Is There A Black Hole of Graft?

by

Fuad Hasanov
Assistant Professor of Economics

and

Nivedita Mukherji
Associate Professor of Economics

Oakland University
Rochester, MI 48309
e-mail: hasanov@oakland.edu, mukherji@oakland.edu

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Abstract

This paper examines the effects of government fiscal and regulatory policies on the size of informal economies and government graft. A two-good, three-sector model in which individuals optimally make labor-leisure and consumption decisions is used to determine the equilibrium allocation of labor across the three sectors. Since one of the three sectors is informal, a change in public policies affects the extent of informality in this economy. The theoretical results are then tested empirically using data from more than 50 countries. The empirical findings are found to be consistent with the findings of the theoretical model. The paper also provides one of the first empirical studies of the effects of fiscal and regulatory policies on graft. The theoretical results show that in certain cases a government can increase graft by following adverse fiscal and regulatory policies. These results are however not supported empirically.

1 Introduction

In recent years the issue of production in informal sectors is drawing considerable attention. de Soto (1989) provides much valuable information regarding factors which promote the development of informal markets. Although it has been recognized for long that the presence of these markets may seriously hamper an economy's ability to develop, it is only recently that serious theoretical and empirical studies of the issue are being conducted.

A large portion of the current empirical literature has studied the effects of regulations and taxation on the size of the informal economy. See Schneider and Enste (2000) for a review of many such studies. While this literature focuses on government tax and regulatory policies that promote the growth of informal economies, there is insufficient attention given to the reasons behind such policies. Marcouiller and Young (1995), Azuma and Grossman (2002) and Mukherji (2004) are some theoretical papers that study the possible rationale behind such government policies. These papers focus on maximizing the government's graft or tax revenue net of government services as the possible reason behind adopting policies that promote informal economies. Higher taxes and regulations are found to have the potential to increase graft. This paper extends the theoretical model in Mukherji (2004) and empirically tests the model's results using data from more than 50 countries. There is no paper to our knowledge that has empirically examined the impact of government policies on graft. This paper thus provides both a theoretical and empirical study of the effects of government policies on graft.

The paper both complements the current literature on informal economies by adding a new dimension to the literature and re-examines some of the existing results. The paper's findings support both theoretically and empirically the existing result that higher regulations

increase the size of the informal economy. Theoretically such regulations have the ability to increase graft in certain cases. The empirical results, however finds that graft decreases as regulations rise.

While the paper's findings with respect to regulations are consistent with existing results, it challenges the conventional result that higher taxes promote informality. Again this result arises both theoretically and empirically. While the theoretical model shows the possibility of higher taxes increasing informality in certain cases, the empirical results do not. Although most papers find higher tax burdens increase the size of the informal economy, Schneider and Enste (2000) caution that the result may not be robust and must be studied in a general equilibrium context that takes into the account the impact of taxes on individual labor-leisure decisions and demand and supply of formal and informal goods. It is precisely in such a context that we find that higher taxes may indeed reduce the size of the informal economy. Higher taxes also increase graft both theoretically and empirically.

Finally, higher government services are found to increase informality by providing access to productive services for which informal producers pay no price. Theoretically higher government expenditures may either increase or decrease graft but the empirical results show a positive relationship.

These results challenge the theoretical results of Marcouiller and Young (1995) that show that a government can tax and regulate a formal sector out of existence to increase its graft.

The rest of the paper is organized as follows. The following section provides a brief survey of the literature. Section 3 describes the theoretical model and its results and section 4 describes the empirical problem and its results. Simulation studies of the theoretical model and empirical results are given in appendixes.

2 Literature Review

The literature on the informal economy has seen an extensive growth in recent years. Since informality is increasingly recognized as a phenomenon affecting countries spanning the entire spectrum of development, many factors are found to contribute to its development. Sociologists, anthropologists, economic psychologists and of course economists have contributed to this literature. See Frank (1988), Frey (1997) and Rabin (1998) for some interdisciplinary work on informality. The notion of informality was formalized by a social anthropologist Keith Hart (see Hart (1971, 1973).

Most researchers and casual observers view the informal sector as having a detrimental impact on the economy. Papers such as Viramani (1989), Goswami et. al. (1991), Besley and McLaren (1993), Shleifer and Vishny (1993), Jain (1998), Tanzi (1994, 1998), Bardhan (1997), Johnson, Kaufmann, Zoido-Lobaton (1998a, b) provide explanations based on corruption of officials, such as tax collectors, and in such papers the government is better off if such corruptions can be eliminated. However, current research in the field is demonstrating that informal production may indeed play a useful role in many economies. For example, Buchanan and Faith (1987) view the secession as a factor limiting the predatory behavior of governments. Using advances in growth theory, papers such as Loayza (1996), Sarte (2000), Loayza, Oviedo, Serven (2005) study the impact of the informal economy on the economy's growth path. While Loayza (1996) and Loayza et. al. (2005) conclude that the informal economy reduces growth, Sarte (2000) shows that the sector may not adversely affect growth. When entry and exit by firms in the formal sector are controlled by a rent-seeking bureaucracy, many firms may choose to operate in the informal sector, provided the loss of public services such as property rights protection is not large. In that case, the informal sector

provides a cheap alternative to producing in the formal sector. Thus, this sector may serve a useful purpose in such situations. Arguing that the endogenous growth models used in these two papers is inappropriate to study the informal sector, Ihrig and Moe (2001) shows that the size of the informal sector decreases as the economy approaches its steady state. However, they also show that the presence of the informal sector may in fact serve a useful purpose in providing employment, particularly in times of economic slowdowns and does not cause too much distortion.

Many of the recent empirical studies focus attention on the effects of taxation and regulatory policies on the growth and size of informal economies. Feige (1989), Cebula (1997), Johnson, Kaufmann, Zoido-Lobaton (1998a, b), Friedman, Johnson, Kaufman and Zoido-Lobaton (1999) are some recent papers in this literature. Johnson, Kaufmann and Shleifer (1997) and Friedman, Johnson, Kaufman and Zoido-Lobaton (1999)show that higher regulations of all types increase the size of the informal economy. These series of papers by Johnson, Kaufmann et.al. show that lower taxes, regulations, and bribery reduce the size of informal economies with high tax revenues. High tax revenues are necessary to support an economy with a healthy legal system.

The informal sector in many countries is very large and it does not seem that the governments in those countries are particularly interested in taking steps to limit their growth. Montiel, Agenor and Ul Haque (1993) note that if these sectors were indeed highly detrimental for an economy it is unlikely that they will be so widespread. Although some of the papers cited above find that there may be benefits accruing from informal production from the economic growth or employment perspective, papers such as Marcouiller and Young (1995) and Mukherji (2001) find that it may be in a government's interest to foster the de-

velopment of such informal markets. These papers determine the circumstances under which public policies can almost eliminate formal production. In studying economies with large informal sectors it may not be appropriate to assume that the government is benevolent and interested in maximizing the welfare of citizens. Like Marcouiller and Young (1995) and Mukherji (2004), this paper assumes that the government's primary objective is to generate the maximum amount of graft. The paper finds that in many cases graft is higher if an informal sector exists.

3 Description of the Economy

The model-economy analyzed is similar to the one used in Mukherji(2004) and Marcouiller and Young (1995). Individuals in this economy produce two goods. Unlike Mukherji's and Marcouiller papers, one of these two goods, denoted by H, can be produced in either the formal sector or an informal sector since its production can be concealed. Production of the other good, J, however cannot be concealed and hence must occur in the formal sector. Output of the concealable good, H, depends on a certain type of public service, g. If production of the good occurs in the informal economy, the producers must bear the cost of privately providing a substitute of the required service.

All producers in the formal sector must pay a tax at the rate τ. Since production of H is concealable, producers of H in the formal sector may hide their production to evade taxes. Thus, the government requires firms to comply with some regulations to reduce tax evasion. The main purpose of regulations in this economy is to reduce tax evasion. Regulations are represented by R. Given R, the probability that a firm will succeed in evading taxes is $1-R$. With probability R, the firm will be caught in its efforts to evade and will have to pay a

penalty. The effective tax rate in that case will become $\tau(1+\nu) \equiv T$. In addition to affecting the rate at which tax evaders are caught, regulations reduce the amount of time producers are able to devote toward productive purposes.

After tax output of H in the formal sector is given by

$$Y_H = (1 - R + R(1 - T))\psi * ((1 - R)l)^{1-\phi} g^{\phi} \tag{1}$$

In this function ϕ and ψ are positive constants.

Like Mukherji (2004), individuals here also choose the amount of labor they supply to produce the two goods by balancing the disutility of labor and the consumption it makes possible. Leisure in this context may involve working on a family enterprise, raising children, education, or other productive activities. Utility derived from consumption of the two goods and leisure is represented by the following utility function:

$$U(H_F, J_F, l_F) = [H_F^{\frac{\sigma-1}{\sigma}} + J_F^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} - \alpha l_F \tag{2}$$

In this utility function σ is the elasticity of substitution between the two goods, α is a parameter, and l is the amount of labor supplied.

Treating the formal good H as the numeraire and using p as the price of good J, the budget constraint of producers of the formal good H is:

$$H_F + pJ_F = (1 - R * T)\psi * ((1 - R)l_F)^{1-\phi} g^{\phi} \tag{3}$$

Producers of the formal good choose their consumption and labor supplies by maximizing the utility given by equation (2) subject to the above budget constraint. Routine calculations yield,

$$H_F = p^{\sigma} J_F \tag{4}$$

$$l_F = \left(\frac{(1-\phi)\psi}{\alpha}\right)^{\frac{1}{\phi}} (1 - R * T)^{\frac{1}{\phi}} (1-R)^{\frac{(1-\phi)}{\phi}} (1 + p^{1-\sigma})^{\frac{1}{\phi(\sigma-1)}} g \tag{5}$$

Substituting from equations (4) and (5) in the budget constraint, consumption of the formal good is given by

$$H_F = (1 - R * T)^{\frac{1}{\phi}} \psi^{\frac{1}{\phi}} (1-R)^{\frac{(1-\phi)}{\phi}} \left(\frac{1-\phi}{\alpha}\right)^{\frac{1-\phi}{\phi}} (1 + p^{1-\sigma})^{\frac{1-\phi\sigma}{\phi(\sigma-1)}} g \tag{6}$$

Indirect utility of producers of the formal good then equals

$$V_F = \phi \left(\frac{1-\phi}{\alpha}\right)^{\frac{1-\phi}{\phi}} \psi^{\frac{1}{\phi}} (1 - R * T)^{\frac{1}{\phi}} (1-R)^{\frac{(1-\phi)}{\phi}} (1 + p^{1-\sigma})^{\frac{1}{\phi(\sigma-1)}} g \tag{7}$$

The informal sector producing good H works much like the formal sector, except that output here is not taxed and producers do not have to comply with any regulations. Producers here, however, do not have access to all public services. While some infrastructure related public services such as roads are available to all producers, certain other services are only partially available at best. Informal producers may expend some resources to gain increased access to these services and in some cases provide private substitutes of those services. Thus, they have to divert some of their labor services for gaining more complete access to partially available public services and/or for the production of substitutes of the public services enjoyed by producers in the formal sector.

