employees. The variable used in the analysis is number of micro enterprises per 1,000 inhabitants.

The mean for the sample is 44 enterprises per 1,000 inhabitants, with some developing countries with extremely large numbers of firms; Czech Republic has 163.70 enterprises/1,000 inhabitants in 1998 and Indonesia has 183.01 firms/1,000 inhabitants the same year. Some African countries have extremely low numbers of enterprises; Botswana has the smallest number of the sample, .03 firms/1,000 inhabitants, and it is closely followed by Kenya with .09 enterprises/1,000 inhabitants.

I also use a bribe variable taken from Frasier Institute's *Economic Freedom of the World: 2006 Annual Report.* It measures how common it is for people to pay bribes in a country. The variable is measured from 0 to 10, where 0 means bribes are very common. In my sample, bribe takes values between 2.8 in Indonesia and 9.89 in Luxembourg. This bribe measure originates from the *Executive Opinion Survey*, an annual survey administered to 11,000 executives from 131 countries by the World Economic Forum. The executives were asked to rank on a discrete scale how common bribes are in their country[4].

Other variables used in the analysis are gdp/capita expressed in 2000 US$, services/gdp, the net output of the service sector as percent of GDP, manufacturing/gdp, the net output of manufacturing sector as percent of GDP, inflation, the percentage change in the consumer price index, female work force/total work force and unemployment rate, % of unemployed individuals out of the total labor force. The country characteristics data comes from the *World Development Indicators 2005.*

Using this data, I estimate the effects of progressivity on the number of micro

[4]The bribe data is missing for some of the countries of interest. Since I have data on bribes on a large number of other countries, I predict the missing values by estimating the following equation:
$bribe_{k,t} = a_0 + a_1 * democracy_{k,t} + a_2 * gdp/cap_{k,t} + a_3 * g/gdp_{k,t} + a_4 * legal\ origin_k + e_{k,t}$,
where k is the country index, t is the year index, bribe is the bribe score, democracy is a measure of democracy, gdp/cap is GDP per capita in 2000 US $, g/gdp is government expenditures/GDP. The bribe data is taken from the Fraser Institute's *Economic Freedom of the World 2006*, the democracy score is taken from the Polity IV dataset, the macroeconomic variables are taken from the World Development Indicators 2005, and legal origin is taken from La Porta et al. (1999).

enterprises/1,000 inhabitants. Specifically, I estimate an ordinary least squares model of the form

$$micro\ enterprises_{k,t} = \beta_0 + \beta_1 progressivity_{k,t} + \beta_2 atr_{k,t} +$$

$$\beta_3 bribe_{k,t} + \beta_4 bribe_{k,t}\ progressivity_{k,t} +$$

$$\sum_{m=5}^{10} \beta_m personal\ characteristics_{m,k,t} + \beta_{11}\vartheta_t +$$

$$\epsilon_{k,t}. \tag{11}$$

where k is the index for country and t is the index for year. The number of enterprises depends on the progressivity of the tax system, average tax rates, bribes, interaction between bribes and progressivity, other country characteristics including gdp/cap, services/gdp, manufacturing/gdp, female work force/total work force, unemployment, inflation, year fixed effects ϑ_t, and an error term $\epsilon_{k,t.}$

I control for mean marginal tax rate because I want to capture the effects of an increase in tax rate spread keeping constant for the mean rate. I also control for bribes and the interaction of progressivity with bribes because I want to test the theoretical prediction that the tax effect is larger in countries with more frequent bribes. The above country characteristics are believed to affect the number of firms in a country; richer countries with higher GDP/capita tend to also have larger numbers of firms. Countries that have a large service sector have fewer micro enterprises and more larger enterprises, while countries with large manufacturing sectors have more micro enterprises than larger ones. Also, in places where it is common for women to work,

it is also relatively common for them to become self-employed. Thus, in those places one is likely to observe more micro enterprises over all, as a larger segment of the population can start enterprises. Inflation might affect the number of micro firms positively, as people don't want to be wage employed when inflation is high because wage income adjusts slower to inflation compared to self-employment income. Finally, high unemployment may lead people who cannot find jobs in wage employment to open small businesses instead.

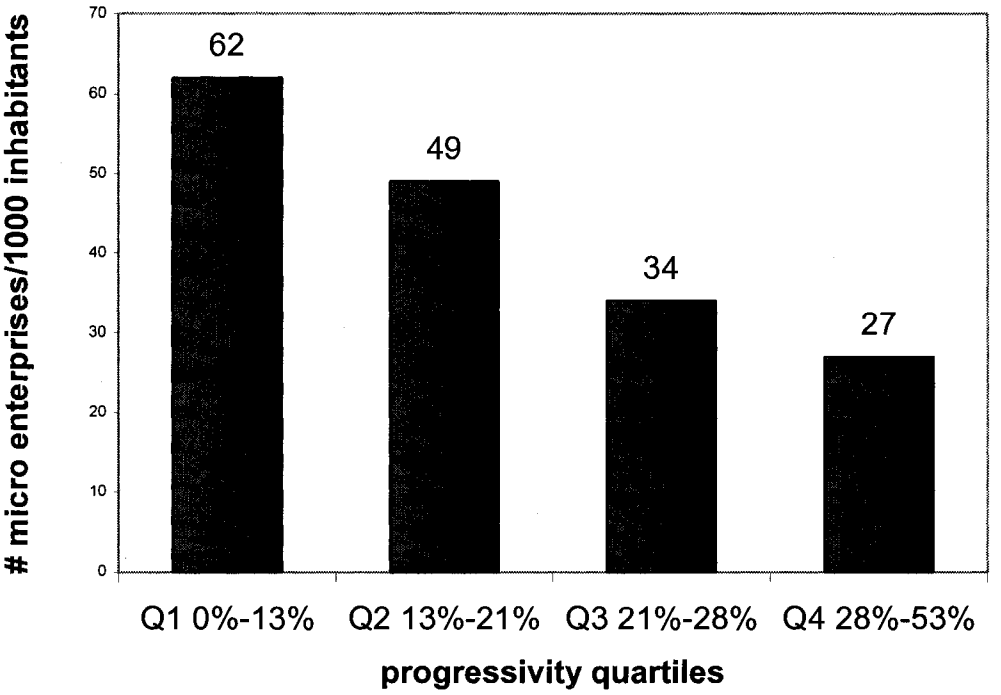
Time fixed effects are also included because there is some time variation in the progressivity measure for each country.

The relationship between progressivity and number of micro enterprises per 1,000 inhabitants can be seen in Figure 1.4. I break the sample into 4 quartiles based on progressivity values. Then, I calculate the mean number of micro enterprises for each quartile. Countries in the first quartile, the ones with the least progressive tax systems, are the ones with the highest average number of micro enterprises. The average number of micro enterprises decrease as we move into highest quartiles, that is, into countries with highly progressive tax systems. Thus, at first glance, the data seems to suggest that there is a negative correlation between progressivity and the number of micro enterprises.

Table 1.7 presents the results for equation (11). In column (1), I estimate the effect of progressivity on the number of micro enterprises, controlling for the mean marginal tax rate, country characteristics and year fixed effects. I find that progressivity has a negative effect on the number of micro enterprises, although not statistically significant.

In column (2), I also control for how common bribes are in that country. The bribery index has a negative but not statistically significant coefficient, which means

Figure 1.4
MEAN NUMBER OF MICRO ENTERPRISES/1,000 INHABITANTS BY PROGRESSIVTY QUARTILE



that as bribes become more common, the number of micro enterprises increases.

Next, in column (3), I also control for the interaction term between bribe and progressivity. The main effect of bribery is now statistically significant and negative at the 10% level. An increase of one standard deviation in bribe score leads to an increase of .5 standard deviations in the number of micro enterprises. Also, results show that the progressivity effects are higher in countries in which bribes are more common, just as the theory predicted. The marginal effect of progressivity at a mean bribe score is -1.38, which means that an increase of one standard deviation in progressivity leads to a decrease of .25 standard deviations in the number of micro enterprises. Or, if the progressivity decreases by 33%, the amount by which progressivity decreased in Russia

Table 1.7
IMPACT OF PROGRESSIVITY ON NUMBER OF MICRO ENTREPRISES

	(1) micro	(2) micro	(3) micro
progressivity	-.78	-.72	-6.42
	(.57)	(.56)	(3.78)*
mean marginal tax	.10	.11	.35
rate	(.67)	(.67)	(.68)
bribe		-6.72	-23.07
		(8.25)	(13.13)*
progressivity*bribe			.74
			(.44)*
gdp/cap	.0001	.0006	.0009
	(.0009)	(.0009)	(.0009)
services/gdp	-3.62	-3.41	-3.06
	(2.27)	(2.11)	(1.72)*
manufacturing/gdp	.95	.79	1.15
	(1.70)	(1.69)	(1.58)
inflation	-.97	-1.02	-.75
	(.61)	(.65)	(.63)
female labor force	.36	.87	.57
	(1.58)	(1.71)	(1.68)
unemployment	-3.19	-3.44	-2.31
	(2.87)	(3.03)	(2.84)
year dummies	yes	yes	yes
observations	159	159	159
R^2	24.03%	24.45%	28.06%

Ordinary least squares models; robust standard errors in parentheses, clustered by country. The level of observation is country year. The dependent variable is the number of micro enterprises/1,000 inhabitants. Bribe is a variable that measures how common bribes are in various sectors of the economy. It is measured on a scale from 0 to 10, where 0 means bribes are extremely common. * significant at 10%.

in the 2001 experiment, then the number of micro enterprises will increase by 45 micro enterprises for a country with mean bribe score. That is, if progressivity decreases by 33%, the number of micro enterprises increases by .63 standard deviations.

But aggregate data cannot show the split between official self-employment and unofficial self-employment. To investigate the effects of taxes on unofficial self-employment, I use individual level data from several countries where employment status can be ascertained.

Individual level data comes from the Living Standards Measurement Study, LSMS.

LSMS is a World Bank research project that collects data on personal characteristics, income, employment, expenditure and health in developing countries. My study uses LSMS surveys from Azerbaijan, Brazil, Bulgaria, China, India, Russia, South Africa and Tanzania between 1991 and 2004[5]. I chose these particular countries because these were the only developing and transitional countries for which there is micro level data on personal characteristics, food consumption, income and occupation and for which I have personal income tax data.

I use only individuals who are heads of households, between 18 and 60 years old, and not employed in agriculture. Most surveys report some types of income only at household level, so in order to use the income variable, I had to choose one person per household. I chose the head of household. I chose a person between 18 and 60 because I wanted to analyze the occupation decisions of working age adults and the 18 to 60 age range was the most appropriate age range for all the countries in the sample. Finally, I leave out people who work and trade in agriculture because I estimate the amount of tax evasion based on food consumption and declared income. This estimation might be different for people who produce most of the food in the household and have little income besides the one from selling a part of the agricultural goods. In the end, I keep about 48,756 observations.

Using this data, I define three occupational dummies: Officially self-employed, other and wage employed. They are defined in the same way as in the previous section. The percentage of people who are in each group varies from country to country: India has the largest share of self-employed at 44% and Bulgaria has the smallest at 3%. Overall, 14% of the heads of household in my sample are officially

[5]More specifically, the countries and years used are Azerbaijan 1995, Brazil 1996 and 1997, Bulgaria 2001, China 1994, India 1997 and 1998, Russia 1992, 1993, 1994, 1995, 1996, 1998, 1999, 2000, 2001, 2002, 2003 and 2004, South Africa 1993 and Tanzania 1991, 1992 and 1993.

self-employed.

I construct personal characteristics variables similar to the ones used in the Russian analysis. I use age, age squared, male, homeowner, married and educational dummies. On average, a head of household from this sample is 40 years old and has a family of 3.96 individuals. In my sample, 60% are males, 67% are homeowners and 68% are married. Table 1.8 reports the descriptive statistics for the cross country data.

In addition to occupation and demographic variables, I also use two macroeconomics indicators for the countries in the sample: GDP/capita and inflation between 1991 and 2004. Other macroeconomics variables like services/GDP, female labor force, etc. used in the aggregate analysis are not included in this analysis because some variables are missing for some of the 8 countries. These measures are taken from the *World Development Indicators 2005.*.

Tax rates and income tax brackets for wage and other incomes are used to calculate measures of progressivity and average tax rates for each individual. I proceed in several steps; First, I estimate k, a percentage of income that official and unofficial self-employed individuals declare to the tax authorities. Then, I estimate y_T, a true income adjusted for under-reporting. Next, I predict y_p, a self-employed income for all individuals based on their personal characteristics and the true income calculated before. I calculate $\overline{y_s}$, a successful income, twice the amount of the predicted self-employed income, and $\underline{y_s}$, an unsuccessful income, half the amount predicted. Then, I estimate $k\ \overline{y_s}$ and $k\underline{y_s}$, the amounts that are being declared from the successful and unsuccessful incomes. The next step is to calculate a progressivity measure that is the difference between the top marginal rate paid on the declared successful income and the top marginal rate paid on the declared unsuccessful income. Finally, the predicted declared income is used to calculate the average tax rate for an income

Table 1.8
DESCRIPTIVE STATISTICS FOR CROSS-COUNTRY INDIVIDUAL LEVEL DATA

variable	method	observations	mean	standard deviation
progressivity (%)	k<1	45142	3.78	7.01
progressivity (%)	k=1	44258	4.78	7.99
progressivity' (%)	k<1	45142	6.20	9.78
atr (%)	k<1	45142	19.79	13.43
atr (%)	k=1	44258	19.23	13.00
officially self-employed		48756	.14	.35
other		48756	.16	.37
wage employed		48756	.68	.46
age		48756	40.03	10.93
age squared		48756	1722.82	888.25
male		47645	.60	.48
homeowner		48030	.67	.46
married		48681	.68	.46
edu4-		47605	.09	.29
edu5-8		47605	.14	.35
edu9-12		47605	.35	.47
edu13+		47605	.39	.48
family size		48754	3.96	2.65
gdp/cap (2000 US$)		48756	1997.03	721.91
inflation (%)		48756	252.59	464.61
bribe		32754	5.24	1.43
property rights		29988	3.63	1.00

Progressivity and atr (k<1) are calculated the way described in the appendix, progressivity and atr (k=1) are calculated by predicting a self-employment income based on personal characteristics and the income reported in the survey (the income is not adjusted for evasion, evasion is assumed to be 0), progressivity' (k<1) is the difference between the top MTR paid on an income 3 times the predicted income and .33 the predicted income (formula (30) from the appendix).

equal to ky_p. The appendix presents in more detail the method used to calculate these tax variables.

