

**ESSAYS IN TAXATION  
AND INTERNATIONAL RELATIONS**

Ioana Maria Petrescu

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*Essays in Taxation and International Relations*

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## **Entrepreneurship, bribes, and the taxation of personal income<sup>1</sup>**

### **1. Introduction**

Bribes to tax officials are common in many countries. A lot of anecdotal evidence supports this claim. In Estonia, a tax-fraud official was arrested for asking for 300,000 kroons from the CEO of a Tallinn company, according to an article from the Baltic News Service (Baltic News Service 2005). In Croatia, two Zagreb Tax Administration officials were charged with taking bribes in exchange for reduction in payments of taxes, according to BBC (BBC 2009). In Vanunu, the former director of the Tax Authority's intelligence unit was convicted of accepting bribes to facilitate tax evasion, according to the Jerusalem Post (Jerusalem Post, September 15 2011). Besley and McLaren (1993) report that Zaire merchants often keep two sets of books: a public one and a secret one and pay off any tax official expressing curiosity about secret books.

When bribes to tax authorities are common, the effects of taxation of people's behavior change. Previous studies document these changes in tax evasion, tax revenue, and labor markets. Carasciuc (2005) finds that businesses are willing to pay tax inspectors to

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<sup>1</sup> This paper previously circulated under the title "Income Taxation and Self-Employment: The Impact of Progressivity in Countries with Tax Evasion."

evade taxes. She concludes that evasion can be reduced by reducing tax payments and the number of taxes. Hindriks et al (1999) find that a government that is only concerned with maximizing revenue and is averse to evasion and corruption should set a flat tax. Chander and Wilde (1992) show that evaders prefer reporting low income when high income is observed as long as there is some chance of being audited by a bribable auditor. Finally, Watson (1985) shows that switching to a progressive tax increases evasion by raising the proportion of workers who report no income.

This paper investigates the ways in which bribes to tax authorities affect the relationship between personal income progressivity and entrepreneurship. I focus on entrepreneurship and progressivity because tax policies meant to encourage entrepreneurship are very common in many countries because it is believed that entrepreneurs foster economic growth (Schumpeter 1911 and 1942), improve innovation and increase competition and employment. Progressivity has been a very important topic around the world in the recent period. Between 1994 and 2009, 25 countries adopted flat taxes<sup>2</sup>. However, starting with 2009, the trend reversed. Latvia and Iceland abandoned flat taxes, and lately in Romania and Hungary are discussing with the International Monetary Fund (IMF) the possibility of returning to progressive income taxation due to sizable deficits and other negative effects of flat taxes (Socol et al 2009).

In this paper, I introduce a framework in which an individual chooses between self-employment<sup>3</sup> and wage employment. I as-

<sup>2</sup> These countries are: Estonia, Latvia, Lithuania, Russia, Serbia, Iraq, Slovakia, Ukraine, Georgia, Romania, Turkmenistan, Trinidad and Tobago, Kyrgyzstan, Albania, Iceland, Macedonia, Mongolia, Montenegro, Kazakhstan, Bulgaria, Czech Republic, Mauritius, Bosnia and Herzegovina, Belarus, Belize.

<sup>3</sup> I use self-employment and entrepreneurship interchangeably in this paper because I measure entrepreneurship as number of enterprises in one section and as self-employment in another.

sume that an individual can evade taxes on part of his income in self-employment, while he cannot evade taxes in wage employment. Self-employed individuals pay bribes if caught tax evading. The model predicts that an increase in income tax progressivity makes people less likely to choose self-employment over wage employment. It also predicts that an increase in the probability that self-employed individuals pay bribes and an increase in average tax rates encourage self-employment.

I test these predictions empirically, first, by exploring the progressivity effects across countries, and second, by exploring the effect of tax changes in one particular country. I start by investigating the relationship between the number of micro enterprises in a country and the progressivity of that country's tax system. I construct a panel dataset of income tax schedules at country level and use it to construct a measure of progressivity. I find that an increase in this measure of progressivity leads to a decrease in the number of micro enterprises in countries where bribes are common and to an increase in the number of micro enterprises in places where bribes are rare.

Next, I exploit changes in the Russian tax schedule from 1994 to 2000. I use individual longitudinal data and estimate a progressivity measure at individual level. I look at the effects of progressivity on the decision to become self-employed in a conditional logistic model with individual and year fixed effects. I find that tax progressivity makes Russians less likely to become self-employed in their own country.

The rest of the study is structured as follows: Section 2 reviews some previous studies on the same topic, Section 3 introduces a framework for occupational choice when bribes are being paid to tax authorities. Section 4 investigates the relationship between progressivity and micro enterprises across countries. Section 5 looks at

the individual decisions about self-employment in Russia. Section 6 concludes.

## 2. Previous studies of entrepreneurship, tax evasion, and bribes

This study relates to three major literature areas: First, the occupational choice literature, second, the entrepreneurship literature and third, the tax evasion literature. In the theoretical literature on occupational choice, Boadway et al (1991), Cowell (1981), Cowell (1975), and Cullen and Gordon (2002) link risk aversion, entrepreneurship entry and taxation. Gordon (1998) looks at the links between corporate, personal income taxes and entrepreneurial entry. The seminal paper by Domar and Musgrave (1944) on proportional tax and risk-taking is relevant to the decision to become self-employed. Self-employment income is uncertain and, thus, self-employment is often seen as adding one riskier 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. My paper also relies on the assumption that entrepreneurship is a risky activity and that progressivity acts as insurance for the entrepreneur in the case in which he does not evade and does not pay bribes to corrupt tax authorities. However, in my paper, progressivity can stop acting as insurance once bribes are paid to tax authorities.

Briscoe et al (2000), Bruce and Moshin (2003), Cullen and Gordon (2006a and 2006b), Da Rin et al (2011), Dietz (2005), Djankov et al (2008), Engelschalk (2005), Holtz-Eakin and Rosen (2001), Schuetze (2000), Schuetze and Bruce (2004) link taxes and entrepreneurship at the macroeconomic level. Similarly, I link

the number of micro enterprises and income tax progressivity at macroeconomic level. In this paper, I construct a dataset of tax schedules and rates and construct a progressivity and mean marginal rate at country level. Bell (1969), Black and Strahan (2002), Blau (1987), Busenitz et al (2000), Desai et al (2003), Staber and Bogenhold (1993), Boadway and Tremblay (2005), Huffman and Quigley (2002) are other macroeconomic level studies that focus on determinants of entrepreneurship other than taxes. I use some of these determinants as controls in my cross-country analysis, but unlike there previous studies I show the importance of bribes on entrepreneurial activity.

Bruce (2000 and 2002), Bruce and Gurley (2005), Cullen and Gordon (2007), Gentry and Hubbard (2000, 2004a, 2004b, and 2004c), Long (1982), Powell and Shan (2012), and Robson and Wren (1999) investigate the relationship between taxation and entrepreneurship/occupational choice at the microeconomic level. I also estimate the effects of taxation on self-employment at the individual level, but unlike these studies, I estimate a progressivity and average tax rate measure for each individual using information about the individual's demographic group. Destre and Henrard (2004), Evans and Leighton (1989), Rees and Shah (1986), Toth (2011) are micro studies that investigate how entrepreneurial entry, survival and investment is affected by other factors such as demographic characteristics, wealth, earnings, and assets. My paper also looks at the effects of such characteristics on entrepreneurship at individual level, but it uses data from a transitional economy.

The framework of this paper is based on previous studies on tax evasion, penalty structure and the probability of detection. Allingham and Sandmo (1972) construct a theoretical model for which an increase in the tax rate makes it more profitable to evade taxes and an increase in the likelihood of being caught leads to

more income being declared. Goerke (2003) shows that the relationship between progressivity and evasion depends on whether the penalty for evasion is a function of the evaded tax or the undeclared income. A higher marginal tax rate increases the gain from evasion for a given penalty and constant tax payment if taxpayers have to declare income. This effect will be strengthened if taxpayer must declare taxes because higher tax progression implies a greater level of tax exemption, and thus, a lower penalty. Panades (2004) finds that an increase in the tax rate could induce tax payers to report less income when fines are imposed proportional to the evaded amount. Christiansen (1980) finds that a large penalty is always a more effective deterrent to tax evasion than a high probability of detection. A higher tax rate or a lower pre-tax income will ensure that less tax escapes the tax collector. Koskela (1983) shows that if the fine depends on the undeclared income, tax evasion will increase, while if the fine depends on the evaded tax, tax evasion will decrease when the tax is progressive. Alm et al (1990) find that tax compliance increases if tax rates are lowered. Individuals will comply less if more severe penalties are imposed or if detection becomes more likely. In line with these papers, in my framework, entrepreneurs decide to evade based on the taxes they face, on the probability of being caught and on the penalty structure. Unlike these papers, the penalty is the bribe paid to tax officials if entrepreneurs get caught evading. The structure of the bribe payment and not the official penalty dictates how much entrepreneurs evade.

### 3. Self-employment, tax evasion, and bribes

This section explains the relationship between tax policy, bribes, and occupational choice. I assume that a person has only two choices, self-employment and wage employment. I exclude

the possibility of being out of the labor force or unemployed. Self-employment is an occupation with uncertain income (one can earn a large income, if successful or a small income, if unsuccessful). Wage employment is an occupation with fixed income (which depends only on personal characteristics). The personal income tax schedule has an exemption at the bottom and a positive tax rate above the exemption level. An increase in progressivity means an increase in the exemption and in the tax rate, keeping the tax liability constant, as defined in Goerke (2003).

First, let's assume that tax evasion is not possible and bribes are not common. If income taxes are progressive, a self-employed individual pays high taxes if he is successful, and low income taxes if he is not, while a wage employed individual always pays the same tax. Progressivity affects self-employment through risk-aversion. Self-employed people take more risk by choosing an occupation with uncertain income. The government shares this risk with them by taxing them less if they fail and more if they succeed. Progressivity makes people take more risk, thus leading to more self-employment. In this way, progressivity has an insurance effect.

Second, let's assume that self-employed individuals can tax evade and wage employed individuals cannot. If people choose self-employment, evade taxes and get caught, they need to pay a bribe to corrupt tax officials. Progressivity could affect self-employment in various ways. First, if the bribe does not depend on the entrepreneur's income and is a fixed amount, then progressive taxes do not have an insurance effect anymore. An entrepreneur will evade progressive taxes and will pay the same amount in bribes no matter whether he earns a large income or a small income. Second, progressivity can lead to situations in which entrepreneurs who evaded and got caught face tax and bribe liabilities much higher than tax liabilities of wage employed individuals who cannot evade. Third, corrupt

tax authorities can extort entrepreneurs and ask for bribes not to report (fake) high incomes (in a similar scenario as the one described in Hindriks et al (1999)). An increase in progressivity means an increase of both the exemption and the marginal rate. A higher rate means that people have more to pay if corrupt tax officials report fake high incomes. Thus, corrupt officials are more likely to threaten entrepreneurs with such high incomes and more likely to succeed in obtaining bribes from them. Thus, higher progressivity can discourage self-employment even if the tax liability is constant.

#### 4. Cross-country analysis of progressivity on the number of micro enterprises

This section tests the above theory using cross-country panel data. It investigates the effects of personal income tax progressivity calculated at country level on the number of micro firms per 1,000 inhabitants. These are very small firms that are unlikely to be incorporated, thus they likely to pay personal income taxes and not corporate income taxes<sup>4</sup>.

I use four types of data in the study. First, I use micro enterprise data from Micro, Small, and Medium Enterprises: A Collection of Published Data (Kozak 2007), an International Finance Corporation (IFC) data set. The *micro* variable measures number of micro enterprises per 1,000 inhabitants and it is likely to capture small businesses that pay at least some taxes and that operate in the official economy. Micro enterprises have one to four employees for most countries. The mean for the sample is 48 enterprises per 1,000 inhabitants, with some developing countries with extremely

large numbers of firms; Czech Republic has over 200 enterprises per 1,000 inhabitants and Netherlands and Turkey have less than three firms per 1,000 inhabitants. For robustness checks, I also use another measure of entrepreneurship, *msme*, which measures the number of medium, small and micro enterprises per 1,000 inhabitants. These firms are larger and hire more employees than micro enterprises. They are also collected from official sources, thus they do not capture unofficial firms. On average, countries in the analysis have 53 such firms per 1,000 inhabitants.

The second data category is bribe data. I use *bribe original*, a bribe variable taken from Frasier Institute's Economic Freedom of the World: 2006 Annual Report (Frasier Institute 2006). It measures how common it is for people to pay bribes in a country. The variable was originally measured from 0 to 10, where 0 means bribes are very common and 10 means bribes are rare, and then, it is rescaled such that higher numbers represent higher bribes. This bribe measure (*bribe original*) comes 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.

Bribe data is missing for some of the countries of interest, so I predict the bribe data for the missing values using other country characteristics. I use determinants of bribes as described in Afzar et al (2001), Baksi et al (2009), Brunetti and Weder (2003), Gauthier and Reinikka (2001), Graeff and Mehlkop (2003), Mocan (2004), Seldadyo and de Haan (2005), Serra (2004), Tresiman (2000), Van Rijckeghem and Weder (2001). I predict the missing values by estimating the following equation:

$$bribe\ original_{k,t} = \alpha_0 + \alpha_1 unemployment_{k,t} + \alpha_2 gdp/capita_{k,t} + \alpha_3 m_{k,t} + \alpha_4 regulation_{k,t} + \sum_{j=5}^9 \alpha_{k,j} legal\ origin_{k,j} + \varepsilon_{k,t} \quad (1)$$

<sup>4</sup> All regressions control also for corporate tax variables to ensure there is no omitted variable bias.

where  $k$  is the country index,  $t$  is the year index, *bribe original* is the original bribe score, *unemployment* is unemployment rate, *gdp/capita* is GDP per capita in 2000 US \$,  $m$  is imports as share of GDP and *legal origin* represents four dummies: British, French, Germanic, and Soviet legal origin. The Scandinavian legal origin is the omitted category. The macroeconomic variables are taken from the World Development Indicators (World Bank 2012), the regulation measure from Freedom of the World (Frasier Institute 2006) and legal origin data are taken from La Porta et al. (1999). I predict the bribe value using the coefficients estimated above and use the predicted values where the variable *bribe original* is missing. The average for the predicted value is 3.6 compared to 3.58 for the *original bribe* variable. Figure 1 shows the average bribe score for all countries in the analysis. Countries like Iceland, New Zealand and Denmark seem to have the lowest scores (bribes are rare) and countries like Uganda and Paraguay have the highest scores (bribes are very common).

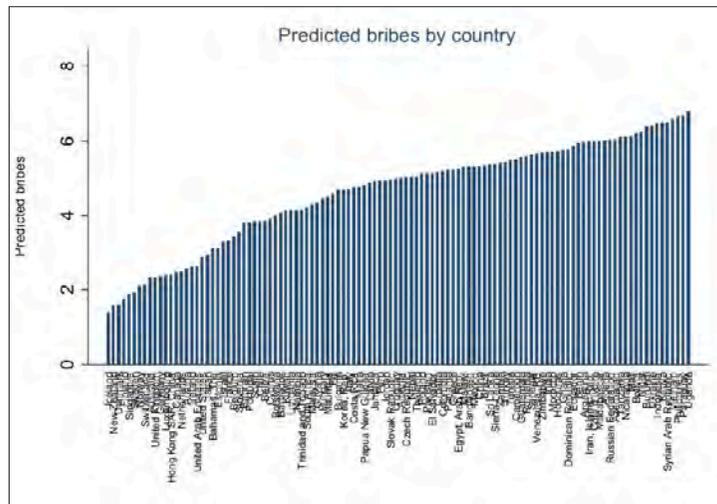


Fig 1. Average predicted bribe scores by country

The third type of data is tax data. The tax data comes from four sources: AEI International Tax Database (American Enterprise Institute 2011), Eurostat tax data (European Commission 2007), PricewaterhouseCoopers tax (PricewaterhouseCoopers 1990-2005a and b), and World Tax Database (Office of Tax Policy Research 2006). Using information on marginal tax rates and tax brackets from these sources, I estimate *marginal rate* and *progressivity* measures for personal and corporate income taxes. The variable *mean personal rate* is the marginal tax rate paid by individuals with incomes equal to GDP per capita and *mean corporate rate* is the marginal tax rate paid by corporations with profits equal to GDP per capita. Individual rates range from 0% to 45% and corporate rates range from 0% to 48.38%.

Using this data, I also construct several measures of progressivity. *Progressivity* is the difference between the marginal tax rate paid on an income  $x$  times the GDP per capita and the marginal tax rate paid on an income  $1/x$  times the GDP per capita as shown below:

$$\text{progressivity measures} = MTR(x \cdot \text{GDP/cap}) - MTR(1/x \cdot \text{GDP/cap}) \quad (2)$$

where  $x=2$ , or  $x=3$  and *MTR* stands for the marginal tax rate. The variable *progressivity* is the measure using  $x=2$  and *progressivity2* is the measure using  $x=3$ . In the analysis, I use mostly the *progressivity* variable because  $x=2$  because it captures the best the curvature of most tax schedules. Mean *progressivity* is 10% and mean *progressivity2* is 13%. Table 1 presents the summary statistics for these measures for all country-years used in the analysis.

Table 1. Summary statistics

Variable	Mean	Standard Deviation
micro	48.52	46.41
msme	53.88	47.51
progressivity	10.52	8.83
progressivity2	13.21	9.73
mean personal rate	20.45	10.63
progressivity corp	0.54	2.76
mean corporate rate	23.94	9.02
progressivity1	10.47	9.00
mean personal rate1	19.85	10.81
bribe	3.60	1.57
bribe original	3.58	1.55
progressivityXbribe	33.96	33.62
progressivity2Xbribe	43.65	39.72
progressivityXbribe original	33.13	29.74
vat	16.18	7.13
inflation	5.58	7.26
credit	87.97	114.86
gdp/capita	14353.31	12405.98
bureaucracy	3.17	0.88
female	44.07	4.41
regulation	6.73	0.98
manufacturing	19.12	5.51
agriculture	5.25	4.18
services	62.91	8.54
g	18.31	4.85
unemployment	7.99	4.50
urban	71.89	13.59

There is a good deal of variation in personal income tax schedules across countries. Out of the 44 countries, four have flat income tax systems in at least one surveyed year. Countries like Bolivia,

Latvia, Paraguay, the Russian Federation and Uruguay have the least progressive systems, with one single marginal tax rate. Countries like Switzerland have 15 different marginal personal income tax rates, Malaysia has ten, Chile, Korea, and Mexico have eight. Netherlands and Romania have the highest top marginal rate at 60%, while Paraguay has a top rate of 0%. Figure 2 shows the average progressivity for each country in the sample.

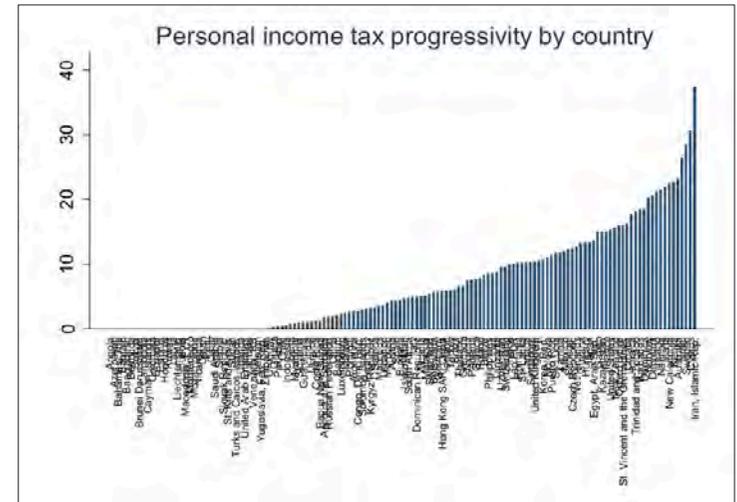


Fig 2. Personal income tax progressivity by country

There is some time variation as well; the data captures some tax changes in various countries like Hungary that increased its progressivity from 9% to 20% from 1995 to 2005. Developing countries seem to have more frequent tax reforms than developed countries and thus, their progressivity varies the most over time, while in developed countries there is little time variation.

I also calculate similar measures for corporate income tax progressivity. The variable *progressivity corp* is the difference in marginal tax rates paid by a corporation with profits twice GDP per

capita and one with profits half GDP per capita, while *progressivity corp2* is the difference in marginal tax rates paid by a corporation with profits three times GDP per capita and one with profits a third GDP per capita. Corporate income tax progressivity is very small and there is little variation among countries. In general, this corporate tax measure does not correlate with other tax measures. *Mean corporate rate* and *mean personal rate* have a correlation coefficient of only -.12 and *progressivity* and *progressivity corp* a coefficient of only .07.

I also include the VAT rate (*vat*) for each country in the analysis. These rates vary between 0% and 25%. VAT rates are also not correlated with the personal rates (the correlation coefficient is .15) or with corporate rates (the correlation coefficient is .08).

The fourth data category is macroeconomic controls. These controls are *gdp/capita* expressed in 2000 US\$, *services*, the net output of the service sector as percent of GDP, *manufacturing*, the net output of manufacturing sector as percent of GDP, *agriculture*, agriculture value added per GDP, *inflation* which is calculated based on the GDP deflator, *female*, female work force as share of total work force, *unemployment*, percentage of unemployed individuals out of the total labor force, *credit*, domestic credit to private sector per GDP, *bureaucracy*, *regulation*, *g*, government expenditures per GDP, and *urban*, share of urban population. The country characteristics data come from the World Development Indicators (World Bank 2012), International Country Risk Guide (PRS Group 2011) and Freedom of the World (Frasier Institute 2006).

Although data from all sources cover 226 countries and 52 years, the final number of observations used in this paper is relatively small due to missing variables. The micro enterprises data has a total of 415 observations, the tax data (marginal rates and progressivity for corporate and individual rates, and VAT rates) has

2,264 observations, the bribe variable has 1,108 observations, the World Development Indicators controls have 1,691, the regulation data from Freedom of the World has 1,809 and bureaucracy data from the International Country Risk Guide has 3,582 observations. Overall, the analysis is run on 142 observations covering 44 countries over eight years<sup>5</sup>. Using this data, I estimate the effects of personal income tax progressivity on the number of micro enterprises per 1,000 inhabitants. Specifically, I estimate an ordinary least squares model of the form:

$$\begin{aligned} micro_{k,t} = & \beta_0 + \beta_1 progressivity_{k,t} + \beta_2 mean\ personal\ rate_{k,t} + \\ & \beta_3 bribe_{k,t} + \beta_4 bribe_{k,t} \cdot progressivity_{k,t} + \beta_5 progressivity\ corp_{k,t} + \beta_6 mean \\ & corporate\ rate_{k,t} + \beta_7 vat_{k,t} + \sum_{n=8}^{19} \beta_n country\ characteristics_{n,k,t} + \vartheta_t + \theta_k \\ & + \varepsilon_{k,t} \quad (3) \end{aligned}$$

where  $k$  is the index for country and  $t$  is the index for year. The number of micro firms per 1,000 inhabitants depends on the progressivity of the personal income tax, mean personal income tax rate, bribes, interaction between bribes and personal income tax progressivity, corporate income tax progressivity, mean corporate tax rate, value added tax rate, other country characteristics such as *gdp/capita*, *services*, *manufacturing*, *agriculture*, *female*, *unemployment*, *inflation*, *credit*, *bureaucracy*, *regulation*, *g*, *urban*, on year fixed effects  $\vartheta_t$ , country fixed effects  $\theta_k$  and an error term  $\varepsilon_{k,t}$ .

<sup>5</sup> The countries covered in the cross-country regression analysis are: Australia, Austria, Bolivia, Botswana, Brazil, Bulgaria, Canada, Chile, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Germany, Hungary, Iceland, Indonesia, Japan, Korea, Rep., Latvia, Lithuania, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Slovak Republic, Slovenia, Sweden, Switzerland, Thailand, Trinidad and Tobago, Turkey, United Kingdom, United States, and Uruguay. The years covered are 1990, 1995, 2000-2005.

I control for the *mean personal rate* because I want to capture the effects of an increase in tax rate spread keeping constant for the mean rate. The mean marginal corporate rate and corporate progressivity might also affect the number of micro firms (which are largely unincorporated) by deterring them from incorporation. VAT rates might affect number of firms negatively if there is no VAT exception for firms with small profits. High VAT rates make firms less profitable and create disincentives to open a business. The VAT might have a positive effect on number of micro enterprises if there is an exemption for firms with low profits because firms want to remain small in order to avoid paying the VAT. I also control for bribes and the interaction of progressivity with bribes because I want to test whether the progressivity effects vary by bribe level. Personal tax progressivity is likely to have a positive effect on firms in countries where bribes are uncommon and a negative effect in countries where bribes are commonly paid to tax officials.