An informal producer has full access to only a fraction γ of the public services g available to producers in the formal sector. By expending some effort they can increase that fraction to $\gamma + s$, where, $0 < s < 1$ also represents the fraction of labor diverted for this purpose. The production function of the informal good I is then given by:

$$Y_I = \psi[(1-s)l'_I]^{1-\phi}[(\gamma + s)g]^{\phi} \tag{8}$$

A positive solution for the fraction s requires the assumption $\phi > \frac{\gamma}{1+\gamma}$.

Informal producers get caught by the authorities with probability π. This probability is assumed to be proportional to the ratio of informal to total population. That is,

$$\pi = \frac{\theta n_I}{N} \tag{9}$$

, where, n_I equals the number of people who produce in the informal sector and N equals total population, and θ is a positive parameter reflecting the government's success in capturing informal producers. The positive relationship between the probability π and the ratio of informal to total population is based on the observation that it is much easier to escape the authorities if a very small fraction of producers produce informally than if a much larger fraction did. The government's incentive to go after these producers will also tend to decrease as the proportion decreased. Once caught, however, these producers have to give up their entire output. The budget constraint facing these producers then becomes:

$$H_I + pJ_I + B = (1-\pi)\psi[(1-s)l_I']^{1-\phi}[(\gamma+s)g]^{\phi} \tag{10}$$

In this equation B represents the amount of bribes or additional expenses expended by these producers to remain informal.

Assuming that producers in the informal sector have similar preference for consumption and leisure as those in the formal economy, the following equations with the exception of equation (11) are the equivalents of equations (4) - (7).

$$s = \phi - \gamma(1-\phi) \tag{11}$$

$$H_I = p^{\sigma} J_I \tag{12}$$

$$l_I = \left(\frac{(1-\phi)\psi}{\alpha}\right)^{\frac{1}{\phi}} (1-\pi)^{\frac{1}{\phi}} (1+p^{1-\sigma})^{\frac{1}{\phi(\sigma-1)}} (1-s)^{\frac{1-\phi}{\phi}} (\gamma+s)^{\frac{1}{\phi}} g \tag{12}$$

Substituting in the budget constraint, consumption of good H is given by

$$H_I = (1-\pi)^{\frac{1}{\phi}}\psi^{\frac{1}{\phi}}\left(\frac{(1-\phi)}{\alpha}\right)^{\frac{1-\phi}{\phi}}(1+p^{1-\sigma})^{\frac{1-\phi\sigma}{\phi(\sigma-1)}}(1-s)^{\frac{1-\phi}{\phi}}(\gamma+s)^{\frac{1}{\phi}}g - B(1+p^{1-\sigma})^{-1} \quad (13)$$

Indirect utility of producers of the informal good then equals

$$V_I = \phi\left(\frac{(1-\phi)}{\alpha}\right)^{\frac{1-\phi}{\phi}}\psi^{\frac{1}{\phi}}(1-\pi)^{\frac{1}{\phi}}(1+p^{1-\sigma})^{\frac{1}{\phi(\sigma-1)}}(1-s)^{\frac{1-\phi}{\phi}}(\gamma+s)^{\frac{1}{\phi}}g - B(1+p^{1-\sigma})^{\frac{1}{\sigma-1}} \quad (14)$$

Production of good J occurs only in the formal sector. Output of this good is impossible to hide. Thus tax evasion and production in an informal market are not possible. The production function is given by $\delta\psi l^{1-\phi}g^{\phi}$, where δ is a positive constant indicating that the technology used by this sector is different from the technology used in the production of good H. The elasticities of output to labor and government services are assumed to be the same as those for good H to keep the problem tractable. Noting that producers here cannot evade taxes, they are not subject to the regulations R and pay taxes at the rate τ. Solutions for optimal choices of consumption and leisure made by these producers parallel those made by the producers of good H and they are as follows:

$$l_J = \left(\frac{(1-\phi)\delta\psi}{\alpha}\right)^{\frac{1}{\phi}}(1-\tau)^{\frac{1}{\phi}}p^{\frac{1}{\phi}}(1+p^{1-\sigma})^{\frac{1}{\phi(\sigma-1)}}g \quad (15)$$

$$H_J = (1-\tau)^{\frac{1}{\phi}}(\delta\psi)^{\frac{1}{\phi}}p^{\frac{(1-\phi)}{\phi}}\left(\frac{1-\phi}{\alpha}\right)^{\frac{1-\phi}{\phi}}(1+p^{1-\sigma})^{\frac{1-\phi\sigma}{\phi(\sigma-1)}}g \quad (16)$$

Indirect utility of the producers equals

$$V_J = \phi\left(\frac{1-\phi}{\alpha}\right)^{\frac{1-\phi}{\phi}}(\delta\psi)^{\frac{1}{\phi}}(1-\tau)^{\frac{1}{\phi}}p^{\frac{1}{\phi}}(1+p^{1-\sigma})^{\frac{1}{\phi(\sigma-1)}}g \quad (17)$$

For these three sectors to co-exist with perfect labor mobility, utilities in all three sectors must be identical. The price that sets $V_H = V_J$, is given by

$$p = \frac{(1-R*T)(1-R)^{1-\phi}}{\delta(1-\tau)} \quad (18)$$

Result 1 *The price of the good produced in the formal sector only (good J) decreases as regulations increase. The relationship between the prices and the tax rate depends on the degree of regulation and the penalty rate for tax evasion.*

These results follow directly from equation 18. These relationships show that as regulations decrease the supply of good H produced formally and/or informally increases which in turn increases the demand for good J by the producers of good H. This increased demand results in a higher price for good J.

Differentiation of the price p with respect to the tax rate τ shows that the sign of the derivative depends on the sign of the term $1 - R(1 + \nu)$. (Recall ν is the penalty for tax evasion.) As long as R and ν are reasonably small, an increase in the tax rate increases the price of good J. However, if regulations are very high or the penalty for tax evasion is high, production of good J becomes more attractive. This results in a lower price for the good.

Setting $V_I = V_H$ yields,

$$\pi = 1 - \frac{1}{(1-s)^{\frac{1-\phi}{\phi}}(\gamma+s)^{\frac{1}{\phi}}}\left[\frac{B(1+p^{1-\sigma})^{\frac{1-\phi}{\phi(1-\sigma)}}}{\phi\psi^{\frac{1}{\phi}}\left(\frac{1-\phi}{\alpha}\right)^{\frac{1-\phi}{\phi}}g} + (1-R*T)^{\frac{1}{\phi}}(1-R)^{\frac{1-\phi}{\phi}}\right]^{\phi} \tag{19}$$

Recall that the probability of getting caught in the informal sector is proportional to the fraction of the population working there. Thus, having determined π in equation (19), the number of producers in the informal sector I directly follows from equation 9. Thus,

$$n_I = \frac{N}{\theta}\left[1 - \frac{1}{(1-s)^{\frac{1-\phi}{\phi}}(\gamma+s)^{\frac{1}{\phi}}}\left\{\frac{B(1+p^{1-\sigma})^{\frac{1-\phi}{\phi(1-\sigma)}}}{\phi\psi^{\frac{1}{\phi}}\left(\frac{1-\phi}{\alpha}\right)^{\frac{1-\phi}{\phi}}g} + (1-R*T)^{\frac{1}{\phi}}(1-R)^{\frac{1-\phi}{\phi}}\right\}^{\phi}\right] \tag{20}$$

Result 2 *Increases in government services and regulations increase production in the informal sector. Higher taxes may increase or decrease informal production.*

This result follows from equation 20. While an increase in government services or regulations unambiguously increases informal production, increases in the tax rate may increase such production. The effect depends on the impact of the tax rate on the price p. If higher tax rates decrease p (see Result 1), informal production unambiguously increases. However, if the price increases and the effect is strong informal production will decrease. (This can be seen by differentiating n_I with respect to the tax rate.)

Given the solution for n_I, the number of producers who produce either good H in the formal sector or produce good J equals $N - n_I \equiv n$. Market clearing conditions in the goods market determine the distribution of producers in the two formal product markets.

Demand for good H comes mainly from the producers of good J since the formal and informal producers of good H use portions of their own production for consumption. The supply of good H equals the portion that remains after personal consumption of the formal and informal producers of H. Demand for good J equals the demand by the formal and informal producers of good H. The supply of good J equals the demand for good H by the producers of good J divided by the price of good J. This market clearing condition is given by the following equation:

$$n_J H_J = \frac{n_F H_F}{p^{\sigma-1}} + \frac{n_I H_I}{p^{\sigma-1}} \tag{21}$$

It follows from the condition $n_H + n_J = n \equiv N - n_I$ and equation 21 that:

$$n_H = \frac{nH_J - \frac{1}{p^{\sigma-1}} n_I H_I}{\frac{H_F}{p^{\sigma-1}} + H_J} \tag{22}$$

$$n_J = \frac{\frac{nH_F}{p^{\sigma-1}} + \frac{1}{p^{\sigma-1}} n_I H_I}{\frac{H_F}{p^{\sigma-1}} + H_J} \tag{23}$$

These equations complete the determination of all endogenous variables. The following section examines the impact of government services, regulations and taxes on graft.