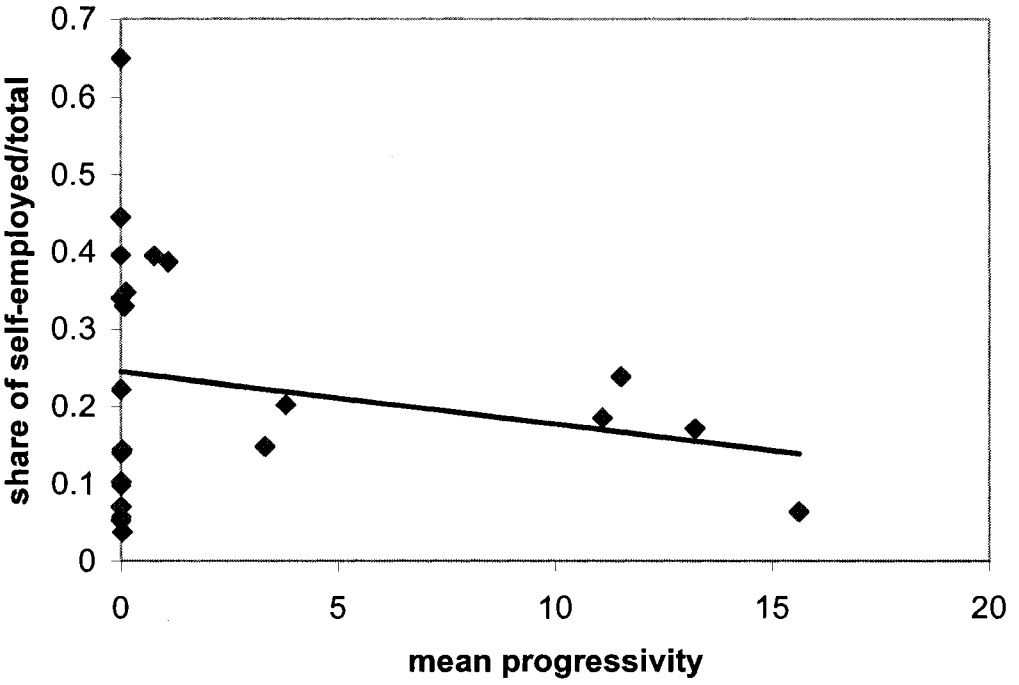
Next, I exploit the variation in progressivity at the individual level, the country level and over time to estimate the effects of progressivity on the probability that a head of household will choose one particular occupation. I estimate a multinomial logit model of the form

$$\begin{aligned}\ln \frac{\Pr(y_{i,k,t}=o)}{\Pr(y_{i,k,t}=b)} = {} & \gamma_{0,o|b} + \gamma_{1,o|b} progressivity_{i,k,t} + \gamma_{2,o|b} atr_{i,k,t} + \\ & \sum_{l=3}^{8} \gamma_{l,o|b} personal\ characteristics_{l,i,k,t} + \\ & \sum_{j=9}^{10} \gamma_{j,o|b} country\ characteristics_{j,i,k,t} + \\ & \mu_{i,k,t} \end{aligned} \tag{12}$$

where i is the index for head, k is the index for country, t is the index for year and o is an occupation (officially self-employed, wage employed or other), b is another occupation, $b \neq o$, atr is the average tax rate for ky_p. I control for bribery because the level of bribes in one country can affect the easiness of tax evading in one sector and thus, the decision to enter in the evading sector. As in the previous sections, I control for a set of personal characteristics — age, age squared, male, married, family size, education categories and homeowner— because personal characteristics play an important role in choosing an occupation, and for country characteristics like GDP/capita and inflation that can have an impact on the decision to become self-employed.

The data is weighted according to the survey weights (where they exist) and re-

Figure 1.5
PROGRESSVITY VS OFFICIAL SELF-EMPLOYMENT



weighted to allow each country to weight equally in the analysis.

Figure 1.5 shows the relationship between progressivity and official self-employment. The scatter plot shows the mean progressivity for all individuals in one country year on the x axis and the mean official self-employment rate for the same country year on the y axis. The graph shows a negative correlation between the mean progressivity in one country and the self-employment ratio of the same country. The correlation between the two variables is -21%, but not statistically significant at the 10% level.

Table 1.9 presents the results from estimating (12). Column (1) shows the effects of progressivity, average tax rate, personal characteristics and country characteristics on the probability of being officially self-employed. Marginal effects and robust standard errors are reported for each variable. The progressivity estimate is negative and

statistically significant at the 1% level, which means that an individual is less likely to choose official self-employment if the progressivity increases. An increase of 1 standard deviation in progressivity leads to a decrease of .04 standard deviations in the probability of being officially self-employed. Also, for a decrease in progressivity of 33%, similar to the one in Russia in 2001, the probability of being officially self-employed increases by 6%, or .17 standard deviations. The results are larger than in Russia, but it is hard to draw a definitive conclusion about what is the effect of such a large change in progressivity on individual decisions because the cross-country results are estimated based on individual progressivity values much smaller than the aggregate progressivity values in Russia.

The average tax rate coefficient is negative, but statistically insignificant. Intuitively, a higher average tax rate on the self-employment income makes self-employment less attractive and thus decreases the probability of being officially self-employed.

Column (2) shows the effects of progressivity on the probability of choosing wage employment. The coefficient estimate is positive and statistically significant at the 1% level, which means that an increase in progressivity makes people more likely to choose wage employment. Also, the coefficient estimate on average tax rate is positive, but statistically insignificant. A higher average tax rate on the self-employment income makes the other alternatives more attractive than official self-employment, so it increases the probability of choosing wage employment.

The last column reports the effects of progressivity on the probability of being unofficially self-employed. Progressivity seems to have a negative and statistically significant effect and average tax rate has a positive but insignificant effect. It seems that an increase in progressivity leads people to move from all types of self-employment to wage employment. Also an increase in average tax rate on self-employment income

Table 1.9
IMPACT OF PROGRESSIVITY ON SELECTING AN OCCUPATION OVER ANOTHER

	(1) officially self-employed	(2) wage employed	(3) other
progressivity	-.002	.005	-.002
	(.001)***	(.001)***	(.0007)***
average tax rate	-.001	.0002	.0007
	(.001)	(.001)	(.001)
age	.01	.01	-.03
	(.003)***	(.003)***	(.002)***
age squared	-.0001	-.0002	.0004
	(.00004)***	(.00005)***	(.00003)***
male	.04	.007	-.05
	(.01)***	(.02)	(.01)***
edu5-8	-.02	-.004	.03
	(.02)	(.05)	(.07)
edu9-12	-.05	.06	-.008
	(.04)	(.03)*	(.07)
edu13+	-.03	.11	-.07
	(.04)	(.03)***	(.07)
homeowner	.03	-.08	.04
	(.01)***	(.02)***	(.02)*
family size	-.003	.003	-.0007
	(.004)	(.007)	(.003)
married	.02	.04	-.07
	(.007)***	(.008)***	(.008)***
gdp/cap	-.00002	.00005	-.00003
	(.00004)	(.00005)	(.00004)
inflation	-.0009	.001	-.0003
	(.00004)	(.0002)***	(.0002)
predicted P	.13	.72	.13
observations		44662	
pseudo-R^2		7.50%	

Multinomial logit models; marginal effects reported, robust standard errors in parentheses, clustered by country. In (1), the dependent variable is being officially self-employed, in (2), is being wage employed and in (3) is other. *** significant at 1%, ** significant at 5% and * significant at 10%.

makes people less likely to choose official self-employment and more likely to choose the other two categories, though this last conclusion is not definitive as it was drawn from insignificant results.

Finally, I perform a variety of robustness checks for these results. Some of the results are presented in Table 1.10. I estimate another progressivity measure, progressivity' and look at its effects on choosing an occupation. Progressivity' is the difference between the top marginal rate paid on an income 3 times the predicted one and the top marginal rate paid on an income .33 times the predicted one. Columns (1)-(3) show the results of progressivity' on occupational choice. These results are almost identical to the ones in the original specification. Allowing individuals to face slightly higher progressivity measures does not change the magnitudes and signs of the results.

I also perform the same analysis under the assumption that people declare their income correctly in the survey. The income is not adjusted for under-reporting; I use the income reported in the survey to predict a self-employment income for all individuals and to estimate a personal progressivity measure for that predicted income. Columns (4)-(6) show these results. Progressivity continues to have a negative and statistically significant effect on official self-employment and a positive and statistically significant effect on wage employment. The magnitude of the effect of progressivity on official self-employment is higher when I assume no tax evasion because an increase in progressivity leads to higher tax burdens for people who declare all their income rather than for the ones who evade.

Table 1.10
ROBUSTNESS CHECKS

	(1) officially self –employed	(2) wage employed	(3) other	(4) officially self-employed k=1	(5) wage employed k=1	(6) other k=1
progressivity				-.003	.003	-.00008
				(.0009)***	(.003)***	(.003)
progressivity'	-.002	.005	-.002			
	(.0009)***	(.001)***	(.0007)***			
average tax	-.001	.0002	.0007	-.001	.00003	.0001
rate	(.001)	(.001)	(.001)	(.001)	(.002)	(.001)
age	.01	.01	-.03	.01	.01	-.03
	(.003)***	(.003)***	(.002)***	(.003)***	(.003)***	(.002)***
age squared	-.0001	-.0002	.0004	-.0002	-.0002	.0004
	(.00004)***	(.00005)***	(.00003)***	(.00004)***	(.00005)***	(.00003)***
male	.04	.007	-.05	.04	.01	-.05
	(.01)***	(.02)	(.01)***	(.01)***	(.02)	(.01)***
edu5-8	-.02	-.004	.03	-.02	.01	.007
	(.02)	(.05)	(.07)	(.02)	(.03)	(.05)
edu9-12	-.04	.06	-.008	-.05	.08	-.02
	(.03)	(.03)*	(.07)	(.03)	(.02)***	(.05)
edu13+	-.02	.11	-.07	-.03	.12	-.09
	(.03)	(.03)***	(.07)	(.03)	(.02)***	(.05)
homeowner	.03	-.08	.04	.02	-.08	.05
	(.01)***	(.02)***	(.02)*	(.01)***	(.02)***	(.01)*
family size	-.002	.003	-.0007	-.002	.004	-.001
	(.004)	(.007)	(.003)	(.004)	(.006)	(.003)
married	.03	.04	-.07	.02	.04	-.06
	(.008)***	(.008)***	(.008)***	(.005)***	(.009)***	(.009)***
gdp/cap	-.00002	.00005	-.00003	-.00002	.00005	-.00003
	(.00004)	(.00005)	(.00004)	(.00005)	(.00005)	(.00004)
inflation	-.001	.001	-.0003	-.001	.001	-.0002
	(.0001)***	(.0002)***	(.0002)	(.0001)***	(.0004)**	(.0004)
predicted P	.13	.72	.13	.13	.73	.13
observations		44662			43778	
pseudo-R^2		7.62%			8.04%	

Multinomial logit models; marginal effects are reported, robust standard errors in parentheses, clustered by country. (4)-(6) report results if we assume people declare all their income correctly. The omitted education category is edu4-. *** significant at 1%, ** significant at 5% and * significant at 10%.

1.5 Conclusion

Using various data sets, I find that personal income tax progressivity affects self-employment even when people tax evade and pay bribes. First, a theoretical model suggests that high progressivity affects negatively the decision to become self-employed under certain conditions. Then, I look at tax changes in Russia and find that after large decreases in progressivity people became more likely to become officially self-employed and less likely to become wage employed. Next, aggregate data shows that the number of official micro businesses declines when progressivity increases and that the effects of progressivity are larger when bribes are more common in the economy. Finally, cross-country individual data shows that high progressivity makes individuals less likely to choose official self-employment, less likely to choose unofficial self-employment and more likely to choose wage employment.

How do these effects compare to the ones from US studies? The elasticity of entry into self-employment with respect to progressivity is -.3 in the US according to the results[6] in Gentry and Hubbard (2000). The elasticity of the probability of being officially self-employed with respect to progressivity for the countries in my sample is -.05. The elasticity of number of micro firms with respect to progressivity varies by bribe level: It is -.22 in Indonesia, the country with the most common bribes and it is 0 in Luxemburg, the country with the least common bribes. It seems that self-employment is less responsive to tax progressivity in countries with high tax evasion than in the U.S. and that frequent bribes make people more responsive to changes in taxes because they also have to pay bribes in addition to paying some taxes.

These results have important policy implications for developing and transitional

[6] The elasticity is calculated at the reported mean self-employment of 3.1% and mean progressivity 17.40%.

economies. If encouraging official self-employment and small businesses is the goal, then less progressive taxes are desirable. Although the effects of taxes are higher when bribes are more frequent, the highest response to taxes is achieved in countries like the US, where tax evasion is very low and there are no bribes. Thus, a policy of eliminating bribes and evasion should be pursued in addition to tax reform.

Chapter 2: Rethinking Economic Sanction Success: Sanctions as Deterrents

2.1 Introduction

In the past few decades, the use of economic sanctions has increased substantially and sanctions have become the foreign policy tool of choice for many countries. In theory, the way sanctions work is simple; sanctioned countries (called targets) suffer costs resulting from actions taken by the sanctioning countries (called senders). In order to avoid the costs, targets modify their behavior in the direction desired by the senders. The problem is that this theory rarely holds in practice. There are

few sanctions that managed to change the behavior of targets in a significant way. Thus, many scholars believe that sanctions are used mostly for sending messages to the international community and for deterring certain behaviors. The intuition of this paper is that countries perceive economic sanctions as signals of disapproval and expect senders to impose more sanctions on countries that repeat the target's "offense." Thus, countries are less likely to repeat the "offense" because they try to avoid the costs associated with economic sanctions. This paper investigates whether sanctioning a country involved in a militarized dispute makes countries involved in the dispute and countries like the ones in the dispute less likely to participate in other disputes in the future.

At a first glance, data seems to support the deterrence hypothesis. Figure 2.1 shows the number of disputes in which India participated before and after a military dispute with Pakistan (the first two bars), the number of disputes in which both India and Pakistan participated before and after the same dispute (the third and fourth bars), the number of disputes in which countries with similar capabilities to India participated before and after the Indian-Pakistani conflict (the fifth and sixth bars) and the number of disputes in which countries with similar democratic governments to India participated before and after the same conflict (the last two bars). Figure 2.2 is similar to 2.1 except that 2.2 uses another Indian-Pakistani conflict for comparing the number of disputes before and after. The conflict in A was sanctioned[7] and the one in B was not. The United States suspended military trade and economic aid to India until India withdrew the troops at the Pakistani border in dispute A, but no economic action was taken in dispute B. The difference between 2.1 and 2.2 is striking. In 2.1, India, Pakistan and similar countries to India participated in less

[7]A militarized dispute is called a sanctioned dispute if at least one participant country in the dispute was sanctioned because its involvement in that dispute.

disputes in the five years following the sanctioned dispute than in the five years before it. In 2.2, the same countries participated in more conflicts in the five years after the unsanctioned[8] dispute than in the five years before it.

The idea that sanctions are meant to express disapproval and deter is not new. Galtung (1967) is one of the first authors to point out that sanctions are a way of communication between countries and that senders express disapproval of targets' actions. Chan (2000) expands this idea and states that sanctions act as signals to other countries who might behave similarly to the target. Lindsay (1986) believes that the four possible objectives of economic sanctions are compliance, subversion, domestic symbolism, deterrence and international symbolism (sending messages to the international community). This paper tests whether economic sanctions imposed on a country involved in a militarized dispute deters future militarized actions by showing disapproval of militarized disputes and willingness to inflict costs.

There are many papers that predict militarized conflicts. Choi et al. (2006), Dixon (1994), Fearon (1994), Mousseau (1998), Oneal et al. (1996), (1997), and (2003) and Raymond (1994) believe that democratic countries are less likely to engage in international conflicts. This study also includes democracy as one factor that predicts future conflicts. Russett et al. (1998) adds relative military capabilities as a determinant of militarized disputes. This paper also controls for military capabilities measured as military personnel as percentage of total population. Nordhaus and al. (2006) estimate that the probability of a militarized conflict between two countries is a function of the number of years they were at peace and of other variables. This study also controls for the country's belligerence by adding in the analysis the number of militarized disputes in which the country was involved in previous years and the level

[8] A militarized dispute is called an unsanctioned dispute if no participant country in the dispute was sanctioned because its involvement in that dispute.