I also control for various other non-tax characteristics of the country that are known to be affect the level of entrepreneurship; richer countries with higher GDP per capita tend to have more firms. The service sector is characterized by smaller firms, thus countries with a large service sector have more micro enterprises. The manufacturing sector is characterized by larger firms, thus countries with large manufacturing sectors have few micro enterprises. Also, agricultural countries tend to have fewer small firms because larger firms are more common in the agriculture sector due to economies of scale. In places where it is common for women to work, it is also common for them to become self-employed. Thus, in those places one is likely to observe more micro enterprises, as a larger share of the population can work as entrepreneurs. Inflation is expected to increase the number of micro firms because people prefer to be self-employed than work for someone

else when wage increases lag behind the price increases. High unemployment may lead people who cannot find jobs to start their own businesses. Credit is the domestic credit to the private sector provided by banks and measures how easily the private sector can access credit. Easiness to receive credit results in easiness to open a business, thus, the effects of credit on *micro* are likely to be positive. Bureaucracy and regulation are likely to negatively affect small business creation since additional paperwork and excessive regulation can be very costly to a very small firm. Government expenditure might affect the number of micro firms positively if the government provides subsidies and other programs meant to help small firm creation and survival. Finally, the more urbanized a country, the larger the number of firms in that country since most micro firms are opened in cities.

I include country fixed effects and time fixed effects to capture some country specific or time specific characteristics that are not covered by the control variables.

It is unlikely that the number of micro enterprises affect the structure of the personal income tax because the firms are too small to have the necessary power to influence the tax policy. However, in the unlikely event that they are able to influence the government to make the tax schedule more or less progressive according to their interests, I also use instrumental variables to eliminate the simultaneity bias. I instrument for *progressivity* with *lagged progressivity*. *Progressivity* is correlated from year to year, but the lagged values do not affect directly the number of micro enterprises. The current tax schedule and not last year's affects whether a new firm is created, firm remains open or a firm exits the market. Other controls are likely to be endogenous, but they should not bias the progressivity coefficient unless they are correlated with the progressivity measure. The *mean personal rate* is likely to be endogenous with micro

enterprises and also correlated with the interest variable, progressivity. Thus, I also instrument *mean personal rate* with lagged mean marginal personal rate. The other variables are not correlated with *progressivity*. Corporate tax variables and VAT tax variables are not correlated with the personal income tax values. Thus, the only variables that are instrumented are progressivity, *mean personal rate* and the interaction terms between progressivity and bribes. The first stage regressions are as follows:

$$Y_{k,t} = \gamma_0 + \gamma_1 \text{lagged } Y_{k,t} + \gamma_2 \text{bribe}_{k,t} + \gamma_3 \text{progressivity corp}_{k,t} + \gamma_4 \text{mean corporate rate}_{k,t} + \gamma_5 \text{vat}_{k,t} + \sum_{n=6}^{17} \gamma_n \text{country characteristics}_{n,k,t} + \vartheta_t + \theta_k + \varepsilon_{k,t} \quad (4)$$

where  $Y$  is *progressivity*, *mean personal rate*, *progressivity2*, interaction between *bribe* and *progressivity*, interaction between *bribe* and *progressivity2*, interaction between *bribe original* and *progressivity*.

First, I present some graphical results. Figure 3 shows the number of micro enterprises per 1,000 inhabitants and progressivity in Russia between 1999 and 2003. During this period, the number of micro enterprises increased from 28 to 35 per 1,000 inhabitants, while progressivity decreased from 8% to 0%. In Figure 4, we see that in Australia, between 1999 and 2004, the number of micro enterprises increased from 45 to 56 per 1,000 inhabitants and progressivity increased from 27% to 30%. Figures 3 and 4 show that progressivity and number of micro enterprises are negatively correlated for a country where bribes are common like Russia and positively correlated for a country where bribes are rare like Australia.

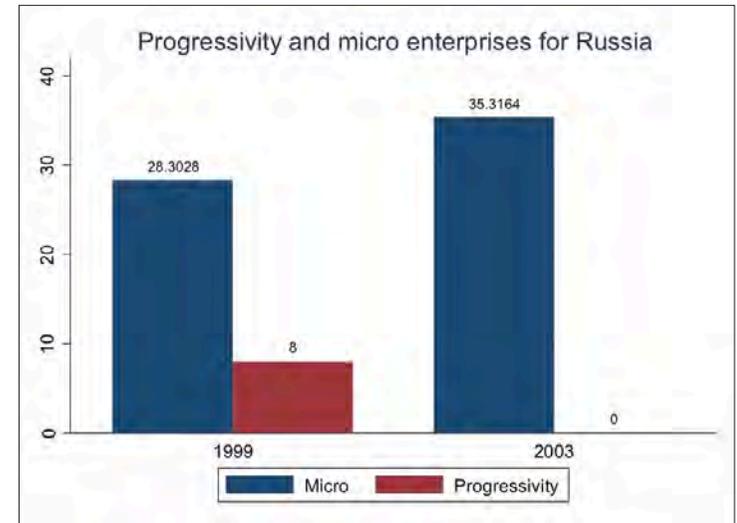


Fig 3. Personal income tax progressivity and number of micro enterprises between 1999-2003 for a country with high bribes

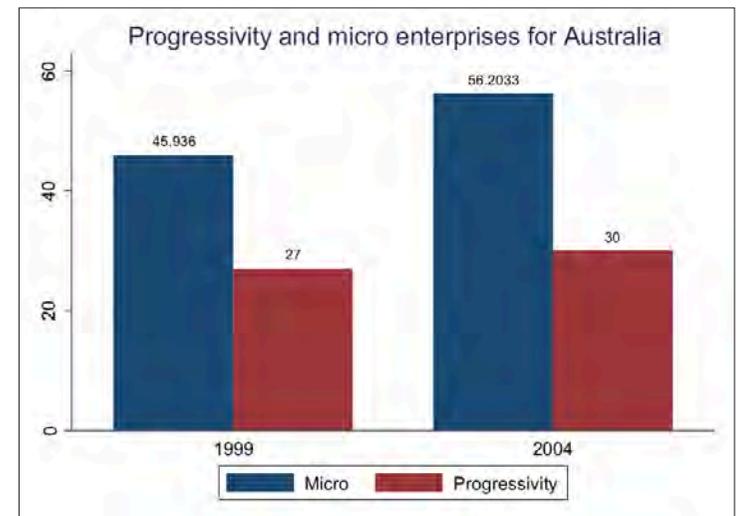


Fig 4. Personal income tax progressivity and number of micro enterprises between 1999-2004 for a country with low bribes

Figure 5 shows the scatter plot of micro enterprises and progressivity for all countries in the sample. Without taking into consideration the differences in bribe levels, the relationship between these two variables seems to be mildly positive. The next figure, Figure 6, shows the scatter plots of micro enterprises and progressivity by bribe decile. For countries with low bribes, the relationship is mostly positive, while for the countries with high bribes, the relationship is negative.

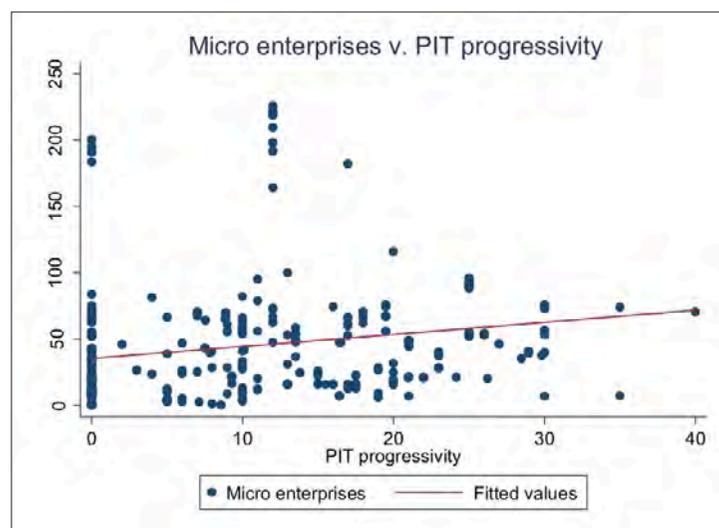


Fig 5. Micro enterprises per 1,000 inhabitants versus personal income tax progressivity

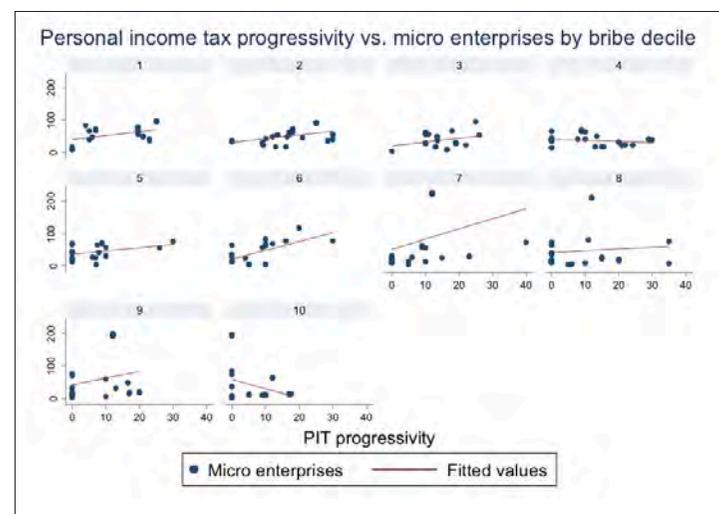


Fig 6. Micro enterprises per 1,000 inhabitants versus personal income tax progressivity by bribe level decile

Second, I show the results of the regression analysis. Table 2 presents the results for equation (3). I want to look at the effects of personal income tax progressivity on number of micro enterprises while controlling for *mean personal rate*, other tax and non-tax determinants and country and year fixed effects. First, I look at the effects of *progressivity* on micro enterprises without taking into consideration bribes. Then, in column (2), I introduce bribes and in column (3) I interact bribes with progressivity. The standard errors are clustered at country level. Without bribe interactions, *progressivity* has positive effects on the number of micro enterprises. However, once I interact *bribe* with *progressivity* the effect of *progressivity* is positive only for countries with low level of bribes (bribe level below 2.60), countries such as United Kingdom or Sweden and negative for countries with high levels of bribes, countries such as countries such as Russian Federation or Romania. The marginal

effect of progressivity at a mean bribe score is -1.56, which means that an increase of progressivity of 10% leads to an increase 15.6 of micro enterprises per 1,000 inhabitants; in other words, an increase of one standard deviation in progressivity at a mean level of bribes leads to a decrease of 0.29 standard deviations in micro enterprises.

**Table 2. Effects of progressivity on micro enterprises**

Micro	(1)	(2)	(3)
Progressivity	0.78 (0.46)*	0.78 (0.46)*	4.12 (2.05)**
mean personal rate	-0.12 (0.25)	-0.13 (0.26)	-0.14 (0.26)
progressivity corp	-0.38 (1.19)	-0.39 (1.20)	-0.24 (1.05)
mean corporate rate	0.06 (0.54)	-0.04 (0.74)	0.78 (0.88)
bribe		-1.36 (4.55)	10.36 (9.06)
progressivityXbribe			-1.58 (0.79)**
Vat	3.38 (3.49)	3.53 (3.47)	2.01 (3.08)
Inflation	-1.78 (0.74)**	-1.70 (0.89)*	-1.67 (0.84)**
Credit	-0.19 (0.24)	-0.19 (0.25)	-0.07 (0.16)
gdp/capita	0.0005 (0.005)	0.0006 (0.005)	-0.002 (0.005)
Bureaucracy	-23.85 (16.49)	-23.22 (17.75)	-37.05 (21.30)*
Female	-2.22 (5.40)	-1.97 (5.74)	-1.95 (5.06)
Regulation	-8.34 (6.95)	-9.02 (7.59)	-12.94 (7.53)*
Manufacturing	-0.80 (1.68)	-0.75 (1.73)	-1.88 (1.53)
Agriculture	-1.90 (5.77)	-1.70 (6.03)	-1.79 (5.27)
Services	-4.71 (3.46)	-4.51 (3.91)	-5.37 (3.67)
G	0.86 (2.50)	0.80 (2.61)	-0.32 (1.98)
Unemployment	0.51 (1.49)	0.47 (1.54)	1.27 (1.65)
Urban	-9.30 (7.34)	-9.19 (7.60)	-11.76* (7.04)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R <sup>2</sup>	0.96	0.96	0.96
Observations	142	142	142

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

The results in Table 2 show that once country and year fixed effects are included few other country characteristics affect the number of micro enterprises. Inflation has a negative and statistically significant effect on the number of micro enterprises. This runs against the original intuition. Periods of high inflation are characterized by low purchasing power and thus small businesses might be particularly badly hit and might not have the resources to weather such bad times.

Table 3 presents some robustness checks. I reproduce the preferred specification (Table 2, column (3)) but I replace three variables (*bribe*, *progressivity* and *micro*). The bribe variable is a constructed variable and not the original score from the Freedom of the World and one might worry that this constructed variable might drive the results. I also use the initial bribe variable (*bribe original*) in the regression in column (1) and find that progressivity has a positive effect on number of micro enterprises for countries with bribe levels below 2.18 and a negative effect for countries with bribes higher than that. These are very similar results both in sign and magnitude to the previous specifications. Unlike in the previous specifications, bribes have a positive effect. The interpretation could be either that bribes keep the firm small or that knowing that paying a bribe to tax authorities is an option make people more likely to become entrepreneurs to avoid taxes.

Table 3. Effects of progressivity on number of firms (robustness)

Dependent variable	micro		msme (3)
	(1)	(2)	
progressivity	4.18 (1.42)***		4.20 (2.04)**
progressivity2		3.63 (2.20)*	
mean personal rate	0.12 (0.12)	-0.13 (0.25)	-0.14 (0.26)
progressivity corp	0.12 (0.41)		-0.87 (1.04)
progressivity corp2		0.26 (2.51)	
mean corporate rate	2.09 (1.10)*	0.32 (0.74)	0.63 (0.65)
bribe original	26.45 (8.92)***		
bribe		8.15 (7.68)	4.47 (6.95)
progressivity X bribe original	-1.91 (0.59)***		
progressivity X bribe			-1.41 (0.67)**
progressivity2Xbribe		-0.87 (0.46)*	
vat	1.72 (1.36)	3.27 (3.38)	-1.36 (2.24)
inflation	-1.75 (0.62)***	-1.37 (0.76)*	-0.51 (0.43)
credit	-0.09 (0.10)	-0.13 (0.19)	-0.05 (0.24)
gdp/capita	-0.01 (0.004)***	-0.001 (0.005)	-0.002 (0.005)
bureaucracy	-48.89 (14.34)***	-34.93 (18.78)*	-19.64 (14.53)
female	-4.67 (4.39)	-4.46 (6.19)	-3.65 (6.68)
regulation	-5.16 (6.61)	-12.23 (7.68)	-18.18 (8.95)**
manufacturing	-3.20 (1.11)***	-1.39 (1.59)	-0.98 (1.93)
agriculture	-0.32 (3.52)	-3.14 (5.99)	-0.22 (4.14)
services	-5.05 (2.47)**	-5.54 (4.03)	-1.79 (2.36)
G	3.85 (2.44)	0.62 (2.51)	-0.68 (1.82)
unemployment	-0.65 (1.09)	1.75 (2.04)	1.02 (1.28)
urban	-18.59 (5.23)***	-10.06 (6.96)	-10.00 (7.03)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R <sup>2</sup>	0.98	0.96	0.95
Observations	124	140	160

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

Column (2) controls for *progressivity2*, another measure of personal income tax progressivity that checks whether the way progressivity is measured plays a role in obtaining these results. *Progressivity2* is the difference between the marginal tax rate paid by an individual earning an income three times the GDP per capita and the marginal rate paid by a person earning an income a third of the GDP per capita. I also control for a corporate progressivity measure measured in a similar way (*progressivity corp2*). Again, personal income tax progressivity has a positive effect for countries with low bribe levels and negative for countries with high bribe levels. The major difference between this specification and the preferred one (Column (3) Table 2), is that the coefficients are significant only at the 10% level.

In the last column, I look at the effects of progressivity on medium, small and micro enterprises per 1,000 inhabitants (*msme*). This measure also includes larger firms that might have up to 500 employees. The effects seem to be similar to the effects of progressivity on *micro* both in sign and magnitude.

Next, I estimate the effects of progressivity on number of micro enterprises in a 2SLS model. I instrument *progressivity* with *lagged progressivity*, *mean personal rate* with *lagged mean personal rate*, and the interaction term between *progressivity* and *bribe* with the interaction between *lagged progressivity* and *bribe*. The first stage regressions are described in Table 4. In all of these regressions, the relationship between the endogenous variable and the instrument is very strong, the correlation is positive and is statistically significant at 1% level.

Table 4. First stage regressions

Dependent variable	progres- sivity (1)	mean personal rate (2)	progres- sivity Xbribe (3)	progres- sivityXbribe original (4)	progres- sivity2 (5)	progres- sivity2 Xbribe (6)
lagged progressivity	0.78 (0.04)***					
lagged mean personal rate		0.92 (0.05)***				
lagged progressivity X bribe			0.73 (0.07)***			
lagged progressivityX bribe original				0.68 (0.13)***		
lagged progressivity2					0.76 (0.08)***	
lagged progressivity2 X bribe						0.69 (0.10)***
bribe	0.10 (0.29)	0.23 (0.18)	2.48 (1.80)		-0.43 (0.36)	
bribe original				1.86 (1.51)		.88 (1.61)
mean corporate rate	0.06 (0.04)	0.001 (0.02)	0.36 (0.25)	0.22 (0.29)	0.04 (0.03)	0.28 (0.22)
progressivity corp	-0.03 (0.06)	-0.014 (0.07)	-0.19 (0.31)	0.04 (0.48)		
progressivity corp2					-0.04 (0.12)	-0.11 (0.70)
vat	-0.15 (0.08)*	-0.10 (0.06)	-0.85 (0.48)*	-1.67 (2.14)	-0.26 (0.11)**	-1.65 (0.74)**
gdp/capita	-0.0003 (0.0001)*	-0.00007 (0.0001)	0.0008 (0.0001)	-0.001 (0.001)	-0.001 (0.0001)	-0.001 (0.001)
unemployment	-0.06 (0.07)	-0.0001 (0.04)	-0.20 (0.34)	-0.01 (0.40)	-0.12 (0.07)*	-0.43 (0.46)
inflation	-0.0001 (0.0002)	-0.0001 (0.0001)	-0.001 (0.001)	0.25 (0.19)	-0.001 (0.0002)***	-0.007 (0.001)***
credit	0.0001 (0.0003)	-0.0004 (0.0003)	0.0002 (0.001)	-0.01 (0.05)	0.0006 (0.0004)	0.001 (0.001)
bureaucracy	-0.47 (0.33)	-0.05 (0.25)	-2.64 (1.94)	-2.53 (3.74)	-0.61 (0.99)	-4.55 (5.86)
female	-0.33 (0.27)	0.18 (0.11)	-1.32 (1.28)	0.35 (1.56)	0.006 (0.14)	0.15 (0.79)
regulation	-0.73 (0.34)**	-0.25 (0.33)	-4.22 (2.04)**	-2.58 (3.08)	-0.44 (0.48)	-3.07 (2.95)
manufacturing	0.02 (0.09)	0.04 (0.05)	-0.04 (0.52)	0.22 (0.77)	0.18 (0.08)**	1.04 (0.51)**
agriculture	0.17 (0.15)	0.03 (0.07)	0.70 (0.74)	0.63 (0.86)	0.28 (0.20)	1.76 (1.15)
services	0.02 (0.10)	0.02 (0.05)	-0.02 (0.56)	-0.08 (0.62)	0.08 (0.06)	0.38 (0.35)
G	0.17 (0.11)	-0.005 (0.08)	0.90 (0.50)*	-0.53 (1.21)	0.10 (0.11)	0.66 (0.67)
urban	0.008 (0.10)	-0.004 (0.03)	0.16 (0.55)	1.46 (1.55)	0.18 (0.12)	1.11 (0.80)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.94	0.97	0.91	0.91	0.94	0.91
Observations	489	489	489	348	487	487

Table 5 shows the results of the 2SLS model using the above instruments. The first specification takes the preferred specification and uses instruments for *progressivity*, *mean personal rate* and interaction terms between *progressivity* and *bribe*. The results are similar to the ones in the preferred specification. The variable *progressivity* has positive effects on micro enterprises for countries where bribes are rare (scores below 1.79) and negative for countries where bribe are common (scores above 1.79). The marginal effect of *progressivity* for a country with mean *bribe*=3.60 is -6.99, that is for an increase of 10% in progressivity, the number of micro enterprises will decrease by 69.9 per 1,000 inhabitants. In other words, an increase of one standard deviation in *progressivity* leads to a decrease of 1.32 standard deviations in number of micro enterprises per 1,000 inhabitants.

Table 5. 2SLS regressions

Dependent variable	micro			msme
	(1)	(2)	(3)	(4)
progressivity	6.94 (2.30)***	5.62 (1.53)***		12.12 (7.09)*
progressivity2			2.78 (1.17)**	
mean personal rate	-0.13 (0.34)	0.004 (0.21)	-0.04 (0.23)	-0.39 (0.72)
progressivityXbribe	-3.87 (1.25)***			-7.48 (4.39)*
progressivityXbribe original		-3.13 (0.56)***		
progressivity2Xbribe			-1.05 (0.33)***	
bribe	27.51 (12.28)**		9.90 (6.08)	49.07 (33.12)
bribe original		36.27 (5.86)***		
mean corporate rate	2.13 (1.23)*	2.73 (0.95)***	0.33 (0.72)	4.24 (2.92)
progressivity corp	0.40 (1.59)	-0.54 (0.53)		1.13 (3.10)
progressivity corp2			1.18 (2.43)	
vat	-0.35 (4.63)	0.49 (2.48)	3.78 (3.74)	-12.88 (8.86)
gdp/capita	-0.008 (0.006)	-0.01 (0.004)***	-0.002 (0.005)	-0.02 (0.01)
unemployment	2.01 (1.75)	-0.51 (1.22)	1.97 (2.09)	1.37 (1.61)
inflation	-1.61 (1.03)	-1.69 (0.71)**	-1.29 (0.79)	0.68 (1.31)
credit	0.07 (0.13)	-0.05 (0.08)	-0.13 (0.20)	0.35 (0.38)
bureaucracy	-61.75 (27.79)**	-63.45 (15.24)***	-36.97 (18.10)**	-88.88 (55.13)
female	1.12 (7.13)	-4.11 (5.07)	-4.81 (5.99)	1.85 (11.49)
regulation	-18.36 (11.32)	-5.73 (7.41)	-10.80 (10.01)	-39.70 (20.64)*
manufacturing	-2.89 (1.44)**	-3.92 (1.07)***	-1.52 (1.60)	-3.32 (3.14)
agriculture	-1.01 (4.99)	-1.38 (4.06)	-3.68 (5.85)	-2.12 (7.36)
services	-6.17 (3.08)**	-5.10 (2.12)**	-5.79 (4.06)	-3.18 (3.24)
G	-2.72 (2.66)	3.39 (2.58)	0.57 (2.49)	-3.92 (4.36)
urban	-15.68 (7.32)**	-17.56 (5.29)***	-8.24 (7.32)	-15.33 (9.70)
Country FE	Yes	Yes	Yes	Yes
Yesr FE	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.94	0.98	0.96	0.83
Observations	142	124	140	160

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

The next three specifications are variations of the one in column (1). The regression in column (2) uses the original bribe variable (*bribe original*) instead of bribe and the above instruments, the regression in column (3) uses *progressivity2* instead of *progressivity* and uses *lagged progressivity2*, *lagged mean personal rate* and interaction between *lagged progressivity2* and bribe as *instruments*, and the specification in (4) uses *msme* as dependent variable. All show that *progressivity* has positive effects in countries where bribes are rare and negative where they are common. The cutoff for the *bribe* value varies slightly among specifications (1.79 in (2), 2.64 in (3) and 1.62 in (4)).