3.1 Impact of Public services, Regulations and Taxation on Graft

As defined in Marcouiller and Young (1995) and Mukherji (2004), graft equals tax revenue net of public services. In this paper tax revenue is obtained from the formal production of goods H and J. Thus graft equals

$$G = n_F R * T\psi * ((1-R)l_F)^{1-\phi} g^{\phi} + n_J \tau \delta \psi l_J^{1-\phi} g^{\phi} - g \tag{24}$$

Since the parameters g, R, τ affect the number of producers n_F, n_J, the labor supplies l_F, l_J in complex ways the dependence of G on these parameters is not easily determined by differentiating G with respect to these parameters. We thus report the results of some numerical simulations of the model. While the simulation experiments conducted did not completely exhaust all reasonable model parameter values, fairly large ranges were considered. We report here a sample of the typical results obtained. See Appendix A for a sample of the numerical results. The following result summarizes the key findings of these numerical exercises.

Result 3

- *An increase in government services increases the size of the informal sector but may or may not increase graft.*
- *An increase in the tax rate decreases the size of the informal sector but increases graft.*
- *An increase in government regulations increases the size of the informal sector but may or may not increase graft.*

Government services are found to increase the size of the informal sector by providing informal producers free access to a productive resource. The higher service increases productivity of all firms which results in higher tax revenue. This is partially offset by the increase in informal production. Thus, the net effect on graft remains ambiguous.

Higher regulations increase the cost of producing formally and encourages informal production. However. higher regulations also increase tax collection in the model. Like government services, the net effect on graft depends on which of these two effects dominate. Simulation results show that both results may hold.

Result 1 shows that the price of the substitute good J may increase if the tax rate increases. This effect when coupled with the fact that informal producers need to bear the additional cost of bribes and have inadequate access to public services may increase the total burden of informality to such an extent that firms are better off in the formal sector. We observe such a result in the numerical exercises conducted.

In the next section of the paper we test the results of this theoretical model empirically.

4 Empirical Investigation

In this section, we present our first pass at empirically examining the effect of productive government expenditures and taxes on graft as well as informal sector of the economy. Results 2 and 3 summarize the key findings of the theoretical model. We would like to investigate these predictions using cross-country data. The basic specifications of our model described in detail below are:

$$Graft = f(taxrates, expenditures, regulation, controls)$$

$$Informalsector = f(taxrates, expenditures, regulation, controls)$$

4.1 Data and Descriptive Statistics

First, one of the major questions to tackle is the definition of graft. We follow the theoretical definition of graft, which is the government's tax revenue minus productive government expenditures. We obtain the data on tax revenues and government expenditures for many countries for the 1972-2000 period from the *Government Finance Statistics* yearbooks published annually by the International Monetary Fund (IMF). The data are expressed as percentages of GDP and are available at the NYU's Development Research Institute (DRI) website. The total tax revenues are provided in the dataset. However, measuring government productive services is not as straightforward. Given the theory, these services are part of the firms' production functions and are also available to firms in the informal sector although to a lesser extent. Thus we define government expenditures as the sum of the expenditures on public order and safety, fuel and energy, and transportation and communications. Of course, this is not a perfect measure but given data limitations, it should provide a useful benchmark [1].

We use World Tax Database at the University of Michigan to get the top marginal corporate and individual income tax rates. We also obtain data on regulation and other components of measures of institutions from Heritage Foundation, Fraser Institute, and PRS Group's *International Country Risk Guide*. The measure of institutions we use is a sum of ten major components, which include government stability, socioeconomic conditions,

[1] The issue of measurement error in the expenditure variable needs to be taken more seriously as the variable appears as a regressor thus potentially resulting in errors-in-variables problem. We plan to analyze this issue further using an instrumental variable approach.

internal and external conflicts, corruption, military in politics, religion in politics, law and order, democratic accountability, and bureaucratic quality, provided by the *International Country Risk Guide*. In our estimations, we also use regulation, government intervention, and fiscal balance variables from Heritage Foundation. Regulation and economic freedom indices by the Heritage Foundation and Fraser Institute are highly correlated. Lastly, the data on informal sector of the economy comes from Schneider (2004) and we use the World Bank's *World Development Indicators* for the GDP data. There are missing data for some years. We impute data for informal sector, corporate and individual income tax rates, and a measure of institutions using regressions of variables for which we have data. We report our results using both filled-in and unfilled datasets.

The first approach we take is analyzing a cross-section of countries with the 5-year data averages taken over 1995-1999 [2]. We have 75 countries that have data for graft. Figure 1 depicts graft vs. government expenditures scatter plot. Note there are 4 outliers in the data. The chart indicates that quadratic function of expenditures produces a better fit. Omitting these outliers, we see that the relationship is linear with a positive slope, but it is not strong with R2 of about 11% (see Figure 2). Other variables are also important in explaining variation in graft. As expected, the relationship is positive and stronger between individual income tax rates and graft (Figure 3). Finally, not surprisingly, Figure 4 indicates that regulation and graft are negatively related. The next three figures show the relationship of the informal sector with the expenditures, tax rates, and regulation. Figure 5 shows that the relationship between informal sector and expenditures is weakly positive, while the correlation with the tax rate is negative and is not strong, either (Figure 6). Note that

[2]We also plan to estimate the models in a panel setting with 5-year averages and yearly data. However, it would also be necessary to control for business cycles effects in the yearly panel.

regulation and informal sector are more strongly positively correlated (Figure 7). Finally, we show means and standard deviations as well as correlation matrix of our variables in Tables 1 and 2.

4.2 Estimation and Results

First we run a cross-sectional regression of 71 observations with graft as a dependent variable. The estimation method is OLS and we use heteroskedasticity consistent standard errors[3]. The regressors, measures of institutions and tax rates, can be safely assumed as exogenous to graft. Productive government expenditures seem to create a problem of simultaneity since expenditures are subtracted from tax revenues to arrive at graft and the same variable is also used as a regressor. However, it is exactly because expenditures are subtracted from tax revenues, they are no longer part of the graft measure, which should avoid the simultaneity problem. Nonetheless, we perform an instrumental variable estimation using a lagged expenditures variable (namely, average over 1990-1994) as an instrument.

Table 3 presents the results using the whole sample, and Table 4 excludes three outliers (with expenditure level of above 6%) from the original sample. We concentrate our discussion on the Table 4 results. Equation (3) that includes a regulation variable shows that expenditure (5% significance) and tax rates (10% significance) positively affect graft. The regulation has a negative impact on graft. Equation (4) introduces an additional control of a log of per capita GDP. Due to collinearity, the regulation variable becomes statistically insignificant. Without the regulation variable and with log of GDP per capita as a major control for initial conditions and level of development, both tax rate and expenditure variables are highly statistically significant with an adjusted R2 of about 0.5.

[3]The estimation is done in TSP.

By directly controlling for the level of institutions, we perform a few estimations as well. We arrive at similar conclusions. Using the instrumental variable approach and controlling for potential endogeneity of expenditures, we estimate equation (7) and note that the coefficient on expenditure is larger and more precise. Lastly, performing a median regression using least absolute deviations (LAD) approach that controls for the presence of data outliers, we obtain similar results. Both productive government expenditures and tax rates positively affect graft while regulation has a negative impact. In addition, coefficients on expenditures and tax rates do not differ substantially across various estimations. Our estimated results imply that if productive government expenditures increase by one percentage point relative to GDP, graft rises by about 2-2.5 percentage points relative to GDP.

Tables 5 and 6 show the estimation results when the variable of interest is the informal sector of the economy. The relationship between the informal sector and government expenditures is weak. Other variables are also important. Regulation seems to be one of those variables. Examining Table 6, we note that the impact of expenditures and regulation is positive while that of taxes is negative. Equations (7) and (8) show that all variables are statistically significant [4]. It is not as surprising that higher regulation implies higher informal sector and that higher expenditure while providing firms with productive services, creates more incentives for a firm to become informal as access to services is reduced a little but tax payments are reduced by a lot, The interesting result is that higher income tax rate implies a lower informal sector of the economy. This is consistent with the theoretical findings (see section 3 for details).

In summary, our estimation results based on cross-section of more than 50 countries over

[4]The results are qualitatively similar when performing estimations with the unfilled data. However, the dataset has a smaller number of observations

1995-1999 time period are as follows. The impact of tax rates and government expenditures on graft is positive and the impact of regulation is negative. The parameters are mostly statistically significant and not small in magnitude (see tables). In most cases the theoretical model shows that based on parameter values, graft may increase or decrease with changes in government fiscal and regulatory policies. Moreover, higher expenditures, higher regulation, and lower tax rates also imply a lower informal sector share of the economy. All of these results are consistent with the theoretical results summarized in Result 3 of the previous section.