Figure 2.1
NUMBER OF DISPUTES 5 YEARS BEFORE AND 5 YEARS AFTER THE 1971 INDIAN-PAKISTANI MILITARIZED DISPUTE

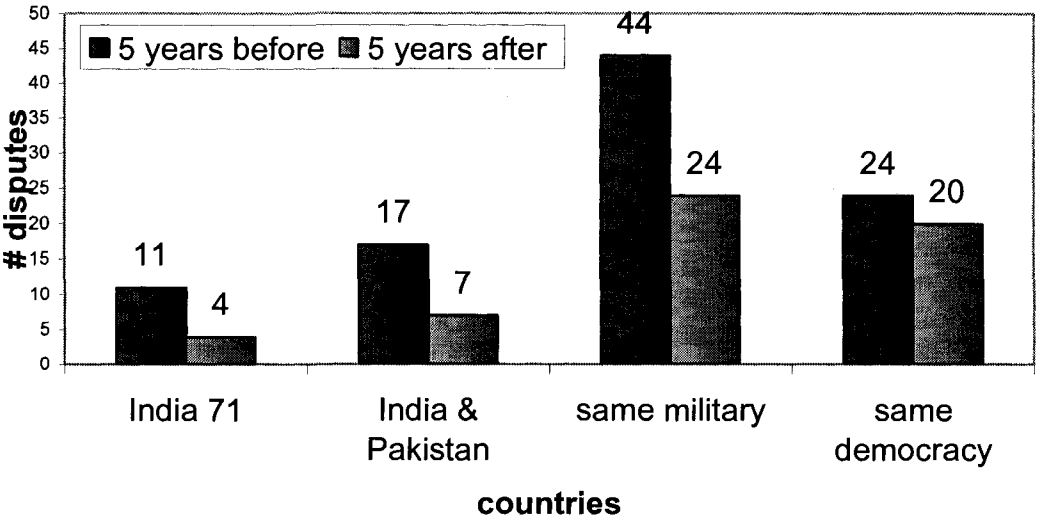
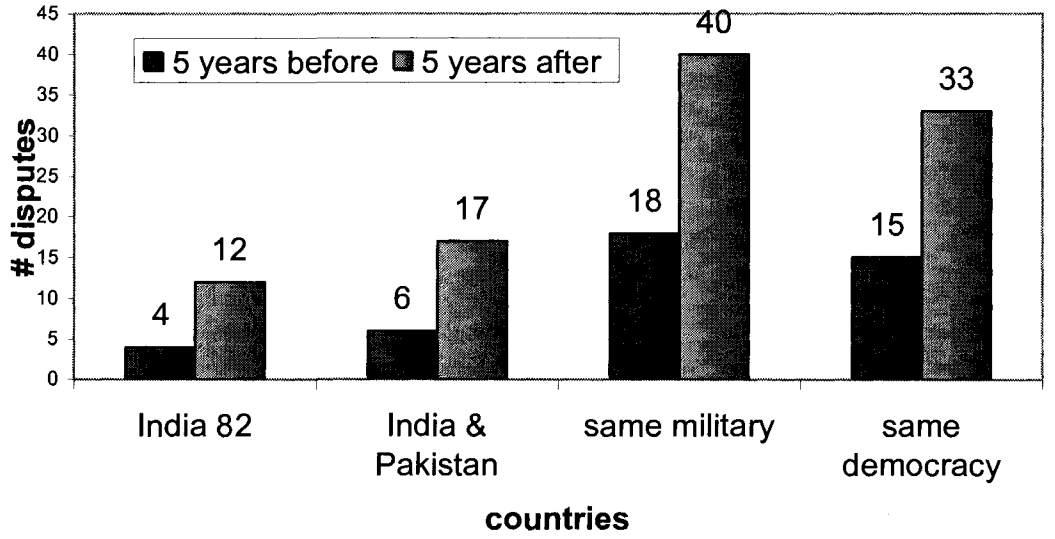


Figure 2.2
NUMBER OF DISPUTES 5 YEARS BEFORE AND 5 YEARS AFTER 1982 INDIAN-PAKISTANI MILITARIZED DISPUTE



The first two bars show the number of disputes for India, the next two show the number of disputes for all the countries involved in the dispute, the next two show the number of disputes for countries with similar military capabilities to India and the last two bars show the number of disputes for countries with similar democratic systems to India. India was sanctioned for its participation in the 1971 dispute (2.1) and no country was sanctioned for its participation in the 1982 dispute (2.2).

of violence reached in previous disputes. Unlike previous studies, this one considers the effect of previous dispute's fatalities on the outbreak of future disputes.

The paper that looks at the effect of economic sanctions on the outbreak of militarized disputes is Drury (2004). The author estimates the effects of economic sanctions on the probability of an outbreak of a militarized dispute between sender and target. He finds that sanctions are complements to militarized disputes and not substitutes. This paper looks at the effects of sanctioning a country involved in a militarized dispute on the probability that the same country or similar countries will participate in another dispute in the future.

This paper's framework is simple. At time t, countries $T_1, \ldots, T_n$ get involved in a militarized conflict, C. Countries $S_1, \ldots, S_m$ impose economic sanctions E on some or all of the countries involved in the conflict C. Country M_i is a country with similar military capabilities to country T_i[9] , country D_i is a country with similar democratic system to the system in T_i, and G_i is a country situated in the same geographic area as T_i. The paper looks at the effect of economic sanction E on the probability that country T_i will be involved in a militarized conflict $C\prime \neq C$, in the period $(t, t+5]$, on the probability that country M_i will be involved in $C'' \neq C$, in the period $(t, t+5]$, on the probability that country D_i will be involved in $C''' \neq C$ in the period $(t, t+5]$, and on the probability that country G_i will be involved in $C'''' \neq C$ in the period $(t, t+5]$.

The study also looks at the effects of reducing trade or development aid to countries involved in a conflict if an economic sanction was not imposed. The paper analyzes instances in which a decline in trade or aid is observed, but the country reducing the trade or aid made no official threats, didn't impose economic sanctions

[9] i=1,...,n.

publicly and didn't link the decline to a militarized dispute[10]. If reducing trade and aid are messages for the international community, then a decline in trade or aid that is not accompanied by a public economic sanction is less visible than an economic sanction, and thus, less effective in deterring future military conflicts. In the above framework, we call τ a significant decrease in trade between United States and T_i, and we call α, a significant decrease in total development aid to T_i. The paper investigates the effects of τ and α on the probability that country T_i will be involved in a militarized conflict $C\prime \neq C$, in the period $(t, t+5]$.

The paper finds that economic sanctions decrease the probability that T_i will participate in another dispute by 9%, the probability that M_i will participate in another dispute by 12%, the probability that D_i will participate in another dispute by 5% and that G_i will participate in another dispute by 11%. Finally, the study concludes that a significant decrease in trade or aid to T_i that is not accompanied by an economic sanction does not affect the future military behavior of T_i.

The rest of this chapter is organized as follows. Section 2.2 describes what types of conflicts I am using in the analysis, Section 2.3 describes the economic sanctions, Section 2.4 shows the way the variables are constructed. Section 2.5 shows the econometric model, Section 2.6 presents the results of the paper, Section 2.7 presents robustness checks and finally Section 2.8 concludes.

2.2 Militarized Disputes

In this study, the militarized disputes data comes from the Correlates of War. Militarized interstate disputes are united historical cases in which the threat, display

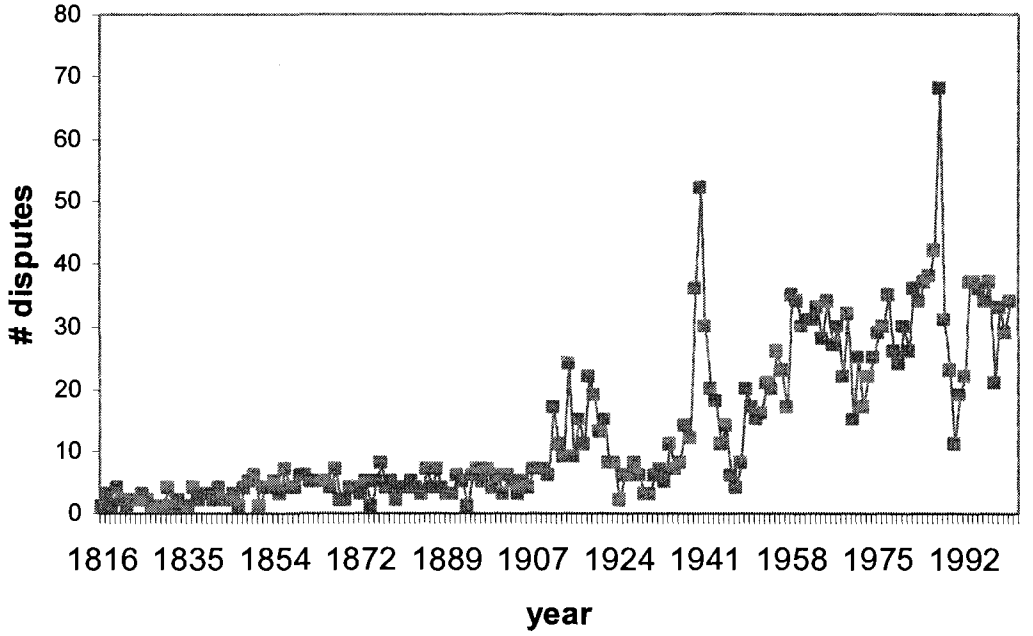
[10]If an economic sanction is not recorded in Hufbauer et al.'s dataset, it will show up simply as a decline in trade/aid in this analysis.

or use of military force short of war by one member state is explicitly directed towards the government, official representatives, official forces, property, or territory of another state. Interstate disputes include only disputes between recognized state and exclude any non-recognized state or non-state entities. A militarized dispute is a single military action involving a threat, display, or use of force by one country towards another. Different militarized actions between two countries that are at war count as one dispute. Actions taken by officials of country against private citizens of another country are usually not considered militarized disputes unless they are seizures within a disputed territory, attacks on international shipping or pursuit of forces across borders.

Militarized disputes range from fairly minor to severe. Minor examples include a 1993 incident in which Russian 14th army that was stationed in Moldova since the collapse of the U.S.S.R. started participating in military exercises. A more serious example is an incident from 1995 when a Nicaraguan coast guard cutter boarded 4 Honduran fishing boats and arrested their crew. Most crew was released, but the tension between the two countries continued as Honduras threatened to open fire at any patrol boats from Nicaragua. A more serious dispute was one between Kenya and Uganda in 1995. Uganda sent troops at its border with Kenya to curb alleged incursions into Uganda by Kenyan troops. Uganda claimed that Kenyan troops entered Uganda, burnt villages and killed at least one person.

I use militarized disputes from 1816-2001. Figure 2.3 shows the number of disputes for each year during this period. There are three major peaks during this time period: one during the first world war, the second during the second world war, and the third during the late 1980s. The peaks for the first two world wars are not as big because once a country is at war with another one all the subsequent disputes are counted as

Figure 2.3
NUMBER OF DISPUTES PER YEAR 1816-2001



one dispute. The disputes in 1980s were smaller in magnitude than the ones during the world wars, but numerous. They include disputes between China and Vietnam in 1987, Indonesia and Papua New Guinea in 1988, and Egypt and Sudan in 1989. The length of the disputes varies between 0 to 13 years. 74.77% of disputes lasted less than an year, 18.30% lasted a year, 3.29% lasted 2 years, and the rest of 3.64% lasted 3-13 years.

Certain parts of the world have more frequent disputes than others. Out of all countries involved in disputes during 1816-2001, 24.57% are African countries, 14.29% are Central and Eastern European countries, 12% are Western European countries, 11.43% Middle Eastern countries, 10.86% from Latin America and the rest of 26.86% from the rest of the world. On average countries in the sample have military personnel of 0.1% of total population. However, the countries with most military personnel like

USSR and UK are also involved in most disputes: USSR is involved in 341 disputes and UK is involved in 263 disputes.

2.3 Economic Sanctions

The economic sanctions used in this study come from Hufbauer et al.'s dataset[11]. Economic sanctions are the deliberate, government withdrawal, or threat of withdrawal, of customary trade or financial relations. I use only sanctions related to militarized disputes. These are sanctions whose goals are to stop a militarized dispute, punish the participants of a militarized dispute or to demonstrate resolve regarding a militarized conflict. The goals of sender are official goals declared to the public by a government official when the sanction was imposed. For example, when the League of Nations and UK sanctioned Italy in 1935 because of its dispute with Abyssinia (Ethiopia), the Cabinet of the British Prime Minister released this statement:"The object of an oil sanction was to stop war." (Renwick 16).

Sanctioned disputes vary in gravity from border conflicts to actual wars. Examples include sanctions by the League of Nations against Yugoslavia in 1921 because of Yugoslav troops invading Albania, sanctions by US and United Nations against Iraq in 1990 because of the Iraqi invasion of Kuwait and sanctions of UK against Germany in 1914 at the beginning of the first world war. Senders of sanctions are mostly large coalitions of countries or large countries like United Nations, European Union, UK, United States, China. The list of targets is much larger and countries are from almost all continents and of all sizes, from as small as Armenia to large as USSR.

On average, sanctions are imposed for 5 years, but they can last at little as 0

[11]Data on economic sanctions is used with permission of the Peterson Institute for International Economics. Copyright 2007. All rights reserved.

years and as much as 21 years. There are three possible types of sanctions, export sanctions (limit, stop exports to target), import sanctions (limit, stop imports from targets) and financial sanctions (delaying/denying credit, grants to targets). The most common type of sanction in my sample is a combination of the 3. 52.94% of all sanction cases are a combination of import, export and financial sanctions. The second common is export sanction (17.65% of all cases). Other types of sanctions used are a combination of financial and export, import, and combination of import and export.

Out of all sanctions, only 3 cases were completely successful in attaining the official goal according to Hufbauer et al. 2007[12]. The three successful sanctions are League of Nations against Yugoslavia, League of Nations against Greece and United States against Egypt. In the first case, Yugoslavia withdrew its troops from Albania "in order to avoid the dangerous consequences of nonacceptance" (Toynbee 346). In the second case, Greece accepts League of Nations' recommendation to withdraw the troops from Bulgaria and to pay damages. In the third case, Egypt ends aid to Congolese rebels, stops anti-US attacks in the Egyptian press and withdraws support from Arab Jordan River Project.

2.4 Variables

This study uses six types of variables, dispute characteristics, country characteristics, probability, sanction, trade and development aid variables. First, dispute characteristics variables are taken from the Correlates of War -The Militarized Interstate Dispute v3.02. I use 2331 disputes between 1816 and 2001. This paper uses

[12]The sanctions are credited with attaining the foreign policy goal. It is hard to assess if indeed the sanctions alone led to the positive outcome.

Table 2.1
LEVELS OF VIOLENCE

level of violence	score
no militarized action	0
threat to use force	1
threat to blockade	2
threat to occupy territory	3
threat to declare war	4
threat to use CBR weapons	5
threat to join war	6
show of force	7
alert	8
nuclear alert	9
mobilization	10
fortify border	11
border violation	12
blockade	13
occupation of territory	14
seizure	15
attack	16
clash	17
declaration of war	18
use of CBR weapons	19
begin interstate war	20
join interstate war	21

The scores attached to each level of violence will be used later in analysis.

data at participant-incident level which means that one observation is a country T_i involved in a dispute C. For example, for a conflict between Albania and Yugoslavia in 1921, the dataset has two observations, one for each participant. The two dispute characteristics variables used are fatalities and violence. Fatalities approximates the number of fatalities of country T_i in dispute C and violence measures the highest level of violence taken by country T_i in dispute C. The violence level is measured on a scale from 0 to 21, where 0 is no militarized dispute and 21 is joining an interstate war. Table 2.1 shows all the levels of violence. Table 2.2 shows the definitions of all variables and Table 2.3 shows the descriptive statistics.