## 5. Micro analysis of russian longitudinal data

Next, I estimate the effects of personal income tax progressivity on the decision to be self-employed in Russia. Russia is a country where bribes are commonly paid to officials. According to the St. Petersburg Time in 2002, Russians pay \$36 billion per year in bribes. The article says that 75% of bribes paid by businesses go to tax inspectors or city administrators (Saint Petersburg Times May 24). In 2005, The Moscow Times reported that two persons were caught accepting a bribe of \$5.3 million from a large bank to drop a back tax claim (Moscow Times 2005). The variable *bribe original* averaged a score of 6.94 out of 10 for Russia over the period of time 1995 to 2000 (roughly the time studied in this section). This value is in the 90th percentile of the bribe distribution in my cross-country dataset.

In this section, I exploit changes in progressivity created by changes in tax structure in Russia between 1994 and 2000 and due to individual variation. Between 1994 and 2000, the personal income tax schedule changed every year in terms of bracket

composition and marginal rates. Top marginal rates varying from 30% to 45% and the number of brackets varied from two to five. In 2001, the income tax schedule became flat: all income above 4,800 rubles was taxed at 13% and there was almost no variation at individual level in progressivity, thus I am not using data after 2001.

Other changes took place in Russia during this time. GDP increased every year from 610 billion constant rubles in 1994 to 730 billion constant rubles in 2000. During the same period, inflation decreased drastically from 307% in 1994 to 20% in 2000. Unemployment increased from 8% in 1994 to 13% in 1998 and then decreased to 10% in 2000. All these economic factors could play a role on self-employment decisions and they are captured in year fixed effects in the analysis.

I analyze the impact of these tax changes on self-employment using longitudinal data from the Russia Longitudinal Monitoring Survey (RLMS) (USAID et al. various years). RLMS collects data on demographic characteristics, income, occupation, expenditure and health status of its respondents. I use survey data from 1994 (round 5), 1995 (round 6), 1996 (round 7), 1998-1999 (round 8) and 2000 (round 9). I exclude the surveys before 1994 because they were not nationally representative and after 2000 because there is almost no variation in progressivity at individual level<sup>6</sup>.

Previous studies conduct the analysis at the head of the household level. I use data only on males who are between 18 and 60 years old because RLMS does not provide information on the head of the household, so males are a good proxy for the head of the household. For the six years and five waves of data considered for this analysis, there are 30,931 observations for individuals between 18 and 60, and out of these observations, 14,123 are males. In my

analysis, I use from 1,354 to 10,278 observations depending on the specification. The difference in number of observations between all males in the survey and the ones in the regression analysis comes from the lack of data on certain individuals regarding their primary occupation. Another reason why data is dropped in the analysis is because some individuals do not show up in the data more than once, thus cannot be considered for a conditional logit fixed effects model.

Using this data, I define *self-employment*, an occupational dummy that takes value 1 if the person answered "yes" to working for his own firm or to owning the firm for which he works. In my sample, 17% of males are self-employed. Table 6 shows descriptive statistics for the Russian data of the sample considered in the analysis and for each occupational group (self-employed and not self-employed). I also construct demographic variables such as age dummies: *age1830*, *age3140*, *age4150*, *age4150*, *age5160*, *married*, marital status dummy, family size dummies: *size12*, *size34*, *size5*, and four educational dummies, *edu14*, *edu58*, *edu912*, *edu13*. The average age is 37, 76% of males are married, they have an average family size of 3.64, and on average they have completed 12 years of formal education.

<sup>6</sup> I weight the data used in the analysis using the survey weights.

Table 6. Descriptive statistics for Russian data

Variable	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
	All		Self-employed		not self-employed	
self-employment	0.17	0.38	1	0	0	0
exit	0.06	0.25	0	0	0.08	0.27
entry	0.04	0.21	0.25	0.43	0	0
prog	10.82	4.82	10.79	3.95	11.30	4.72
prog2	5.79	4.09	5.46	4.24	6.02	4.06
atr	16.80	3.30	16.83	3.12	16.93	3.17
atr1	16.17	3.51	16.26	3.30	16.26	3.36
atr2	18.18	4.12	18.24	3.87	18.33	3.96
edu04	0.004	0.06	0.0005	0.02	0.002	0.04
edu58	0.05	0.22	0.04	0.21	0.04	0.20
edu912	0.27	0.44	0.21	0.41	0.24	0.42
edu13	0.66	0.47	0.73	0.44	0.71	0.45
edu	12.42	2.62	12.74	2.54	12.69	2.52
age1830	0.31	0.46	0.17	0.37	0.31	0.46
age3140	0.27	0.44	0.33	0.47	0.29	0.45
age4150	0.23	0.42	0.28	0.45	0.25	0.43
age5160	0	0	0	0	0	0
age	37.67	11.76	41.04	10.32	37.45	10.95
size12	0.23	0.42	0.21	0.40	0.22	0.41
size34	0.54	0.49	0.59	0.49	0.55	0.49
size5	0.22	0.41	0.19	0.39	0.21	0.41
size	3.64	1.55	3.64	1.46	3.65	1.50
married	0.76	0.42	0.89	0.30	0.82	0.38

I use data on personal income tax rates and brackets for Russia from the AEI International Tax Database (American Enterprise Institute 2008) and Pricewaterhouse Coopers (Pricewaterhouse Coopers Organization, 1990-2005b). Using this data, I estimate a

progressivity and an average tax rate measure for each individual. I first create demographic categories based on age, education, marital status and gender. Second, I use the income reported in the survey by self-employed individuals and calculate an average self-employment income for each category in every year,  $\mu$ . Third, I calculate half this mean income,  $\mu/2$  and twice this mean income,  $2\mu$ . Fourth, I estimate a progressivity measure (*prog*) equal to the difference between the marginal personal income tax rate paid by someone who earns  $2\mu$  and the marginal personal income tax rate paid by someone who earns  $\mu/2$ .

$$prog_j = MTR(2\mu_j) - MTR(\mu_j/2) \quad (5)$$

where  $j$  is a demographic category and *MTR* stands for marginal tax rate. This measure attempts to capture the progressivity that is relevant for each individual when he decides whether to be self-employed. This individual does not know how much income he will make as an entrepreneur, but he knows his demographic characteristics and looks at entrepreneurs who share those characteristics to estimate a mean income for himself. Then, he considers the possibility he will be successful and earn twice that amount and the possibility that he might be unsuccessful and earn half that mean income. The difference between the rates he would pay in these two circumstances is the progressivity measure that is relevant for this individual. This measure also tries to mirror the measure for progressivity estimated at country level as the difference between the marginal rate paid by a person earning twice GDP per capita and the marginal rate paid by a person earning half the GDP per capita. Finally, this measure helps avoid endogeneity issues as it measures the tax variable based on the potential income earned by people in the individual's demographic group rather than based on his own income.

The average tax rate (*atr*) is the mean of the average tax rates paid by someone who earns  $2\mu$  and someone who earns  $\mu/2$ . The mean value for progressivity is 10.82% and the mean value for average tax rate is 16.80%. There is a lot of variation in the individual progressivity measure due to the changes in tax system over time and due to the fact that this variable varies with demographic characteristics. Figure 7 shows the variation over time and Figure 8 shows the mean progressivity by demographic category.

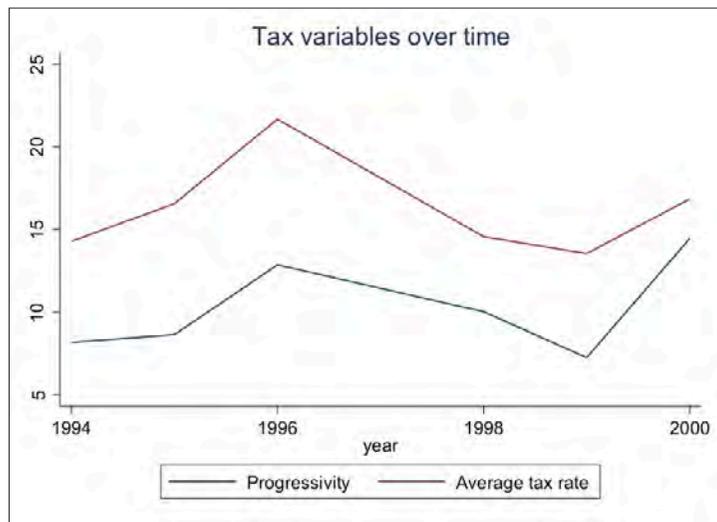


Fig 7. Mean progressivity and average tax rate by year (percent)

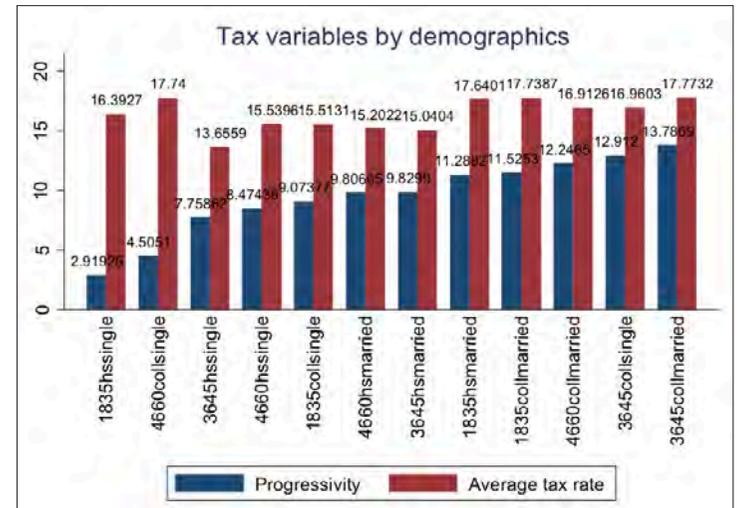


Fig 8. Mean progressivity and average tax rates by demographic characteristics

Next, I estimate a conditional fixed effects logistic regression of the form:

$$Pr(\text{self-employed}_{i,t} = 1) = f(\text{prog}_{i,t} + \text{atr}_{i,t} + z_{i,t} + \tau_t + v_i) \quad (6)$$

where  $i$  is the index for individuals,  $t$  is the index for year, *self-employed* <sub>$i,t$</sub>  is the self-employment dummy, *prog* <sub>$i,t$</sub>  is the individual measure for income tax progressivity, *atr* <sub>$i,t$</sub>  is the individual level average tax rate,  $z_{i,t}$  is a vector for demographic characteristics such as education, age, size of household, marital status dummies,  $\tau_t$  are time fixed effects and  $v_i$  are individual fixed effects.

I expect progressivity to have a negative effect on self-employment since Russia is a country where bribes are often paid to tax officials. Average tax rate is likely to encourage self-employment in a country with high tax evasion like Russia, because higher tax burden gives people incentives to choose an occupation which allows

for more tax evasion. Demographic characteristics could matter as well: more education probably leads to a smaller probability of being self-employed since people with more formal education tend to be wage employed, larger household size might also have a negative effect since people who have many dependents tend to take less risk, and thus are less likely to become self-employed individuals and finally, age might also affect self-employment also negatively if younger people are more prone to risk and become entrepreneurs.

Table 7 shows the effects of personal income tax progressivity on the probability of being self-employed while controlling for the average tax rate, education, age, size and marital status. In the first column, I estimate a logistic model without including year or individual fixed effects, in the second column, I introduce individual fixed effects by estimating a conditional fixed effects logistic model, and in the last column, I add year dummies to the conditional logistic model. More progressivity decreases the odds of being self-employed as stated in the theory. A coefficient of -0.03 can be interpreted as an increase of 1% in progressivity leads to a decrease in of 3.4% in the odds of being self-employed. Average tax rate has a positive effect as more people have to pay in income taxation, the more likely they are to choose an occupation where they can tax evade. The coefficient for average tax rate is significant only for the first two specifications, and insignificant once year dummies are included. It is possible that average rate is not that important and the coefficient picks up the effects of particular years that were particularly good for entrepreneurship. Education, size, age and marital status lose statistical significance once the individual and year fixed effects are included.

**Table 7. Effects of progressivity on self-employment in Russia**

	Logistic regression (1)	Conditional FE logistic regression (2)	Conditional FE logistic regression (3)
prog	-0.05 (0.007)***	-0.07 (0.01)***	-0.03 (0.01)**
atr	.02 (0.009)**	0.03 (0.01)**	0.02 (0.03)
edu58	0.72 (0.55)	0.43 (0.88)	0.19 (0.92)
edu912	0.63 (0.54)	0.09 (0.85)	-0.06 (0.89)
edu13	0.80 (0.54)	0.34 (0.85)	0.05 (0.89)
age1830	-0.94 (0.08)***	1.46 (0.43)***	-0.03 (0.48)
age3140	-0.28 (0.07)***	1.05 (0.33)***	0.01 (0.36)
age4150	-0.26 (0.07)***	0.50 (0.26)*	-0.05 (0.27)
size12	-0.007 (0.08)	-0.35 (0.24)	0.05 (0.25)
size34	0.15 (0.06)**	0.06 (0.19)	0.11 (0.20)
married	0.48 (0.09)***	-0.04 (0.27)	-0.01 (0.27)
Individual FE	No	Yes	Yes
Year FE	No	No	Yes
Pseudo-R <sup>2</sup>	0.02	0.04	0.07
Observations	10,278	2,635	2,635

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

In Table 8, I add some robustness checks. In the first column, I control for average tax rate measured as the average tax rate paid by an individual who earns  $\mu$ , the mean income for his demographic group (*atr1*). The effects of progressivity are negative and statistically significant. The magnitude of the effect is the same as in the

preferred specification (Table 7 column (3)). In the next column, I control for age, size and education as continuous variables instead of using dummies for each category. The effect of progressivity stays the same. Finally, I construct a different progressivity measure *prog2*, the difference between the marginal tax rate paid by an individual who earns a self-employment income equal to twice the income for his category and the marginal tax rate paid by someone who earns the mean income for his category. I assume that would be entrepreneurs are too optimistic and take into consideration only the cases in which they earn the mean income for their demographic category and twice that income. I also control for *atr2*, the mean of the average tax rates paid by someone with mean income and someone with twice the mean income. As in previous specifications, progressivity has a negative and significant effect on self-employment. The magnitude of the effect is slightly smaller than in the preferred specification.

Table 8. Robustness checks for the Russian analysis

	(1)	(2)	(3)
<i>prog</i>	-0.03 (0.01)*	-0.03 (0.01)*	
<i>prog2</i>			-0.02 (0.01)**
<i>atr</i>		0.02 (0.03)	
<i>atr1</i>	0.02 (0.02)		
<i>atr2</i>			0.02 (0.02)
<i>edu58</i>	0.19 (0.92)		0.10 (0.92)
<i>edu912</i>	-0.06 (0.89)		-0.12 (0.88)
<i>edu13</i>	0.05 (0.89)		-0.08 (0.89)
<i>edu</i>		0.03 (0.03)	
<i>age1830</i>	-0.02 (0.48)		-0.009 (0.48)
<i>age3140</i>	0.01 (0.36)		0.02 (0.36)
<i>age4150</i>	-0.05 (0.27)		-0.06 (0.27)
<i>age</i>		0.03 (0.07)	
<i>size12</i>	0.05 (0.25)		0.05 (0.25)
<i>size34</i>	0.11 (0.20)		0.12 (0.20)
<i>size</i>		-0.002 (0.06)	
<i>married</i>	-0.01 (0.27)	-0.04 (0.28)	-0.10 (0.27)
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pseudo-R <sup>2</sup>	0.07	0.07	0.07
Observations	2,635	2,629	2,635

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

This approach assumes that individuals report their income correctly in the survey, but lie to tax authorities. If people are lying in the survey as well, I need to estimate by how much. I use the Pissarides and Weber (1989)<sup>7</sup> technique to estimate how much income self-employed individuals underreport. The intuition is that self-employed tax evade, while wage employed cannot evade. The method also assumes that people report the correct amount of food expenditure. If self-employed and wage employed individuals earn the same amount of money, they will spend the same amount on food controlling for personal characteristics. One can estimate the true income of a self-employed individual by looking at the amount spent on food. Formally, this can be estimated with a regression as the one below:

$$\ln(\text{food}_i) = \delta_0 + \delta_1 \ln(\text{income}_i) + \delta_2 \text{se}_i + \delta_3 \text{other}_i + \sum_{j=1}^9 \delta_{j,i} \text{personal characteristics}_{i,i} + \psi_j \quad (7)$$

where *food* is the food expenditure for the household, *income* is the declared household income, *se* and *other* are occupational dummies for self-employment and out of labor force or unemployed and the set of personal characteristics.

Then, I estimate *k*, the share of income that is declared if the person is self-employed as:

$$k = e^{-\delta_2/\delta_1} \quad (8)$$

I use information from the survey on food expenditure. I add all the food expenditures (at home, in restaurants, produced,

<sup>7</sup> Johansson (2005) uses a similar technique to Pissarides and Weber (1989). Gorodnichenko et al (2009) use a related approach based on total expenditures and total income.

bought from stores) since it is harder to lie about many items than to lie about the overall food expenditure. I find that individuals are reporting 99% of their self-employment income in this survey. Thus, the income I use to estimate the progressivity and average tax income is reported correctly.

Finally, many studies looking at the effects of taxation at the individual level suffer from endogeneity problems because individuals choose the income they earn/report in order to be in a convenient tax bracket. However, in this paper, the tax measures are estimated for potential incomes earned by entrepreneurs with same demographic characteristics as the person studied and not on actual income earned by that person. This reduces the chances of endogeneity problems in this model.

## 6. Conclusions

This paper develops a framework of occupational choice that depends on the structure of the personal income tax and also on the structure of the bribes paid to tax authorities to avoid paying taxes to the government. It predicts that progressivity encourages self-employment in countries with little tax evasion and few corrupt tax officials and discourages self-employment in places where entrepreneurs evade taxes and pay bribes to tax authorities if caught. I test these hypotheses using two types of data.

First, I use cross-country panel data and find that progressivity has a positive effect on number of micro enterprises per 1,000 inhabitants in countries where bribes are rare, where the bribe score is below 2.60 and negative for countries where bribes are common, where bribe scores are above 2.60. These results show that for a country like the United Kingdom, where bribes are uncommon

and the mean bribe score is 1.99<sup>8</sup>, an increase of 10% in personal income tax progressivity leads to an increase of 9.7 in the number of micro enterprises per 1,000 inhabitants. However, for a country like Russia, where bribes are common and the mean bribe score is 5.86<sup>9</sup>, an increase of 10% in personal income tax progressivity will lead to a decrease of 51.38 in the number of micro enterprises per 1,000 inhabitants.

Second, I use longitudinal micro data to estimate the effects of progressivity estimated at personal level on the decision to be self-employed in Russia. I find that an increase in progressivity of 1% keeping constant for the average tax rate leads to a decrease of 3.4% in the odds of being self-employed.

These results have important policy implications, especially for developing and transitional economies. In countries where bribes are common, less progressive tax systems encourage entrepreneurship, but this is achieved at the expense of the government who loses tax revenue to corrupt tax officials and to some extent, at the expense of entrepreneurs who can fall victims to extortion by the tax authorities. A better policy is to eliminate corruption in the tax administration and allow the tax code to be more progressive. Such policies are likely to bring more revenue to the government, encourage entrepreneurship, and potentially allow for income redistribution in the society.

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<sup>8</sup> For the years used in the cross-country analysis.

<sup>9</sup> For the years used in the cross-country analysis

## References

- Allingham, Michael G., & Sandomo, A., 1972. Income Tax Evasion: A Theoretical Analysis. *Journal of Public Economics* 1, 323-38.
- Alm, J., Bahl, R., & Murray, M., 1990. Tax Structure and Tax Compliance. *Review of Economics and Statistics* 72 (4), 603-13.
- American Enterprise Institute, 2008. AEI International Tax Database. Washington, D.C.: American Enterprise Institute.
- Afzar, O., Lee, Y., & Swamy, A., 2001. The Causes and Consequences of Corruption. *Annals of the American Academy of Political and Social Science* 573, 42-56.
- Baksi, S., Bose, P. & Pandey, M., 2009. The Impact of Liberalization on Bureaucratic Corruption. *Journal of Economic Behavior & Organization* 72, 214-24.
- Baltic News Service, 2005. "Estonia: Tax Fraud Investigator Suspected of Taking Bribes." July 22. <http://news.bns.ee/en/>.
- BBC, 2009. "Croatian Tax Officials, Inspectors Arrested on Suspicion of Corruption." February 13. [http://www.accessmylibrary.com/coms2/summary\\_0286-36726888\\_ITM](http://www.accessmylibrary.com/coms2/summary_0286-36726888_ITM).
- Bell, P., 1969. A Quantitative Study of Entrepreneurship and Its Determinants in Asia. *The Canadian Journal of Economics* 2 (2), 288-98.
- Besley, T. & McLaren, J., 1993. Taxes and Bribery: The Role of Wage Incentives. *The Economic Journal* 103 (416), 119-41.
- Black, S. & Stahan, P., 2002. Entrepreneurship and Bank Credit Availability. *The Journal of Finance* 57, 2807-33.
- Blau, D.M., 1987. A Time-Series Analysis of Self-Employment in the United States. *Journal of Political Economy* 95 (3), 445-67.
- Boadway, R., Marchand, M., & Pestieau, P., 1991. Optimal Linear Income Taxation in Models with Occupational Choice. *Journal of Public Economics* 46 (1), 6133-62.
- Boadway, R. & Tremblay, J.F., 2005. Public Economics and Start-up Entrepreneurs. *Venture Capital, Entrepreneurship, and Public Policy*, 181-219.
- Briscoe, G., Daiinty, A., & Millett, S., 2000. The Impact of the Tax System of Self-Employment in the British Construction Industry. *International Journal of Manpower* 21 (8), 596-614.
- Bruce, D., 2000. Effects of the United States Tax System on Transitions into Self-Employment. *Labour Economics* 7, 545-74.
- Bruce, D., 2002. Taxes and Entrepreneurial Endurance: Evidence from the Self-Employed. *National Tax Journal* LV (1), 5-24.
- Bruce, D. & Gurley, T., 2005. Taxes and Entrepreneurial Activity: An Empirical Investigation Using Longitudinal Tax Returns. *Small Business Association Research Summary* 252.
- Bruce, D. & Moshin, M., 2003. Tax Policy and Entrepreneurship: New Time Series Evidence. *Small Business Economics* 26 (5), 253-66.
- Brunetti, A. & Weder, B., 2003. A free press is bad news for corruption. *Journal of Public Economics* 87, 1801-24.
- Busenitz, L. W., Gomez, C. & Spencer, J.W., 2000. Country Institutional Profiles: Unlocking Entrepreneurial Phenomena. *The Academy of Management Journal* 43 (5), 994-1003.
- Carasciuc, L., 2005. Tax Evasion within a Corrupt Environment. *Problems of Economics Transition* 48 (3), 84-97.
- Chander, P. & Wilde, L., 1992. Corruption in Tax Administration. *Journal of Public Economics* 49 (3), 333-49.
- Christiansen, V., 1980. Two Comments on Tax Evasion. *Journal of Public Economics* 13 (3), 389-93.
- Cowell, F.A., 1975. Some Notes on Progression and Risk Taking. *Economica* 42 (167), 313-18.
- Cowell, F.A., 1981. Taxation and Labour Supply with Risky Activities. *Economica* 48 (192), 365-79.
- Cullen, J.B. & Gordon, R.H., 2002. Taxes and Entrepreneurial Activity: Theory and Evidence for the U.S.. *National Bureau of Economic Research Working Paper* 9015.
- Cullen, J.B. & Gordon, R.H., 2006a. How Do Taxes Affect Entrepreneurial Activity? A Comparison of U.S. and Swedish Law. Paper presented at *Entreprenörskap och Tillväxt: Kunskap, Kommersialisering och Ekonomisk Politik*, eds. P. Braunerhjelm and J. Wiklund. Stockholm: Forum För Småföretagsforskning.

Cullen, J.B. & Gordon, R.H., 2006b. Tax Reform and Entrepreneurial Activity. *Tax Policy and the Economy* 20, 41-71.

Cullen, J.B. & Gordon, R.H., 2007. Taxes and Entrepreneurial Risk-Taking: Theory and Evidence for the U.S.. *Journal of Public Economics* 91 (7), 1479-505.

Da Rin, M., Giacomo, M.D., & Sembenelli, A., 2011. Entrepreneurship, Firm Entry, and the Taxation of Corporate Income: Evidence from Europe. *Journal of Public Economics* 95, 1048-65.

Desai, M., Gompers, P. & Lerner, P., 2003. Institutions, Capital Constraints and Entrepreneurial Firm Dynamics: Evidence from Europe. National Bureau of Economic Research Working Paper 10165.