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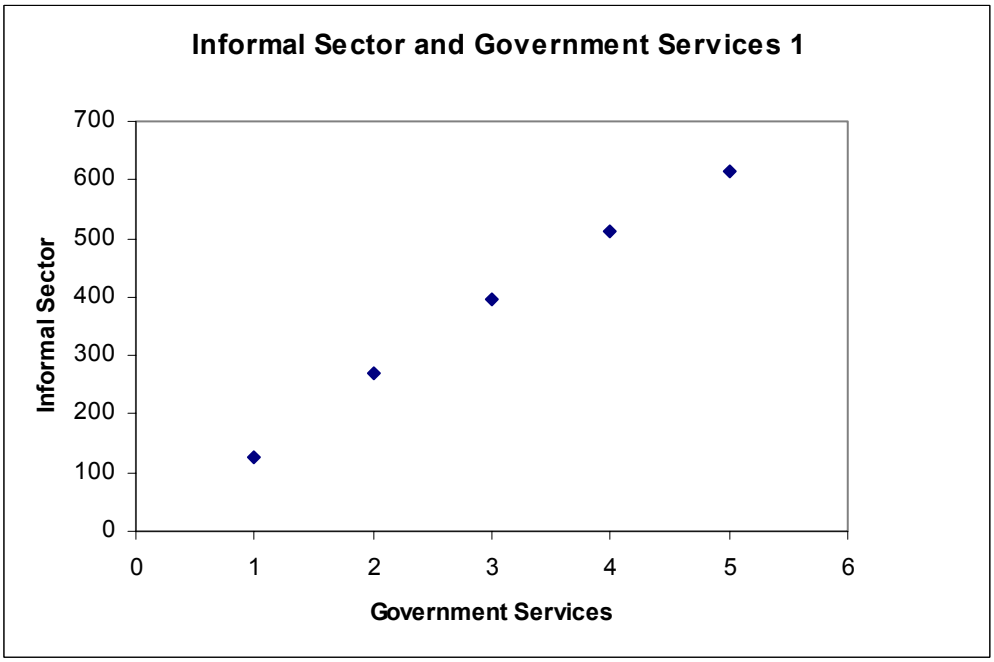
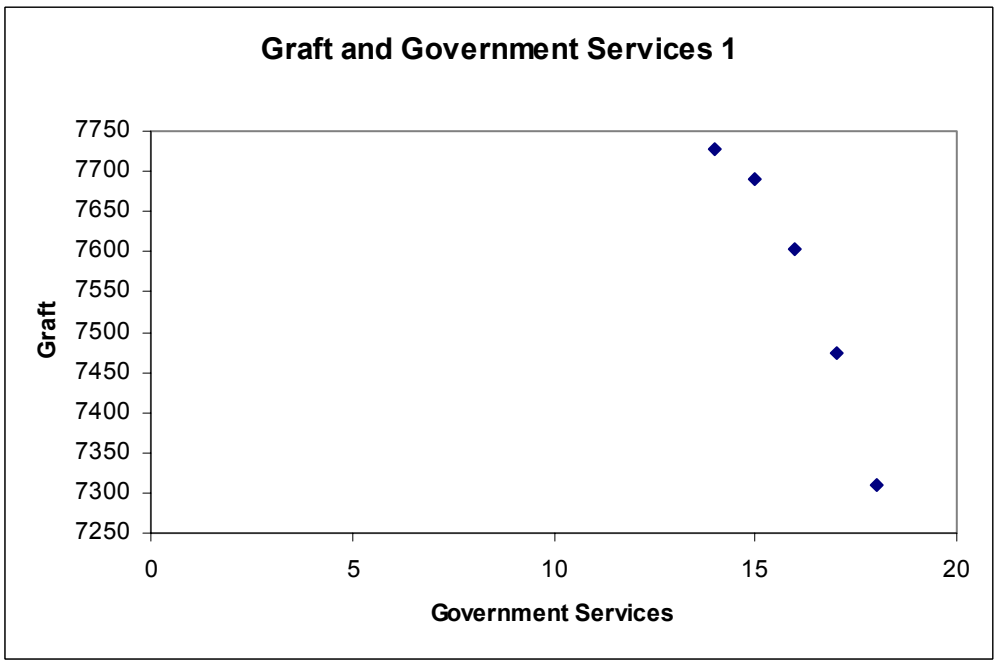
Appendix A

α = 0.5, φ = 0.4, v = 0.2, δ = 6, ψ = 3, σ = 0.2, B = 3, τ = 0.7, R = 0.6

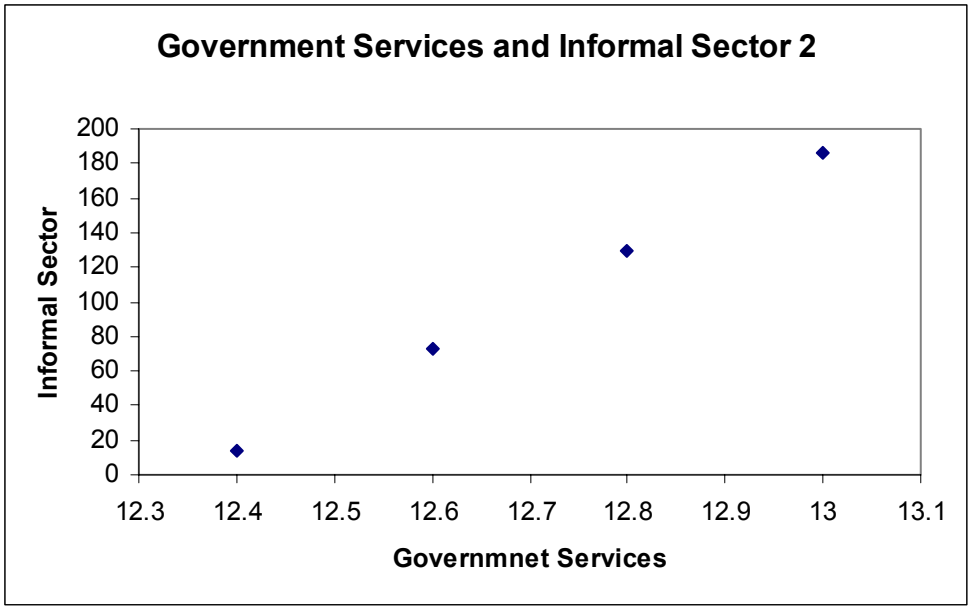
g	n-Informal	n-Formal H	n-J	Graft
14	126	643	231	7727
15	269	454	277	7690
16	396	290	314	7603
17	511	145	344	7475
18	615	16	369	7310

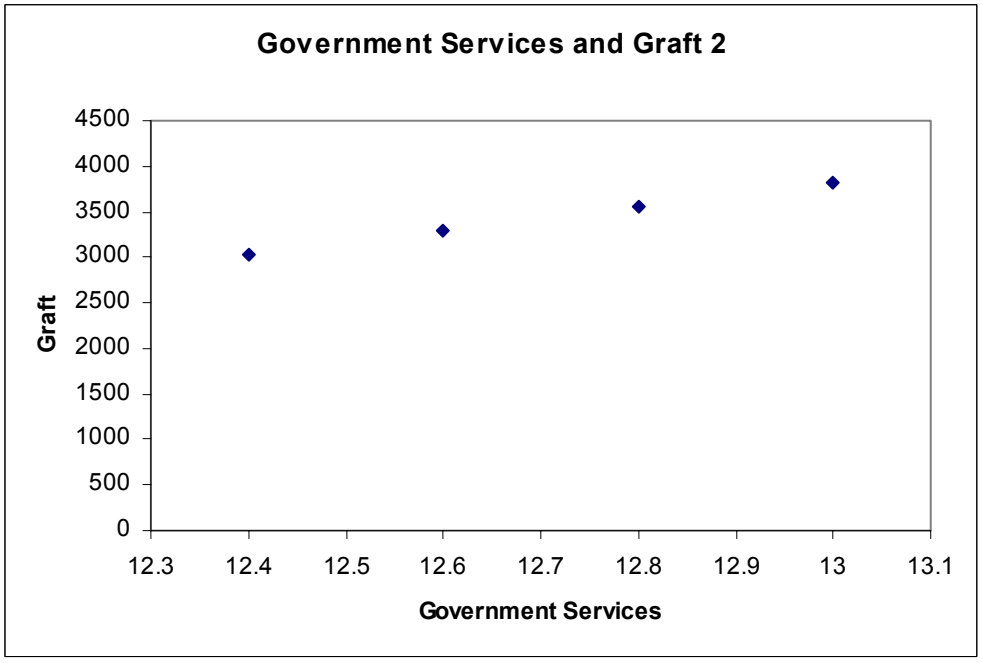




α = 0.6, φ = 0.4, v = 0.2, δ = 6, ψ = 3, σ = 0.3, B = 6, τ = 0.8, R = 0.7

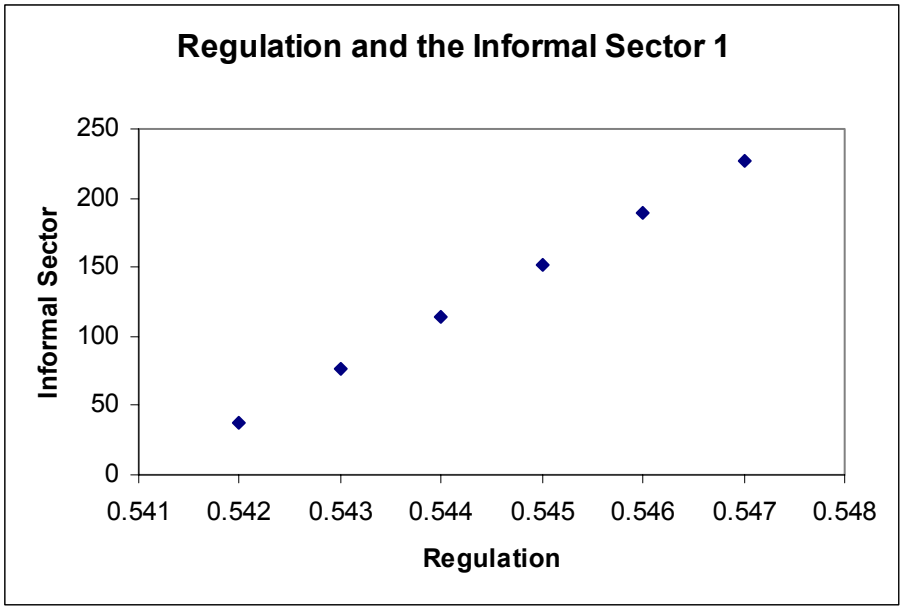
g	n-Informal	n-Formal H	n-J	Graft
12.4	14	754	232	3024
12.6	73	540	387	3298
12.8	130	336	534	3564
13	186	141	673	3820