Second, the country characteristics variables are democracy, military, previous disputes and region dummies. Democracy is taken from the Polity IV dataset

Table 2.2
LIST OF VARIABLES

variable	source	definition
dispute characteristics		
fatalities	Correlates of War –The Militarized Interstate Dispute v3.02	Approximation of fatalities in the dispute. It takes values from 0 to 6. 0=no fatality and 6= 999 or more fatalities.
violence	Correlates of War –The Militarized Interstate Dispute v3.02	Highest level of violence taken by the country in the dispute. It takes values from 0 to 21. 0=no militarized action and 21=join interstate war.
country characteristics		
democracy	Polity IV Dataset	Democracy score of the country. It measures general openness of political institutions. It takes values from 0 to 10. 0=least democratic country and 10=most democratic country.
military	Correlates of War National Material Capabilities v3.02& author's calculations	Military personnel as percentage of total population.
previous disputes	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes in which the country participated in the 5 years period before the outbreak of the dispute.
probabilities		
P	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The probability that a country involved in a dispute will participate in a different dispute in the following 5 years.
P^M	Correlates of War –The Militarized Interstate Dispute v3.02 & National Material Capabilities v3.02& author's calculations	The probability that a country with similar military capabilities to the one involved in the dispute will participate in a different dispute in the following 5 years.
P^D	Correlates of War –The Militarized Interstate Dispute v3.02, Polity IV& author's calculations	The probability that a country with a similar democratic system to country in the dispute will participate in a different dispute in the following 5 years.
P^G	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The probability that a country situated in the same region of the world as the country involved in the dispute will participate in a different dispute in the following 5 years.
sanctions		
sanction	Hufbauer et al. (2007)	It takes value 1 if any country involved in the dispute was sanctioned because of its involvement in that dispute. It takes values 0 if no country in the dispute was sanctioned.

Table 2.2 (CONTINUED)

multi	Hufbauer et al. (2007) & authors' calculations	The sanction is multilateral (more than one country imposed the same sanction on the target).
cost t	Hufbauer et al. (2007)	Cost imposed on the target as percentage of the target's GNP.
cost s	Hufbauer et al. (2007)	Cost of the sanction to the sender. Takes values between 1 and 4. 1=major gain and 4=major cost.
big	Hufbauer et al. (2007) & authors' calculations	The sender is a big country or a large coalition of countries.
trade		
trade50	International Trade Database & author's calculations	The amount of trade between US and the country involved in the dispute decreased by 50% or more in the year following the outbreak of the dispute.
trade75	International Trade Database & author's calculations	The amount of trade between US and the country involved in the dispute decreased by 75% or more in the year following the outbreak of the dispute.
tradegdp50	International Trade Database & author's calculations	The amount of trade between US and the country involved in the dispute/ (GDP of the country in the dispute) decreased by 50% or more in the year following the outbreak of the dispute.
tradegdp75	International Trade Database & author's calculations	The amount of trade between US and the country involved in the dispute/ (GDP of the country in the dispute) decreased by 75% or more in the year following the outbreak of the dispute.
development aid		
aid50	World Development Indicators & author's calculations	The amount of development aid to the country involved in the dispute decreased by 50% or more in the year following the outbreak of the dispute.
aid75	World Development Indicators & author's calculations	The amount of development aid to the country involved in the dispute decreased by 75% or more in the year following the outbreak of the dispute.
aidgdp50	World Development Indicators & author's calculations	Development aid to the country involved in the dispute /(GDP of recipient country) decreased by 50% or more in the year following the outbreak of the dispute.
aidgdp75	World Development Indicators & author's calculations	Development aid to the country involved in the dispute /(GDP of recipient country) decreased by 75% or more in the year following the outbreak of the dispute.

Table 2.3
DESCRIPTIVE STATISTICS

variable	obs	mean	SD	min	max
dispute characteristics					
fatalities	4980	.46	1.32	0	6
violence	5600	9.88	7.22	0	21
country characteristics					
democracy	4916	3.95	4.12	0	10
military	5475	.001	.001	0	.02
previous disputes	5572	9.41	8.52	1	78
probabilities					
P	5600	.72	.44	0	1
P^M	5475	.98	.12	0	1
P^D	4916	.97	.15	0	1
P^G	5441	.98	.12	0	1
sanctions					
sanction	4658	.04	.19	0	1
multi	191	.72	.44	0	1
cost t	191	6.39	10.34	0	30
cost s	191	3.19	.99	1	4
big	191	.97	.16	0	1
trade					
trade50	2666	.05	.22	0	1
trade75	2666	.02	.16	0	1
tradegdp50	1185	.02	.15	0	1
tradegdp75	1185	.006	.08	0	1
development aid					
aid50	1517	.05	.23	0	1
aid75	1517	.02	.14	0	1
aidgdp50	1360	.06	.24	0	1
aidgdp75	1360	.02	.14	0	1

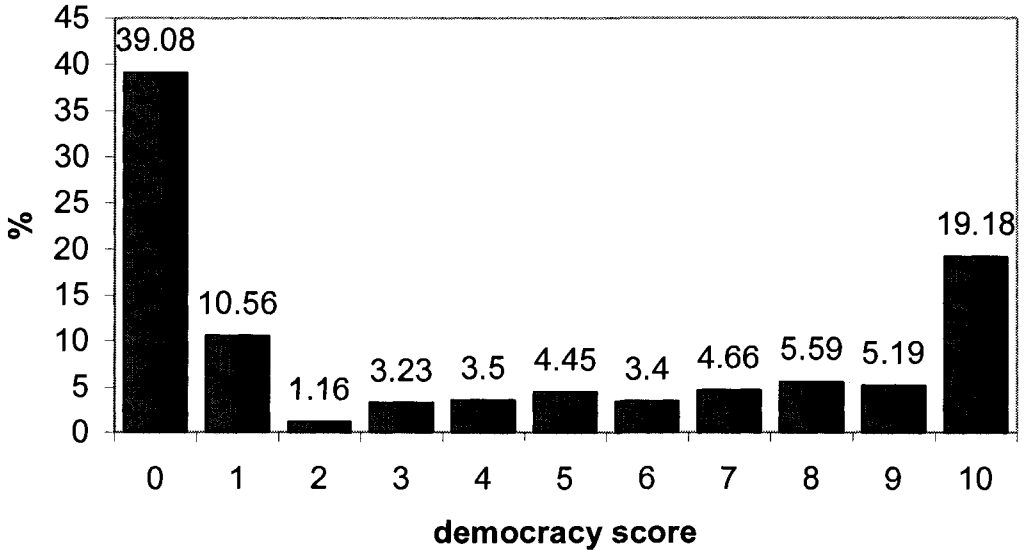
Sanction data is available for years 1914-2001, trade data is available for years 1870-1992, development aid is available for years 1960-2001 and militarized disputes data is available for years 1816-2001.

and measures openness of political institutions on a scale from 0 to 10, where 0 is the least democratic country and 10 is the most democratic country. The countries involved in disputes are either very democratic or very undemocratic: 39.08% of the sample has a score of 0 and 19.18% have a score of 10. Figure 2.4 shows this distribution by democracy in more detail. Military comes from another Correlates of War dataset called National Military Capabilities v3.02 and it measures military personnel as percentage of total population. Finally, previous disputes measures the number of disputes in which country T_i participated in the 5-year period before the outbreak of dispute C. The values of this variable are quite large mostly because this dataset contains countries that were involved in at least one conflict, thus contains mostly belligerent countries. The mean for previous disputes is 9.41 and the median is 6. Countries like Iran and Germany have more than 60 disputes in some 5-year periods and countries like Luxembourg, Finland and Denmark have less than 5 disputes in most 5-year periods.

Third, this paper uses four probabilities as dependent variables. P is the probability that country T_i will participate in another conflict $C\prime \neq C$ in $(t, t+5]$. For example, in 1974, Turkish troops invaded northern Cyprus. Cyprus shows up as a participant in a militarized conflict in 1974 along Turkey. In 1978, Egypt initiated a military conflict against Cyprus, thus Cyprus shows up as a participant in another conflict two years after the 1974 conflict. Thus, $P = 1$ for Cyprus in the 1974 conflict. As mentioned before, the group of countries represented in this dataset is quite belligerent and it is not surprising that the mean P for these countries is .72.

Another probability is P^M, the probability that a country M_i with similar military capabilities to country T_i will participate in conflict $C'' \neq C$ in $(t, t+5]$. Two countries are considered to have similar military capabilities if their military

Figure 2.4
DISTRIBUTION OF COUNTRIES BY DEMOCRACY SCORE



score is in the same decile. For example, in 1943, the United States had .006% of its population in its military service and United Kingdom had .008% of its population in military service. Both countries' scores were in the 10th decile in the dataset, thus for 1943 disputes, United States and United Kingdom are considered to have similar military capabilities.

The other probabilities are P^D and P^G. P^D is the probability that a country D_i that has the same democracy score as T_i will participate in conflict $C''' \neq C$ in $(t, t+5]$. And P^G is the probability that a country G_i that situated in the same geographic area as T_i will participate in another conflict $C'''' \neq C$ in $(t, t+5]$.

Fourth, sanction variables are constructed using the sanctions in Hufbauer et al.'s dataset mentioned in the previous section. This dataset provides information on economic sanctions imposed on various countries between 1914 and 2000. 53 countries in our sample were sanctioned because of their participation in a militarized

dispute and 191 countries were involved in conflicts in which at least one country was sanctioned because of its participation in the conflict. The variable sanction is a dummy that takes value 1 if any country involved in conflict C is sanctioned because its involvement in the conflict.

Other sanction variables are multi, cost t, cost s, and big. Multi is a dummy that takes value 1 if more than one country imposed the sanction. Cost t is an estimate of the economic costs that sanctions imposed on the target and it is measured as percentage of target's GNP. Cost s is an estimate of the economic costs to the sender measured on a scale from 1 to 4, where 1 is major gain for the sender and 4 is major cost for the sender. The final sanction variable is big, a dummy that takes value 1 if any of the senders is a big country.

Fifth, the study uses four trade variables, trade50, trade75, tradegdp50 and tradegdp75. Trade50 and trade75 are dummies that take value 1 if trade between United States and T_i decreased at least 50% and 75%, respectively in the year following the outbreak of conflict C. Similarly, tradegdp50 and tradegdp75 are dummies that take value 1 if trade between United States and T_i as a share of T_i's GDP decreased at least 50% and 75%, respectively in the year following the outbreak of C. These dummies capture declines in trade that are not associated with economic sanctions, thus these dummies take value 0 if the decrease in trade is accompanied by import or export sanctions imposed on T_i. These declines in trade are rare. Out of 5600 observations, there are only 137 instances in which a country involved in a dispute experienced a decline of 50% or more in trade with the United States the year after the outbreak of a dispute and only 71 instances when the decline was larger than 75%.

Finally, the aid variables are aid50, aid75, aidgdp50 and aidgdp75. These

are dummies similar to the trade dummies. Aid50 and aid75 take value 1 if total development aid to Ti declined by at least 50% and 75%, respectively and aidgdp50 and aidgdp75 take value 1 if total development aid to T_i as a share of T_i 's GDP declined by at least 50% and 75%, respectively. Similarly to the trade dummies, the aid dummies become 0 if the decline in aid was accompanied by financial sanctions imposed on T_i.

2.5 Econometric Strategy

The goal is to estimate the effect of sanctioning a country involved in a militarized dispute on the probability that any country involved in that dispute will participate in another dispute in the following 5 years. The paper uses a basic probit model like the one below,

$$P_{kj} = F(\beta_0 + \beta_1 sanction_j + \beta_2 country\ characteristics_{kj} + \beta_3 dispute\ characteristics_{kj} + \beta_4 t_{kj}), \quad (13)$$

where k indicates the country, j indicates the dispute, P_{kj} is the probability P for country k and dispute j and t_{kj} is a year dummy. Next, the study adds interaction terms to (13) to check whether certain sanction characteristics make the sanction effect stronger or weaker. I use the equation,

$$P_{kj} = F(\gamma_0 + \gamma_1 sanction_j + \gamma_2 sanction_j sanction\ characteristics_j + \gamma_3 country\ characteristics_{kj} + \gamma_4 dispute\ characteristics_{kj} + \gamma_5 t_{kj}). \quad (14)$$

Then, I test whether sanctioning a country involved in a conflict affects the probability of militarized conflict of similar countries to the ones in the sanctioned conflict. The model is

$$\rho_{kj} = F(\delta_0 + \delta_1 sanction_j + \delta_2 country\ characteristics_{kj} + \delta_3 t_{kj}) \quad (15)$$

where ρ_{kj} is P^M, P^D or P^G and country characteristics is military when ρ_{kj} is P^M, democracy when ρ_{kj} is P^D and region dummies when ρ_{kj} is P^G.

Finally, I investigate if declines in trade or aid with country k that are not accompanied by economic sanctions affect the probability that k will participate in another conflict in the future. The new model is

$$P_{kj} = F(\zeta_0 + \zeta_1 X_{kj} + \zeta_2 country\ characteristics_{kj} + \zeta_3 dispute\ characteristics_{kj} + \zeta_4 t_{kj}), \quad (16)$$

where X_{kj} is trade50, trade75, tradegdp50, tradegdp75, aid50, aid75, aidgdp50 or aidgdp75.

2.6 Results

Table 2.4 column (1) reports results for equation (13). The most important finding of (1) is that economic sanctions reduce the probability that T_i will participate in another militarized dispute by 9%. Democracy is positive and not statistically significant. Most studies find that democracies are less likely to fight each other. Our result doesn't necessarily contradict these studies; it only suggests that the level of democracy in a country has no effect on the probability that country will participate in a militarized dispute against a democracy or a non-democracy. The other country characteristics are highly significant; an increase of 1% in military personnel as share of population results in an increase of 7.79% in P and an increase of 1 in number of previous disputes increases P by .03%. These results support the view that more belligerent countries characterized by large military and numerous past militarized disputes are more likely to be part of militarized disputes in the future.

(1) also shows that an increase in the level of fatalities in the present conflict decreases the probability that the country that suffered the fatalities will be involved in another conflict in the future. It is not a surprising result; countries that suffered large human life losses are probably lacking capabilities or are too demoralized to start other conflicts soon after the large fatality dispute. Violence has no effect on P. The highest degree of violence reached by a country in a conflict doesn't depend on the country's belligerence alone, but also on its adversaries' actions, and thus, violence in the present conflict explains little of the probability of a future dispute.

Next, the results in (2)-(5) correspond to equation (14). (2)-(5) interact sanction characteristics with the sanction variable while keeping all the other controls from (1). A key result is that multi is negative and significant and that the sanction

Table 2.4

EFFECTS OF SANCTIONING A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT A COUNTRY IN THE SAME DISPUTE WILL PARTICIPATE IN ANOTHER DISPUTE IN THE FUTURE

	(1)	(2)	(3)	(4)	(5)
sanction	-.09	.03	-.05	.08	.08
	(.05)**	(.04)	(.05)	(.02)	(.01)***
sanction*multi		-.21			
		(.15)**			
sanction*cost t			-.004		
			(.002)*		
sanction*cost s				-.07	
				(.03)**	
sanction*big sender					-.46
					(.11)***
democracy	.0005	.0004	.0004	.0005	.0005
	(.001)	(.001)	(.001)	(.001)	(.001)
fatalities	-.007	-.008	-.008	-.007	-.008
	(.005)	(.005)	(.005)	(.005)	(.005)
military	7.79	7.91	7.86	8.01	7.78
	(3.60)**	(3.58)**	(3.59)**	(3.67)**	(3.60)**
previous disputes	.03	.03	.03	.03	.03
	(.001)***	(.001)***	(.001)***	(.001)***	(.001)***
violence	.0003	.0003	.0004	.0003	.0003
	(.0007)	(.0007)	(.0007)	(.0007)	(.0007)
year dummies	yes	yes	yes	yes	yes
observations	3511	3511	3511	3511	3511
pseudo-R^2	26.95%	27.09%	27.03%	27.16%	27.04%

The dependent variable is the P, the probability that a country involved in a dispute will participate in a different dispute in the following 5 years. Results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 1% level, ** denotes significant at 5% level and * denotes significant at 10% level.

coefficient becomes positive and insignificant. Thus, sanctions deter future military disputes only when they are multilateral, that is when sanctions are imposed by multiple senders. Many studies argue that economic sanctions are more successful in attaining the stated goals if they are multilateral because the target is less likely to find substitutes for the lost trade and aid and the sanction is likely to impose larger costs. This result shows that multilateral sanctions are also more likely to deter future behavior probably because the message of disapproval is stronger when coming from more countries and because the threat of future economic costs is bigger when sanction is backed by more than one country.