Destre, G. & Henrard, V., 2004. The Determinants of Occupational Choice in Colombia: An Empirical Analysis. *Cahiers de la Maison des Sciences Economiques, Université Panthéon-Sorbonne Working Paper*.

Dietz, M.D., 2005. Capital Income Taxation, New Firm Creation, and the Size Distribution of Firms. University of St. Gallen Working Paper.

Djankov, S., Ganser, T., McLiesh, C., Ramalho, R. & Shleifer, A., 2008. The Effect of Corporate Taxes on investment and Entrepreneurship. National Bureau of Economic Research Working Paper 13756.

Domar, E.D. & Musgrave, R.A., 1944. Proportional Income Taxation and Risk-Taking. *Quarterly Journal of Economics* 58 (3), 388-422.

Engelschalk, M., 2005. Creating a Favorable Tax Environment for Small Business Development in Transition Countries. Paper presented at the Tax and the Investment Climate in Africa Conference, Livingston, Zambia.

European Commission. 2007. Taxation Trends in the European Union Main Results. [http://publications.europa.eu/index\\_en.htm](http://publications.europa.eu/index_en.htm)

Evans, D.S. & Leighton, L.S., 1989. The Determinants of Changes in U.S. Self-Employment, 1968-1987. *Small Business Economics* 1(2), 111-19.

Fraser Institute, 2006. Economic Freedom of the World: 2006 Annual Report. The Fraser Institute, Vancouver, BC. [http://publications.europa.eu/index\\_en.htm](http://publications.europa.eu/index_en.htm).

Gauthier, B. & Reinikka, R., 2001. Shifting Tax Burdens Exemptions and Evasion: An Empirical Investigation of Uganda. World Bank Policy Research Working Paper Series 2735.

Gentry, W.M. & Hubbard, R.G., 2000. Tax Policy and Entrepreneurial Entry. *American Economic Review* 90 (2), 283-87.

Gentry, W.M. & Hubbard, R.G., 2004a. Tax Policy and Entry into Entrepreneurship. *Advances in Economic Analysis & Policy* 4 (1).

Gentry, W.M. & Hubbard, R.G., 2004b. 'Success Taxes,' Entrepreneurial Entry, and Innovation. National Bureau of Economic Research Working Paper 10551.

Gentry, W.M. & Hubbard, R.G., 2004c. The Effects of Progressive Income Taxation on Job Turnover. *Journal of Public Economics* 88 (11), 2301-22.

Goerke, L., 2003. Tax Evasion and Tax Progressivity. *Public Finance Review* 31.

Gordon, R.H., 1998. Can High Personal Tax Rates Encourage Entrepreneurial Activity? *IMF Staff Papers* 45(1).

Gorodnichenko, Y., Martinez-Vasquez, J. & Peter, K.S., 2009. Myth and Reality of Flat Tax Reform: Micro Estimates of Tax Evasion Response and Welfare Effects in Russia. *Journal of Political Economy* 117(3), 504-54.

Graeff, P. & Mehlkop, G., 2003. The Impact of Economic Freedom on Corruption: Different Patterns for Rich and Poor Countries. *European Journal of Political Economy* 19, 605-20.

Hindriks, J., Keen, M. & Muthoo, A., 1999. Corruption, Extortion and Evasion. *Journal of Public Economics* 74 (3), 395-430.

Holtz-Eakin, D. & Rosen, H., 2001. Economic Policy and the Start-up, Survival, and Growth of Entrepreneurial Ventures. Small Business Administration Report. [http://archive.sba.gov/advo/research/rs206\\_tot.pdf](http://archive.sba.gov/advo/research/rs206_tot.pdf)

Huffman, D. & Quigley, J., 2002. The Role of the University in Attracting High Tech Entrepreneurship: A Silicon Valley Tale. *Annals of Regional Science* 36 (3), 403-20.

Jerusalem Post, September 15, 2011. <http://www.jpost.com/National-News/Tax-Authoritys-Vanunu-convicted-of-accepting-bribes>.

- Johansson, E., 2005. An Estimate of Self-Employment Income Underreporting in Finland. *Nordic Journal of Political Economy* 31 (1), 99-110.
- Koskela, E., 1983. A Note on Progression, Penalty Scheme and Tax Evasion. *Journal of Public Economics* 22 (1), 127-33.
- Kozak, M. 2007. *Micro, Small, and Medium Enterprises: A Collection of Published Data*. Washington, D.C.: International Finance Corporation.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A. & Vishny, R., 1999. The Quality of Government. *Journal of Law Economics & Organization* 15 (1), 222-79.
- Long, J.E. 1982. The Income Tax and Self-Employment. *National Tax Journal* 35 (1), 31-42.
- Desai, M., Gompers, P. & Lerner, P., 2003. Institutions, Capital Constraints and Entrepreneurial Firm Dynamics: Evidence from Europe. National Bureau of Economic Research Working Paper 10165.
- Mocan, N., 2004. What determines corruption? International Evidence from Micro Data. NBER Working Paper 10460.
- Moscow Times. 2005. "Two Charged in \$5.3 Million Bribe." October 20. [http://www.accessmylibrary.com/coms2/summary\\_0286-11177135\\_ITM](http://www.accessmylibrary.com/coms2/summary_0286-11177135_ITM)
- Office of Tax Policy Research. 2006. *World Tax Database*. Stephen M. Ross School of Business, University of Michigan.
- Panades, J., 2004. Tax Evasion and Relative Tax Contribution. *Public Finance Review* 32(183).
- Pissarides, C.A. & Weber, G., 1989. An Expenditure-Based Estimate of Britain's Black Economy. *Journal of Public Economics* 39 (1), 17-32.
- Powell, D. & Shan, H., 2012. Income Taxes, Compensating Differentials, and Occupational Choice: How Taxes Distort the Wage-Amenity Decision. *American Economic Journal: Economic Policy* 4 (1), 224-47.
- PricewaterhouseCoopers Organization. 1990-2005a. *Corporate Taxes Worldwide Summaries*. John Wiley & Sons, New York.
- PricewaterhouseCoopers Organization. 1990-2005b. *Individual Taxes Worldwide Summaries*. John Wiley & Sons, New York.
- PRS Group. 2011. *International Country Risk Guide*. [www.countrydata.com](http://www.countrydata.com) (accessed February 7, 2011).
- Rees, H. & Shah, A., 1986. An Empirical Analysis of Self-Employment in the U.K. *Journal of Applied Econometrics* 1 (1), 95-108.
- Robson, M.T. & Wren, C., 1999. Marginal and Average Tax Rates and the Incentive for Self-Employment. *Southern Economic Journal* 65(4), 757-73.
- Saint Petersburg Times, 2002. "Study: Russians Pay Out \$36 Billion per Year in Bribes." *Saint Petersburg Times*, May 24. <http://www.highbeam.com/doc/1P1-53214605.html>
- Schuetze, H.J., 2000. Taxes, Economic Conditions and Recent Trends in Male Self-Employment: A Canada-US Comparison. *Labour Economics* 7 (5), 507-44.
- Schuetze, H. & Bruce, D., 2004. The Relationship Between Tax Policy and Entrepreneurship: What We Know and What We Should Know. Paper presented at the Conference of Self-Employment, Stockholm.
- Schumpeter, J., 1975 [1942]. *Capitalism, Socialism, and Democracy*. New York: Harper & Row.
- Schumpeter, J., 1982 [1911]. *The Theory of Economic Development*. Edison, NJ, Transition Books.
- Seldadyo, H. & Haan, J., 2005. The Determinants of Corruption: A Reinvestigation. Paper presented at the EPCS-2005 Conference, Durham, England.
- Serra, D., 2004. Empirical Determinants of Corruption: A Sensitivity Analysis. Global Poverty Research Group Working Paper GRPG-WPS-012.
- Socol, C., Socol, A., & Marius, M., 2009. Traps of the flat tax in emerging countries. *African Journal of Business Management* (11), 781-85.
- Staber, U. & Bogenhold, D., 1993. Self-Employment: A Study of Seventeen OECD Countries. *Industrial Relations Journal* 24 (2), 126-37.

Toth, R., 2011. Credit Misplaced? Testing for Household-level Financial Constraints to Enterprise Activity. Paper presented at the NEUDC Conference, Yale.

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

USAID, NIH, Higher School of Economics, & Pension Fund of Russia. Various years. Russia Longitudinal Monitoring Survey. [www.cpc.unc.edu/projects/rlms](http://www.cpc.unc.edu/projects/rlms). (accessed August 12, 2007)

Van Rijckeghem, C. & Weder, B., 2001. Bureaucratic Corruption and the Rate of Temptation: do Wages in the Civil Service Affect Corruption, and by How Much? *Journal of Development Economics* 65, 307-31.

Watson, H., 1985. Tax Evasion and Labour Markets. *Journal of Public Economics* 27 (2), 231-46.

World Bank. 2012. *World Development Indicators 2012*. Washington, DC.

## Financial Sector Quality and Tax Revenue: Panel Evidence

### 1. Introduction

Countries differ in tax policies and in amount of tax revenue they collect from taxpayers. However, there are countries with similar tax policies that collect strikingly different tax revenues as share of GDP. This paper examines the role of financial sector quality on the amount of income tax revenue the government collects from its taxpayers.

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' incomes and economic activities are difficult to monitor and when many firms operate in the underground economy, 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, an increase in the quality of the financial sector can lead to more tax revenue. At the same time, it is possible that the development of the financial sector can facilitate more sophisticated tax planning that leads to a reduction in the tax base. Ultimately, which of these two effects dominates is an empirical question.

At a first glance, data seem to support a positive relationship between financial sector quality and tax revenue. Figure 1 shows the financial sector quality<sup>1</sup> and income tax revenue as share of GDP for the Czech Republic and Poland in 1995 and 2004. The financial sector quality in the Czech Republic changed very little during this period and so did the income revenue as share of GDP. Poland went through a financial reform during this period. But, according to Mullineux (1996), the reforms had many adverse effects on the banking sector. During this time, many private banks were on the brink of bankruptcy, prudential regulations were not observed in the banking sector, the National Bank of Poland gave preferences to state-owned banks and limited the number of licenses for new banks. As a result, the financial indicator decreased from 5.68 in 1995 to 4.63 in 2004. At the same time, income tax revenue as a share of GDP decreased from 11.1% to 5.9%. This figure suggests there is a positive relationship between financial sector quality and income tax revenue.

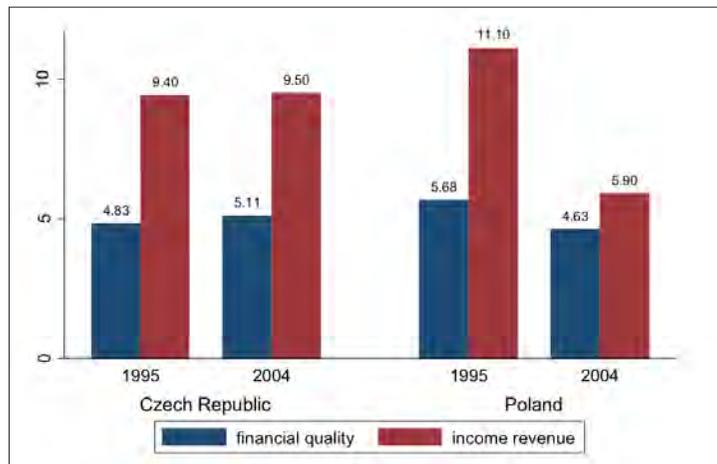


Fig 1. Financial sector quality and income revenue for two countries

<sup>1</sup> It is measured on a scale from 0 to 10 where 0 stands for poor financial sector and 10 for a very good financial sector.

Figure 2 shows the average income tax revenue collected by governments in countries with different levels of financial sector quality. Countries in the bottom 33 percentile of financial quality collect only 5.11% of GDP in income taxes, while countries in the top 33 percentile collect 11.95% of GDP in income taxes. This figure suggests that income tax revenue increases as financial quality improves.

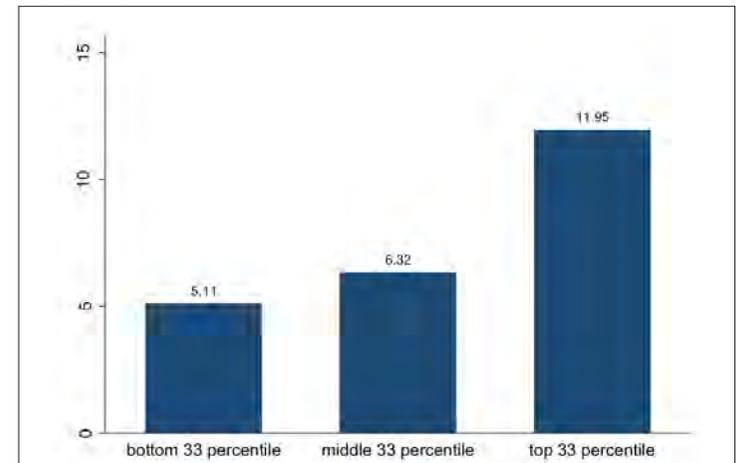


Fig 2. Income tax revenue per GDP by F percentiles

Obviously these two graphs are not definite proof that an increase in financial sector quality leads to more income tax revenue. Other factors such as a decrease in GDP could explain both the decrease in financial sector quality and the decline in income tax revenue in Poland and specific characteristics of the countries at the top of the financial sector quality distribution could explain their ability to collect more income taxes. Such factors are taken into account in a regression analysis. In this study, I use an unbalanced panel data from 57 countries and 17 years in a fixed effect model to estimate the effects of financial quality on tax revenue. I construct

a financial sector indicator; F. F contains measurements of banking sector, stock market, other financial institutions, monetary policy and quality of institutions. It covers most areas of the financial sector that might lead to more transparency and thus, to more revenue. I construct a dataset of tax variables from five sources that include marginal tax rates for personal income tax, corporate income tax, and the tax brackets for these two taxes. I find that financial quality leads to more personal and overall income revenues as share of GDP. I also use instrumental variables in order to avoid reverse causality. The two stage least square approach shows that financial sector quality leads to more personal, corporate and overall income revenue per GDP. In the end, I perform various robustness checks and the results remain the same. I also use a placebo test and measure the effects of financial quality on revenues from taxes on activities that do not require good transparency in the financial sector to measure them. The results show that financial sector does not affect tax revenues of this sort.

The paper is organized as follows. Section 2 reviews previous studies that analyze tax revenue and financial sector development. Section 3 describes the tax dataset I constructed for this study, Section 4 presents the rest of the data and the way the variables were constructed, Section 5 shows the econometric model, Section 6 describes the results of the paper and Section 7 concludes.

## 2. Previous studies of tax revenues and financial sectors

Numerous papers study the determinants of tax revenues, but the one that is the most relevant to this paper is Gordon and Li (2005). The authors develop a tax model 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 is low and the tax base is narrow. 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 various measures of income tax revenue as a share of GDP.

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 such as bureaucracy and corruption in the construction the financial sector indicator and in regression analysis, as direct determinants of tax revenue. I find that higher bureaucracy and corruption contribute to a worse financial sector that, in turn, leads to less tax revenue as share of GDP. When analyzed in the same regression, more bureaucracy and corruption lead to less personal income tax revenue as share of GDP and more bureaucracy leads to less corporate income tax revenue per GDP.

Various studies link tax revenue to tax rates and macroeconomic conditions. Treisman (1999) tries to explain the sharp fall in Russian tax revenues and concludes that tax rates and general macroeconomic problems common to transitional economies play an important role in the declining tax revenue. Dye (2004) links tax revenue to business cycles. Peter et al (2010) use cross-country regression to find a positive relationship between tax rates and revenue for high income countries, but that this relationship decline with weaker institutions and lower levels of economic

development. I also consider macroeconomic indicators like GDP per capita and inflation and marginal tax rates in the analysis of tax revenue.

Boadway and Sato (2009) examine the trade-offs between a value added tax (VAT) system of taxation with a system of trade taxes in their ability to raise revenue in the informal sector. In the same spirit, I am considering VAT revenue as an alternative to income tax revenue when the financial sector is not fully developed and the government cannot extract income tax revenue from the underground economy. I look at the determinants of VAT revenue and find that financial sector quality does not influence the VAT revenue since the government does not need a sophisticated financial sector to collect this type of revenue.

This paper also adds to the research related to the measurement of the financial sector development. Amable and Chatelain (2001), Beck et al. (2004), Luintel et al. (2008), and Odedokun (1996) investigate the relationship between financial intermediary and economic growth, total factor productivity growth, physical capital accumulation and private saving rates. My paper looks at other possible effects of improving financial quality. Similar to some of these previous studies, I also use private credit per GDP as one of the measures of financial quality, but I add other measures in order to capture multiple aspects of the financial sector that might affect tax revenue.

In their 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 the Crane et al study because I use continuous values of each variable rather than discrete values and I use factor analysis to extract more information from several highly correlated variables.

### 3. Tax dataset

I construct a dataset of tax rates and tax brackets for personal, corporate income and value added taxes that cover 162 countries over 30 years (1981-2010) and account for 3,490 observations. The tax data comes from five sources: AEI International Tax Database (American Enterprise Institute 2011), Eurostat tax data (European Commission 2007), PricewaterhouseCoopers tax data (PricewaterhouseCoopers 1990-2005a and b), World Development Indicators (World Bank 2011), and the World Tax Database (Office of Tax Policy Research 2006). The personal income tax rates and brackets have been collected from multiple yearly issues of the "Individual Taxes Worldwide Summaries," yearly PricewaterhouseCoopers books on the details of personal income tax of every country. The highest corporate income tax rates and brackets have been collected from issues of the "Corporate Taxes Worldwide Summaries," yearly PricewaterhouseCoopers books on the details of corporate income tax of every country. The corporate tax rates have been also added from "Taxation trends in the European Union Main results," a publication of the European Commission. This data was merged with the marginal rates and tax brackets for both corporate and income taxes from the AEI International Tax Database and with top marginal tax rates from the World Development Indicators and the World Tax Database.

In this data, the highest personal income tax rate ranges from 0% in countries like Kuwait, Oman or Saudi Arabia to 95% in Tanzania. The median value is 37% in countries like Finland, Thailand, Japan and Peru. The highest corporate income tax rate ranges from 0% in several countries like Bahamas, Bahrain, and Bermuda to 75% in Iran. Countries like Argentina, Brazil and Italy with the highest marginal tax rate of 33% are at the 50th percentile of the distribution. Figure 3 shows the highest personal and corporate income tax rates averaged by region of the world. Sub-Saharan Africa has the highest average for personal income tax rates and South Asia has the highest for corporate income tax rates. Figure 4 shows the trend of highest personal and corporate marginal tax rates from 1980 to 2010. The rates decreased steadily over time.

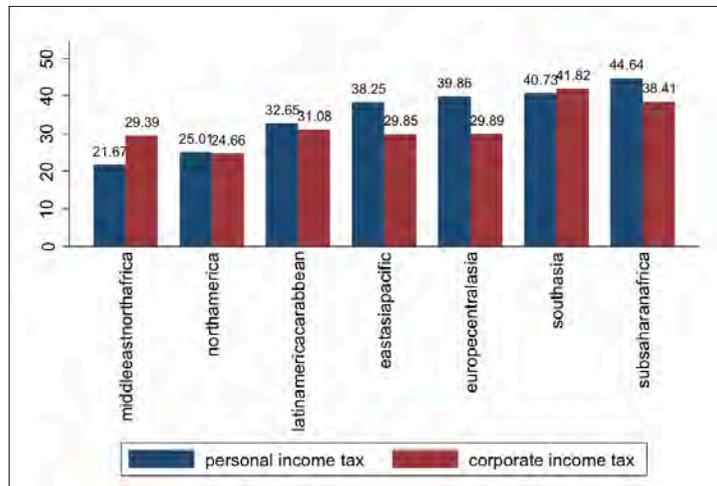


Fig 3. Highest personal and corporate income tax rates by region

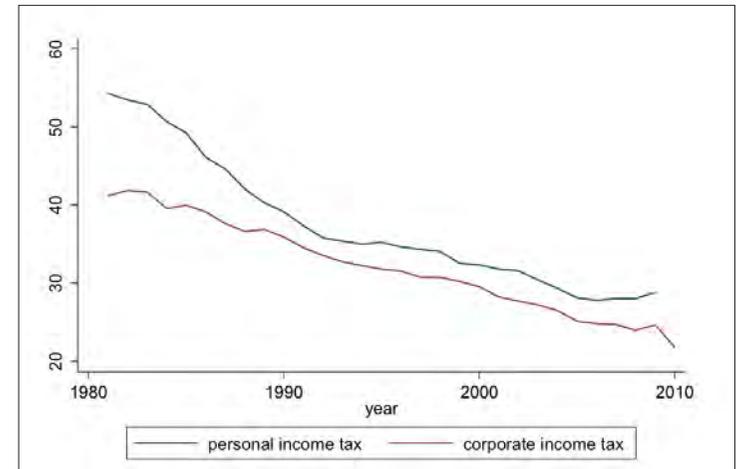


Fig 4. Highest personal and corporate rates over time

The data contains the tax brackets for personal and corporate income taxes. Countries like Mexico, Philippines, and Spain with 26 different tax brackets have the highest number of personal income tax brackets in the dataset. Countries like Austria, Barbados, Costa Rica and Honduras with four different brackets are at the 50th percentile, while countries like Hungary, Iceland and Jamaica with one bracket (flat personal income tax rates with an exemption at the bottom) are in the bottom 10th percentile of the distribution.

Corporate income taxes are in general less progressive than personal income taxes. On average, countries have 3.39 corporate income tax brackets compared to 5.69 personal income tax brackets. Also, the number of personal income tax brackets does not correlate well with the number of corporate income taxes (the correlation coefficient is 0.18). It is common for countries to have very progressive personal income taxes and flat corporate taxes. For example, Mexico and Philippines have 26 personal income

tax brackets and only one bracket for the corporate income tax. Figure 5 shows the number of brackets for personal and corporate income taxes averaged by region of the world. Sub-Saharan Africa has the most progressive personal income tax systems and North America has the most progressive corporate income tax systems. Figure 6 shows the evolution of number of brackets over time for personal and income taxes. Both countries seem to become less progressive over time, but the decrease in progressivity is more pronounced in personal income taxes than in corporate income taxes.

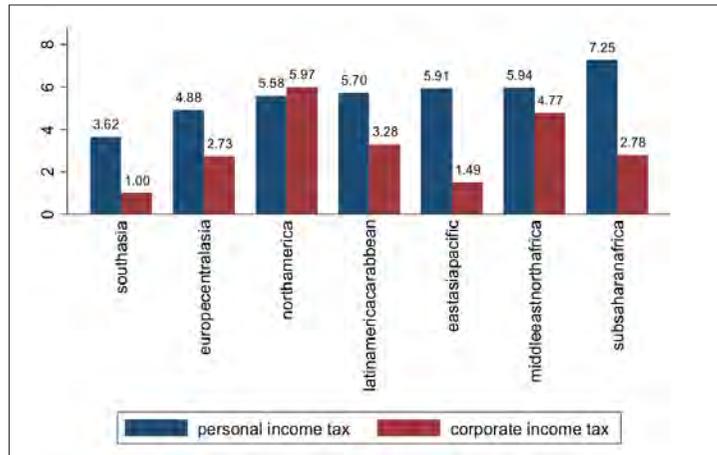


Fig 5. Number of brackets for personal and corporate income taxes by region

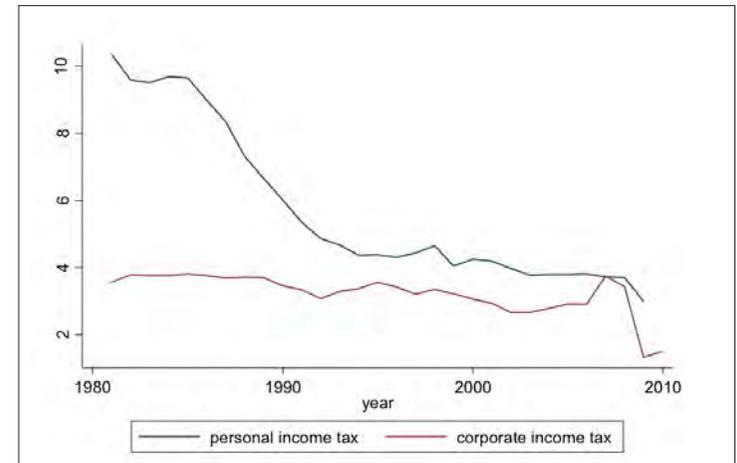


Fig 6. Number of brackets for personal and corporate income taxes over time

#### 4. Data description and construction of the financial sector indicator

I use an unbalanced panel of data from 57 countries and over 17 years (1988-2004). Table 1 shows the summary statistics for the observations used in the regression analysis. Data in this paper can be broken into three main categories: financial sector data, tax data, and macroeconomic controls.