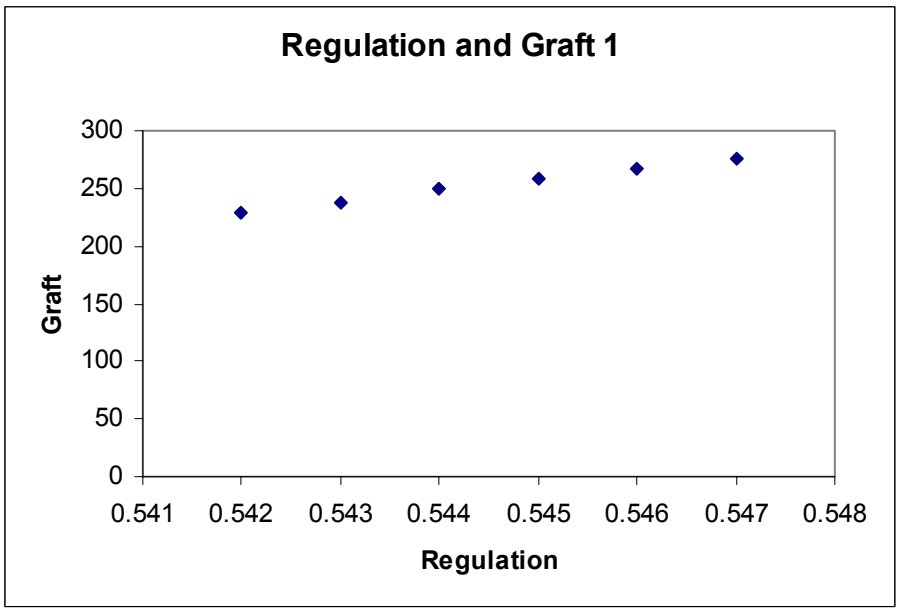




α = 0.6, φ = 0.2, v = 0.2, δ = 6, ψ = 3, σ = 0.2, B = 0.0021, g = 2, τ = 0.9

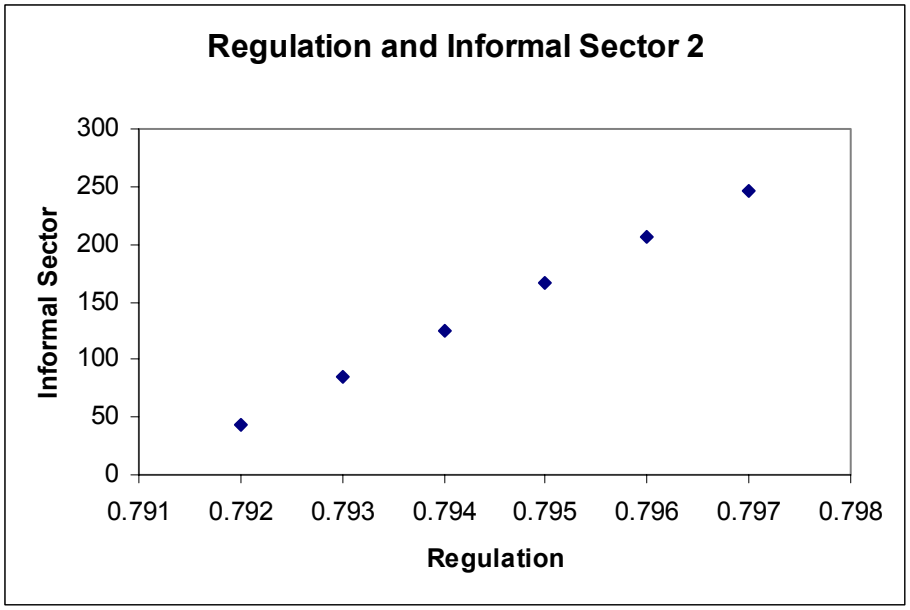
R	n-Informal	n-Formal H	n-J	Graft
0.542	38	475	487	229
0.543	76	390	534	238
0.544	114	306	580	249
0.545	152	222	626	258
0.546	190	138	672	267
0.547	227	54	719	276

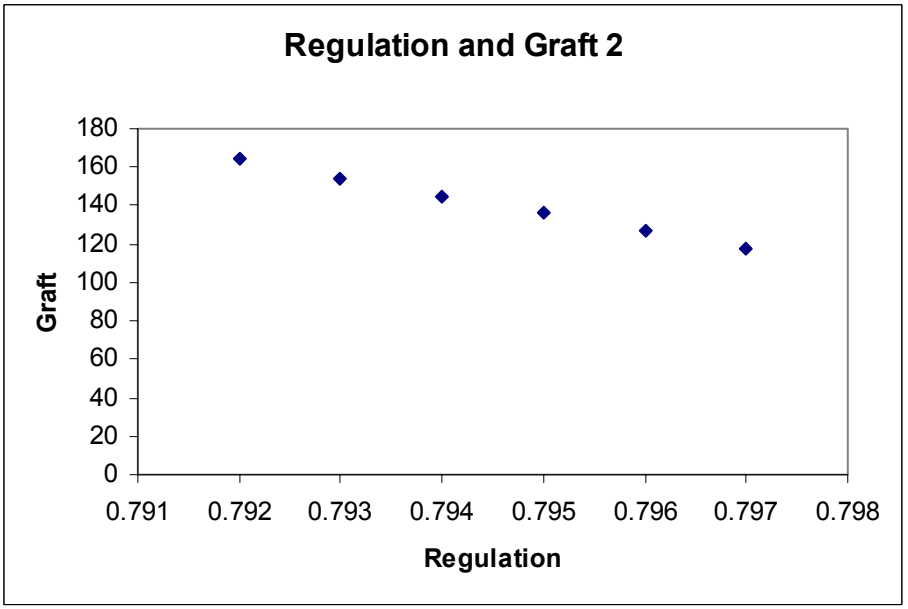




α = 0.6, φ = 0.2, v = 0.2, δ = 6, ψ = 3, σ = 0.2, B = 0.0021, g = 2, τ = 0.2

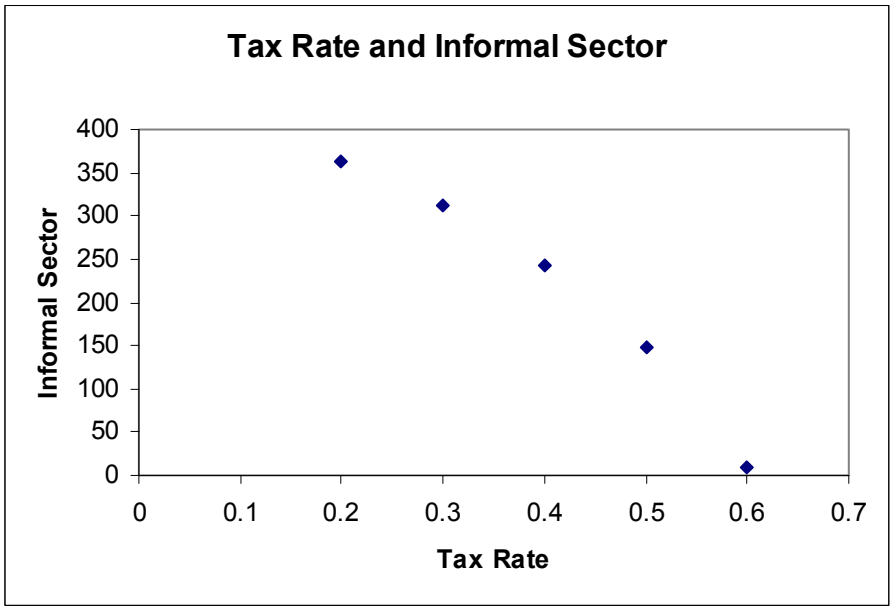
R	n-Informal	n-Formal H	n-J	Graft
0.792	44	810	146	164
0.793	85	758	157	154
0.794	125	706	168	145
0.795	166	654	180	136
0.796	207	603	191	127
0.797	247	551	202	118

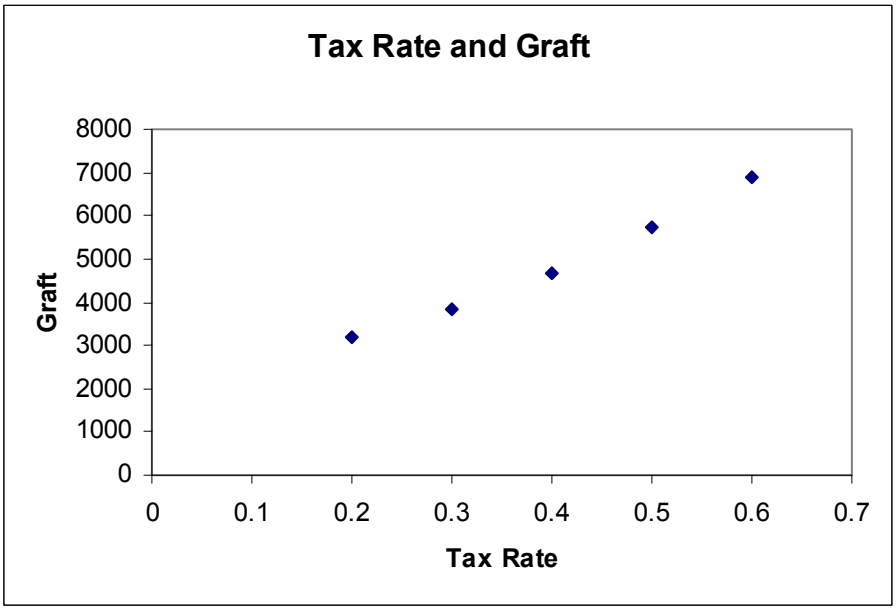




α = 0.6, φ = 0.2, v = 0.2, δ = 6, ψ = 5, σ = 0.3, B = 3, g = 5, R = 0.6

τ	n-Informal	n-Formal H	n-J	Graft
0.2	364	312	325	3205
0.3	311	365	324	3829
0.4	242	450	308	4657
0.5	147	594	259	5726
0.6	9	870	121	6912





Appendix B

Table 1. Descriptive Statistics

Variables	Average	St. Dev.
Graft	18.34	9.66
Expend	2.98	1.88
Informal	29.98	13.04
Corp. Tax Rate	31.14	9.80
Indiv. Tax Rate	35.03	14.95
Econ Freedom	2.93	0.73
Fiscal Burden	3.75	0.70
Gove't Interv	3.01	0.78
Prop. Rights	2.39	1.08
Regulation	2.95	0.85
Econ Freedom-FI	6.38	1.18
Legal	6.45	1.71
Regulation-FI	5.94	1.10
Credit Reg	6.90	1.85
Labor Reg	5.19	1.03
Business Reg	6.41	1.27
Gove't Stability	8.79	0.90
Sociecon	5.82	1.63
Invest. Prof	6.76	1.19
Int Conflict	10.04	1.96
Ext Conflict	10.70	1.28
Corruption	3.76	1.21
Military	4.48	1.46
Religion	5.02	1.08
Law/Order	4.59	1.11
Ethnic	4.59	1.36
Democracy	4.35	1.46
Bureaucracy	2.64	0.95
Institutions	60.19	9.34
GDP Growth	2.42	2.31
Log of GDP/capita	8.19	1.49