(3) shows that larger costs imposed on targets make the sanction effect stronger. Large economic sanction costs signal willingness to impose large economic sanction costs on future "offenders," thus sanctions that impose large costs on their targets better deter than the ones that impose low costs. An even more interesting result is the sender's cost result. The marginal effect of sanction is negative only if the sender's cost is higher or equal to two[13]. So, (4) shows that economic sanctions have a negative effect on P only if the sender suffers some costs as well. This result is consistent to previous literature that says that senders need to incur costs of their own in order to convince the international community they are committed to the message they are sending.

Another interesting result is that the sanctions have a negative effect on P only if the sender is a large country or a coalition of countries. It is an intuitive result since a warning message from a small country is less important to the international community than a message from a large and powerful country. However, it is hard to generalize this result since our sample consists mostly of big senders.

[13]Cost s is a variable that takes 4 values, 1=the sanction created some sort of gain for the sender, 2=little loss to sender, 3=modest loss to sender, and 4=major loss to sender.

Table 2.5
EFFECTS OF SANCTIONING A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT A SIMILAR COUNTRY TO THE ONES INVOLVED IN THE DISPUTE WILL PARTICIPATE IN ANOTHER DISPUTE IN THE FUTURE

	(1)	(2)	(3)
sanction	-.12	-.05	-.11
	(.07)***	(.02)***	(.05)***
military	1.03		
	(5.49)		
democracy		-.002	
		(.001)**	
year dummies	yes	yes	yes
region dummies	no	no	yes
observations	400	1193	699
pseudo-R^2	13.58%	16.90%	29.81%

The dependent variable in (1) is P^M, the dependent variable in (2) is P^D, and the dependent variable in (3) is P^G. Results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 15% level, ** denotes significant at 5% level and * denotes significant at 10% level.

Next, Table 2.5 presents the results corresponding to (15). (1) regresses P^M on sanction, military and year dummies, (2) regresses P^D on sanction, democracy and year dummies and (3) regresses P^G on sanction, region and year dummies. The results show that economic sanctions decrease P^M by 12%, P^D by 5% and P^G by 11%. Thus, sanctions are messages of disapproval that are heard by other countries than the ones involved in the sanctioned dispute. Similar countries are feeling warned that certain behavior is unacceptable and they modify their behavior to avoid the costs associated to economic sanctions.

Tables 2.6 and 2.7 estimate the effects of declines in trade or aid on P. These results correspond to equation (16). It seems that declines in trade have no effect on the probability that the country suffering this decline in trade will participate in another dispute in the next 5 years. It is certainly possible that the decline in trade observed soon after the outbreak of the conflict occurs because the country's infrastructure is destroyed by the conflict and not because United States intentionally

Table 2.6
EFFECTS OF A LARGE DECREASE IN TRADE TO A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT THE SAME COUNTRY WILL BE INVOLVED IN ANOTHER DISPUTE IN THE FUTURE

	(1)	(2)	(3)	(4)
trade50	-.02			
	(.03)			
trade75		-.04		
		(.07)		
tradegdp50			.03	
			(.04)	
tradegdp75				-.09
				(.16)
democracy	.0002	.0002	.002	.002
	(.001)	(.001)	(.002)	(.002)
fatalities	.002	.002	.002	.002
	(.006)	(.006)	(.009)	(.009)
military	22.35	22.24	24.17	24.01
	(7.74)***	(7.78)***	(11.09)**	(11.24)**
previous disputes	.04	.04	.05	.05
	(.002)***	(.002)***	(.004)***	(.004)***
violence	-.0002	-.0002	.0004	.0005
	(.0009)	(.0009)	(.001)	(.001)
year dummies	yes	yes	yes	yes
observations	2116	2116	1016	1016
pseudo-R^2	20.68%	20.67%	22.58%	22.58%

The dependent variable is P. Results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 1% level, ** denotes significant at 5% level and * denotes significant at 10% level.

decreased trade with that country to punish or warn that country. In that's the case, it is not surprising that the targets[14] are not modifying their behavior. But large drops in development aid are less likely to be anything else but punishments or warning messages. And as seen in Table 2.7, large declines in aid have no effect on P when they are not accompanied by economic sanctions. Thus, economic policies that are not visible don't have a deterrent effect. Senders need to send clear messages of disapproval that can be heard and understood by all countries in order to modify future behavior.

[14]We call targets the countries that experience the decline in trade or aid although no economic sanctions were imposed in those cases

Table 2.7
EFFECTS OF A LARGE DECREASE IN AID TO A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT THE SAME COUNTRY WILL BE INVOLVED IN ANOTHER DISPUTE IN THE FUTURE

	(1)	(2)	(3)	(4)
aid50	-.07			
	(.06)			
aid75		-.04		
		(.10)		
aidgdp50			-.07	
			(.07)	
aidgdp75				-.03
				(.10)
democracy	.004	.004	.004	.004
	(.003)	(.003)	(.003)	(.003)
fatalities	.01	.01	.008	.008
	(.01)	(.01)	(.01)	(.01)
military	-5.07	-6.37	-2.55	-4.77
	(17.58)	(17.37)	(19.53)	(19.25)
previous disputes	.07	.07	.07	.07
	(.006)***	(.006)***	(.007)***	(.007)***
violence	.001	.001	.0008	.0008
	(.001)	(.001)	(.002)	(.002)
year dummies	yes	yes	yes	yes
observations	1258	1258	1130	1130
pseudo-R^2	22.90%	22.83%	23.77%	23.69%

The dependent variable is P. Results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 1% level, ** denotes significant at 5% level and * denotes significant at 10% level.

It is important to mention that the way trade and aid variables were constructed might influence the above results. Data on total trade was used to construct the trade variable, thus if United States cut the trade in one specific area (possibly one in which United States has monopoly) and the total trade did not change much, then we don't observe this policy. Thus, we might be ignoring exactly some trade policy that can have an important impact on target's economy and have an important deterrent effect. Also, aid variables are target's total aid received from all sources. So, if only one country decides to cut the aid to the target and that cut is not large enough to be noticed in the total aid, then we don't observe this policy in the aid

variables.

2.7 Robustness Checks

Tables 2.8-2.10 show a number of robustness checks. Table 2.8 shows 4 additional specifications estimating the probability that T_i will participate in the another dispute in the future. (1) shows the effects of sanctions on P when the sample is restricted to more important disputes defined as disputes in which the highest level of action was at least some show of force. The sanctions coefficient is negative and statistically significant. Thus, sanctions deter major disputes.

(2) and (3) look at the effects of sanctions on the behavior of the target further into the future. (2) estimates the effects of sanctions on the probability that T_i will participate in another dispute 8 years in the future. The effect of the sanction is negative, but the magnitude is smaller. Sanctions decrease the probability that T_i will participate in another dispute 8 years in the future by 8% while they decreased the probability that T_i will participate in another dispute in 5 years by 9%. (3) shows that sanctions still have a negative effect on the probability that the country will participate in another dispute 10 years in the future. The magnitude of this effect is even smaller than the effect from (2). It seems that sanctions have a deterrent effect further in the future, but the magnitude decreases with time. Sanctions seem to send a disapproval message and countries are less likely to engage in disputes immediately after the sanctions but, as time passes, the signal loses in power, probably because targets' and senders' governments change. The signal might not be relevant for new sender governments and the target governments might not observe past signals.

(4) looks at the effects of sanctions when I eliminate the two world wars related

Table 2.8
ROBUSTNESS CHECKS FOR THE EFFECTS OF SANCTIONING A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT A COUNTRY IN THE SAME DISPUTE WILL PARTICIPATE IN ANOTHER DISPUTE IN THE FUTURE

	(1) important disputes	(2) 8 years in the future	(3) 10 years in the future	(4) no world wars
sanction	-.08	-.08	-.06	-.10
	(.05)*	(.04)**	(.03)**	(.06)**
democracy	-.001	.0002	.0002	.0004
	(.001)	(.0009)	(.0008)	(.001)
fatalities	-.01	-.003	-.003	.004
	(.006)*	(.004)	(.004)	(.006)
military	1.27	5.28	2.81	13.37
	(4.00)	(2.42)**	(2.13)	(5.07)***
previous disputes	.04	.02	.02	.04
	(.002)***	(.001)***	(.001)***	(.001)***
violence	-.001	-.00004	-.0002	-.0002
	(.001)	(.0005)	(.0005)	(.0009)
year dummies	yes	yes	yes	yes
observations	2310	3500	3481	3133
pseudo-R^2	33.22%	27.33%	28.70%	26.16%

In the first column, the dependent variable is the P. The first column reports results ran on more serious disputes (the highest level of action was at least some show of force). The second column shows the results on the probability that the country will participate in another dispute in following 8 years and the third column shows the results for participating in another dispute in the following 10 years. Last column presents results ran on disputes that exclude the two world wars. Results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 1% level, ** denotes significant at 5% level and * denotes significant at 10% level.

disputes. The whole sample contains world wars related disputes and two sanctions imposed on Japan and Germany in the two world wars. I expect that eliminating these types of disputes and sanctions would make the effect stronger since the sanctions imposed before the two world wars were not successful in deterring future disputes. Indeed, the effect of sanctions is negative and the magnitude is larger than in the original specification (Table 2.4 column 1).

Table 2.9 shows the effects of sanctions on the probability that a country similar to T_i will participate in another dispute. The sample is restricted for major disputes for all 3 regressions. P^M is the dependent variable in (1), P^D is the dependent variable

Table 2.9
ROBUSTNESS CHECKS ON THE EFFECTS OF SANCTIONING A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT A SIMILAR COUNTRY TO THE ONES INVOLVED IN THE DISPUTE WILL PARTICIPATE IN ANOTHER DISPUTE IN THE FUTURE

	(1)	(2)	(3)
sanction	-.11	-.13	-.19
	(.08)*	(.05)***	(.07)***
military	1.32		
	(10.20)		
democracy		-.004	
		(.001)***	
year dummies	yes	yes	yes
region dummies	no	no	yes
observations	271	736	637
pseudo-R^2	12.75%	16.70%	23.36%

The dependent variable in (1) is P^M, the dependent variable in (2) is P^D, and the dependent variable in (3) is P^G. The results are for more significant disputes (the ones where the highest level of action was at least show of force). The results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 1% level, ** denotes significant at 5% level and * denotes significant at 10% level.

in (2) and P^G is the dependent variable in (3). Sanctions still have negative effects on these 3 probabilities.

Table 2.10 looks at the effects of large reductions in trade on P. (1) looks at the effect of a significant decline in trade with France on P, (2) on the effect of a significant decline in trade with USSR on P and (3) on the effect of a large decline in trade with UK[15] on P. Similarly to the results for declines in trade with the US, these decreases in trade also don't seem to have an effect on P.

Since the original dispute might affect the infrastructure of a country and damaged infrastructure might lead to decreases in trade, I run a regression on a restricted sample of minor disputes for which there is no reason to believe that affected trade. (4) shows the effects of a decline in trade with US on P for this reduced sample. tr50 is negative and again statistically insignificant.

[15] A significant decline in trade is a decrease of 50% or more in trade between the specific country (France, USSR or UK) and T_i.

Table 2.10
ROBUSTNESS CHECKS OF THE EFFECTS OF A LARGE DECREASE IN TRADE WITH A COUNTRY INVOLVED IN A DISPUTE ON THE PROBABILITY THAT THE SAME COUNTRY WILL BE INVOLVED IN ANOTHER DISPUTE IN THE FUTURE

	(1)	(2)	(3)	(4)
		all disputes		minor disputes
tr50 fr	-.01			
	(.01)			
tr50 ussr		-.02		
		(.03)		
tr50 uk			-.01	
			(.03)	
tr50				-.16
				(.13)
democracy	.001	.001	.003	.02
	(.001)	(.002)	(.002)**	(.005)***
fatalities	-.004	-.01	-.01	.14
	(.003)	(.01)	(.007)*	(.14)
military	-.87	-.01	8.13	-18.96
	(5.20)	(18.51)	(12.25)	(29.13)
previous disputes	.01	.03	.02	.09
	(.006)***	(.005)***	(.009)***	(.01)***
violence	.0001	-.002*	.0006	-.009
	(.0003)	(.001)	(.0008)	(.04)
year dummies	yes	yes	yes	yes
observations	603	447	526	553
pseudo-R^2	42.84%	26.66%	39.31%	19.88%

The dependent variable is P. (1)-(3) presents results for all disputes and (4) presents results for a dataset restricted to minor disputes (the highest level of violence is a threat to join interstate war). Results are probit marginal effects. Standard errors are in parentheses. *** denotes significant at 1% level, ** denotes significant at 5% level and * denotes significant at 10% level.

2.8 Conclusion

The central intuition is that economic sanctions imposed on countries involved in militarized conflicts show sender's disapproval of militarized conflicts and a willingness to impose economic costs on similar countries involved in militarized conflicts. Thus, countries that were sanctioned due to their involvement in a militarized dispute, countries that took part in the sanctioned dispute or countries similar to the ones in the sanctioned dispute are less likely to participate in future disputes because they try avoiding the economic and political costs associated with economic sanctions.

This study finds that economic sanctions decrease the probability that a country in the militarized dispute will participate in another dispute by 9%. The marginal effect of economic sanctions is negative and significant only if the sanction is multilateral and if the sender bears some economic costs as a result of the sanction. The effect of economic sanctions is stronger when the target cost is larger. Then, the paper finds that economic sanctions make countries similar to the ones in the sanctioned dispute less likely to participate in other militarized disputes in the future. Sanctions decrease the probability that M_i will participate in another dispute by 12%, that D_i will participate in another dispute by 5% and that G_i will participate in another dispute by 11%. Finally, the study finds that decreasing trade and aid to a country involved in a militarized dispute without imposing economic sanctions have no effect on the future military behavior of this country.

A number of lessons can be drawn from the above results. Economic sanctions deter future military behavior only if the sanctions are imposed by multiple senders, or if the sender is a large country. The deterring effects are larger when the target suffers large economic costs from the sanction. Also, the sanctions deter only if the sender

bears some economic costs from the economic sanction. Thus, import and export sanctions might deter better than financial ones, since the sender costs imposed by financial sanctions are usually very small or negative. Cutting trade or aid tacitly does not deter future military actions. The decrease in trade or aid needs to be made public and visible to all countries involved in the dispute and to all countries similar to the sanctioned ones.

This study provides some answers regarding the deterrent effect of economic sanctions, but many important questions are left unanswered. If a sender sanctions a country involved in a dispute, but it doesn't sanction another country in a similar situation, does the sender's message become less credible? Are certain governments more likely "to hear" the message than others? Do large sender and target costs borne by innocent civilians worth the 9% drop in the probability of another dispute? Future research should investigate these aspects of economic policy that could affect the success of sanctions as deterrents.

Chapter 3: Financial Sector Quality and Tax Revenue: Panel Evidence

3.1 Introduction

Countries differ in the tax policies they adopt and also in amount of tax revenue/GDP they collect from taxpayers. However, there are countries with similar tax policies that collect strikingly different tax revenues/GDP. This paper examines the role of financial sector quality on the amount of tax revenue the government collects from its taxpayers. The study also shows that revenues coming from income, sales, property and gift taxes are affected in different ways by changes in financial sector quality.