Table 1. Descriptive statistics for dependent and independent variables

	Obs	Mean	Std. Dev.	Min.	Max.
interest spread	427	8.22	10.66	-8.85	114.15
domestic credit	427	1587.67	11754.34	6.29	112186.3
liquid reserves	427	9.26	9.36	0.23	60.80
turnover ratio	427	47.11	50.48	0.03	380.3
market capitalization	427	46.66	53.28	0.16	328.87
insurance export	427	4.36	6.31	-1.46	41.25

	Obs	Mean	Std. Dev.	Min.	Max.
insurance import	427	6.41	6.29	-0.09	43.13
exchange rate stability	427	-2.27	20.65	-254.8	43.5
corruption	427	3.51	1.36	0	6
bureaucracy	427	2.68	1.03	0	4
F	427	4.93	1.71	0	10
F lagged	360	4.90	1.72	0	10
inflation	427	9.51	13.99	-1.16	154.76
inflation GDP deflator	427	9.94	14.16	6.57	147.30
GDP/cap	427	8749.13	10127.33	306.44	38551.03
agriculture	427	9.10	6.89	0.39	32.49
G/GDP	427	15.43	5.08	4.50	32.19
income tax/GDP	427	8.24	5.15	0.21	28
personal tax/GDP	192	8.15	4.46	0	24.8
corporate tax/GDP	191	3.16	1.27	1	8.9
VAT/GDP	203	5.74	2.38	0	9.9
personal rate	427	35.48	11.24	0	60
corporate rate	427	31.75	7.70	0	50
min rate	427	37.03	9.56	0	60
VAT rate	383	14.08	6.98	0	25

First, the financial data is used to assess the quality of the financial sector. All the financial variables are taken from the World Development Indicators (World Bank 2011). The paper uses ten indicators to measure five areas of the financial sector that can have an impact on government's ability to collect revenue. The quality of the financial sector is measured in the banking sector, stock market, insurance and other financial services, monetary policy and institutional quality.

The paper uses interest rate spread, domestic credit to the private sector provided by the banking sector as a share of GDP (*domestic*

*credit*), and bank liquid reserves to bank assets ratio to measure the quality of the banking sector (*liquid reserves*). *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 cash in transactions. If using cash is common in an economy, then it is harder for the government to detect income from legal activities and also easier for people to operate in the underground economy and thus, hide even more income from authorities. 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. *liquid reserves* 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. When the *domestic credit* is large and the ratio is small, more companies and individuals use bank loans, making easier for the government to collect financial information on taxpayers.

Next, I use *turnover ratio* and market capitalization as a share of the GDP (*market cap*) to measure the stock market development. The variable *turnover ratio* is the total value of shares traded during the period divided by the average market capitalization for the period. The variable *market capitalization* as a share of the GDP is the value of the listed shares divided by the GDP. *Market capitalization* indicates 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 for 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 other financial services exports as share of service exports (*insurance exports*) and insurance and other financial services imports as share of service imports (*insurance imports*) as two measures for these other areas of financial markets. If exports and imports of insurance and financial services represent a large share of the traded service sector, then more financial transactions take place. Assuming that financial exports and imports are equally easy or easier to monitor by the government than the domestic financial transactions, then a large volume of exports and imports of financial services corresponds 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. The stability of the exchange rate 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.

Finally, the institutional environment plays an important role in the overall quality of the financial sector, so I also consider measures of bureaucracy and corruption in this analysis. These two measures are taken from the International Risk Guide (PRS Group 2011). 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. *Bureaucracy* is an index that ranges from 0 to 4, where higher values indicate lower bureaucracy levels. *Corruption* is measured on a scale from 0 to 6, where 6 indicates a lower level of corruption.

I use all of the above variables to create a comprehensive financial quality indicator. I fit a principal factor model on the z scores of the ten variables, 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

$$F_{ij} = 10 \frac{f_{ij} - \min f_{ij}}{\max f_{ij} - \min f_{ij}} \quad (1)$$

I keep only the first factor since it is one that explains the most and it is much higher than 1. The other factors have eigenvalues very close to one the critical value under which factors do not explain enough of the variation. Table 2 shows the factor loadings used in estimating the financial indicator  $f_{ij}$ , Table 3 shows the scoring coefficients for each of the ten z scores and Table 4 the Kaiser-Meyer-Olkin measure of sampling adequacy. The measure varies between 0 and 1, and an overall value of .64 is an acceptable value showing that the variables have enough in common to warrant factor analysis.

Table 2. Factor loadings

Observables	Factor1
interest spread z score	-0.44
domestic credit z score	0.09
liquid reserves z score	-0.68
turnover ratio z score	0.49
market capitalization z score	0.62
insurance export z score	0.37
insurance import z score	-0.12
exchange rate stability z score	0.26
corruption z score	0.69
bureaucracy z score	0.84

Table 3. Scoring coefficients

Observables	Factor1
interest spread z score	-0.16
domestic credit z score	0.03
liquid reserves z score	-0.24
turnover ratio z score	0.18
market capitalization z score	0.22
insurance export z score	0.13
insurance import z score	-0.04
exchange rate stability z score	0.09
corruption z score	0.25
bureaucracy z score	0.30

Table 4. Kaiser-Meyer-Olkin measure of sampling accuracy

Observables	kmo
interest spread z score	0.68
domestic credit z score	0.61
liquid reserves z score	0.78
turnover ratio z score	0.83
market capitalization z score	0.63
insurance export z score	0.48
insurance import z score	0.35
exchange rate stability z score	0.83
corruption z score	0.63
bureaucracy z score	0.65
overall	0.64

The median of the financial indicator is 4.57 (value attained by Trinidad and Tobago in 1999). 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 have higher financial sector quality than developing countries. Mean  $F$  for Switzerland is 9.20 and mean  $F$  for Canada is 7.33. Mean  $F$  for Bangladesh is 3.53 and mean  $F$  for Colombia is 4.08.  $F$  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 in developed countries than in developing countries. Figure 7 presents the mean  $F$  for all the countries in the sample.

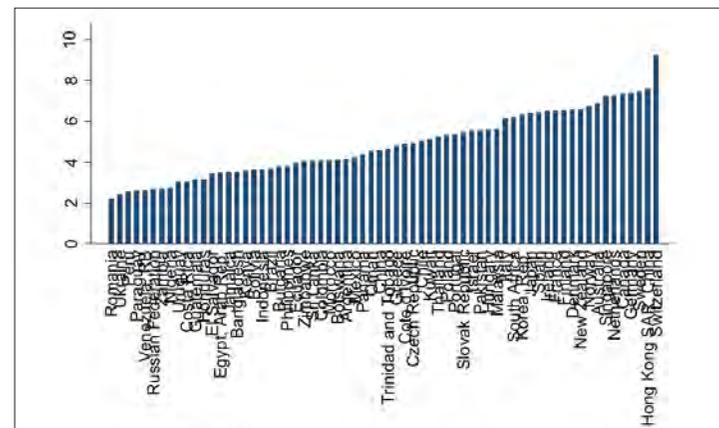


Fig 7. Mean financial indicator by country

Other variables used in the analysis are *inflation*, measured as annual percentage change in the consumer price index, GDP per capita measured in 2000 US dollars (*GDP/capita*), agriculture value added as share of GDP (*agriculture*) and government expenditures

per GDP ( $G/GDP$ ). The macroeconomic variables come from the World Development Indicators (World Bank 2011). Table 1 presents the summary statistics for the observations used in the regression analysis.

Using the tax dataset, I construct four tax rate variables: highest personal rate, the top marginal rate for personal income tax, highest corporate rate, the top marginal rate for corporate income tax, mean personal rate, and the minimum between these two highest rates (min rate). Ideally, this last variable would capture the most relevant marginal rate since taxpayers try to pay the lowest of the two rates by incorporating or failing to incorporate. In the analysis, I also use the value-added tax rate (VAT rate) which is taken from the AEI International Database.

The dependent variables in this paper are income tax revenue per GDP ( $income\ tax/GDP$ ), personal income tax revenue per GDP ( $personal\ income\ tax/GDP$ ), corporate income tax revenue per GDP ( $corporate\ income\ tax/GDP$ ) and VAT revenue per GDP ( $VAT/GDP$ ). Income tax revenue includes personal income tax revenues, corporate tax revenues, and capital gains. The median income tax revenue per GDP is 5.89% (Zambia 1994). Denmark in 2005 with 31.2%, Israel in 1982 with 24.09% and Sweden in 1988 with 22.8% are in the top 10% percentile of the distribution while countries like Tajikistan in 1999 with .7%, Russia in 2003 with 1.25% and Peru in 1989 with 1.13% are in the bottom 10% percentile of the distribution. The income tax revenue, personal income tax revenue, corporate income tax revenue and VAT revenue come from Government Finance Statistics (International Monetary Fund 2011), OECD Tax Statistics (Organization for Economic Cooperation and Development 2011), European Commission tax revenue data (European Commission 2012), and the World Development Indicators (World Bank 2011).

Table 10 in the Data Appendix presents average by country for the highest personal rate, highest corporate rate, and  $F$ . It also shows which countries are included in the regression analysis (have non-missing values for all variables in the main specification).

Data comes from various sources and unfortunately the number of observations that have all the information for the regression analysis is small. Data on financial sector quality cover 66 countries over 17 years and represent 590 observations, data on tax rates and revenues cover 38 countries over 28 years and represent 739 observations and data on macroeconomic controls cover 161 countries and 49 years and represent 4,640 observations. In the end, the data used in the analysis covers 17 years (1988-2004) and 57 countries and the number of observations ranges from 159 to 428, depending on the specification.

## 5. Econometric model

This paper estimates the effects of the financial sector quality on the income tax revenue as share of GDP. Tax revenue per GDP 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 financial information.

In the first estimation, I use income tax revenue as a share of GDP as the dependent variable and the measure of financial quality as an independent variable. I also control for tax rates, macroeconomic variables, time and country dummies. Equation (2) summarizes this approach:

$$\text{income tax/GDP}_{it} = \beta_0 + \beta_1 F_{it} + \beta_2 X_{it} + \beta_3 \text{highest personal rate}_{it} + \beta_4 \text{highest corporate rate}_{it} + c_i + \tau_t + \varepsilon_{it} \quad (2)$$

where  $i$  the index for country  $i$ ,  $t$  is the index for year  $t$ ,  $c_i$  is the country dummy and  $\tau_t$  is the year dummy,  $X_{it}$  is a vector of macroeconomic controls including GDP/capita, inflation, agriculture and government expenditures/GDP.

I expect an increase in  $F$  to lead to an increase in income tax revenue as a share of GDP. As financial sector improves, more people use it and leave more paper trails and the government can tax more income. I control for GDP per capita because an increase in GDP leads to more economy activity and to more income tax revenue per GDP. 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 losses, 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 the economy declines more, then an increase in inflation leads to a decrease in income tax revenue as share of GDP. I also include tax rates in the analysis because the higher the rate, higher the collected tax revenue. The two marginal tax rates should increase the income tax revenue as share of GDP. I also add agriculture value added per GDP as a control because income from agriculture is notoriously hard to tax (Long (1990) documents the high tax avoidance in the agriculture sector). It follows that countries that rely on agriculture face high tax evasion and collect little tax revenue. High government expenditures might lead the government to increase tax revenues.

Specification (2) might suffer from endogeneity. It is possible that when governments collect more revenue, they use that revenue to improve the financial sector and thus, we can have reverse causality in (2). I use  $F$  lagged as an instrument for  $F$  to correct this potential problem. The quality of the financial sector in the previous year is correlated with the financial sector quality of the current year, but the only way last year's quality of the financial sector affects the income tax revenue per GDP in the current year is through the current year's financial sector quality. Thus,  $F$  lagged is correlated with  $F$  and not correlated with the error term. The first stage regression is:

$$F_{it} = \alpha_0 + \alpha_1 F_{it} \text{ lagged} + \alpha_2 Z_{it} + \alpha_3 \text{personal rate}_{it} + \alpha_4 \text{corporate rate}_{it} + c_i + \tau_t + \varepsilon_{it} \quad (3)$$

$Z_{it}$  is a vector of country characteristics including GDP per capita, government expenditures per GDP, inflation and agriculture.

In robustness checks, I also control for the minimum between the highest personal and corporate rates because people might incorporate if the corporate rate is lower than the personal tax rate and fail to incorporate if the opposite is true. Thus, the minimum between the two highest rates for the two types of income might have the most explanatory value. I also use other measures of inflation to see if the results remain unchanged.

Finally, I use a placebo test. I look at the effects of financial quality  $F$  on value added tax revenue as share of GDP. If the effects of  $F$  capture the increased visibility of income due to increased use of financial services, the effects of  $F$  on VAT revenue should be zero. VAT is "self-enforcing" because every trader makes sure that their suppliers paid the VAT in order to claim the correct credit for themselves. The authorities can also cross-check invoices and

verify that every claim is matched by an output tax (Keen and Smith 2007). The government does not need a good financial sector in order to see the sources of value added tax. They can collect the revenue even if the financial sector is mediocre. The equation I am estimating is:

$$VAT/GDP_{it} = \gamma_0 + \gamma_1 F_{it} + \gamma_2 X_{it} + \gamma_3 VAT\ rate_{it} + c_i + \tau_t + e_{it} \quad (4)$$

## 6. Empirical results

First, Figure 8 shows the results graphically. The scatterplot of the financial sector indicator against income tax revenue as share of GDP shows a positive correlation between the two variables. Second, Tables 5-9 show the effects of the financial sector on income tax revenues as share of GDP using OLS and 2SLS approaches.

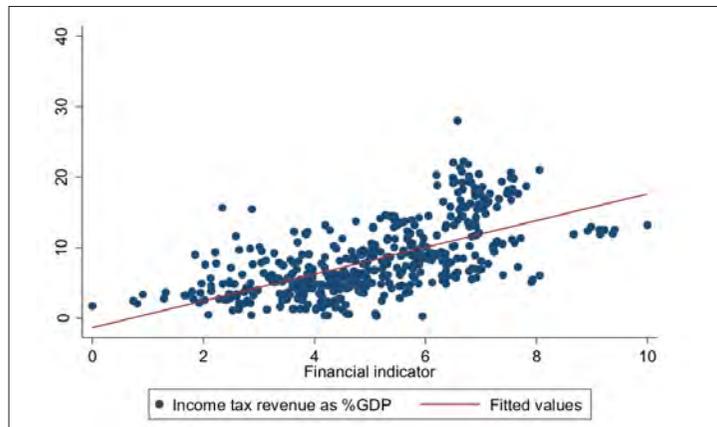


Fig 8. Income tax revenue as percent of GDP versus financial quality

Table 5 shows the regression results of the effects of financial sector quality on various tax revenues as shares of GDP. The first specification, in column (1), has income tax as share of GDP as

dependent variable and financial sector quality, highest personal rate, highest corporate rate, GDP/capita, inflation, agriculture, government expenditures per GDP, time and country dummies as independent variables. The results show that an increase of 1 point in  $F$  leads to an increase of 0.64 percentage points in income tax as share of GDP. An increase of one point in  $F$  is equivalent to a change in the quality of financial sector from in Colombia in 1993 to the level of the one in Spain in 1995. ....64% This effect could also be interpreted as one standard deviation increase in  $F$  leading to an increase of ...0.21 standard deviations in income tax revenue per GDP.

Table 5. The effects of  $F$  on income tax revenues (OLS)

	income tax/GDP (1)	personal tax/GDP (2)	corporate tax/GDP (3)
$F$	0.64 (0.28)**	0.62 (0.25)**	0.29 (0.18)
corporate rate	0.06 (0.03)*		0.02 (0.02)
personal rate	-0.03 (0.04)	0.03 (0.02)	
GDP/cap	0.0002 (0.0002)	0.00006 (0.0001)	0.0002 (0.0001)
inflation	0.01 (0.007)**	-0.003 (0.007)	0.004 (0.005)
agriculture	-0.02 (0.09)	-0.07 (0.12)	-0.07 (0.07)
G/GDP	-0.04 (0.10)	0.19 (0.06)***	0.002 (0.11)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
R-squared	0.9501	0.9802	0.7525
Observations	427	193	194

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

Column (2) shows the results of the regression with the personal income tax revenue as share of GDP as a dependent variable. The coefficient of  $F$  is again positive and it is significant at 5% level, but it is lower than in the first specification. An increase of one point in the financial indicator leads to an increase of 0.62 percentage points in personal income tax as share of GDP. Column (3) shows the effects of  $F$  on corporate income tax revenue as share of GDP. The effect of  $F$  is again positive, but it is not significant at 10% level.

The data on personal income tax and corporate income tax revenue come from different sources than the income tax revenue data. As a result, the number of observations for the specifications involving personal income tax revenue and corporate income tax revenue is much smaller than the one with income tax revenue.

The highest marginal rates for corporate and personal taxes affect income tax revenues positively in most specifications. However, in the first column, highest personal rate is not significantly different from zero when the regression controls for highest corporate rate, country and year fixed effects. In later specifications, I control for other measures of marginal tax rates such as the minimum between the highest marginal tax rates for personal income tax and corporate income tax to correctly capture the rates that matter the most in determining the tax revenue.

Table 6 shows further robustness checks. I control for the individual variables that enter into  $F$ : *interest rate spread*, *domestic credit*, *liquid reserves*, *turnover ratio*, *market capitalization*, *insurance exports*, *insurance imports*, *exchange rate stability*, *corruption* and *bureaucracy*. Column (1) uses income tax as share of GDP as a dependent variable, column (2) uses personal income tax revenue as share of GDP as dependent variable and finally, (3) uses corporate income tax revenue as share of GDP as dependent variable. Across all three specifications, only six out of the ten financial

sector variables are statistically significant probably because these variables are highly correlated with each other. As the interest rate spread increases, the banking market becomes less competitive, and the government collects less income tax revenue as share of GDP. As banks keep more liquid reserves, they are lending less to the private sector, they provide less information the government, and the government collects less income tax revenues per GDP. *Market cap* is positive and statistically significant. High market capitalization means that more information from financial transactions is made available to the government and that the government is better able to collect income tax revenue and corporate income tax revenue. When the value of exchange rate stability is high, the financial sector quality is poor which leads to less corporate income tax per GDP. The coefficients for corruption and bureaucracy are positive and significant. Since high bureaucracy and corruption scores mean less bureaucracy and less corruption, the positive coefficients of bureaucracy and corruption mean that less bureaucracy and less corruption lead to higher tax revenue as share of GDP.

**Table 6. Effects of individual financial variables on income tax revenue (OLS)**

	income tax/GDP (1)	personal tax/GDP (2)	corporate tax/GDP (3)
interest spread	-0.03 (0.01)***	0.08 (0.09)	0.05 (0.04)
domestic credit	-0.00001 (0.0001)	0.00004 (0.00009)	-0.00005 (0.00008)
liquid reserves	-0.04 (0.02)**	-0.01 (0.02)	-0.004 (0.01)
turnover ratio	0.005 (0.005)	0.001 (0.002)	-0.0003 (0.001)
market capitalization	0.008 (0.004)*	0.006 (0.004)	0.01 (0.005)**
insurance export	0.004 (0.02)	0.01 (0.03)	-0.04 (0.07)
insurance import	-0.005 (0.03)	0.03 (0.06)	-0.003 (0.06)
exchange rate stability	-0.003 (0.004)	-0.005 (0.005)	-0.01 (0.004)**
corruption	0.12 (0.13)	0.25 (0.10)**	0.12 (0.13)
bureaucracy	0.30 (0.47)	1.26 (0.44)***	0.87 (0.23)***
corporate rate	0.06 (0.03)*		0.03 (0.02)
personal rate	-0.03 (0.04)	0.02 (0.01)	
GDP/cap	0.0002 (0.0002)	0.00006 (0.0001)	0.0002 (0.0001)
inflation	0.01 (0.007)**	0.001 (0.01)	0.009 (0.006)
agriculture	-0.02 (0.08)	-0.07 (0.13)	-0.10 (0.08)
G/GDP	-0.05 (0.08)	0.24 (0.08)***	0.02 (0.09)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
R-squared	0.9519	0.9823	0.7886
Observations	427	193	194

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

Table 7 shows the first stages of the instrumental variable approach using  $F$  lagged as an instrument for  $F$ . The first column shows the first stage regression estimating the effects of the lagged financial sector quality on the financial sector quality controlling for the highest personal and corporate income tax rates and the other exogenous macroeconomic variables. The second column controls for the highest personal income tax rate and the other macroeconomic controls and the final one controls for the highest marginal corporate income tax rate and the other macroeconomic variables. In all three first stage regressions, the  $F$  lagged and  $F$  are highly correlated. The coefficient for  $F$  lagged is significant at 1% level in all three specifications. The F-statistic is higher than 90 in all regressions. The instrument and the endogenous variables are clearly correlated and there is no reason why the quality of the financial sector in the previous year to affect tax revenues other than through the quality of the financial sector in the current year.

Table 7. First stage regressions

	(1)	F (2)	(3)
F lagged	0.61 (0.06)***	0.61 (0.06)***	0.60 (0.06)***
corporate rate	-0.002 (0.01)		0.0008 (0.009)
personal rate	0.005 (0.009)	0.004 (0.008)	
GDP/cap	0.00001 (0.00003)	0.00001 (0.00003)	0.00001 (0.00003)
inflation	0.002 (0.003)	0.002 (0.003)	0.002 (0.003)
agriculture	-0.003 (0.01)	-0.003 (0.01)	-0.004 (0.01)
G/GDP	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
R-squared	0.9456	0.9456	0.9448
F statistic	99.46	100.64	94.93
Observations	414	414	428

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

Next, I look at the second stage regressions for these 2SLS models. Table 8 shows the effects of  $F$  on *income tax/GDP*, *personal income tax/GDP*, and *corporate income tax/GDP* using the instrument described above.  $F$  affects positively the personal income tax revenue per GDP, the corporate income tax per GDP and the overall income tax revenue per GDP. The magnitude of the effects is higher than in the OLS specifications. Unlike the OLS analysis, the coefficient of  $F$  is statistically significant in all three 2SLS specifications.

Table 8. Second stage regressions (2SLS)

	income tax/GDP (1)	personal tax/GDP (2)	corporate tax/GDP (3)
F	0.86 (0.46)*	0.96 (0.47)**	0.66 (0.37)*
corporate rate	0.06 (0.04)		0.01 (0.02)
personal rate	-0.04 (0.04)	0.009 (0.03)	
GDP/cap	0.0002 (0.0002)	-0.0001 (0.0001)	0.0001 (0.0002)
inflation	0.01 (0.007)**	-0.002 (0.01)	-0.003 (0.009)
agriculture	-0.02 (0.10)	-0.03 (0.15)	-0.03 (0.11)
G/GDP	-0.05 (0.10)	0.18 (0.08)**	0.07 (0.09)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
R-squared	0.9469	0.9829	0.8078
Observations	360	159	160

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

Table 9 presents some robustness checks. First, I control for the inflation calculated based on the GDP deflator instead of the usual measure based on CPI. The effect of  $F$  stays positive and significant and the magnitude stays almost the same as in the 2SLS regression (Table 8 column (1)). Next, I control for the minimum between the two highest marginal tax rates for personal and corporate income because people might choose to pay the income tax for which the tax is the lowest. The effect of  $F$  is positive and significant, but higher than in the original 2SLS specification. The R-squared is almost the same for the two specifications and the minimum rate is not significant, so it is not clear that this rate is a better determinant of the tax revenue than the two highest rates used in the original

specification. Finally, I perform a placebo test by looking at the effects of  $F$  on the *VAT revenue*. VAT is self-enforcing and thus it is not necessarily to have a good financial system to observe the value added that is being taxed. Thus, we do not expect this revenue to be affected by  $F$ . Indeed, the coefficient of  $F$  is statistically not different from zero.