Table 2. Correlation Matrix

	Graft	Expend	Informal	Corp. Tax Rate	Indiv. Tax Rate	Econ Freedom	Fiscal Burden	Gove't Interv	Prop. Rights	Regulation
Graft	1.00									
Expend	-0.17	1.00								
Informal	-0.25	0.09	1.00							
Corp. Tax Rate	0.01	0.03	-0.12	1.00						
Indiv. Tax Rate	0.41	-0.27	-0.25	0.53	1.00					
Econ Freedom	-0.36	-0.06	0.40	0.37	0.18	1.00				
Fiscal Burden	0.32	-0.28	-0.15	0.64	0.79	0.33	1.00			
Gove't Interv	-0.03	0.37	0.02	0.21	-0.08	0.45	0.02	1.00		
Prop. Rights	-0.37	-0.06	0.49	0.29	0.10	0.91	0.27	0.33	1.00	
Regulation	-0.27	-0.18	0.41	0.25	0.17	0.76	0.33	0.24	0.69	1.00
Econ Freedom-FI	0.31	0.00	-0.46	-0.20	-0.07	-0.88	-0.18	-0.41	-0.82	-0.58
Legal	0.61	0.00	-0.68	-0.02	0.21	-0.69	0.10	-0.05	-0.71	-0.46
Regulation-FI	0.37	-0.12	-0.34	-0.38	-0.11	-0.81	-0.23	-0.40	-0.74	-0.51
Credit Reg	0.29	0.02	-0.21	-0.44	-0.16	-0.79	-0.32	-0.38	-0.69	-0.50
Labor Reg	-0.26	-0.13	0.01	0.10	-0.15	-0.16	-0.04	-0.32	-0.08	-0.20
Business Reg	0.43	-0.12	-0.60	-0.25	0.07	-0.76	-0.12	-0.09	-0.69	-0.55
Gove't Stability	0.07	0.09	-0.10	-0.09	-0.04	0.09	-0.05	0.18	0.07	-0.05
Sociecon	0.19	0.04	-0.43	-0.01	-0.10	-0.65	-0.12	-0.23	-0.60	-0.45
Invest. Prof	0.23	0.02	-0.07	-0.26	-0.12	-0.38	-0.24	-0.27	-0.28	-0.33
Int Conflict	0.24	0.13	-0.36	-0.03	0.01	-0.32	-0.03	0.05	-0.41	-0.24
Ext Conflict	0.17	-0.02	0.00	-0.28	-0.21	-0.37	-0.23	-0.29	-0.32	-0.12
Corruption	0.56	0.08	-0.55	-0.08	0.15	-0.51	0.10	-0.07	-0.53	-0.35
Military	0.43	0.00	-0.37	-0.03	0.06	-0.40	0.07	-0.01	-0.46	-0.28
Religion	0.33	-0.32	-0.07	-0.35	0.00	-0.37	-0.07	-0.31	-0.33	-0.09
Law/Order	0.37	0.13	-0.62	0.06	0.22	-0.46	0.13	0.02	-0.54	-0.36
Ethnic	0.14	0.10	-0.13	0.02	-0.01	-0.15	-0.02	-0.08	-0.18	-0.09
Democracy	0.51	-0.19	-0.42	-0.02	0.22	-0.55	0.15	-0.33	-0.53	-0.27
Bureaucracy	0.45	-0.17	-0.57	-0.12	0.22	-0.61	0.10	-0.22	-0.69	-0.40
Institutions	0.46	-0.02	-0.49	-0.12	0.06	-0.60	0.00	-0.17	-0.62	-0.38
GDP Growth	0.27	0.02	-0.19	0.03	0.29	-0.24	0.04	-0.18	-0.20	-0.14
Log of GDP/capita	0.48	-0.12	-0.54	-0.16	0.01	-0.82	-0.19	-0.15	-0.80	-0.60

Table 2, continued.

	Econ Freedom-FI	Legal	Regulation-FI	Credit Reg	Labor Reg	Business Reg	Gove't Stability	Sociecon	Invest. Prof	Int Conflict
Econ Freedom-FI	1.00									
Legal	0.72	1.00								
Regulation-FI	0.88	0.66	1.00							
Credit Reg	0.84	0.55	0.86	1.00						
Labor Reg	0.25	0.03	0.45	0.09	1.00					
Business Reg	0.70	0.82	0.82	0.60	0.14	1.00				
Gove't Stability	0.01	0.29	-0.01	-0.08	0.04	0.49	1.00			
Sociecon	0.72	0.63	0.53	0.48	0.15	0.63	0.10	1.00		
Invest. Prof	0.39	0.32	0.42	0.40	-0.02	0.47	0.45	0.40	1.00	
Int Conflict	0.35	0.60	0.26	0.16	0.06	0.54	0.35	0.51	0.38	1.00
Ext Conflict	0.34	0.21	0.44	0.35	0.11	0.35	0.01	0.26	0.40	0.45
Corruption	0.57	0.80	0.51	0.43	-0.16	0.76	0.21	0.56	0.35	0.59
Military	0.49	0.72	0.49	0.38	0.09	0.60	0.18	0.43	0.40	0.72
Religion	0.29	0.32	0.40	0.33	-0.10	0.44	0.12	0.22	0.21	0.40
Law/Order	0.49	0.82	0.35	0.26	-0.02	0.71	0.39	0.61	0.35	0.72
Ethnic	0.26	0.31	0.15	0.18	-0.04	0.22	0.14	0.28	0.25	0.66
Democracy	0.56	0.65	0.57	0.47	-0.02	0.68	-0.09	0.52	0.47	0.44
Bureaucracy	0.65	0.79	0.60	0.51	-0.10	0.70	0.06	0.69	0.43	0.51
Institutions	0.63	0.81	0.58	0.46	0.02	0.76	0.29	0.72	0.54	0.84
GDP Growth	0.23	0.33	0.29	0.21	0.06	0.31	0.25	0.09	0.25	0.05
Log of GDP/capita	0.72	0.83	0.64	0.62	-0.08	0.74	0.09	0.67	0.29	0.43

	Ext Conflict	Corruption	Military	Religion	Law/Order	Ethnic	Democracy	Bureaucracy	Institutions	GDP Growth	Log(GDP/capita)
Ext Conflict	1.00										
Corruption	0.32	1.00									
Military	0.42	0.70	1.00								
Religion	0.50	0.40	0.31	1.00							
Law/Order	0.24	0.68	0.62	0.18	1.00						
Ethnic	0.39	0.30	0.44	0.34	0.34	1.00					
Democracy	0.35	0.70	0.70	0.41	0.50	0.19	1.00				
Bureaucracy	0.23	0.73	0.67	0.31	0.70	0.17	0.75	1.00			
Institutions	0.55	0.84	0.84	0.53	0.80	0.49	0.76	0.80	1.00		
GDP Growth	-0.08	0.18	0.08	0.14	0.13	-0.03	0.21	0.18	0.16	1.00	
Log of GDP/capita	0.19	0.64	0.54	0.43	0.63	0.27	0.61	0.74	0.70	0.26	1.00

Table 3.

Estimation of Graft

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) - IV	(9) - LAD
Constant	20.89	12.14	13.03	-24.20	-26.69	-13.02	3.80	-1.19	-7.10
St. error	2.78	3.17	5.67	8.10	5.59	12.67	6.19	5.45	4.26
P-value	0.00	0.00	0.02	0.00	0.00	0.31	0.54	0.83	0.10
Expenditures	-0.85	4.23	6.94	7.73	7.95	6.62	5.95	7.27	6.01
St. error	0.95	1.91	1.23	1.21	1.22	1.18	1.26	1.15	1.20
P-value	0.37	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Expenditures squared		-0.52	-1.01	-1.07	-1.10	-0.93	-0.94	-1.03	-0.84
St. error		0.25	0.16	0.15	0.15	0.15	0.17	0.14	0.17
P-value		0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indiv. Income Tax Rate			0.20	0.21	0.19	0.18	0.12	0.12	0.18
St. error			0.10	0.08	0.07	0.09	0.09	0.08	0.05
P-value			0.04	0.01	0.01	0.04	0.15	0.16	0.00
Regulation			-3.83	-0.54		-1.91	-2.37	-1.73	-0.91
St. error			1.04	1.19		1.35	0.98	0.93	0.86
P-value			0.00	0.65		0.16	0.02	0.06	0.29
Log of GDP/Capita				3.15	3.29				
St. error				0.54	0.48				
P-value				0.00	0.00				
Institutions						0.35			
St. error						0.16			
P-value						0.03			
Corruption							2.71	2.90	3.63
St. error							0.74	0.61	0.57
P-value							0.00	0.00	0.00
R^2	0.03	0.21	0.40	0.56	0.55	0.49	0.56	0.72	0.53
Adj. R^2	0.01	0.19	0.36	0.52	0.53	0.45	0.52	0.71	0.49
Number of obs.	75	75	71	71	72	71	61	58	61

Note: Heteroskedasticity-consistent standard errors.

Equations are estimated using OLS except for eq. (8) thatuses IV estimator and eq. (9) that uses LAD estimator.

Table 4.

Estimation of Graft (No outliers)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) - IV	(9) - LAD
Constant	13.05	10.15	20.53	-17.68	-22.46	-6.08	9.13	5.31	-3.39
St. error	2.29	3.97	5.75	7.82	5.12	13.22	6.70	6.13	4.57
P-value	0.00	0.01	0.00	0.03	0.00	0.65	0.18	0.39	0.46
Expenditures	2.37	5.22	2.01	2.55	2.66	2.06	1.39	2.66	2.33
St. error	0.83	3.58	0.74	0.71	0.70	0.75	0.78	0.64	0.57
P-value	0.01	0.15	0.01	0.00	0.00	0.01	0.08	0.00	0.00
Expenditures squared		-0.55							
St. error		0.71							
P-value		0.44							
Indiv. Income Tax Rate			0.17	0.17	0.15	0.15	0.11	0.09	0.18
St. error			0.10	0.08	0.07	0.09	0.09	0.09	0.05
P-value			0.09	0.03	0.02	0.09	0.21	0.30	0.00
Regulation			-4.31	-0.92		-2.32	-2.69	-2.26	-1.59
St. error			1.02	1.16		1.38	1.03	1.01	0.92
P-value			0.00	0.43		0.10	0.01	0.03	0.09
Log of GDP/Capita				3.26	3.54				
St. error				0.54	0.47				
P-value				0.00	0.00				
Institutions						0.35			
St. error						0.16			
P-value						0.03			
Corruption							2.83	2.89	3.82
St. error							0.75	0.65	0.60
P-value							0.00	0.00	0.00
R^2	0.11	0.12	0.30	0.51	0.50	0.41	0.44	0.63	0.42
Adj. R^2	0.10	0.09	0.27	0.48	0.48	0.37	0.40	0.62	0.38
Number of obs.	71	71	69	69	70	69	59	56	59

Note: Heteroskedasticity-consistent standard errors.

Equations are estimated using OLS except for eq. (8) thatuses IV estimator and eq. (9) that uses LAD estimator.