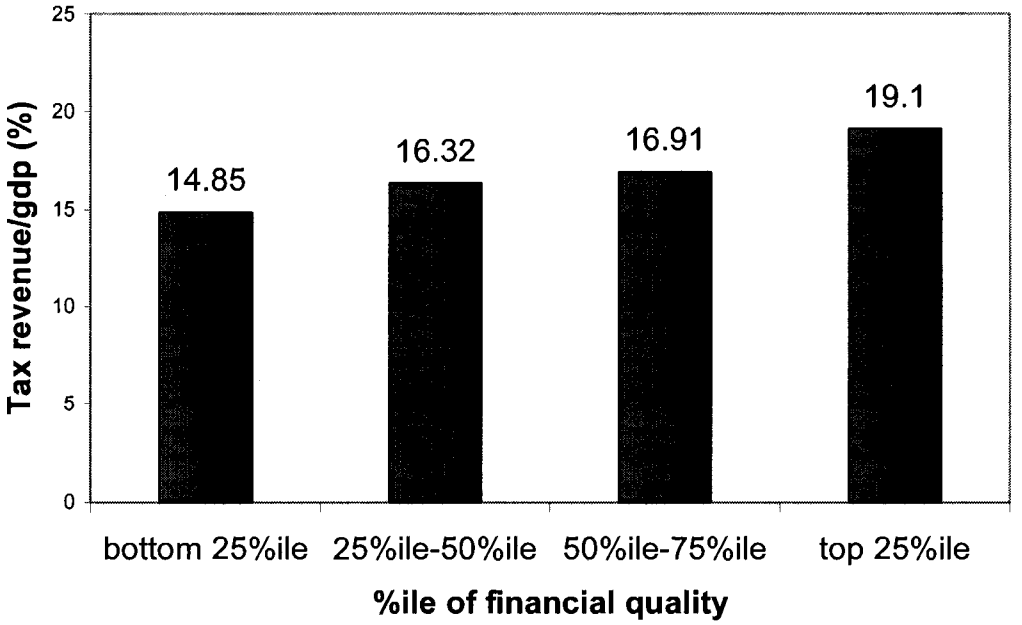
The central intuition behind this analysis is that fiscal policy and tax laws have little effect on the actual revenue if the level of underground economy is high. When taxpayers are difficult to monitor and firms are not formally organized, then the task of collecting tax becomes extremely difficult. When a country has financial institutions that are efficient, transparent and not corrupt, more taxpayers are given incentives to use the financial institutions in their transactions. Then, the government can obtain valuable information about taxpayers from financial institutions. So, one possible determinant of the level of tax revenue can be the quality and level of development of the financial sector.

Figure 3.1 shows the average tax revenue collected by governments in countries with different financial sector quality[16]. The first bar represents tax revenues collected by countries with low financial sector quality (countries with financial sector indicators in the bottom 25%ile of the sample). The second, third and fourth bars represent tax revenues of countries with financial sectors in the 2nd, 3rd and top quartile, respectively.Countries in the bottom quartile of financial quality collect only 14.85% of GDP in taxes, while countries in the top quartile collect 4.25% points more in taxes. This figure seems to suggest a positive correlation between financial sector quality and taxes/GDP.

A similar conclusion can be drawn by looking at the development of the financial sectors of two similar countries. In 1992, Peru had poor quality financial sector quality and collected only 11.97% of GDP in taxes. In the following years, the Peruvian financial sector underwent important changes. Peru passed a number of laws that regulated monetary policy, banks and capital markets. In 1992, a new organic law was

[16]Financial sector quality is measured on a scale from 0 to 10, where 0 represents poor quality and 10 represents excellent quality. The details regarding the calculation of this measure of financial quality are explained in Section 3.

Figure 3.1
TAX REVENUE BY FINANCIAL SECTOR QUALITY QUARTILE

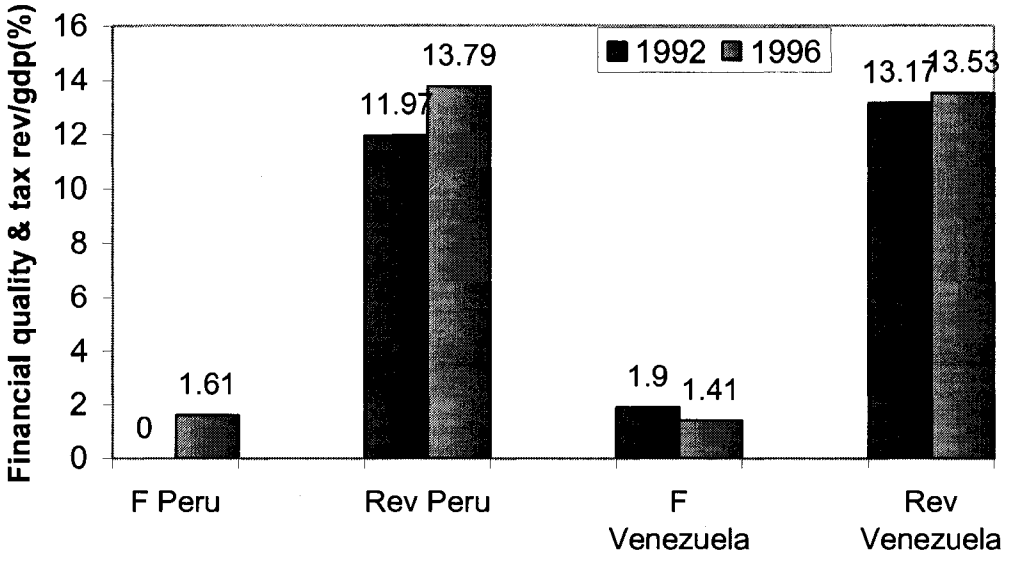


The first bar represents tax revenues collected by countries with low financial sector quality (countries with financial sector indicators in the bottom 25%ile of the sample). The second, third and fourth bars represent tax revenues of countries with financial sectors in the 2nd, 3rd and top quartile, respectively.

approved that regulated the Central Bank and its role. Next, commercial banks were allowed to be more active in the capital markets. In 1996, Law 26702 set standards for the financial and insurance markets compatible to the Basel agreement. As a result, in 1996, the quality of the financial sector was much higher than 4 years ago. The same year, Peru collected more tax revenue, 13.79% of GDP, almost 2% points more than 4 years before. Figure 3.2 shows the data for financial sector quality[17] and tax revenue in Peru. By contrast, Peru's neighbor, Venezuela didn't improve the quality of the financial sector during those years. Its financial quality scores were 1.90 in 1992 and 1.41 in 1996. Venezuela collected almost the same amount of tax revenue in 1992 and in 1996. Figure 3.2 also shows the data for Venezuela. Thus, the data

[17]The financial sector quality in Figure 3.2 is measured on the same 0 to 10 scale mentioned before.

Figure 3.2
FINANCIAL SECTOR QUALITY AND TAX REVENUE FOR PERU AND VENEZUELA



The darker bars represent data from 1992 and the lighter bars data from 1996. The first two bars show the financial sector quality in Peru, the third and fourth show the total tax revenue/GDP in Peru, the fifth and sixth the financial sector quality in Venezuela and the last two bars show the total tax revenue/GDP in Venezuela.

seem to suggest that countries that increase the quality of their financial sectors also collect more tax revenue/GDP.

In order to calculate the effect of financial sector quality on tax revenue, I use a panel of data from 72 countries and 14 years and constructs a financial sector indicator, F. F contains measurements of the banking sector, the stock market, other financial institutions, the monetary policy and the quality of institutions.

I show that an increase in the financial sector quality determines an increase in total tax revenue/GDP and in income tax revenue/GDP. However, sales, property and gift taxes don't seem to be affected by the quality in the financial sector.

This chapter is organized as follows. Section 3.2 reviews some previous studies

that analyze tax revenue and financial sector development. Section 3.3 describes the data and the way the variables were constructed, Section 3.4 presents the econometric model, Section 3.5 shows the results of the paper and Section 3.6 presents robustness checks. Section 3.7 concludes.

3.2 Previous Studies of Tax Revenues and Financial Sectors

Numerous studies investigate tax revenues in different countries, but the one that is the most relevant to this paper is Gordon and Li (2005). The authors develop a model for the choice of tax structure under the assumption that firms can avoid tax payments by shifting to cash transactions and not using the financial sector. They find that in countries with weak financial sectors, tax revenue as a share of GDP is low, the tax base is narrow and optimal tax structure puts more weight on capital taxes. They also conclude that policies that improve the quality of the financial sector will give more incentives to local companies to use the financial sector, increasing in this way, tax revenue as a share of GDP. I use their model and tests empirically their hypothesis regarding the effect of the financial sector quality on the tax revenue.

Berkowitz and Li (2000) examine the effects of tax rights on the economic development of transition countries. They compare the fiscal institutions of China and Russia and find that in China, where tax rights are more clearly defined, tax collections and public good provisions are higher than in Russia where tax rights are less clearly defined. Also they find that burdensome taxation increases tax evasion in Russia. I also use measures of institutions, law and order and corruption and find that countries with better institutions collect more revenue than the ones with poor

institutions.

Treisman (1999) tries to explain the sharp fall in Russian tax revenues in recent years. He concludes that tax rates reductions and general macroeconomic problems common to transitional economies play an important role in the declining tax revenue. This paper also considers macroeconomic indicators like GDP/capita and inflation in the analysis of tax revenue. I also control for tax rates and find that a decline tax rates determines a decline in tax revenue.

Beck et al. (2004) investigate the relationship between financial intermediary and economic growth, total factor productivity growth, physical capital accumulation and private saving rates. They use private credit/GDP as a proxy for financial development. In this paper, I also use private credit/GDP as one of the measurements of financial quality, but I use other measurements as well in order to capture other aspects of the financial sector.

In their IMF study, Creane et al. (2004) estimate the financial development for countries in the Middle East and North Africa. They use indicators from six areas: development of the monetary sector and monetary policy, banking sector development, non-bank financial development, regulation and supervision, financial openness, and institutional quality. However, they don't use the actual values of the indicators; they scale each indicator from 0 (worst) to 2 (best) and calculate their weighted average. I use a similar method to construct a financial indicator, but my financial indicator captures more information than Crane's because I use continuous values of each variable rather than discrete values.

3.3 Data Description and Construction of the Financial Sector Indicator

This study uses a panel of data from 72 countries and from 14 years (1990-2003). Table 3.1 provides short descriptions of the independent and dependent variables. Data in this paper can be broken into three main categories: financial sector data, macroeconomic controls and tax data.

First, the financial data is used to assess the quality of the financial sector. The paper uses interest rate spread, domestic credit to the private sector provided by the banking sector as a share of GDP and bank liquid reserves to bank assets ratio to measure the quality of the banking sector. Interest rate spread is the interest rate charged by banks on loans to prime customers minus the interest rate paid by commercial banks for savings deposits. The interest rate spread is a measure of bank competition and a larger interest rate spread is correlated with less competitive banking sectors where interest rates are set administratively or collusively. Banks operating in competitive environments are more efficient and they attract more customers that would otherwise use hard to detect cash transactions or operate in the informal economy.

Domestic credit to the private sector provided by the banks includes all bank credit to private sector and measures the ease of the private sector access to bank credit. The ratio of bank liquid reserves to bank assets is the ratio of domestic currency holdings and deposits with monetary authorities to claims on other governments, non-financial public enterprises, the private sector, and other banking institutions. When domestic credit is large and the ratio is small, more companies and individuals use bank loans, making easier for the government to gather financial information on taxpayers.

Table 3.1
DEFINITIONS AND SOURCES

Variable	Definition and sources
financial sector variables	
interest rate spread	It measures the lending rate minus the deposit rates charged by banks. Source: *World Development Indicators.*
domestic credit by banking sector/GDP	Domestic credit provided by the banking sector as a share of GDP measures all credit to various sectors on a gross basis, with the exception of credit to the central government over GDP. Measured in percentage points. Source: *World Development Indicators.*
bank liquid reserves/bank assets	It measures the ratio of domestic currency holdings and deposits with the monetary authorities to claims on other governments, non-financial public enterprises, the private sector, and other banking institutions. Source: *World Development Indicators.*
turnover ratio	Turnover ratio is ratio of the total value of shares traded in one period to the average market capitalization for the period. Measured in percentage points. Source: *World Development Indicators.*
market cap/GDP	Market capitalization as a share of GDP measures the share price times the number of shares outstanding over GDP. It is measured in percentage points. Source: *World Development Indicators.*
net export of insurance & financial services/GDP	It measures net exports of freight insurance on goods and other direct insurance such as life insurance; of financial intermediation services such as commissions, of foreign exchange transactions, and brokerage services; and of auxiliary services such as financial market operational and regulatory services as a percentage of GDP. Measured in percentage points. Source: Author's calculation and *World Development Indicators.*
exchange rate stability	It measures the annual percentage change in the exchange rate of the national currency against the US dollar (against the euro in the case of the USA). Source: *International Country Risk Guide.*
law and order	A measure of law (assesses the strength and impartiality of the legal system) and of the order (measures the observance of the law in the country). Each sub-component equals half of the total. The best score is 6 and the worst is 0. Source: *International Country Risk Guide.*
corruption	A measure of corruption within the political system. The least corrupt system has a score of 6 and the most corrupt has a score of 0. Source: *International Country Risk Guide.*

Table 3.1 (CONTINUED)

macroeconomic variables	
shadow economy /GDP	It measures all market-based legal production of goods and services that are deliberately concealed from public authorities as a share of GDP. Measured in percentage points. Note: The shadow economy data from the original dataset was calculated in form of averages over two years. In this paper, we used the average value for both years in order to increase the number of observations, i.e. in the original dataset mean shadow economy/GDP for Austria for 1990/1991 was 5.47%. In this paper, shadow economy/GDP is 5.47% in 1990 and 1991 for Austria. Source: Author's calculations, Chaudhuri and al. (2006), Schneider (2000), Schneider (2003), Schneider (2005a), Schneider (2005b), Schneider and Savasan (2005), *World Development Indicators*.
shadow economy/capita	It measures the shadow economy divided by midyear population. Measured in constant US dollars. Source: Author's calculations, Chaudhuri and al. (2006), Schneider (2000), Schneider (2003), Schneider (2005a), Schneider (2005b), Schneider and Savasan (2005), *World Development Indicators*.
inflation	Measures the annual percentage change in the cost to the average consumer of acquiring a fixed basket of goods and services from year to year. Measured in percentage points. Source: *World Development Indicators*.
GDP/capita	It measures GDP per capita is gross domestic product divided by midyear population. Measured in constant U.S. dollars (US dollar in year 2000). Source: *World Development Indicators*.
tax variables	
total tax/GDP	It measures all the revenue that comes from taxes as a percentage of GDP. Measured in percentage points. Source: Author's calculations and *World Development Indicators*.
total tax/ overall economy	It measures all the revenue that comes from taxes as a percentage of GDP and shadow economy. Source: Author's calculations, Chaudhuri and al. (2006), Schneider (2000), Schneider (2003), Schneider (2005a), Schneider (2005b), Schneider and Savasan (2005) and *World Development Indicators*.
income tax/GDP	It measures the taxes on income, profits, and capital gains are levied on individuals, on the profits of corporations and enterprises, and on capital gains, whether realized or not, on land, securities, and other assets as a share of GDP. Measured in percentage points. Source: Authors' calculations and *World Development Indicators*.