**Table 9. Robustness checks (2SLS second stage)**

	income tax/GDP (1)	income tax/GDP (2)	VAT/GDP (3)
$F$	0.89 (0.48)*	0.98 (0.49)**	0.17 (0.16)
corporate rate	0.04 (0.03)		
personal rate	-0.03 (0.04)		
min rate		-0.03 (0.03)	
VAT rate			-0.008 (0.06)
GDP/cap	0.0002 (0.0002)	0.0002 (0.0002)	-0.00004 (0.00005)
inflation GDP deflator	0.01 (0.008)*		
inflation		0.02 (0.008)**	-0.02 (0.009)**
agriculture	-0.009 (0.09)	-0.002 (0.10)	0.04 (0.15)
G/GDP	-0.04 (0.10)	-0.01 (0.10)	-0.005 (0.06)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
R-squared	0.9468	0.9453	0.9738
Observations	381	360	160

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

## 7. Conclusions

This paper constructs a dataset of marginal tax rates and brackets and a new measure of financial quality,  $F$ .  $F$  is constructed from ten variables that measure the quality of the banking sector, stock market, insurance and other financial markets, monetary policy, and institutions. The paper uses this constructed dataset and new measure of financial quality to examine the effects of financial sector quality on income tax revenue as a share of GDP.

The study reaches four main conclusions. First, an increase of 1 point in financial sector quality increases personal income tax revenue as share of GDP by 0.86 percentage points (2SLS estimation). Second, an increase of one point in  $F$  leads to an increase of personal income tax by 0.96 percentage points. Third, the same increase in financial sector quality increases corporate income tax by 0.66 percentage points (2SLS estimation). And fourth, revenues coming from taxes levied on activities that are easily observable are not affected by changes in financial sector quality.

Despite the encouraging results, the study still 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 revenue data is available, but it comes from various sources and some data are inconsistent across these different sources.

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 also run the analysis on a cross-section of countries, but unfortunately, the sample is too small to do an econometric analysis using 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 and measures of the development, profitability, privatization and concentration in the banking sector. However, there is difficult to find such variables that are measured similarly for all countries in the sample.

Finally, the results have important policy implications. The results indicate that reforms of certain areas of the financial sector may lead to an increase in income 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 this paper's results, the government can hope to recoup some of the costs later from higher income tax revenues.

Also, the results show that an increase in financial sector quality increases personal, corporate and overall income tax revenue per GDP even if we keep marginal tax rates constant. Thus, a government who wishes to increase tax revenues without increasing marginal tax rates could accomplish this simply by improving the quality of its financial sector.

## References

- Amable, B., & Chatelain, J., 2001. Can financial infrastructures foster economic development? *Journal of Development Economics* 64(2), 481-498.
- American Enterprise Institute., 2011. AEI International Tax Database. Washington, D.C.: American Enterprise Institute.
- Beck, T., & Levine, R., 2004. Stock Markets, Banks, and Growth: Panel Evidence. *Journal of Banking and Finance* 28(3), 423-442.
- Berkowitz, D., & Li, W., 2000. Tax Rights in Transition Economies: A Tragedy of the Commons? *Journal of Public Economics* 76(3), 369-397.
- Boadway, R., & Sato, M., 2009. Optimal Tax Design and Enforcement with an Informal Sector. *American Economic Journal, Economic Policy* 1(1), 1-27.
- Creane, S., Goyal, R., Mobarak, A., & Sab, R., 2004. Financial Sector Development in the Middle East and North Africa. IMF Working Paper Series 04/201.
- Organization of Economic Cooperation and Development, 2011. OECD Tax Statistics. Organization of Economic Cooperation and Development. Retrieved March 6, 2011, from <http://www.oecd-ilibrary.org/>
- Dye, R., 2004. State Revenue Cyclicalilty. *National Tax Journal*, LVII(1), 133-145.
- European Commission, 2007. Taxation Trends in the European Union Main Results. Eurostat statistical books. Retrieved March 6, 2011, from Eurostat statistical books: [http://publications.europa.eu/index\\_en.htm](http://publications.europa.eu/index_en.htm)
- European Commission, Taxation and Customs Union., 2012. Revenue data by individual tax. Retrieved June 20, 2012, from [http://ec.europa.eu/taxation\\_customs/taxation/gen\\_info/economic\\_analysis/tax\\_structures/article\\_5985\\_en.htm](http://ec.europa.eu/taxation_customs/taxation/gen_info/economic_analysis/tax_structures/article_5985_en.htm)
- Gordon, R., & Li, W., 2005. Tax Structures in Developing Countries: Many Puzzles and a Possible Explanation. NBER Working Paper w11267.

International Monetary Fund, 2011. Government Finance Statistics. Washington, DC: International Monetary Fund.

Keen, M., & Smith, S., 2007. VAT Fraud and Evasion: What Do We Know, and What Can Be Done? . IMF Working Paper 07/31. Washington, DC: International Monetary Fund.

Long, J., 1990, February. Farming the Tax Code: The Impact of High Marginal Tax Rates on Agricultural Tax Shelters. American Journal of Agricultural Economics 72(1), 1-12.

Luintel, K., Khan, M., Arestis, P., & Theodoridis, K., 2008. Financial Structure and Economic Growth. Journal of Development Economics 86(1), 181-200.

Mullineux, A., 1996. Financial reform in Central and Eastern Europe. New York: Nova Science Publishers, Inc.

Odedokun, M., 1996. Alternative Econometric Approaches for Analysing the Role of the Financial Sector in Economic Growth: Time-series Evidence from LDCs. Journal of Development Economics 50(1), 119-146.

Office of Tax Policy Research, Ross School of Business at the University of Michigan, 2006. World Tax Database.

Peter, K., Buttrick, S., & Duncan, D., 2010. Global Reform of Personal Income Taxation, 1981-2005: Evidence from 189 Countries. National Tax Journal 63(3), 447-478.

PricewaterhouseCoopers Organization, 1990-2005a. Corporate Taxes Worldwide Summaries. New York: John Wiley & Sons.

PricewaterhouseCoopers Organization, 1990-2005b. Individual Taxes Worldwide Summaries. New York: John Wiley & Sons.

PRS Group., 2011. International Country Risk Guide. Retrieved February 7, 2011, from <http://www.countrydata.com>

Treisman, D., 1999. Russia's Tax Crisis: Explaining Falling Revenues in a Transitional Economy. Economics and Politics 11(2), 145-169.

World Bank., 2011. World Development Indicators. Washington, D.C.: World Bank.

## Data Appendix

Table 10. Main variables for each country

country	corporate rate	personal rate	F	used
Afghanistan	20			0
Albania	16.6	20		0
Angola	40	15		0
Antigua and Barbuda	38.39286	3.125		0
Argentina	32.67586	36.75862	4.17602	1
Armenia	21.25	20		0
Aruba	30.8			0
Australia	37	49.48552	6.89393	1
Austria	37.55172	53.42857		0
Azerbaijan	26.61539	35		0
Bahamas, The	0	0		0
Bahrain	0	0		0
Bangladesh	45.86207	42.91667	3.530793	1
Barbados	36.67241	48.04167		0
Belarus	24			0
Belgium	42.42655	60.76621		0
Belize	38.80952	49.16667		0
Benin	38	35		0
Bermuda	0	0		0
Bolivia	18.91379	17.30769	3.617219	1
Bosnia and Herzegovina	25	5		0
Botswana	31.03448	38.57143	4.136261	1
Brazil	37.50586	34.31034	3.663569	1
Brunei Darussalam	30	0		0
Bulgaria	23.46667	26.90909	3.786852	1
Cambodia	20	20		0
Cameroon	38.75	60		0
Canada	29.30724	31.63483	7.330979	1

country	corporate rate	personal rate	F	used
Cayman Islands	0	0		0
Channel Islands, Guernsey	19.23077	20		0
Channel Islands, Jersey	19.23077	20		0
Chile	18.31517	47.10345	5.039238	0
China	29.65517	40.25862	4.585212	0
Colombia	35.48276	36.9331	4.084022	1
Congo, Dem. Rep.	45.37931	57.14286		0
Congo, Rep.	45	50		0
Costa Rica	36.32759	24	3.03235	1
Cote d'Ivoire	39.82759	45.18966	4.888759	1
Croatia	24.6875	39.66667		0
Cyprus	27.75862	44.48276		0
Czech Republic	34.38095	34.83333	4.91328	1
Denmark	35.89655	34.89965	6.577618	1
Dominica	35	45.58823		0
Dominican Republic	34.43793	46.724		0
Ecuador	24.74545	30.125	3.929425	0
Egypt, Arab Rep.	36.96552	45.2069	3.506071	1
El Salvador	25	30	3.448105	1
Estonia	11.0625	24.75		0
Ethiopia	30	35		0
Fiji	34.74138	40.46296		0
Finland	30.10345	40.82759	6.529593	1
France	38.90138	58.94104	6.508955	1
Gabon	35	53		0
Georgia	17.5	12		0
Germany	43.42793	52.93655	7.400827	1
Ghana	39.5	41.60714		0
Gibraltar	30	40		0
Greece	37.74667	48.84483	4.810434	1
Grenada	35.71429	24.16667		0

country	corporate rate	personal rate	F	used
Guatemala	27.92593	33.30769	3.1557	1
Guyana	45	33.33		0
Honduras	27.9375	28	3.156011	0
Hong Kong SAR, China	16.94828	21.01724	7.591401	0
Hungary	24	41.71429	5.596184	1
Iceland	36.13793	34.87571		0
India	43.43827	41.77172		0
Indonesia	32.76667	35.18518	3.639063	1
Iran, Islamic Rep.	36.95862	53.1875		0
Ireland	33.01724	50.03448	6.508157	1
Isle of Man	15.41667	19.21739		0
Israel	34.21053	48.57222	5.529502	0
Italy	35.08261	48.37391	6.151059	1
Jamaica	35.7446	32.61414	3.524075	1
Japan	36.74759	51.41379	6.402319	1
Jordan	25.83333			0
Kazakhstan	28.69048	27.69231		0
Kenya	37.05357	45.72917	3.583705	1
Korea, Rep.	29.95	47.24828	6.341956	1
Kuwait	4.310345	0	5.139262	1
Kyrgyz Republic	27.77778	40		0
Lao PDR	35	40		0
Latvia	20.4	24.85714		0
Lebanon	20.82069	25.01111		0
Liberia	50	65		0
Libya	55.02111	38		0
Liechtenstein	15	6.227143		0
Lithuania	23.11765	30.4		0
Luxembourg	44.02552	50.23138		0
Macao SAR, China	12			0
Macedonia, FYR	17.20471	33.77778		0

country	corporate rate	personal rate	F	used
Malawi	42	43		0
Malaysia	32.5	33.20833	5.628483	1
Malta	34.22414	44.64286		0
Mauritius	27.30769	30.76923		0
Mexico	35.47586	40.05172	4.208664	1
Moldova	10	18		0
Montenegro	9	15		0
Morocco	41.57143	44.25	4.104711	1
Mozambique	36.26667	27.63636		0
Myanmar	31.53846	30		0
Namibia	35.35714	35.85714		0
Netherlands	37.57241	61.26724	7.257795	1
Netherlands Antilles	40.05172	54.8		0
New Caledonia	29.65517	38.33333		0
New Zealand	35.72414	42.15517	6.601234	1
Nicaragua	32.97727	28.75		0
Nigeria	36.2069	46.59091	2.724354	0
Norway	27.92414	30.16241	6.727912	1
Oman	32.65517	0	4.538562	1
Pakistan	39.68966	37.6	5.534112	1
Panama	38.7931	40.14286	4.356079	1
Papua New Guinea	29.58621	44.14116		0
Paraguay	27.24138	15.06897	2.621822	0
Peru	35.13793	37.96552	2.573284	1
Philippines	34.10345	35.10345	3.818025	1
Poland	32.57143	42.66667	5.346612	1
Portugal	33.44828	50.56552	5.349932	1
Puerto Rico	43.32143	42.53		0
Qatar	35	0		0
Romania	29.66667	40.83333	2.207805	1
Russian Federation	14.75	23.35294	2.679232	1

country	corporate rate	personal rate	F	used
Samoa	38.64706	40		0
Saudi Arabia	38.10345	0		0
Senegal	33.08609	51.05		0
Serbia	12.04125	12.14286		0
Singapore	28.31034	29.75893	7.239679	0
Slovak Republic	33.94737	35.11765	5.454218	1
Slovenia	25.33333	48.3125		0
Solomon Islands	33.51852	42		0
South Africa	38.99828	44.35815	6.179258	1
Spain	34.25	48.25667	6.441789	1
Sri Lanka	41.2931	41.05357	4.070856	1
St. Kitts and Nevis	35	0		0
St. Lucia	36.64615	37.77778		0
St. Vincent and the Grenadines	42.5	52.05882		0
Sudan	45.61304	47.5		0
Swaziland	35.43103	40.31034		0
Sweden	34.07931	33.71517	7.4536	1
Switzerland	9.698966	15.04828	9.209711	1
Syrian Arab Republic	36.72727			0
Taiwan, China	35.92593	45.18518		0
Tanzania	38.44828	44.03846		0
Thailand	30	39.33333	5.249866	1
Trinidad and Tobago	39.66071	44.77778	4.665455	1
Tunisia	31.85714			0
Turkey	35.77896	47.59259		0
Turks and Caicos Islands	0	0		0
Uganda	36.2069	41.51786		0
Ukraine	27.46667	25.81818	2.406074	1
United Arab Emirates	2.291667	0		0
United Kingdom	32.5	43.07692		0
United States	41.53333	40.271		0

country	corporate rate	personal rate	F	used
Uruguay	29.82759	2.586207	3.031028	1
Uzbekistan	21.27273	32.66667		0
Vanuatu	0	0		0
Venezuela, RB	39.10345	37.37931	2.638264	1
Vietnam	32.33333	50.83333		0
West Bank and Gaza	16			0
Yemen, Rep.	35			0
Yugoslavia, Fed. Rep.	20.45455	32.5		0
Zambia	39.46429	47.6087	2.70763	1
Zimbabwe	41.3969	47.78333	4.059537	1

## Rethinking Economic Sanction Success: Sanctions as Deterrents

### 1. Introduction

In recent history, many countries started using more frequently economic sanctions as foreign policy tools. In theory, sanctioned countries (called targets) incur the costs resulting from actions taken by the sanctioning countries (called senders). To reduce the costs, targets modify their policies in the direction desired by the senders. However, in practice, the current policy of targets does not seem to change in the direction desired by the senders. Thus, many scholars believe that sanctions are used mostly for sending messages to the international community and for deterring certain behaviors. The principal 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 the sanctioned country less likely to initiate other disputes in the future.

At a first glance, data<sup>1</sup> seems to support the deterrence hypothesis. Figure 1 shows the number of disputes which India initiated before and after a militarized dispute with Pakistan in 1971 (the first two bars) and the number of disputes which Pakistan initiated before and after the same dispute (the third and fourth bars). The next four bars show the number of disputes which India and Pakistan initiated before and after another dispute in 1990. Both India and Pakistan were sanctioned because of their participation in the 1971 dispute, but no such action was taken in the 1990 dispute. The first four bars show that India and Pakistan initiated fewer disputes in the three years following the sanctioned dispute than in the three years before it. The last four bars show that India and Pakistan initiated the same number of conflicts in the three years after the dispute that was not sanctioned as in the three years prior to it.

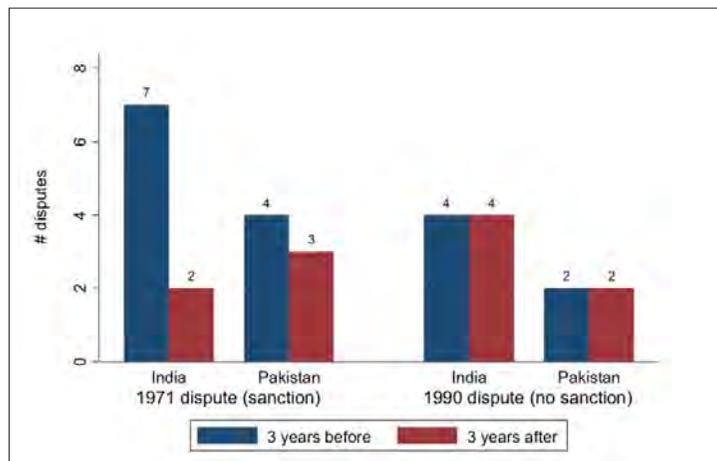


Fig 1. Sanctions and the number of disputes for India and Pakistan

<sup>1</sup> Data on economic sanctions used with permission of the Peterson Institute for International Economics. Copyright 2007. All rights reserved.

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. Lindsay (1986) believes that the five 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 deter 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), Oneal and Russett (1997) and Raymond (1994) believe that democratic countries are less likely to engage in international conflicts. My study also includes measures of autocracy (lack of democracy) as one factor that predicts future conflicts. Russett et al. (1998) adds relative military capabilities as a determinant of militarized disputes. My paper also controls for military capabilities measured as a function of military personnel, military expenditure, iron or steel production, energy consumption and population. Nordhaus et al. (2006) estimates that the probability of a militarized conflict between two countries is a function of the number of years they were at peace. This study also controls for the country's belligerence by adding in the analysis the number of militarized disputes which the country initiated in previous years and the level of violence reached in current disputes as determinants of future disputes. Unlike previous studies, my study considers the effect of current dispute's fatalities on the outbreak of future disputes.

Drury and Park (2004), Lektzian and Sprecher (2007) and Martin et al (2008)<sup>2</sup> estimate the effects of economic sanctions on the outbreak of a militarized dispute between sender and target. Drury and Park (2004) and Lektzian and Sprecher (2007) find that sanctions are complements to militarized disputes, while Martin et al (2008) does not find a statistically significant effect of a sanction between target and sender and war later between the two of them. Unlike these studies, my paper looks at the effects of sanctioning a country involved in a militarized dispute on the probability that the same country will initiate another dispute in the future. Peterson and Drury (2011) find that sanctions imposed for any reasons (not only military) increase the probability that the target will be involved in a dispute. This effect is attributed to an increase in the target's probability of being attacked by a third party. Unlike this study, I focus only on sanctions imposed because of participation in wars in order to measure deterrence. I also focus only on the initiators of wars, not on attacked countries. More belligerent countries are more likely to be sanctioned and to be involved in a militarized dispute after the sanction is imposed. Endogeneity could explain why Peterson and Drury (2011) find the sanctioned countries are more likely to be involved in a dispute. In my paper, I address the endogeneity of sanctions and wars by using an instrumental variables approach.

This paper's framework is simple. At time  $t$ , country  $k$  initiates a militarized dispute,  $j$ . Countries  $s_1, \dots, s_m$  impose economic sanctions  $E$  on  $k$ . I look at the effect of economic sanction  $E$  on the probability that country  $k$  will initiate a militarized conflict  $i \neq j$ , in the period  $(t, t+3]$ , where  $i \neq j$  if  $i$  and  $j$  share less than two participant countries.

<sup>2</sup> Martin et al (2008) estimate primarily the effects of trade on war between two countries, but they control for economic sanctions in one of their robustness checks.

I also look at the effects of reducing trade or development aid to countries that initiated a conflict if an "official" economic sanction was not imposed. I analyze 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 publicly and didn't link the decline to a militarized dispute<sup>3</sup>. 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  $\tau$  a significant<sup>4</sup> decrease in trade between United States and  $k$ , and we call  $\alpha$ , a significant<sup>5</sup> decrease in total development aid to  $k$ . I investigate the effects of  $\tau$  and  $\alpha$  on the probability that country  $k$  will initiate a militarized conflict  $i \neq j$ , in the period  $(t, t+3]$ .

I find that economic sanctions decrease the probability that  $k$  will initiate another dispute. I find that multilateral sanctions, sanctions imposed by large countries or large group of countries, financial, import and export sanctions have deterrent effects. I also find a deterrent effect on participating in a conflict in the future, not only on initiating one. However, a significant decrease in trade or aid to  $k$  that is not accompanied by an economic sanction does not affect the future military behavior of  $k$ .

The rest of the study is structured as follows. Section 2 describes what types of conflicts I am using in the analysis, Section 3 describes the economic sanctions, and Section 4 describes the

<sup>3</sup> 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.

<sup>4</sup> A significant decrease is a decrease of 50% or more of trade between  $k$  and the U.S. or a decrease of 100% or more of trade between  $k$  and the U.S. For more details, read the definitions for `tradeus50` and `tradeus100` in Table 2.

<sup>5</sup> A significant decrease is a decrease of 50% or more in aid to  $k$  or of 100% or more in aid to  $k$ . For more details, read the definitions for `aid50` and `aid100` in Table 2.

channels through which economic sanctions could affect future wars. Section 5 shows the way the variables are constructed, Section 6 describes the econometric model, Section 7 presents the results, and finally Section 8 concludes.

## 2. Militarized disputes

In this study, the militarized disputes come from the Correlates of War v3.02 (Ghosn et al 2004 and Jones et al 1996). According to the Correlates of War's definitions, militarized interstate disputes are cases in which the threat, display or use of military force by one member state is explicitly directed towards another state. Interstate disputes include only disputes between recognized states. Actions taken by officials of country against private citizens of another country are usually not considered militarized disputes.

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 four 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. An even more serious dispute was the 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.

The dataset contains militarized disputes from 1816 to 2001<sup>6</sup>. Figure 2 shows the number of disputes for each year during this

<sup>6</sup> I use data only from 1914-2001 in the analysis since economic sanctions data is available only after 1914.

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 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 zero and 13 years. Out of all disputes, 74.77% of disputes lasted less than a year, 18.30% lasted a year, 3.29% lasted two years, and the rest of 3.64% lasted three to 13 years.

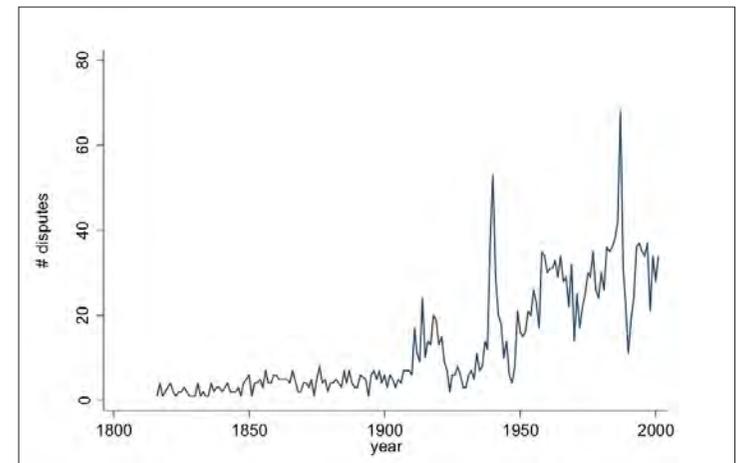


Fig 2. Number of disputes over time

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. Some of the most belligerent countries in this sample are U.S.S.R. and U.K. that were involved in 341 disputes and 263 disputes, respectively.

### 3. Economic sanctions

Hufbauer et al (2007) define economic sanctions as "deliberate, government withdrawal, or threat of withdrawal, of customary trade or financial relations". Senders impose sanctions when they want to change a policy or a behavior of the target of which they do not approve. The sender's alternatives are to go to war, start diplomatic talks or do nothing. The political science literature is divided on why senders choose sanctions over other alternatives.

In general, they agree that the situation in the sender country is an important determinant of economic sanctions. Sanctions are often motivated by special-interest groups in the sender country (Andreasson 2008). In the U.S., the president's decision to impose sanctions depends on the relationship with the government of the targeted country and domestic political situation (Drury 2000). Also, lobbying and special interests groups have been playing a role in advocating sanctions in recent years (Hufbauer et al 2007 and Drury 2001). Hufbauer et al (2007) claim that domestic political motives may overshadow foreign policy concerns. The economic sanctions against South Africa were satisfying to the domestic audiences in Europe, United States and Canada. U.S. sanctions against China following the Tiananmen Square massacre also targeted domestic political constituencies, according to Hufbauer et al (2007). Also, according to Drury (2005), presidents are less likely to impose sanctions before an election because they are trying to avoid bringing up sanction issues into the electoral debate. The economic situation of the sender also affects the probability of

sanctioning. Higher unemployment in the U.S. is positively correlated with economic sanctions on other countries, according to Drury (2001). Also, when the sender's economy is not going well, presidents do not want to impose sanctions because they do not want to seem they are paying more attention to foreign problems than to the domestic problems, according to Drury (2005). And, finally, if a country has a trade deficit with another country, it is more likely to sanction that country because it can gain political points by enacting protectionist measures towards a trade partner (Drury 2005).