Table 5.

Estimation of the Informal Sector

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) - LAD
Constant	29.01	26.59	14.65	63.51	76.65	58.91	40.36	39.08
St. error	2.49	4.05	6.52	11.13	8.79	16.90	7.63	5.87
P-value	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Expenditures	0.32	1.73	5.43	4.41	3.36	5.98	9.13	8.20
St. error	0.60	1.82	2.24	1.99	2.07	1.89	1.86	1.65
P-value	0.60	0.35	0.02	0.03	0.11	0.00	0.00	0.00
Expenditures squared		-0.14	-0.71	-0.62	-0.51	-0.84	-1.18	-1.08
St. error		0.15	0.31	0.25	0.25	0.23	0.22	0.23
P-value		0.35	0.03	0.01	0.05	0.00	0.00	0.00
Indiv. Income Tax Rate			-0.37	-0.38	-0.30	-0.34	-0.30	-0.23
St. error			0.13	0.11	0.11	0.11	0.12	0.07
P-value			0.00	0.00	0.01	0.00	0.01	0.00
Regulation			7.08	2.77		3.82	3.11	2.79
St. error			1.23	1.48		1.82	1.61	1.19
P-value			0.00	0.07		0.04	0.06	0.02
Log of GDP/Capita				-4.13	-4.90			
St. error				0.96	0.78			
P-value				0.00	0.00			
Institutions						-0.60		
St. error						0.24		
P-value						0.01		
Corruption							-5.88	-5.78
St. error							1.22	0.79
P-value							0.00	0.00
R^2	0.002	0.01	0.31	0.46	0.41	0.45	0.52	0.52
Adj. R^2	-	-	0.27	0.42	0.38	0.41	0.48	0.47
Number of obs.	74	74	71	71	72	71	61	61

Note: Heteroskedasticity-consistent standard errors.

Equations are estimated using OLS except for eq. (8) that uses LAD estimator.

Table 6.

Estimation of the Informal Sector (No outliers)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) - LAD
Constant	26.57	27.73	19.04	66.44	78.63	64.48	46.26	41.69
St. error	3.79	5.13	6.72	10.87	8.79	18.50	8.21	6.09
P-value	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Expenditures	1.33	0.17	1.92	1.25	0.82	1.84	3.45	3.54
St. error	1.31	4.06	1.04	0.97	0.99	1.01	1.16	0.77
P-value	0.31	0.97	0.07	0.20	0.41	0.07	0.00	0.00
Expenditures squared		0.22						
St. error		0.81						
P-value		0.78						
Indiv. Income Tax Rate			-0.39	-0.39	-0.31	-0.36	-0.31	-0.25
St. error			0.13	0.11	0.11	0.11	0.11	0.07
P-value			0.00	0.00	0.01	0.00	0.01	0.00
Regulation			6.90	2.69		3.52	2.86	2.70
St. error			1.21	1.45		1.90	1.63	1.22
P-value			0.00	0.07		0.07	0.08	0.03
Log of GDP/Capita				-4.05	-4.80			
St. error				0.96	0.78			
P-value				0.00	0.00			
Institutions						-0.60		
St. error						0.25		
P-value						0.02		
Corruption							-5.72	-5.25
St. error							1.24	0.80
P-value							0.00	0.00
R^2	0.02	0.02	0.31	0.45	0.41	0.45	0.52	0.51
Adj. R^2	0.001	-	0.28	0.42	0.38	0.42	0.48	0.48
Number of obs.	70	70	69	69	70	69	59	59

Note: Heteroskedasticity-consistent standard errors.

Equations are estimated using OLS except for eq. (8) that uses LAD estimator.