Table 3.1 (CONTINUED)

income tax/ overall economy	It measures the taxes on income, profits, and capital gains are levied on individuals, on the profits of corporations and enterprises, and on capital gains, whether realized or not, on land, securities, and other assets as a share of GDP and shadow economy. Measured in percentage points. Source: Authors' calculations, Chaudhuri and al. (2006), Schneider (2000), Schneider (2003), Schneider (2005a), Schneider (2005b), Schneider and Savasan (2005) and *World Development Indicators.*
sales tax/GDP	It measures the revenue from sales taxes as a share of GDP. Measured in percentage points. Source: Authors' calculations and *the OECD Tax Revenue as percent of GDP*
gift taxes/GDP	It measures the revenue from taxes on gifts as a share of GDP. Measured in percentage points. Source: Authors' calculations and *the OECD Tax Revenue as percent of GDP.*
property tax/GDP	It measures the revenue from taxes on property as a share of GDP. Measured in percentage points. Source: Authors' calculations and *World Development Indicators.*
individual rate	It measures the highest rate shown on the schedule of tax rates applied to the taxable income of individuals. Measured in percentage points. Source: *Economic Freedom of the World 2005 Annual Report, World Tax Database, World Development Indicator, Individual taxes Worldwide Summaries –various issues.*
corporate rate	It measures the highest rate shown on the schedule of tax rates applied to the taxable income of corporations. Source: *World Tax Database, World Development Indicators, Corporate taxes Worldwide Summaries –various issues.*

Next, I use turnover ratio and market capitalization as a share of the GDP and to measure the stock market development. Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period. Market capitalization as a share of the GDP is the value of the listed shares divided by the GDP. Turnover ratio and market capitalization indicate the trading volume of stock market relative to the economy's size. High turnover ratios are usually associated with liquid stock markets that provide good incentive for long-term investments and efficient resource allocation. Also, a higher trading volume of the stock market creates the opportunity for the government to monitor these financial activities more easily and decreases the costs of acquiring information on the financial status of individuals and corporations.

Banking and stock market are not the only sectors of the financial system that are important to this analysis. The existence of housing finance, pension funds, mutual funds and insurance companies are important to the development of the financial sector. Unfortunately, I don't have enough data on each of these financial instruments to run a regression analysis. I use instead insurance and financial services net exports as share of GDP as a measure for these non-banking financial markets. If net exports of insurance and financial services represent a large share of GDP, then more financial transactions take place. Assuming that financial exports and imports are equally easy to monitor by the government than the domestic financial transactions, then a large volume of net exports of financial services corresponds to a more developed financial sector and to more financial transparency in the economy

The development of the monetary sector and monetary policy affects the overall quality of the financial sector. The only measure I use to quantify the monetary sector is exchange rate stability. Exchange rate stability is the annual percentage

change of the exchange rate. Exchange rate stability is very important for the good functioning of the financial sector. Highly volatile exchange rates increase risk in the financial transactions, increase the costs of conducting transactions and decrease the overall quality of the financial sector services. Also, high money to GDP ratios are associated to high liquidity services in the financial sector, thus associated to harder to monitor transactions.

Finally, the institutional environment plays an important role in the overall quality of the financial sector, so I also consider measures of law and order and corruption in this analysis. An inefficient legal system and corrupt government officials can limit the range of financial services offered on the market and decrease their quality. Also, tax collection is directly affected by these variables. Tax enforcement is weak in countries with inefficient legal systems and tax revenue is lower in environments with high corruption. Law and order is an index that ranges from 0 to 6, where higher values indicate a better legal system. Corruption is measured on a scale from 0 to 6 and 6 indicates a low level of corruption.

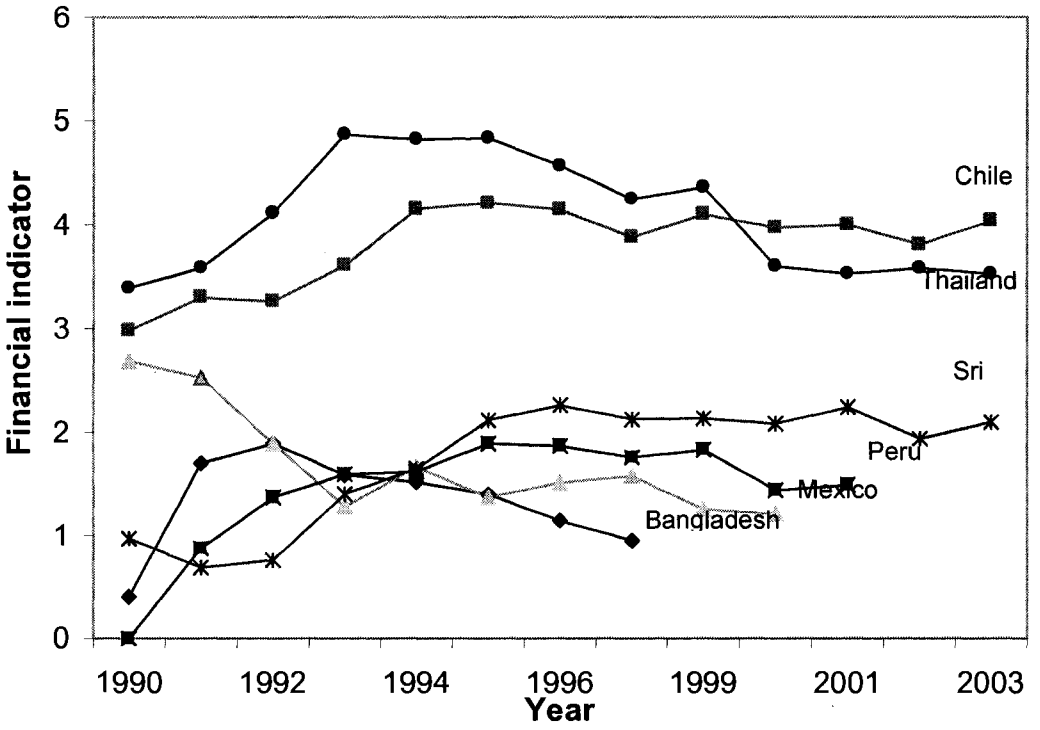
I use all of the above variables to create a comprehensive financial quality indicator. I create z scores for each variable, then I fit a maximum-likelihood factor model on the 9 z scores, then I estimate the first factor $f_{ij,}$ and finally I rescale f_{ij} such that its lowest value to be 0 and its highest 10. The financial quality indicator is

$$F_{ij} = 10\frac{f_{ij} - \min f_{ij}}{\max f_{ij} - \min f_{ij}}. \tag{17}$$

The mean of the financial indicator for the countries in the sample is 3.11.

The financial sector quality indicator takes the value 10 in Switzerland in 2000 and the value 0 in Peru in year 1992. In general, more developed countries tend to

Figure 3.3
FINANCIAL INDICATOR FOR 6 COUNTRIES (1990-2003)



have higher financial sector quality. Mean F for Switzerland is 8.59 and for United Kingdom is 6.26. Less developed countries have lower financial sector quality indicator. Mean F for Bangladesh is 1.32 and for Colombia is 1.25. F can increase over years due to financial reforms like banking sector restructuring, strengthening banking supervision and developing capital market infrastructure. F can decrease due to political changes that affect the institutions in a negative way, due to bad monetary policies that make the exchange rate more volatile. F varies less over time for more developed countries. These variations come usually from changes in market capitalization and domestic credit. Figure 3.3 presents the variation in F over time for Chile, Thailand, Sri Lanka, Peru, Mexico and Bangladesh.

Other variables used in the analysis are shadow economy, inflation, measured as annual percentage change in the consumer price index and GDP/capita measured in 2000 US dollars. The shadow economy measures the legal production of goods and services concealed from the government. The estimates come from Friedrich Schneider's dataset and have been calculated using the DYMIMIC approach. Table 3.2 describes these variables in more detail. The mean shadow economy per capita is $10,907.70, the mean inflation is 9.60% and the mean income per capita is $8,248.05.

In the analysis, I use total tax revenue and income tax revenue as shares of GDP and as shares of the overall economy (GDP and shadow economy). The mean tax revenue/GDP is 16.67% and the mean tax revenue/GDP and shadow economy is 13.16%. The paper also analyzes the revenues from sales, gift and property tax as a share of GDP. I use the highest marginal tax rates for individual income and for corporate income as controls. Individual rates range from 0% to 68% and corporate rates range from 0% to 55%.

3.4 Econometric Model

This paper estimates the effects of the financial sector quality on the total tax, income tax, sales tax, gift tax and property tax revenues. It also includes shadow economy in the model and measures the effects of F on revenues as shares of overall economy, GDP and shadow economy. Tax revenue increases when the financial sector quality improves because more people choose to use financial institutions instead of cash transactions. When more people use financial institutions, the government can acquire information about them because they leave a paper trail. Ultimately, the government can collect more revenue from the taxpayers for whom they have more

Table 3.2
DESCRIPTIVE STATISTICS

variable	obs.	mean	sd	min	max
financial indicators					
interest rate spread	448	8.06	10.33	-8.85	114.15
domestic credit by banking sector/ GDP	448	56.11	45.58	4.69	203.26
bank liquid reserves/bank assets	448	9.96	8.70	.18	60.79
turnover ratio	448	36.09	40.34	0	329.03
market cap/GDP	448	42.55	53.08	.26	379.17
net export of insurance & financial services/GDP	448	-.12	.58	-1.51	3.91
exchange rate stability	448	-8.65	27.71	-328.3	51.10
law and order	448	4.22	1.46	0	6
corruption	448	3.35	1.25	.08	6
financial quality indicator	448	3.11	1.72	0	10
macroeconomics indicators					
shadow economy/cap	339	10907.7	12076.24	334.56	48226.54
inflation	448	9.60	13.44	-3.96	99.87
GDP/capita	448	8248.05	9992.43	262.39	40526.5
tax variables					
total tax/GDP	233	16.67	6.25	1.17	31.88
total tax/overall economy	179	13.16	5.17	1.08	27.49
income tax/GDP	233	6.23	4.08	.28	19.27
income tax/ overall economy	179	5.12	3.70	.23	17.15
sales tax/GDP	133	.32	1.06	0	8.4
gift tax/GDP	137	.008	.03	0	.30
property tax/GDP	385	9.55	3.89	0	22.09
individual rate	429	35.02	12.32	0	68
corporate rate	436	30.90	7.87	0	55

financial information.

For the first estimation, I use tax revenue as a share of GDP as dependent variable and measures of financial quality as independent variables. I also control for tax rates and GDP/capita. Equation (18) summarizes this approach

$$\begin{aligned} tax_k/gdp_{it} = \beta_0 + \beta_1 F_{it} + \beta_2 GDP/cap_{it} + \beta_3 \inf lation_{it} + \\ \beta_4 individual\ rate_{it} + \beta_5 corporate\ rate_{it} + \\ \Sigma_i \beta_i c_i + \Sigma_t \beta_t \tau_t + \epsilon_{it}, \end{aligned} \tag{18}$$

where i is country i, t is year t, c_i is the country dummy and τ_t is the time dummy. tax_k is total tax revenue, income tax revenue and $t = 1990, 1991, ..., 2003$. F_{it} is the financial quality indicator for country i in year t.

I expect an increase in F to lead to an increase in tax revenue/GDP. I control for GDP/capita because an increase in GDP leads to more economy activity and to more tax revenue. I also control for inflation. The effect of inflation could be positive or negative. When inflation is high, using cash transactions can lead to serious loses, so firms and individuals have an incentive to switch to financial institutions. In this way, they leave a paper trail and the government can obtain financial information more easily, leading to eventually more revenue. So, in this case, an increase in inflation leads to an increase in revenue. However, an increase in inflation leads to a decrease in the real values of taxes and of GDP. If the real value of GDP declines more, then an increase in inflation leads to a decrease in tax revenue/GDP. I also include tax rates in the analysis because the higher the rate, higher the collected tax revenue.

The problem with (18) is that it doesn't take into consideration the shadow econ-

omy. Due to tax evasion, total tax doesn't represent all the revenue that can be collected at the given rates and GDP doesn't represent all the economic activity. If I scale the tax revenue by the overall economy, then I have a better measure of share of taxes collected. Equation (19) summarizes this approach.

$$\begin{aligned} tax_k/overall\ gdp_{it} = \beta_0 + \beta_1 F_{it} + \beta_2 GDP/cap_{it} + \beta_3 shadow/gdp_{it} + \\ \beta_4 \inf lation_{it} + \beta_5 individual\ rate_{it} + \\ \beta_6 corporate\ rate_{it} + \Sigma_i \beta_i c_i + \Sigma_t \beta_t \tau_t + \epsilon_{it}, \end{aligned} \tag{19}$$

where i is country i, t is year t, c_i is the country dummy and τ_j is the time dummy. tax_k is total tax revenue, income tax revenue and $t = 1990, 1991, ..., 2003$. F_{it} is the financial quality indicator for country i in year t. $overall\ gdp_{it}$ is the sum of GDP and shadow economy for country i and year t.

In (19), I control for both GDP/capita and shadow/capita. Both variables measure economic activities and income that have an effect on tax revenue; GDP/capita has a positive effect and shadow/capita has a negative effect.

Finally, I also look at the effect of F on revenue coming from sales, gift and property taxes. These taxes are levied on activities and assets that are easily observable even in absence of a good financial sector. The government doesn't need a good financial sector and paper trails in order to determine for example, that an individual owns two houses. So I don't expect financial quality to have any effect on these types of revenues. I would like to test this hypothesis using equation (20)

$$tax_k/gdp_{it} = \beta_0 + \beta_1 F_{it} + \beta_2 GDP/cap_{it} + \beta_3 \text{inflation}_{it} + \Sigma_i \beta_i c_i + \Sigma_t \beta_t \tau_t + \epsilon_{it}, \quad (20)$$

where i is country i, t is year t, c_i is the country dummy and t_j is the time dummy. tax_k is sales tax revenue , gift tax revenue, property tax revenue and $t = 1990, 1991, ..., 2003$. F_{it} is the financial quality indicator for country i in year t.

I don't control for tax rates in (20) because there is few data on sales tax rates, gift tax rates and property tax rates.

3.5 Empirical Results

First, I estimate the effects of financial sector quality on total tax revenue. Table 3.3 presents the results of this analysis. The first specification, in column (1), has total tax/GDP as dependent variable and financial quality, individual rate, corporate rate, GDP/capita, inflation, time and country dummies as independent variables. The results show that an increase of 1 point in F leads to an increase of 1.22% in total tax/GDP. Countries can increase F by as much as 3 points when they adopt policies that affect the financial sector. So it is likely a financial sector reform will increase total tax/GDP by almost 3%.

Results show that increases in marginal tax rates increase the total revenue/GDP, but the coefficients are not statistically significant. Other tax rates affect tax revenue, so I might have a positive OVB on the financial quality coefficient. However, OVB is probably very small. In most countries, income tax brings the most revenue to the

Table 3.3
EFFECTS OF F ON TOTAL TAX REVENUE

	total tax/GDP (1)	total tax/overall economy (2)
financial quality	1.22	1.02
	(.28)***	(.28)***
individual rate	.02	.01
	(.02)	(.02)
corporate rate	.02	.02
	(.01)	(.02)
GDP/cap	-.0002	.003
	(.0002)	(.001)*
inflation	.008	.005
	(.01)	(.01)
shadow economy/cap		-.002
		(.001)*
observations	216	167
R^2	97.35%	97.83%
country dummies	yes	yes
year dummies	yes	yes

This table presents the results of the analysis with total tax revenue as a dependent variable. (1) shows effects of F on total tax revenue as a share of GDP. Column (2) shows the effects of F on total tax revenue as a share of overall GDP (GDP and shadow). Standard errors are in parentheses. * denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level.

treasury, so other taxes account only for a small part of total tax revenue. So, tax rates that affect the other tax revenues have a small impact on total tax revenue and OVB is small.

The second specification, in column (2), has total tax/overall economy as a dependent variable and has an additional independent variable, shadow economy/capita. Again, when F increases, total tax/overall economy also increases, but by a smaller extent. Individual and corporate rates have again a positive and insignificant effect. As expected, shadow economy/cap affects the revenue in a negative way. An increase of \$100 in the shadow economy/cap decreases total tax/overall economy by .2%. Inflation is not significant in either (1) or (2) probably because the two opposite effects cancel out.

Next, I investigate the effect of F on tax revenues collected from different taxes.

