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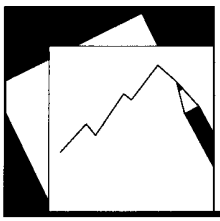

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The Culture of Corruption, Tax Evasion, and Optimal Tax Policy

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Abstract

This paper studies the effects of corruption and tax evasion on the determination of fiscal policy in a general equilibrium growth model. In particular, we focus on how corruption and tax evasion affects the determination of tax rates and the fraction of tax revenue that is invested in public capital rather than diverted for private use by public officials—an example of "grand" or political corruption. Our quantitative theory also introduces a "culture-of-corruption" effect where the level of corruption among public officials directly affects the private sector's willingness to evade taxation. We show that this effect is needed to match the estimated level of evasion in developing countries and the estimated correlation between corruption and tax revenue. The presence of corruption and evasion is shown to have large positive effects on tax rates and large negative effects on economic growth and tax revenue. The model implies that cracking down on tax evasion before addressing corruption is a bad idea and that higher wages for public officials is a good idea.

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INTRODUCTION

It is now well recognized that corruption is a major impediment to economic development. (Mauro (1995)). This paper studies the interaction between corruption, tax evasion, and the determination of a country's fiscal policy—including the possibility that corruption may have negative effects on growth that work directly through the determination of tax rates and public investment. We develop a dynamic quantitative theory where corruption, evasion, and fiscal policy are endogenously determined and where the macroeconomic characteristics of the economy are realistic. Our goal is to quantify the joint effects of corruption and evasion on fiscal policy and growth and to examine the consequences of various institutional changes designed to eliminate corruption and evasion.

There are three main components to our theory. First, there is an interaction between corruption and evasion where the causation works in both directions. We introduce a "culture of corruption" effect where the average level of government corruption affects an individual's willingness to engage in illegal behavior-- in particular a households' willingness to evade taxes and an individual government official's willingness to be corrupt. Slemrod (2003) emphasizes and provides evidence for the notion that tax evasion is affected by household's distaste for illegal activity and by their perceptions of government performance. Tax evasion, in turn, influences corruption by limiting the ability to raise funds that may be diverted for private use.

A culture of corruption effect is consistent with the data plotted in Figures 1 and 2. The figures are based on data from the World Values Survey (1980-2007). The survey asks households questions about their views on government performance and tax evasion. The public perception of government performance and the presence of corruption is plotted on the horizontal axis and public willingness to engage in evasion is plotted on the vertical axis. In both cases there is a positive and statistically significant correlation between the public's concerns about their government and the public's willingness to evade taxes.[1] Johnson et al (1999, Figures 6-9) also find a positive correlation between actual evasion and more objective measures of corruption that come from outside the country.

Second, we follow Tanzi and Davoodi (1997) and focus on the corruption associated with implementing public investment projects—an example of "grand" or political

corruption. There is evidence that large fractions of the budgets allocated for public school investments (Reinikka and Svensson (2004)) and physical capital infrastructure (Tanzi and Davoodi (1997), Pritchett (1996, 2000), and Olken (2007)) are diverted to public officials for their private use. Much of the previous work on corruption focuses primarily on bribes that entrepreneurs must pay bureaucratic to avoid regulation— "petty" or bureaucratic corruption. The corruption associated with public investment projects would seem to be at least as important for economic growth.[2]

Third, we examine how the presence of corruption and evasion affects the determination of a country's fiscal policy. In particular we study how tax rates and public investment budgets are set when the government takes into account how the its choices affect both corruption and tax evasion.

Our first finding is that the culture of corruption effect is needed to match the range of estimates for the shadow economy in developing countries at reasonable tax rates. Without the culture of corruption effect the aversion to engage in illegal activity must be set very high to target observed levels of evasion. When the aversion to engage in illegal activity is high, evasion is not very responsive to tax rate increases and the government can set high tax rates without concerns that evasion will lower their tax base. In this case, matching observed evasion levels requires unrealistically large tax rates. When the culture of corruption effect is present, the level of tax evasion varies with corruption. The corruption-evasion interaction makes each variable more responsive to changes in parameters and helps target observed evasion levels without assuming a high degree of aversion to illegal activity. The corruption-evasion interaction and the lower aversion to illegal activity makes evasion more responsive to tax rates and causes the government to set much more reasonable tax rates.

The weak response of tax evasion to tax rates without a culture-of corruption effect creates a second counterfactual prediction--tax revenues rise with corruption. More corrupt officials set higher tax rates. If evasion only responds weakly to corruption and tax rates, then the government will collect more tax revenue the more corrupt it is. This prediction is inconsistent with the empirical evidence indicating an inverse relationship between corruption and tax revenue collected. When the culture of corruption effect is included, we find that higher corruption leads to less tax revenue collected.