Policies targeted by economic sanctions range from hindering nuclear proliferation to punishing human rights violations. In this study, I use economic sanctions incidents from Hufbauer et al (2007) that are imposed for war related reasons. These are sanctions whose goals are to stop a militarized dispute, punish the participants of militarized disputes or to demonstrate resolve regarding militarized conflicts. Sanctions imposed in order to stop a militarized dispute include The League of Nations and U.K. vs. Italy in 1935 when Italy invaded Abyssinia. Statements from the sender countries such as the one from the British Prime Minister Stanley Baldwin: "The object of an oil sanction was to stop war" (Renwick 1981) make the goal of the sanction clear. The 1971 sanction, U.S. vs. India and Pakistan, is an example of a sender who is seeking to punish the sanctioned country and to show disapproval of the military activity of the target (Hochman 1975 and Knorr 1975). The whole list of sanctions included in my analysis is in Table 1.

Table 1. List of sanctions used in the analysis

sender1	sender2	target1	target2	starts	dispute
United States		Indonesia		1963	dispute between the newly formed Malaysia and Indonesia
Turkey	Azerbaijan	Armenia		1989	Nagorno-Karabakh
United States	European Union	Yugoslavia		1998	Kosovo
United Kingdom		Germany		1914	World War I
United States	South Vietnam	North Vietnam		1975	Vietnam War related disputes, North Vietnam attacks Kampuchea
United Kingdom		Argentina		1982	Falklands wars
South Africa		Lesotho		1982	South Africa invades Lesotho and then sanctions it as part of the war
Greece		Turkey		1986	Aegean Island related disputes between Greece and Turkey
Indonesia		Malaysia		1963	Disputes between Indonesia and Malaysia over the separation of Malaysia from Indonesia
League of Nations		Yugoslavia		1921	Yugoslavia enters in Albania
League of Nations		Greece		1925	Greece military invasion of Bulgaria
League of Nations		Paraguay	Bolivia	1932	Chaco War between Paraguay and Bolivia
League of Nations	United Kingdom	Italy		1935	Italy invades Abyssinia
United States	Alliance Powers	Germany	Japan	1939	World War II
United States		Japan		1940	US sanctions Japan because of the World War II
United States	Chincom	China		1949	Chinese involvement in the Korean War
United States	United Nations	North Korea		1950	Korean War

sender1	sender2	target1	target2	starts	dispute
United States		Israel		1956	Israel attacks Suez Channel
United States		United Kingdom	France	1956	Suez Channel dispute
United States		Egypt		1963	UAR troops in Yemen
OAU	United Nations	Portugal		1963	disputes in Africa between Portugal and their colonies (former colonies) that wanted independence
United States		India	Pakistan	1971	military dispute at the Indian Pakistani border
United States		Turkey		1974	Turkey invades Cyprus
China		Vietnam		1978	military dispute at the Vietnamese-Chinese border
United States		USSR		1980	invasion of Afghanistan
United States		USSR		1983	USSR shoots down a plane
United States		Angola		1986	Soviet troops are still in Angola, United States asks them to leave
United Nations Economic Community Of West African States	United States	Iraq		1990	Kuwait invasion
United Nations Economic Community Of West African States	United Nations	Liberia		2000	Liberia's dispute in Sierra Leone
United States		Peru	Ecuador	1995	border dispute between Peru and Ecuador

Sanctions in my sample were imposed between 1914 and 1995. The senders in my sample are mostly large countries or coalitions of countries such as the UN, EU, US or China. The targets vary from very large such as Germany and Iraq to small such as Armenia or Lesotho. The gravity of the sanctioned disputes varies greatly from conflicts like border skirmishes between Greek and

Bulgarian forces in the League of Nations vs. Greece sanction to conflicts like the war between Paraguay and Bolivia over the Chaco region in the sanction League of Nations vs. Paraguay and Bolivia. The level of violence reached in these disputes varies widely as well. On average, the sanctioned militarized disputes reach the level of mobilization.

Economic sanctions are of three types, the ones that cut imports from the target (import sanctions), the ones that cut exports to the target (export sanctions), and finally the ones that cut financial aid to the target and/or freeze financial assets of the target (financial sanctions). These three types of sanctions are rarely used one at a time. U.S. vs. India and Pakistan was an export and financial sanction and The League of Nations and U.K. vs. Italy sanction was an import, export and financial sanction.

It is believed that sanctions are lifted when the goals of the sender have been met or when the sender country changed its mind. I could find only three sanctions in my data sample that are considered to have attained their official goals, according to Hufbauer et al. (2007) and they were subsequently lifted because they reached these goals. Such sanctions include League of Nations vs. Yugoslavia in 1921 when Yugoslavia withdrew its troops from Albania "in order to avoid the dangerous consequences of nonacceptance" (Toynbee 1925). In most cases, though, the sanctions were lifted because the sender gave up/changed its goal. Sanctions sometimes do not stop the ongoing war for which they were imposed. Such a case is the League of Nations vs. Italy, when a year after the sanction was imposed, Italy entered the capital of Abyssinia. The sanction was lifted shortly after that.

#### 4. The effects of economic sanctions on militarized disputes

The main reason why economic sanctions reduce the likelihood of future wars is because economic sanctions imposed because of wars are signaling disapproval with wars. Targets take the sanctions as a warning that sanctions will be imposed again if they start other wars. The expected costs of the sanctions increase, thus the probability of war decreases.

Sanctions can also have a deterrent effect through reducing the economic power and the military capabilities of the target. Cuts in imports, exports or financial aid could weaken the country's economy and the ability of the country to spend on military. Cuts in military imports can further weaken the military capabilities of a country. For example, Lopez and Cortright (2004) claim that economic sanctions against Iraq in 1990 reduced Saddam Hussein's revenues, blocked imports of vital materials for the weapons of mass destruction (WMD) and in that way, military capabilities were eroded and weapons programs were destructed. Such changes in a country can make it less likely to start a war in the future.

Trade is another economic channel through which the economic sanctions can decrease the probability of future wars. Martin et al (2008) find that countries more open to global trade have are more likely to go to war because multilateral trade decreases bilateral dependence to any particular trade partner and the cost of a bilateral war with those trade partners. Following this argument, an economic sanction imposed by a large number of trade partners will decrease the probability of war of the target with non-senders because sanctions will increase bilateral dependence to non-senders and will increase the cost of bilateral conflict with non-senders.

According to Blainey (1973), sanctions create imbalances between sender and target and such imbalances reduce the

uncertainty about the outcome of a war, thus making violence less necessary for the resolution of disagreements. Thus, according to this argument, economic sanctions reduce the need to start a war between target and sender.

Dispersion of power in the target is a political channel through which sanctions can affect future wars. According to Garfinkel and Skaperdas (2007), if a country is sanctioned, governance of the targets evolves, the power is dispersed in the target, and institutions are consolidated. These changes make organized warfare in the target less likely.

Next, economic sanctions have differential effects on the supporters and opponents of the ruling regime and lead to changes in policy, according to Kaempfer and Lowenberg (2007). The Kaempfer and Lowenberg (2007) model can be extended to explain the attitudes towards war of different political fractions in the target. If sanctions strengthen the power of the anti-war parties and they take power in the target, it is possible that a new regime will be less likely to start a war than the former belligerent regime. Alternatively, the weakened pro-war regime will be less belligerent in the future faced with a stronger anti-war opposition.

Finally, Hegre (2008) suggests that the risk of conflict between two countries is increased if the larger country of the two increases its power. If sanctions weaken the power of one country, then according to Hegre's arguments, they also decrease the risk of war of the target with smaller countries.

## 5. Variables

This study uses seven types of variables, dispute characteristics, country characteristics, probability, sanction, trade, development aid and instrumental variables. First, dispute characteristics

variables are taken from the Correlates of War -The Militarized Interstate Dispute v3.02 (Ghosn et al 2004 and Jones et al 1996). There are 2,331 disputes between 1816 and 2001, however I only use the data after 1914 because I have sanction data starting with 1914. This paper uses data at participant-incident level which means that one observation is a country  $k$  involved in a dispute  $j$ . For example, for a conflict between Albania and Yugoslavia, the dataset has two observations, one for each participant.

The two types of dispute characteristics variables are *fatalities* and *violence*. *Fatality* approximates the number of fatalities of country  $k$  in dispute  $j$  and it is measured on a scale from zero to six, where zero stands for zero fatalities and six stands for 1,000 or more fatalities. I also construct four dummies for the level of fatalities. I construct *fatality1* that takes value 1 if there are zero fatalities, *fatality2* that takes value 1 if fatalities are between one and 100, *fatality3* that takes value 1 if fatalities are between 101 and 999, and *fatality4* that takes value 1 if fatalities higher than 1,000. *Violence* measures the highest level of violence taken by country  $k$  in dispute  $j$ . The violence level is measured on a scale from zero to 21, where zero means no militarized dispute and 21 means joining an interstate war. I also use three dummy variables for violence, *violence1* that takes value 1 if the highest level of violence in a dispute ranged from no militarized action to threats to join war, *violence2* that takes value 1 if the highest level of violence ranged from a show of force to fortifying borders, and *violence3* that takes value 1 if the highest level of violence ranged from border violation to joining an interstate war. Table 2 presents all the definitions of these variables and Table 3 shows the descriptive statistics.

Table 2. List of variables

variable	source	definition
dispute characteristics		
fatality	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.
fatality1	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy taking value 1 if zero fatalities.
fatality2	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy variable taking value 1 if the number of fatalities is between 1 and 100.
fatality3	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy variable taking value 1 if the number of fatalities is between 101-999.
fatality4	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy variable taking value 1 if 1000 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.
violence1	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy taking value 1 if the highest level of violence is between 0=no militarized action and 6=threat to join war.
violence2	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy taking value 1 if the highest level of violence is between 7=show of force and 11=fortify border.
violence3	Correlates of War –The Militarized Interstate Dispute v3.02	Dummy taking value 1 if the highest level of violence is between 12=border violation and 21=join interstate war.
country characteristics		
autocracy	Polity IV Dataset	An autocracy score that varies from 0 (least autocratic) to 10 (most autocratic).
polity	Polity IV Dataset	Polity score of the country. It measures a regime score that ranges from 10(full democracy) to -10(full autocracy).
military	Correlates of War National Material Capabilities v3.02.	CINC score, a Composite Index of National Military Capability that is a function of military expenditures, military personnel, iron and steel production, energy consumption, population. It varies from 0.000001 to .38.
previous disputes	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes which the country initiated in the three years period before the outbreak of the dispute.

variable	source	definition
previous disputes participation	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes in which the country participated in the three years period before the outbreak of the dispute.
previous disputes4	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes which the country initiated in the four years period before the outbreak of the dispute.
previous disputes5	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes which the country initiated in the five years period before the outbreak of the dispute.
previous disputes6	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes which the country initiated in the six years period before the outbreak of the dispute.
previous disputes7	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The number of disputes which the country initiated in the seven 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 initiate another different dispute+ in the following three years.
P4	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The probability that a country involved in a dispute will initiate another different dispute+ in the following four years.
P5	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The probability that a country involved in a dispute will initiate another different dispute+ in the following five years.
P6	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The probability that a country involved in a dispute will initiate another different dispute+ in the following six years.
P7	Correlates of War –The Militarized Interstate Dispute v3.02 & author's calculations	The probability that a country involved in a dispute will initiate another different dispute+ in the following seven years.
$\pi$	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 three years.
Sanctions		
sanction	Hufbauer et al. (2007)	It takes value 1 if the country was sanctioned because of its involvement in that dispute. It takes values 0 if the country in the dispute was not sanctioned.
big	Hufbauer et al. (2007) & authors' calculations	The sender is a big++ country or a large coalition of countries.

variable	source	definition
financial	Hufbauer et al. (2007)	A dummy that takes value 1 if a financial sanction is imposed.
import	Hufbauer et al.(2007)	A dummy that takes value 1 if an import sanction is imposed.
export	Hufbauer et al.(2007)	A dummy that takes value 1 if an export sanction is imposed.
multilateral	Hufbauer et al.(2007)	A dummy that takes value 1 if a multilateral sanction is imposed. A multilateral sanction is a sanction imposed by an international organization or by two or more countries.
Trade		
tradeus50	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.
tradeus100	International Trade Database & author's calculations	The amount of trade between US and the country involved in the dispute decreased by 100% or more in the year following the outbreak of the dispute.
tradeussr50	International Trade Database & author's calculations	The amount of trade+++ between USSR and the country involved in the dispute decreased by 50% or more in the year following the outbreak of the dispute.
tradeussr100	International Trade Database & author's calculations	The amount of trade between USSR and the country involved in the dispute decreased by 100% 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.
aid100	World Development Indicators & author's calculations	The amount of development aid to the country involved in the dispute decreased by 100% or more in the year following the outbreak of the dispute.
Instrument		
diplomacy	Diplomatic Exchange Data set, v2006.1. & author's calculations	The standard deviation of the five diplomatic scores between the given country and the top five powers (United States, United

variable	source	definition
		Kingdom, Russia, France and China). The diplomatic scores are 0=no evidence of diplomatic exchange, 1=chargé d'affaires, 2=minister and 3=ambassador. When the diplomacy scores are reported every five years, the diplomacy scores from the past five years are used.

Notes: +A different dispute is a dispute that has less than 2 participants in common with the original dispute. ++ The big countries or alliances are: United States, United Kingdom, League of Nations, OAU, China, United Nations, Economic Community of West African States, European Union, and the Alliance Powers. +++ Trade between countries A and B is the sum of the merchandise that A imports from B + the value of the merchandise that B imports from A. The amounts are in million US dollars.

**Table 3. Summary statistics**

	Dispute Characteristics				
fatality	4980	0.46	1.32	0	6
fatality 1	4980	.82	.38	0	1
fatality 2	4980	.11	.31	0	1
fatality 3	4980	.02	.15	0	1
fatality 4	4980	.03	.19	0	1
violence 1	5600	.29	.45	0	1
violence 2	5600	.17	.38	0	1
violence 3	5600	.52	.49	0	1
violence	5600	9.88	7.22	0	21
	Country Characteristics				
autocracy	4916	3.94	3.57	0	10
polity	4916	.007	7.49	-10	10
military	5600	.04	.065	0.000001	.38
previous disputes	5596	4.24	6.03	0	47
previous disputes participation	5596	4.74	6.69	0	57
previous disputes 4	5596	5.45	7.41	0	56
previous disputes 5	5596	6.52	8.50	0	68

previous disputes 6	5592	7.52	9.45	0	76
previous disputes 7	5592	8.47	10.24	0	78
Probabilities					
P	5381	.46	.49	0	1
$\pi$	5387	.48	.49	0	1
P4	5337	.47	.49	0	1
P5	5290	.47	.49	0	1
P6	5254	.48	.49	0	1
P7	5357	.74	.43	0	1
Sanctions					
sanction	4658	.05	.22	0	1
big	4658	.05	.22	0	1
multilateral	4658	.03	.18	0	1
financial	4658	.04	.21	0	1
import	4658	.04	.19	0	1
export	4658	.04	.20	0	1
Trade					
tradeus50	2318	.11	.31	0	1
tradeus100	2318	.05	.21	0	1
tradeussr50	644	.21	.41	0	1
tradeussr100	644	.09	.29	0	1
Aid					
aid50	1542	.17	.37	0	1
aid100	1542	.08	.27	0	1
Instrument					
diplomacy	6838	.61	.62	0	1.73

Second, the main country characteristics variables are *autocracy*, *polity*, *military*, and *previous disputes*. *Autocracy* comes from the Polity IV dataset (Marshall and Jaggers 2002). It measures the lack of democratic freedoms and rights in a country and it varies from 0 to 10, where 0 stands for least autocratic and 10 stands for most

autocratic. *Polity* is another variable that measures the level of democracy on a scale from -10 to 10, where -10 is the least democratic country and 10 is the most democratic country. The countries involved in disputes are either very democratic or very undemocratic: Out of the total 5,600 observations, 943 have a polity score of 10 (they are very democratic), 212 have a score of -10 and 559 have a score of -9 (they are very autocratic). *Military* comes from the National Military Capabilities v3.02 (Singer et al 1972 and Singer 1987) and is a function of iron and steel production, military expenditures, military personnel, energy consumption, total population and urban population. The score varies between .000001 and .38, where high numbers represent countries with high military capabilities. The United States right after World War I had a score of .38. This score is superior to other measures of military capabilities because it is created taking into consideration various aspects of military capabilities and it has the advantage of covering all the countries in the militarized dispute dataset. Finally, *previous disputes* measures the number of disputes which country  $k$  initiated in the three-year period before the outbreak of dispute  $j$ . 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 4.24. Iran and Germany are involved in many disputes, thus their means for the previous disputes variable are 15.15 and 17.18, respectively. Countries like Luxembourg, Finland and Denmark have an average of .25, .90 and .54 previous disputes. In the robustness checks, I also use *previous disputes4*, *previous disputes5*, *previous disputes6* and *previous disputes7*, the number of initiated disputes in the four, five, six, and seven years before the current dispute. Finally, I also use a measure of number of disputes in which  $k$  participated in the three years before dispute  $j$ , *previous disputes participate*.

Third, this paper uses probabilities of future disputes as dependent variables.  $P$  is the probability that country  $k$  will initiate another conflict  $i \neq j$  in  $(t, t+3]$ . For example, in 1974, Turkish troops invaded Northern Cyprus. In 1975, Turkey initiated another dispute with Greece (the dispute is considered different because the two conflicts shared only one participant country). Thus,  $P=1$  for Turkey 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 .46. I also use  $\pi$ , the probability that a country  $k$  will participate in another dispute in the next three years. Additionally, I consider different spans of time in the future and construct four additional probabilities,  $P_4$ ,  $P_5$ ,  $P_6$ , and  $P_7$ , the probabilities that  $k$  will initiate another conflict in the next four, five, six or seven years, respectively.

Fourth, I used the data on economic sanctions from the Hufbauer et al. (2007) dataset to build my sanctions variables. Their dataset covers economic sanctions imposed on various countries or coalition of countries between the years 1914 and 2001. Thirty countries in my sample were sanctioned because of their participation in a militarized dispute. The variable *sanction* is a dummy that takes value 1 if the country  $k$  involved in conflict  $j$  is sanctioned because its involvement in conflict  $j$ .

Other sanction variables are *big*, *multilateral*, *financial*, *import* and *export*. *Big* is a dummy that takes value 1 if a country is sanctioned by a large country or a large international organization. *Big* takes value 1 for sanctions imposed by United States, United Kingdom, League of Nations, or the Economic Community of West African States. It takes value 0 for sanctions imposed such as Turkey, Greece, Indonesia or Azerbaijan. *Multilateral* is a dummy that takes value 1 if the country  $k$  was sanctioned by two or more countries. *Financial* is a dummy that takes value 1 if the country

$k$  suffered a financial sanction (financial assets were frozen, loans were cut, aid was cut, etc.). *Import* stands for import sanctions (cuts of imports from  $k$  to the sender country) and *export* stands for export sanctions (cuts in exports from sender to  $k$ ). About 5.3% of countries involved in militarized disputes were sanctioned because of their involvement in those disputes, 5.1% were sanctioned by large countries or organizations, 3.6% were sanctioned by more than one country, 4.8% had financial sanctions imposed, 4.1% had import sanctions imposed, and 4.6% had export sanctions<sup>7</sup> imposed.

Fifth, I use four trade variables, *tradeus50*, *tradeus100*, *tradeussr50* and *tradeussr100* from the Correlates of War Trade dataset v.1.1 (Barbieri et al 2008 and Barbieri et al 2009). *Tradeus50* and *tradeus100* are dummies that take value 1 if trade between United States and  $k$  decreased at least 50%, or at least 100%, respectively in the year following the outbreak of conflict  $j$ . Similarly, *tradeussr50* and *tradeussr100* are dummies that take value 1 if trade between U.S.S.R. and  $k$  decreased at least 50%, or at least 100%, respectively in the year following the outbreak of  $j$ . 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  $k$ . These declines in trade are rare. There are only 258 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 no official economic sanction was imposed. And, there are only 118 instances when this decline was larger than 100% and no sanction was imposed.

<sup>7</sup> Financial, import, and export sanctions are not mutually exclusive. They are sometimes imposed in combination. There are not enough sanction incidents to consider all the possible combinations of sanctions as distinct categories.

Sixth, the aid variables are *aid50* and *aid100*. These are dummies similar to the trade dummies. *Aid50* and *aid100* take value 1 if total development aid to *k* declined by at least 50% or at least 100%, respectively and no financial sanctions were imposed. The aid data is taken from the World Development Indicators (World Bank 2007).

Finally, I use *diplomacy* as an instrument for economic sanctions. *Diplomacy* is the standard deviation of the diplomatic scores between the country *k* and U.S., U.K., France, U.S.S.R/Russia, and China. The diplomatic scores take value zero if there is no evidence of diplomatic exchange between the two countries, value one if there was a charge d'affaires in the country, value two if there is a minister in that country, and value three if there is an ambassador in that country. The *diplomacy* variable (the standard variation of the above scores) varies between 0 and 1.73. The source of the diplomatic scores is the Diplomatic Exchange Data set v.2006.1 (Bayer 2006).

## 6. Econometric strategy

The goal is to estimate the effect of sanctioning a country involved in a militarized dispute on the probability that the same country will initiate in another dispute in the following three years. I use a probit model like the one below,

$$P_{kj} = F(\beta_0 + \beta_1 \text{sanction}_{kj} + \beta_2 \text{country characteristics}_{kj} + \beta_3 \text{dispute characteristics}_{kj} + t_{kj} + \text{region}_k) \quad (1)$$

where *k* indicates the country, *j* indicates the dispute,  $P_{kj}$  is the probability *P* that country *k* will be involved in a dispute other than *j* in the next three years,  $t_{kj}$  is a year dummy for start year of conflict

*j* in country *k* and region is a region dummy for the region of the world of country *k*. There nine regions are Africa, Central and East Europe, Northern Asia, Latin America, Middle East, North and Central America, Oceania and Australia, South East Asia and Western Europe. Western Europe is the omitted category.

If sanctions have a deterrent effect, then the variable *sanction* is expected to have a negative effect on *P*. I control for the autocracy level of the country because previous studies showed that the democracy of the country is a predictor of militarized disputes because democracies are less likely to fight other democracies. Since I estimate the probability of conflict with both democratic and autocratic countries, *autocracy* is likely to be a less important determinant of *P*. *Military* can be an important predictor of future militarized disputes. On one hand, it can prevent future disputes as countries are less likely to attack a highly militarized power and on the other hand, it can lead to more disputes if the militarization was done in order to prepare for future wars. The predicted sign on this variable is ambiguous. The characteristics of the present dispute *j* can predict future disputes. I control for *fatality*, *violence2*, *violence3*. *violence1* is the omitted variable. A high number of fatalities and high level of violence of the current dispute *j* can predict less militarized disputes in the future if the resources were depleted in a very deadly current conflict or it can predict more militarized disputes in the future because the country is particularly violent and belligerent. The predicted sign is ambiguous for these two variables. Finally, it is likely that previous disputes predict the likelihood of future disputes. Higher number of previous disputes is likely to lead to a higher probability of future disputes. Year dummies are included because in some periods militarized disputes are more common than in others, according to Figure 2. Region dummies are also included because some regions are more belligerent than

others and no matter how peaceful one country is, simply being in a belligerent area might lead to more wars. Another reason for using region dummies rather country dummies is because I cover a long period of time over which countries change name and borders several times and country fixed effects will capture only the characteristics of a particular country while it kept the same name. The region dummy will capture the unobserved characteristics of the region no matter how many changes in territory or country names occurred over time.

Next, I use an instrumental variable approach to solve for possible endogeneity. If more belligerent countries are more likely to be sanctioned, then (1) will understate the deterrent effect of economic sanctions. I use *diplomacy* as an instrument for sanction. *Diplomacy* is likely to be correlated with the probability of being sanctioned because countries that have disproportionate diplomatic relationships with one great power relative to other powers are more likely to be sanctioned if they are involved in a militarized dispute. Figure 3 shows that there is a positive correlation between being sanctioned and *diplomacy*. The average *diplomacy* for sanctioned countries involved in disputes is 0.98 and the average *diplomacy* for countries involved in disputes that were not sanctioned is 0.56. There is a political science literature that supports this statement as well. Hufbauer et al (2007) claims that U.S. used sanctions against left-wing leaders in Latin America to destabilize governments viewed as leaning towards U.S.S.R. and that U.S.S.R. sanctioned Yugoslavia when Marshal Tito started tilting towards the West. McKenzie (2008) reports incidents when U.S. tried to sever trade ties with Czechoslovakia that was viewed as having a disproportionate relationship with Communist countries.