Table 3.4
EFFECTS OF F ON INCOME TAX REVENUE

	income tax/GDP	income tax/overall economy
	(1)	(2)
financial quality	1.80	1.37
	(.27)***	(.29)***
individual rate	-.03	-.01
	(.02)	(.02)
corporate rate	.02	.01
	(.01)	(.02)
GDP/cap	-.0001	.002
	(.0002)	(.001)
inflation	.01	.02
	(.01)	(.01)
shadow economy/cap		-.002
		(.001)*
observations	216	167
R^2	93.83%	95.34%
country dummies	yes	yes
year dummies	yes	yes

(1) shows effects of F on income tax revenue as a share of GDP. Column (2) shows the effects of F on income tax revenue as a share of overall GDP (GDP and shadow). Standard errors are in parentheses. * denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level.

Table 3.4 looks at income tax revenue and Table 3.5 at sales tax, gift tax and property tax revenues. F seems to affect income tax revenue more strongly than any other revenues. An increase of 1 point in F increases income tax/GDP by 1.80%. This result is consistent with our theory. A country with a better financial sector uses the financial sector for more transactions. In this way, economic assets and activities become more transparent and thus, more easily taxable. When financial intermediaries are used, the government receives the more additional information on income than on any other assets or activities. So the effect of F is larger on income tax revenue than on other tax revenues.

Similarly to the total tax case, the effect of F is smaller when the income tax is scaled by overall economy. An increase of 1 point in F increases income tax/overall

Table 3.5
EFFECTS OF F ON VARIOUS TAX REVENUES

	sales tax/GDP (1)	gift tax/GDP (2)	property tax/ GDP (3)
financial quality	.02	.002	-.02
	(.20)	(.003)	(.21)
GDP/cap	-.0001	.0000002	-.0001
	(.00009)	(.00001)	(.0001)*
inflation	.06	-.00009	-.01
	(.01)***	(.0002)	(.007)
observations	133	137	385
R^2	61.98%	90.05%	91.42%
country dummies	yes	yes	yes
year dummies	yes	yes	yes

The dependent variables are sales tax revenue as share of GDP in column (1), gift tax revenue as a share of GDP in column (2) and property tax revenue as a share of GDP in column (3). Standard errors are in parentheses. * denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level.

economy only by 1.37%. The highest individual marginal rate is not significant in this specification probably because this rate is not representative for the mean taxpayer. The tax rate corresponding to the median income would make a better instrument, but unfortunately, I don't have median income data for all the countries in the sample.

Finally, Table 3.5 shows the effects of financial sector quality on sales tax revenue, gift tax revenue and property tax revenue. As expected, the revenues coming from relatively transparent activities are not affected by the quality of the financial intermediaries. I don't control for tax rates in these specifications, so I might have an OVB on the coefficient of F. If the property tax rate and F are positively correlated, then I have a positive bias on the coefficient of F, which makes a positive and significant effect of F on revenues even more unlikely. This conclusion is consistent to my theory.

3.6 Robustness Checks

In this section, I perform a series of robustness checks on the total revenue and income tax revenue results. Table 3.6 presents results of effects of financial sector quality on total tax revenue/GDP. In column (1), I control for all nine variables that compose F. Of the nine variables, only 3 are significant. Law and order has a positive effect on total tax revenue: an increase of 1 points in law and order (change equivalent to moving from having Croatian law and order to having Danish law and order) increases total revenue/GDP by .62%. Market capitalization/GDP also has an positive effect on revenue: an increase of 1% in this variable leads to an increase of .01% in total tax revenue/GDP. Domestic credit/GDP also affects total tax revenue: an increase of 1% leads to an increase of .02% in tax revenue. The marginal tax rates have a positive effect on the total revenue as before, but this time the corporate rate is also statistically significant.

In column (2), I control for F and F^2 because I believe that an increase in financial sector quality has a bigger effect when financial sector improves from very poor quality to better quality (when the change involves switching from cash economy to non-cash economy) than when it improves from sophisticated financial sector to an even more sophisticated financial sector (one that might make hiding transactions easier). As predicted, the sign of F^2 is negative, but it is not significant.

In column (3), I introduce another measure of personal rate because I believe the maximum marginal tax rate for personal income is not representative for most taxpayers. I run a regression using the rate corresponding to the mean GDP/capita of the countries in the same quintile as the country analyzed for the highest individual marginal tax rate. For example, in year 1993, Nigeria has a GDP/capita of $217.25,

Table 3.6
EFFECTS OF F AND VARIOUS COMPONENTS OF F ON TOTAL TAX REVENUE

	total tax/GDP			
	(1)	(2)	(3)	(4)
interest rate spread	-.01			
	(.01)			
law and order	.62			
	(.32)*			
exchange rate	.004			
stability	(.009)			
corruption	-.21			
	(.23)			
turnover ratio	.003			
	(.005)			
market cap/GDP	.01			
	(.006)**			
domestic	.02			
credit/GDP	(.01)*			
liquid reserves	.005			
	(.02)			
insurance NX/GDP	-.25			
	(.58)			
individual rate	.04	.03	.03	
	(.02)	(.02)	(.03)	
corporate rate	.03	.03	.03	
	(.02)*	(.02)*	(.02)	
personal rate at			.02	
GDP/cap			(.03)	
min (personal rate,				.06
corporate rate)				(.03)*
financial indicator		1.65	1.69	1.17
		(.44)***	(.43)***	(.28)***
financial indicator		-.06		
squared		(.05)		
inflation	.01	.01	.02	.007
	(.02)	(.01)	(.01)	(.01)
GDP/cap	-.0004	-.0003	-.0004	-.0001
	(.0002)*	(.0002)	(.0002)	(.0001)
observations	216	216	140	216
R^2	97.51%	97.38%	97.97%	97.34%
country dummies	yes	yes	yes	yes
year dummies	yes	yes	yes	yes

The dependent variable is total tax revenue/GDP. Standard errors are in parentheses. * denotes significant at 10% level, ** denotes significant at 5% and *** denotes significant at 1% level.

which places Nigeria in the lowest quintile. The average GDP/capita for all the countries in that quintile is $1,084.93, or NGN49,105.19. The individual marginal tax rate for a Nigerian income of NGN49,105.19 is 25%. I use this individual tax rate of 25% for Nigeria in 1993. However, the individual rate remains insignificant. It is likely GDP/capita is not a good measure of median taxable income, either.

Finally, in column (4), I control for the minimum between the highest marginal tax rate for personal income and the highest marginal tax rate for corporate income. I believe this variable might have a better explanatory value than the two highest rates alone because people tend to switch between the two types of income depending on which rate is lower. The coefficient is positive and statistically significant. An increase in 10% in this minimum marginal rate leads to an increase of .6% in total revenue/GDP.

Table 3.7 presents the same types of robustness checks as in the previous table, but performed on the income tax revenue results. Column (1) controls for the components of F. Law and order is again positive and significant, but the effect is twice as large as in the analysis of the total revenue. Law and order probably affects the monitoring and detecting income much more than monitoring and detecting other types of taxable activities. Contrary to the initial prediction, liquid reserves have a negative and significant sign. It is possible that high liquid reserves mean less loans to private firms and individuals and thus less observable (and easily taxable) transactions. Corporate rate is again positive and significant.

Column (2) controls for F and F^2. As predicted, F^2 has a negative and significant effect suggesting that effects are larger for countries that improve poor financial sectors rather for countries that improve good financial sectors. For example, an increase of 1 point for a country like Peru with an average $F = 1.43$ leads to an increase of

Table 3.7
EFFECTS OF F AND VARIOUS COMPONENTS OF F ON INCOME TAX REVENUE

	income tax/GDP			
	(1)	(2)	(3)	(4)
interest rate spread	-.02			
	(.01)			
law and order	1.30			
	(.30)***			
exchange rate	-.001			
stability	(.009)			
corruption	-.07			
	(.22)			
turnover ratio	.002			
	(.005)			
market cap/GDP	.009			
	(.006)			
domestic	.003			
credit/GDP	(.01)			
liquid reserves	-.07			
	(.02)***			
insurance NX/GDP	-.28			
	(.55)			
individual rate	-.01	-.01	-.04	
	(.02)	(.02)	(.03)	
corporate rate	.03	.04	.02	
	(.02)*	(.01)**	(.02)	
personal rate at			-.005	
GDP/cap			(.02)	
min (personal rate,				.009
corporate rate)				(.03)
financial indicator		3.00	1.70	1.73
		(.42)***	(.36)***	(.28)***
financial indicator		-.18		
squared		(.04)***		
inflation	.02	.02	.01	.01
	(.01)	(.01)**	(.01)	(.01)
GDP/cap	-.0003	-.0002	-.00008	-.0001
	(.0002)	(.0001)	(.0002)	(.0001)
observations	216	216	140	216
R^2	94.47%	94.36%	96.48%	93.71%
country dummies	yes	yes	yes	yes
year dummies	yes	yes	yes	yes

The dependent variable is income tax revenue/GDP. Standard errors are in parentheses. * denotes significant at 10% level, ** denotes significant at 5% and *** denotes significant at 1% level.

2.74% in income tax revenue/GDP, while the same increase of 1 point for a country like Switzerland with an average $F = 8.59$ leads to a much smaller increase of 1.45%. The effect is almost twice as large in the country with poor financial sector than in the one with very good one. It is important to notice that the effect of F is never negative, not even for countries like Switzerland. So the negative effects of having more sophisticated tools to hide income are smaller than the positive effects of using better financial intermediaries.

Column (3) controls for tax rate at average GDP/cap for all countries in the same quintile and again the results are not statistically significant. Column (4) controls for minimum between the two marginal tax rates. The rate has a positive but insignificant effect on the income tax revenue.

3.7 Conclusion

This paper examines the effects of financial sector quality on the tax revenue collected by the government. The study also investigates whether the quality of financial sector affects the revenue collected from different taxes in different ways. The paper uses a variable F to measure the goodness of the financial sector. F is constructed from nine variables that measure the quality of the banking sector, stock market, insurance and other financial markets, monetary policy and institutions.

The study reaches three main conclusions. First, an increase of 1 point in financial sector quality increases total tax revenue/GDP by 1.22%. The result also holds when I take into consideration the existence of shadow economy. Tax revenue as a share of overall economy increases by 1.02% when financial quality increases by 1 point.

Second, financial sector quality also affects income tax revenue. Of all tax rev-

enues, income tax/GDP increases the most when financial quality improves. An increase of 1 point in F leads to an increase of 1.80% in income tax/GDP and 1.37% in income tax/overall economy.

Third, revenues coming from taxes levied on assets or activities that are easily observable are not affected by changes in financial sector quality. Such tax revenues are sales tax revenue, gift tax revenue and property tax revenue.

Despite the encouraging results, the study has a number of problems. First, the analysis is performed on a small number of observations. The approach requires many financial sector variables that are missing for most developing countries. Tax data is available, but is inconsistent across different sources. So this study uses tax data from only one source at a time. Also, it would be helpful to control for the different tax rates when analyzing the relative importance of each tax. Unfortunately, data on various tax rates is very scarce.

Second, some institutional variables change from year to year, but it is very likely I capture a lot of noise in the analysis. For this reason, it would be better to run the analysis on a cross-section of countries, but unfortunately, the sample is too small to do an econometric analysis with cross-country data.

Third, it is likely I didn't capture all the aspects of financial sector quality that might affect tax revenue. F should include more measures of banking regulation and supervision, of the development, profitability, privatization and concentration in the banking sector.

Finally, it is important to mention the policy implications of this paper. The results indicate that reforms of certain areas of the financial sector may lead to an increase in tax revenue, thus some reforms may be paying for themselves. There are various policies that a government can adopt in order to develop its financial

sector. The government can restructure public financial institutions and develop capital market infrastructure. But these policies can be expensive. The government can also implement legal and supervisory framework across the banking, insurance and stock markets. These policies are cheaper and according to our results, the government can hope to recoup some of the costs later from higher tax revenues.

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Appendix: Methodology for Calculating Tax Measures at Individual Level

STEP 1 Calculate the share of income that is declared by an officially self-employed individual

I assume that wage employed individuals declare their income correctly. Most of the countries in this study have withholding tax which makes evasion harder. Even in countries without withholding tax, wage employed individuals have few opportunities to tax evade.

Then, I assume that officially and unofficially self-employed underreport their in-

comes. Tax evasion among self-employed individuals is common even in countries were tax evasion is not rampant. Johansson (2005) estimates that Finish self-employed individuals underreport 16%-40% of their incomes and Finland is considered to have good tax compliance. So, it is likely that individuals in the developing countries from my sample underreport a large share of their incomes.

Also, I assume that household food expenditure is reported correctly. For most countries in my sample, respondents are asked to tell how much of each food item they consumed in the previous 30 days. Since in most cases, respondents don't have to calculate actual expenditures, it is likely they report the consumption correctly.

Finally, the household food expenditure function is the same for all 3 occupations.

I use a method similar to the expenditure approach from Pissarides and Weber (1989) in order to estimate how much tax is evaded. First, I estimate the following equation,

$$\ln(food_i) = \gamma_0 + \gamma_1 \ln(income_i) + \gamma_2 official\ se_i + \gamma_3 unofficial\ se_i + \\ + \sum_{l=4}^{9} \gamma_{j,i} Z_{l,i} + \psi_j, \tag{21}$$

where food is the food expenditure for the household, income is the declared household income, official self-employed and unofficial self-employed are occupational dummies for official self-employment and unofficial self-employment and Z_l is a set of demographic characteristics, age, age squared, male, educational categories, size, married and homeowner. The regression is run on heads of household between 18 and 60 not in agriculture. It is run separately for each country since there are reasons to believe that food expenditure functions might be different across countries.

Then, I estimate k, the share of income that is declared if the head of household

is officially self-employed as

$$k = e^{-\frac{\gamma_2}{\gamma_1}}. \tag{22}$$

STEP 2 Estimate a potential self-employed income for all heads

Using the k calculated in (22) and the declared income, y, I derive the true income y_T for an officially self-employed head.

$$y_T = \frac{y}{k} \tag{23}$$

Next, I use the above true income y_T to estimate an equation for officially self-employed income based on demographic characteristics of the head. I estimate the equation,

$$y_{Ti,k,t} = \delta_0 + \sum_{l=1}^{6} \delta_j Z_{l,i,k,t} + \phi_{i,k,t}, \tag{24}$$

where Z_l is a set of demographic characteristics, age, age squared, male, homeowner, married, size and education categories, i is the index for a head, k is the index for country and t is the index for year. Then, using (24), I estimate a predicted self-employed income for all heads, y_p.

$$y_p = \widehat{\delta_0} + \sum_{l=1}^{6} \widehat{\delta_j} Z_{l,i,k,t}.$$

STEP 3 Calculate the progressivity measure and tax rates for all heads of households

First, I calculate a successful income, $\overline{y_s}$, and an unsuccessful income, $\underline{y_s}$,

$$\overline{y_s} = 2y_p \tag{25}$$

$$\underline{y_s} = 0.5y_p \tag{26}$$

And then, I estimate the amount that is reported from the successful income, $\overline{y_s}^r$ and from the unsuccessful income, $\underline{y_s}^r$using the k calculated in (22).

$$\overline{y_s}^r = k\overline{y_s} \tag{27}$$

$$\underline{y_s}^r = k\underline{y_s}. \tag{28}$$

The progressivity measure is the difference between the top marginal rate paid on Y_s^r and top marginal rate paid on Y_u^r,

$$progressivity = \tau(\overline{y_s}^r) - \tau(\underline{y_s}^r). \tag{29}$$

Other measure of progressivity are calculated for robustness checks. progressivity' is the difference in top marginal paid if the heads earns 3 times the predicted income and if he earns 1/3 of the same income,

$$progressivity' = \tau(3 \cdot ky_p) - \tau(.33 \cdot ky_p). \tag{30}$$

Other tax measures used in the analysis are the top marginal rate on the predicted reported income,

$$mtr = \tau(ky_p), \tag{31}$$

and the average tax rate for the same income,

$$atr = 100 \cdot \frac{T(ky_p)}{ky_p}, \tag{32}$$

where $T(Y)$ is the total tax paid on the income Y.