Appendix C

Figure 1

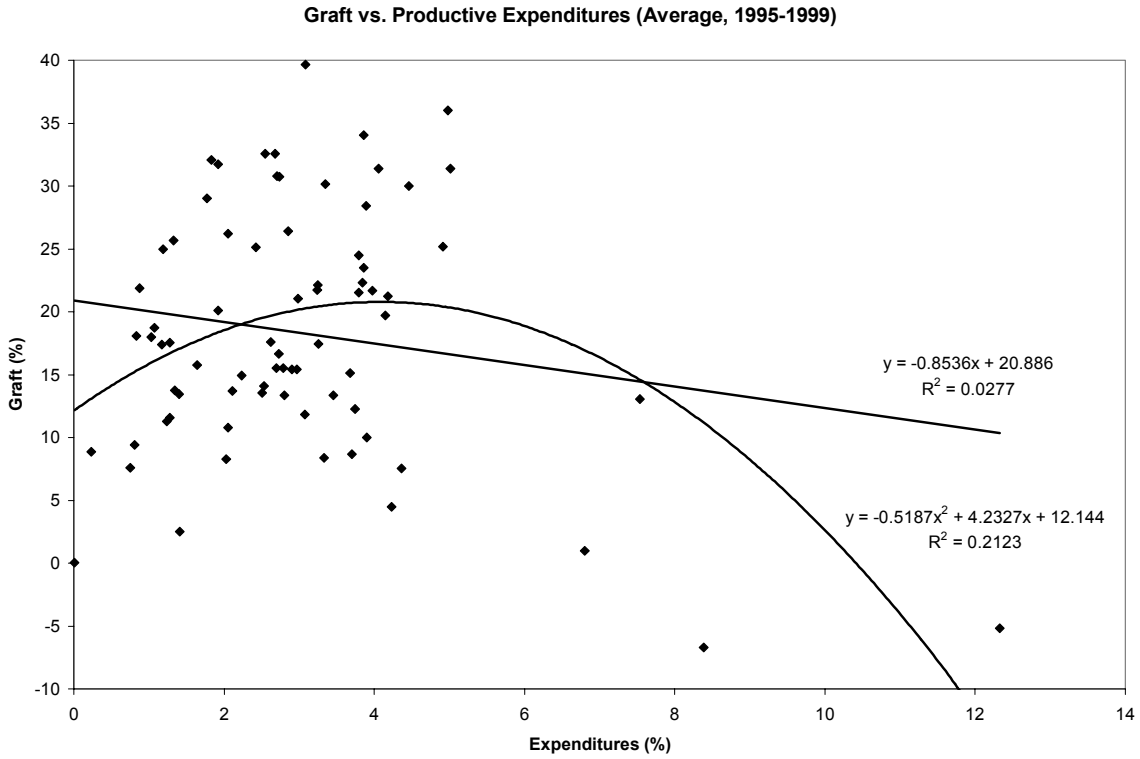


Figure 2

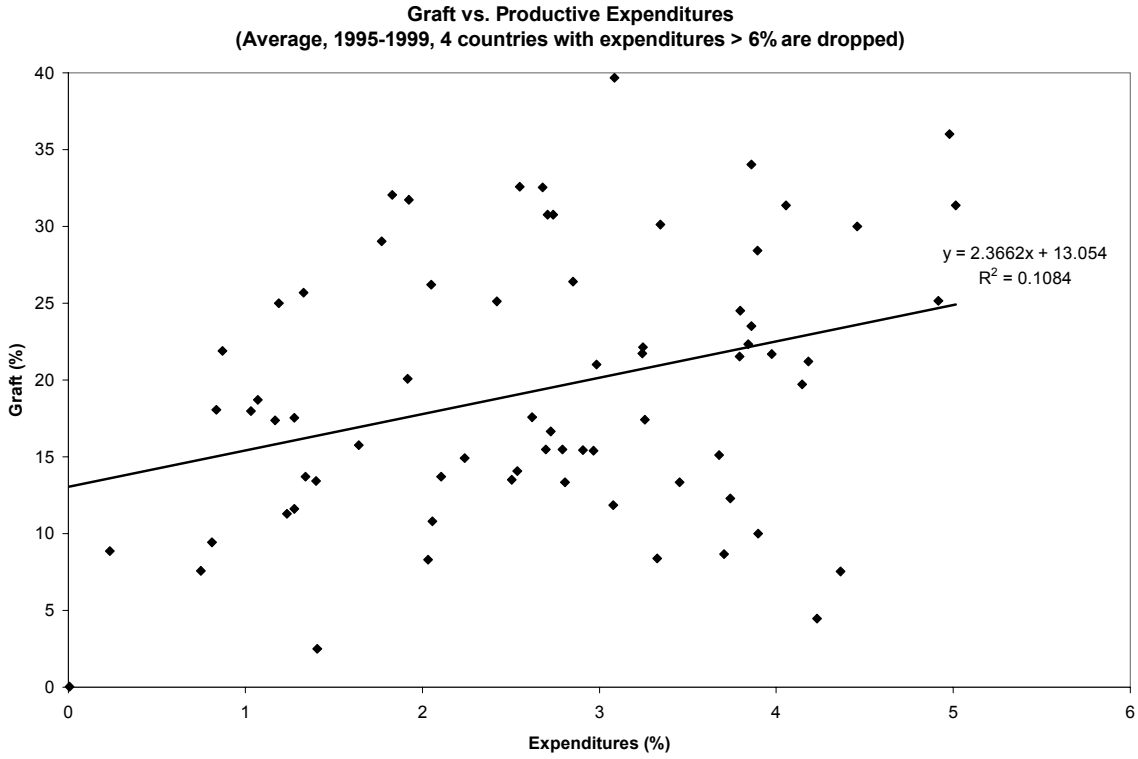


Figure 3

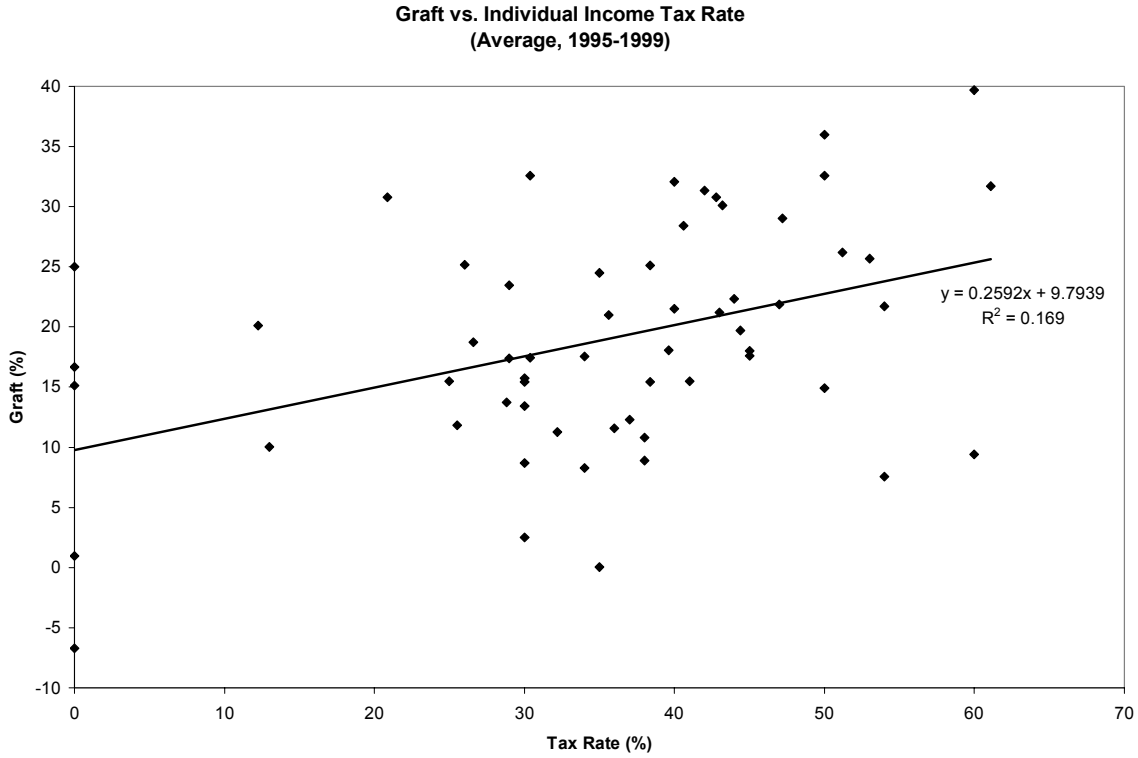


Figure 4

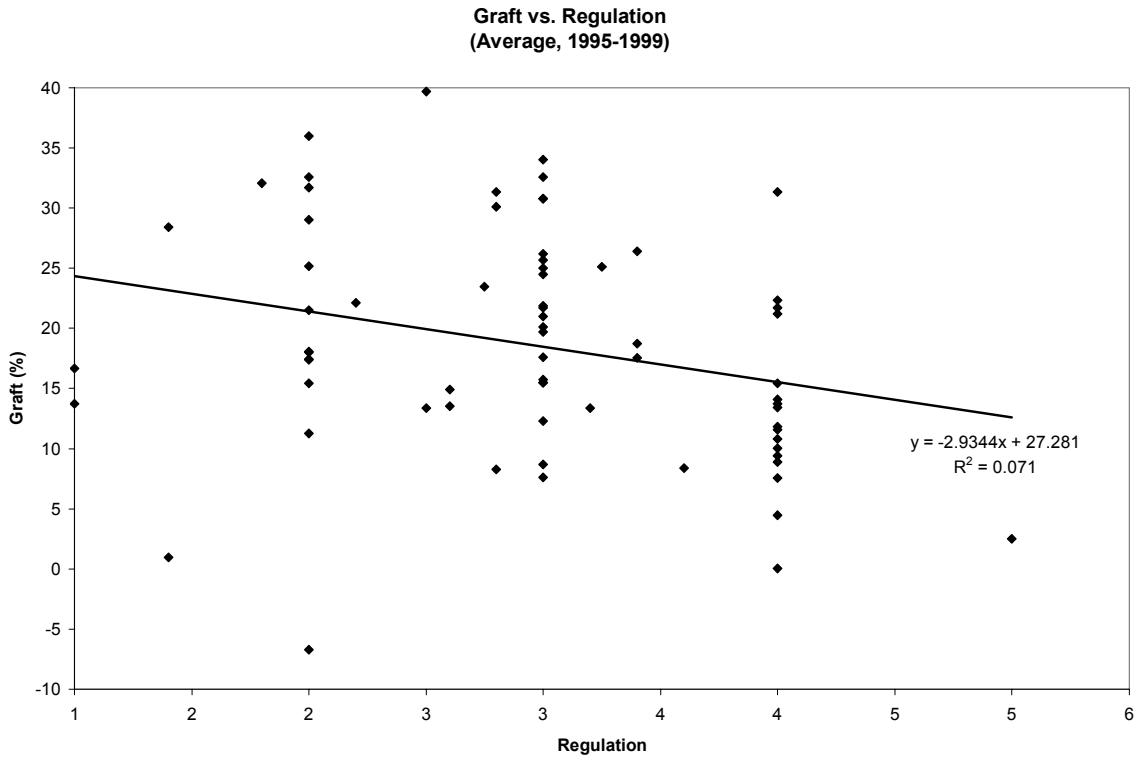


Figure 5

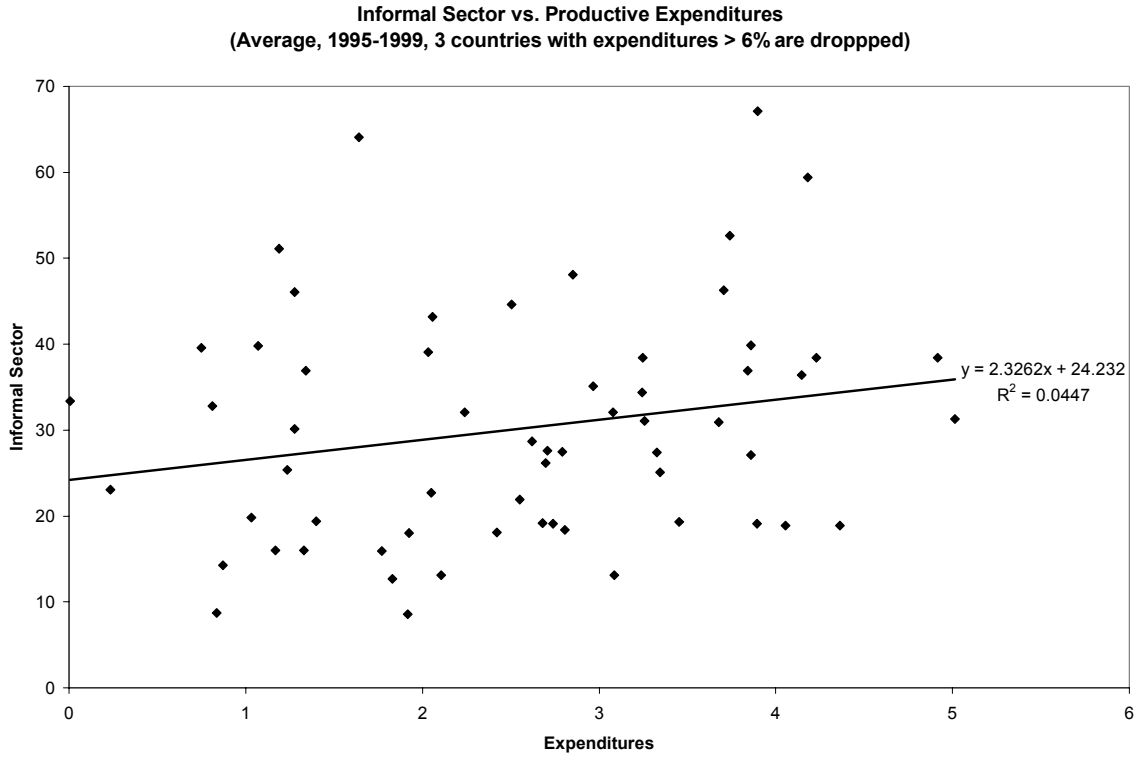


Figure 6

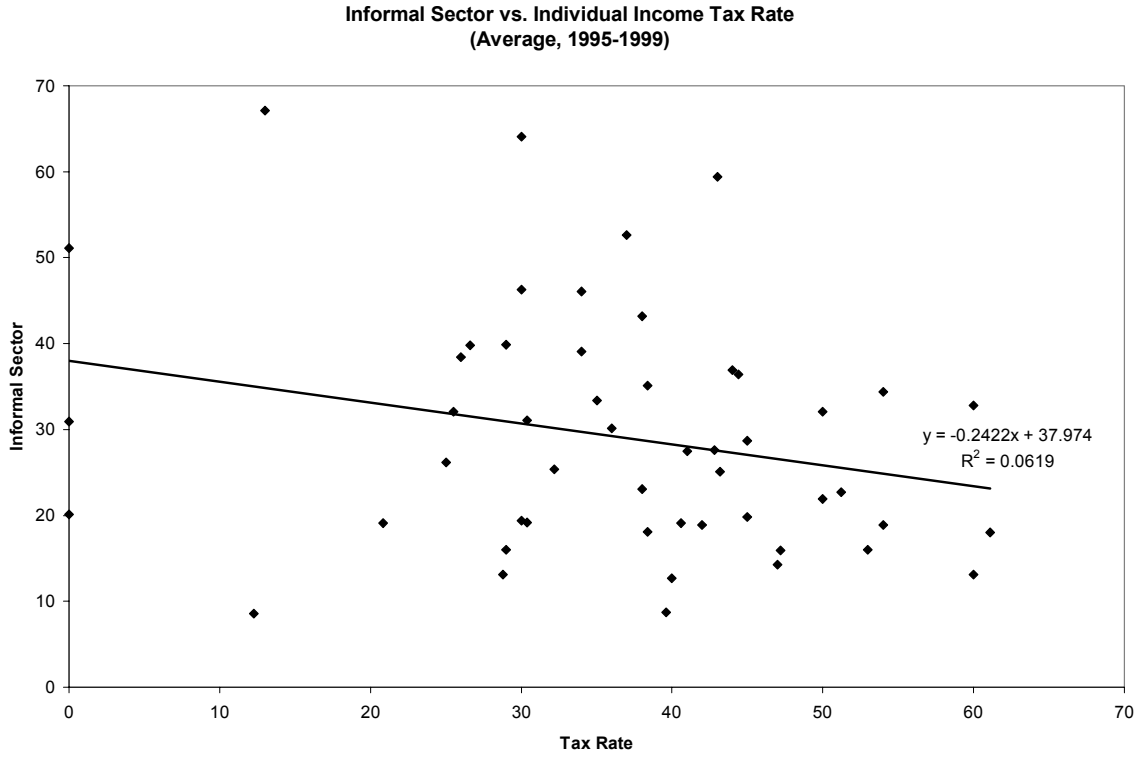


Figure 7