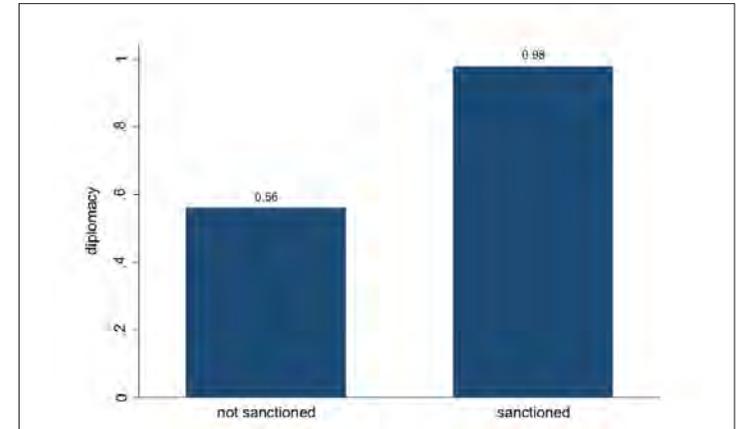


Fig 3. Mean diplomacy variable for sanctioned and not sanctioned countries

In terms of exogeneity of the instrument, there is no reason to believe that countries with skewed diplomatic relationships with the great powers are more or less likely to start a war. While being allied with a large power might help against attacks from small countries or other powers, a disproportionate relationship with one power versus another is not known as a factor in initiating a conflict against another country. The only way the variable *diplomacy* affects the probability that the country will initiate another war in the future is through the sanctions. I use *diplomacy* as an instrument in a 2SLS model because I cannot use a probit model with an endogenous discrete regressor. The first stage is of the form:

$$sanction_{kj} = \gamma_0 + \gamma_1 diplomacy_{kj} + \gamma_3 country\ characteristics_{kj} + \gamma_4 dispute\ characteristics_{kj} + region_k + t_{kj} + \varepsilon_{kj} \quad (2)$$

## 7. Results

This section presents the effects of economic sanctions on the probability that the country will initiate another dispute in the

following three years using probit and 2SLS models. It also presents the effects of different types of sanctions on the probability of future disputes and the effects of sanctions on militarized disputes occurring at various periods of time in the future. It also shows the effects of large cuts in trade and aid that are not accompanied by official sanctions on the probability of future disputes. Finally, it presents various robustness checks for the basic specifications.

Table 4 shows the effects of *sanctions* on *P* using a probit model in column (1) and a 2SLS model in columns (2)-(3). Column (1) reports results for equation (1). The table shows the marginal effects of the probit model and the robust standard errors clustered at region level. Economic sanctions reduce the probability that *k* will initiate another militarized dispute, however the sanction variable not statistically significant at 10% level. This might be due to endogeneity. If sanctions have a deterrent effect on the targets, but sanctions are imposed mostly on the most belligerent countries, then it is possible to see a small negative insignificant effect. Next, I use an instrumental variable approach to fix this problem.

**Table 4. Effects of economic sanctions on the probability that country *k* will initiate another dispute in the next three years**

	P (1)	sanction (2)	P (3)
sanction	-.01 (.15)		-.69 (.26)***
autocracy	-.002 (.007)	.01 (.001)***	.001 (.01)
fatality	-.03 (.007)***	.007 (.003)**	-.01 (.009)**
military	3.19 (.68)***	1.44 (.10)***	3.59 (.73)***
previous disputes	.05 (.008)***	.008 (.0007)***	.02 (.004)***
violence2	-.02 (.02)	-.01 (.01)**	-.02 (.03)
violence3	.02 (.02)	.0004 (.008)	.03 (.02)
diplomacy		.04 (.006)***	
Observations	3331	2826	2826
R <sup>2</sup>		0.41	0.26
Pseudo R <sup>2</sup>	0.29		
Region dummies	yes	yes	yes
Year dummies	yes	yes	yes

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

In column (2), I show the first stage regression described in equation (2). The *diplomacy* coefficient is positive and statistically significant at 1% level which shows a strong correlation between the endogenous regressor and the instrumental variable.

In the third column, I show the second stage regression results for the 2SLS model using *diplomacy* as an instrument for economic sanctions. The results show that economic sanctions reduce the probability of a future disputes started by country *k*. The IV estimates capture the "local average treatment effect" of sanctions,

or their effect in countries where sanctions were imposed because the countries had disproportionate diplomatic relationships with the great powers and which would, otherwise, not have been sanctioned. In other words, I do not capture the effects of sanctions imposed on countries for, say, reasons related to the economic situation in the sender country. The local average treatment effect of economic sanctions on the probability of initiating another war is 69%. On average, the probability of initiating another war for the sanctioned countries in the analysis is 76%, thus this effect represents a 90% decrease in the probability of starting a war in the following three years. This effect is large because the sanction is recent. The magnitude of the deterrent effect decreases with time passed from the start of the sanction, as future results show.

Some of the dispute and country characteristics have statistically significant effects on the probability of a future militarized dispute initiated by country  $k$ . *Autocracy* is not statistically significant. This suggests that the level of autocracy in a country has no effect on the probability that country will initiate another militarized dispute when the level of autocracy of the opponent is not specified. Democracies are less likely to start a war against other democracies and more likely to start a war against an autocracy and thus, the overall effect could be zero. The number of fatalities in the current dispute has a negative and significant effect on the probability of future dispute. It seems that the higher the loss of human life in the current dispute, the less likely the country is to start another dispute in the near future. The other country characteristic that has a positive and highly significant effect is *military*. Also, more disputes in the past lead to more disputes in the future which means that the previous disputes variable is a good measure of the belligerence of one country and predicts future disputes. *Violence2* and *violence3* have no effect on  $P$ . The level of violence

in the current dispute  $j$  could affect future disputes negatively if they country suffered large human life losses in the present dispute or positively if violence proxies for the country's belligerence. The effect could be zero if these two effects cancel out. It could also be zero if violence is not a good proxy for the country's belligerence because 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' belligerence.

Next, in Table 5, the paper shows the effects of different types of sanctions on the probability that a country will initiate another dispute in the following three years. I look at multilateral sanctions in column (1), sanctions imposed by big senders in column (2), financial sanctions in column (3), import sanctions in column (4) and export sanctions column (5). The table shows the results of the second stage 2SLS model with diplomacy as an instrument for the sanction variables. All specifications have year and region dummies and the standard errors are clustered at region level. All types of sanctions have a negative and statistically significant effect on  $P$  which means that sanctions imposed by large senders, financial, import and export sanctions have a deterrent effect on the future militarized disputes. Sanctions imposed by large sender have a larger local average treatment effect than multilateral sanctions. Sanctions imposed by large senders send more powerful signals to targets. Such sanctions signal that a large country disapproves of military activity in  $k$  and that the future sanction imposed by a large country could be particularly expensive for  $k$ . Big includes only sanctions imposed by large senders, while multilateral sanctions include sanctions imposed by two or more smaller countries, thus multilateral does not measure the strength of the sender as well as big. Among the three types of sanctions, financial sanctions seem to have the largest deterrent effect, followed by export

sanctions and then by import sanctions. The large effect of financial sanctions can be explained if cutting financial ties, loans and access to banks make financing a war more difficult than cutting trade to the country. Also if the financial sanction is seen as a signal of future financial sanctions on similar military actions and cuts in financial ties are seen as particularly damaging for the economy, the expected costs of wars increase and the probability of future wars decreases. Export sanctions have larger effects than import sanctions. Export sanctions that involve cuts of imports of military goods and technology to the target can undermine the future military capabilities of the country and make it less able to initiate a war<sup>8</sup>. If these types of sanctions affect the ability to start a war more than cuts in exports from the target to the sender (import sanctions), then the effects of export sanctions will be bigger than those of import sanctions.

**Table 5. Effects of various types of sanctions on the probability that k will initiate another dispute in the following three years**

	(1)	(2)	P (3)	(4)	(5)
multilateral	-0.48 (.18)***				
big		-0.56 (.22)**			
financial			-0.73 (.28)***		
import				-0.48 (.18)***	
export					-0.55 (.21)**
autocracy	-0.002 (.009)	.001 (.01)	.002 (.01)	.0003 (.01)	.001 (.01)
fatality	-0.02 (.006)***	-0.02 (.008)**	-0.02 (.009)**	-0.02 (.006)***	-0.02 (.008)***
military	3.10 (.37)***	3.40 (.53)***	3.67 (.76)***	3.29 (.46)***	3.38 (.52)***
previous disputes	.02 (.003)***	.02 (.004)***	.02 (.004)***	.02 (.003)***	.02 (.004)***
violence2	-.01 (.03)	-.02 (.03)	-.02 (.03)	-.02 (.03)	-.02 (.03)
violence3	.03 (.02)	.03 (.02)	.03 (.02)	.03 (.02)	.03 (.02)
Observations	2826	2826	2826	2826	2826
R2	0.31	0.29	0.27	0.30	0.29
Region dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

Tables 6 and 7 show some robustness checks for the main specification on Table 4 column (3). In column (1) Table 6, I change the dependent variable from the probability of initiating a different dispute in the next three years into the probability of participating in another dispute in the next three years. In this specification,

<sup>8</sup> Unfortunately, there is no dataset of comprehensive sanctioned items to test this theory.

I control for previous disputes participation, the number of disputes in which  $k$  participated in the past three years. The effect of economic sanctions is negative and significant, but the magnitude of the local average treatment effect is smaller than the effect of economic sanctions on the probability that  $k$  initiates another dispute. Sanctions deter participation, but they have a stronger effect in deterring the start of a dispute probably because countries have more control on initiating a dispute than on participating in one.

Table 6. Robustness checks

	$\pi$ (1)	P (2)	P (3)	P (4)
sanction	-.61 (.26)**	-.69 (.26)***	-.69 (.27)**	-.68 (.26)**
autocracy	-.001 (.009)		.001 (.01)	.001 (.01)
fatality	-.02 (.008)**	-.01 (.009)**		-.01 (.009)**
military	3.29 (.63)***	3.59 (.72)***	3.59 (.74)***	3.56 (.71)***
previous disputes participation	.01 (.002)***			
violence2	-.03 (.02)	-.02 (.03)	-.02 (.03)	
violence3	.04 (.02)*	.03 (.02)	.03 (.03)	
polity		-.0006 (.005)		
previous disputes		.02 (.004)***	.02 (.004)***	.02 (.004)***
fatality2			.04 (.02)	
fatality3			-.06 (.06)	
fatality4			-.12 (.06)**	
violence				.002 (.001)
Observations	2830	2826	2826	2826
R2	0.30	0.26	0.26	0.26
Region dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

**Table 7. Effects of economic sanctions on militarized disputes over various periods of time**

	P4 (1)	P5 (2)	P6 (3)	P7 (4)
sanction	-.64 (.25)**	-.54 (.26)**	-.56 (.24)**	-.44 (.22)**
autocracy	.0001 (.009)	-.0004 (.009)	.0001 (.008)	.0002 (.007)
fatality	-.02 (.009)**	-.02 (.009)**	-.02 (.009)**	-.02 (.008)***
military	3.26 (.71)***	3.01 (.71)***	2.87 (.71)***	2.66 (.68)***
violence2	-.02 (.03)	-.01 (.03)	-.01 (.03)	-.01 (.03)
violence3	.04 (.02)	.04 (.02)	.04 (.02)*	.04 (.02)*
previous disputes4	.02 (.003)			
previous disputes5		.01 (.002)***		
previous disputes6			.01 (.002)***	
previous disputes7				.01 (.001)***
Observations	2794	2758	2726	2688
R2	0.29	0.31	0.32	0.34
Region dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

In columns (2)-(4), I use different control measures than in the preferred specification. In (2), I change the measure of democracy from *autocracy* to *polity*. The coefficient of sanction remains negative and significant and the effects of polity like the effects of autocracy are not statistically different from zero. In column (3), I control for three fatality dummies (*fatality2*, *fatality3* and *fatality4*) instead of *fatality* to capture possible nonlinear effects of fatalities

on *P*. *Fatality1*, the dummy for zero fatalities, is the omitted category. The effects of sanctions remain negative and significant and the fatality dummies show that having 1,000 or more fatalities rather than no fatalities has a negative effect on *P*. This is consistent with the results in the preferred specification where the variable fatality shows that increasing the number of fatalities has a negative and significant effect on *P*. In (4), I control for violence instead of the several violence dummies. Similar to the preferred specification, sanctions have a negative and significant effect and violence has no significant effect on *P*.

Next, in Table 7, I look at the strength of the deterrent effect over time. In column (1), I look at the probability that a country will initiate another dispute in the following four years and control for the number of disputes *k* initiated in the previous four years, in (2), I look at the probability that *k* initiates another dispute in the following five years and control for the number of disputes initiated in the past five years, in (3), I look at the probability that *k* initiates another disputes in the following six years and control for the number of disputes initiated by *k* in the previous six years and finally, in (4), I look at the probability that *k* initiates another disputes in the following seven years and control for the number of disputes initiated by *k* in the previous seven years. The effects of sanctions remain negative and significant for all the time periods observed. However, the deterrent effect decreases with the time passed from the sanction. We observe this erosion of the deterrent effect probably because governments in *k* change and believe the sender will not sanction the new government or because governments in the sender countries change and country *k* believe the new governments in sender countries are less likely to sanction wars.

Finally, I want to test whether the cut in trade or aid or the political message sent by the sender leads to less wars in the target. In

Table 8, I estimate the effects of declines in trade or aid on  $P$  that are not accompanied by economic sanctions. Results in (1) and (2) shows that a 50% or a 100% decline in trade with U.S. has no effects on the probability that the country suffering this cut in trade will initiate another dispute in the following three years. However, country  $k$  might have low trade links with U.S. and thus, *tradeus50* or *tradeus100* does not capture large cuts in trade from a large country. In (3) and (4), I also look at the effects of large cuts in trade between  $k$  and U.S.S.R.. Column (3) shows the effects of a decline of 50% of more in trade with U.S.S.R. on  $P$  and (4) the effects of a 100% decline in trade with U.S.S.R. on  $P$ . The cuts in trade with U.S.S.R. that are not accompanied by economic sanctions do not have deterrent effects on future disputes, either.

Table 8. Effects of cuts in trade or aid on future militarized disputes

	P					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>tradeus50</i>	-.08 (.07)					
<i>trus100</i>		-.18 (.11)				
<i>tradeussr50</i>			.05 (.08)			
<i>tradeussr100</i>				.09 (.09)		
<i>aid50</i>					.02 (.03)	
<i>aid100</i>						-.01 (.04)
<i>autocracy</i>	-.002 (.009)	-.002 (.009)	-.005 (.008)	-.004 (.008)	-.001 (.01)	-.0009 (.01)
<i>fatality</i>	-.02 (.009)**	-.02 (.009)**	.03 (.02)	.03 (.02)	-.02 (.009)**	-.02 (.009)**
<i>military</i>	5.03 (1.42)***	5.11 (1.37)***	11.23 (1.70)***	11.29 (1.65)***	5.28 (1.21)***	5.23 (1.19)***
<i>previous disputes</i>	.05 (.009)***	.05 (.009)***	.05 (.007)***	.05 (.008)***	.07 (.005)***	.07 (.005)***
<i>violence2</i>	-.02 (.04)	-.02 (.04)	.06 (.07)	.07 (.07)	-.04 (.05)	-.04 (.05)
<i>violence3</i>	.03 (.03)	.03 (.03)	.01 (.04)	.01 (.04)	-.001 (.03)	-.002 (.03)
observations	1821	1821	516	516	1161	1161
pseudo R2	0.22	0.22	0.33	0.33	0.26	0.26
Region dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes

\*, \*\*, and \*\*\* denote 0.10, 0.05, and 0.01 levels of significance respectively

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 (or U.S.S.R.) intentionally decreases trade with that country

to punish or warn that country. If that's the case, it is not surprising that countries suffering trade cuts are not modifying their behavior.

However, the results on trade might not be completely reliable because the trade measure captures the overall declines in trade with a particular country and does not capture declines in particular goods only. Thus, if United States cuts 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 a trade policy that can have an important impact on target's economy and an important deterrent effect. Unfortunately there is no bilateral trade data by item type that covers all the years and countries in the Correlates of War to properly test this hypothesis.

The analysis on drops in aid alleviates some of the above problems. Large drops in development aid are less likely to be anything else but punishments or warning messages and are not affected by infrastructure destruction. Drops in aid cover aid from all donor countries (not only aid from US or USSR). Columns (5)-(6) show that large declines in aid have no effect on  $P$  when they are not accompanied by economic sanctions. Thus, results from (1)-(6) seem to suggest that economic policies that are not visible do not have a deterrent effect. Senders need to send clear messages of disapproval that can be heard and understood by targets in order to modify future behavior.

The results seem to support the signaling hypothesis according to which sanctions signal disapproval of military disputes and the hypotheses regarding the political channels through which sanctions affect future disputes. However, the results in Table 8 do not support the economics hypotheses according to which sanctions affect the economy, trade and the ability to invest in

military capabilities. If these hypotheses were true, cuts in aid and trade would have a deterrent effect even in absence of an official sanction.

## 8. Conclusions

The central intuition of this paper is that economic sanctions imposed on initiators of militarized conflicts show sender's disapproval of militarized conflicts and a willingness to impose economic costs on countries involved in militarized conflicts. Sanctioned countries also suffer political changes that make initiating a new war more difficult. Thus, countries that were sanctioned due to their involvement in a militarized dispute are less likely to initiate future disputes.

This study uses a 2SLS model and finds that economic sanctions decrease the probability that a country will initiate another dispute. Sanctions also decrease the probability of participating in a dispute. The magnitude of the deterrent effect decreases over time. I also find that decreasing trade or aid to a country involved in a militarized dispute without imposing economic sanctions has no effect on the future military behavior of that country. The results remain consistent in a series of robustness checks.

A number of lessons can be drawn from the above results. 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 countries involved in the dispute. The deterrent effect weakens over time, thus one sanction will not deter wars forever.

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? Are large costs borne by innocent civilians in the target and in the sender worth the drop in the probability of war? Future research should investigate these aspects of economic policy that could affect the success of sanctions as deterrents.

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## References

- Andreasson, G., 2008. Evaluating the Effects of Economic Sanctions in Burma. Retrieved from <http://lup.lub.lu.se/luur/download?func=downloadFile&recordOID=1335119&fileOID=1646821>
- Barbieri, K., O. Keshk, B. Pollins, 2008. Correlates of War Project Trade Dataset Codebook, Version 2.0. Retrieved from <http://corelatesofwar.org>
- Barbieri, K., O. Keshk, B. Pollins, 2009. Trading Data: Evaluating Our Assumptions and Coding Rules. *Conflict Management and Peace Science*. Forthcoming.
- Bayer, R. 2006. "Diplomatic Exchange Data set, v2006.1." Online: <http://correlatesofwar.org>.
- Blainey, G. 1973. *The Causes of War*. 2 ed. New York: The Free Press.
- Choi, S. and P. James, 2006. Media Openness, Democracy and Militarized Interstate Disputes. *British Journal of Political Science* (37), 23-46.
- Dixon, W., 1994. Democracy and the Peaceful Settlement of International Conflict. *The American Political Science Review* 88(1), 14-32.
- Drury, A., 2000. US Presidents and the Use of Economic Sanctions. *Presidential Studies Quarterly* 30(4), 623-642.
- Drury, A., 2001. Sanctions as Coersive Diplomacy: The US President's Decision to Initiate Economic Sanctions. *Political Research Quarterly*, 2001: 54:485.
- Drury, A. and J. Park, 2004. Mids, Economic Sanctions, and Trade: the Effect of Economic Coercion on military Disputes. Annual Meeting of the International Studies Association. Montreal, Canada.
- Drury, A., 2005. *Economic Sanctions and Presidential Decisions: Models of Political Rationality*. Macmillan.
- Fearon, J., 1994. Domestic Political Audiences and the Escalation of International Disputes. *The American Political Science Review* 88(3), 577-592.
- Galtung, J., 1967. On the Effects of International Economic Sanctions: with Examples from the Case of Rhodesia. *World Politics* 19(3), 378-416.
- Garfinkel, M., and S. Skaperdas, 2007. Economics of Conflict: An Overview. In T. Sandler, K. Hartley (Eds.), *Handbook of Defense Economics* (Vol. 2).
- Ghosn, F., G. Palmer, S. Bremer, 2004. The MID3 Dataset, 1993-2001: Procedures, Coding Rules, and Description. *Conflict Management and Peace Science* (21), 133-154.
- Hegre, H. 2008. Preponderance might pacify, but power kills. *Journal of Conflict Resolution, Journal of Conflict Resolution* 52(4): 566-89.
- Hochman, J., 1975. The Suspension of Economic Assistance to India, in vol. 3, Appendices: Commission on the Organization of the Government for the Conduct of Foreign Policy. Washington, DC.
- Hufbauer, G., J. Schott, K. Elliott, B. Oegg, 2007. *Economic Sanctions Reconsidered, 3rd Edition*. Washington DC: Institute for International Economics.
- Jones, D., S. Bremer, J. Singer, 1996. Militarized Interstate Disputes, 1816-1992: Rationale, Coding Rules, and Empirical Patterns. *Conflict Management and Peace Science* 15(2), 163-213.
- Kaempfer, W. H. and A. D. Lowenberg, 2007. The Political Economy of Economic Sanctions. In T. Sandler and K. Hartley (Eds.), *Handbook of Defense Economics* (Vol. 2, pp. 867-911). Elsevier B.V.
- Knorr, K., 1975. *The Power of Nations: The Political Economy of International Relations*. New York: Basic Books.
- Lektzian, D. and C. Sprecher, 2007. Sanctions, Signals, and Militarized Conflict. *American Journal of Political Science* 2, 415-431.
- Lindsay, J., 1986. Trade Sanctions as Policy Instruments: A Re-Examination. *International Studies Quarterly* 30(2), 153-173.
- Lopez, G. A. and D. Cortright, 2004. Containing Iraq: Sanctions Worked. *Foreign Affairs*, 90-103.
- Marshall, M., and K. Jagers, 2002. Polity IV Project, Integrated Network for Societal Conflict Research (INSCR) Program., Center for International Development and Conflict Management (CIDCM), University of Maryland, College Park.

Martin, P., T. Mayer, M. Thoe, 2008. Make Trade Not War? The Review of Economic Studies 75, 865-900.

McKenzie, F., 2008. GATT and the Cold War: Accession Debates, Institutional Development and the Western Alliance, 1947-1959. Journal of Cold War Studies 10(3), 78-109.

Mousseau, M., 1998. Democracy and Compromise in Militarized Interstate Conflicts, 1816-1992. The Journal of Conflict Resolution 42(2), 210-230.

Nordhaus, W., J. O Neal, B. Russett, 2006. Determinants of Threats and military Spending. NBER Summer Institute, Cambridge, Massachusetts.

Oneal, J., F. O Neal, Z. Maoz, B. Russett, 1996. The Liberal Peace: Interdependence, Democracy, and International Conflict, 1950-85. Journal of Peace Research 33(1), 11-28.

Oneal, J. R. and B.M. Russett, 1997. The Classical Liberals Were Right: Democracy, Interdependence, and Conflict, 1950-1985. International Studies Quarterly 41(2), 267-293.

Peterson, T., A. Drury, 2011. Militarized Conflict Sanctioning violence: The Effect of Third-Party Economic Coercion on Militarized Conflict. Journal of Conflict Resolution 55(4), 580-605.

Raymond, G., 1994. Democracies, Disputes, and Third-Party Intermediaries. The Journal of Conflict Resolution 38(1), 24-42.

Renwick, R., 1981. Economic Sanctions. Harvard Studies in International Affairs 45. Cambridge: Harvard University Center for International Affairs.

Russett, B., J. O Neal, D. Davis, 1998. The Third Leg of the Kantian Tripod for Peace: International Organizations and Militarized Disputes, 1950-85. International Organization 52(3), 441-467.

Singer, J. 1987. Reconstructing the Correlates of War Dataset and Material Capabilities of States, 1816-1985. International Interactions (14), 115-132.

Singer, J., S. Bremer, J. Stuckey, 1972. Capability Distribution, Uncertainty, and Major Power War, 1820-1965. In B. Russett, Peace, War, and Numbers (pp. 19-48). Beverly Hills: Sage.

Toynbee, A., 1925. Survey of International Affairs: 1920-1923. London: Oxford University Press.

World Bank, 2007. World Development Indicators CD-ROM. Washington DC: World Bank.