Quantitatively, we find that the presence of corruption and evasion increases the economy's tax rate by more than 50 percent and causes a 22 percent drop in steady state worker productivity when compared to a baseline model without corruption and evasion. While evasion helps to limit taxation, corruption creates an incentive to increase tax revenues that can be diverted for private use. Unless aversion to illegal activity is relatively low, the presence of corruption will dominate the restraint that evasion places on taxation and tax rates will be higher than in the baseline model. In addition to the effect on tax rates, corruption reduces the fraction of capital budgets that are actually invested. In our model less than half of the capital budget is invested. With much higher tax rates and much lower public investment one might expect a larger decline in output than 22 percent. However, tax evasion is also high, 33 percent of income goes untaxed. The untaxed income increases the funds available for private investment, helping to mediate the negative effects of higher tax rates and lower public investment.

As indicated above, despite the fact that corruption causes higher tax rates, it reduces tax revenue by 16 percent. This result is consistent with the empirical literature that finds a robust inverse correlation between corruption and tax revenue (Tanzi and Davoodi (1997), Johnson et al (1999), and Kaufmann (2010)). Kaufmann's (2010) explanation for the inverse relationship is based on corruption through bribes paid to tax collectors that allow private agents to avoid taxation. Our model offers a complementary explanation where increased political corruption causes tax rates to rise and actual government investment to fall. Grand corruption reduces tax revenue in three ways. First, it lowers actual public investment by diverting a significant part of the investment budget for private use. The decline in public capital lowers worker productivity and the tax base. Second, corruption directly raises tax evasion and lowers tax revenue through the culture of corruption effect. Finally, the higher tax rates associated with corruption reduce private investment and further encourage evasion, thereby limiting the positive effect of the tax rate on tax revenue.

Next, we consider how changes in certain exogenous features of the government affect equilibrium outcomes. We find that increasing the pay of government officials lowers both corruption and evasion with little associated rise in the economy's tax rate. The increased taxes needed to raise public official's wages are approximately offset by the reduced corruption and evasion that serves to raise tax revenue and public investment. The

increase in public capital accumulation raises steady-state worker productivity. In fact, when public wages are sufficiently high, corruption and evasion can be completely eliminated and both private and public households are better off.

We also find that making tax evasion more difficult, without simultaneously addressing corruption, is a bad idea. When tax evasion becomes more difficult, corrupt governments have incentives to raise tax rates as larger tax revenues give them additional opportunities to divert public funds resulting in more corruption. Higher taxes also lower private disposable income, which reduces private capital accumulation, while the increase in corruption lowers public investment, causing worker productivity and the welfare of private households to fall.

II. Related Literature

Our paper relates corruption and evasion to fiscal policy and worker productivity. Thus, our work has connections to the corruption-evasion literature as well as the literatures explaining the size of government and the determinants of economic growth.

Corruption and Evasion

The literature on corruption has primarily focused on bribes to public officials made by entrepreneurs in order to avoid taxation and regulation and to win public contracts (Becker and Stigler (1974), Rose Ackerman (1975), Besley and McLaren (1993), Shleifer and Visny(1993), Hendricks et al (1999), Sanyal et al (2000)). This literature has also been limited to a detailed microeconomic analysis of corruption.

As suggested by Tanzi and Davoodi (1997), and more recently and generally by Kaufman (2010), there may be direct connections between corrupt activity by the government and various aspects of their fiscal policy, not working through bribes and "petty" corruption of bureaucrats, but through the formation of policies themselves or "grand" corruption. We focus on grand corruption in our paper within a dynamic general equilibrium model that can be used to examine the macroeconomic consequences of corruption.

The corruption literature as largely been developed independently from the literature on tax evasion. Exception include papers by Hendricks et al (1999), Sanyal et al (2000), and Choi and Thum (2005). Of particular interest is the paper by Choi and Thum where they

consider how the decisions of entrepreneurs to produce in the underground economy limits the bribes charged by government regulators.

We connect the theories of corruption and tax evasion in two ways. First, we follow the suggestion of Slemrod (2003) that the willingness to evade taxation is influenced by the government's performance. While this idea has intuitive appeal and is consistent with the data presented in the introduction, to our knowledge, a cultural effect of corruption by public officials on the willingness of private households to evade taxation has never been formally modeled.[3] Second, our model allows for tax evasion to discourage corruption, similar to Choi and Thum (2005), by limiting the size of the budget that is managed by public officials.

Economic Growth

Corruption has been shown to have a strong negative correlation with economic growth (Mauro (1995)). This finding has motivated attempts to explain the negative correlation by introducing corruption into dynamic general equilibrium models (Ehrlich and Lui (1999), Barreto (2000), Mauro (2002), James Ellis and Fender (2006), and Brevik and Gartner (2008)) as we do in this paper.[4] Our approach is different from this literature because we include both private and public capital and both tax evasion and corruption. While tax evasion and corruption will reduce public investment, they may increase funds for private use and thereby raise private investment. To accurately quantify the effects of corruption and evasion on economic growth one needs to account for this possible substitution of private for public capital.

The emphasis on quantifying the effects of corruption and evasion is a second way that we differ from the theoretical literature. The goal in the literature is to qualitatively explain the negative correlation between corruption and growth. We attempt a reasonable calibration of our theory by targeting observed levels of evasion and corruption in developing economies. We then generate quantitative implications for fiscal policy and growth.

Finally, the other papers in the literature assume that the government is entirely selfish. We assume that government officials have the same basic preferences as all other households. Households in our model are motivated by both selfish and altruistic concerns, thus the government officials are neither entirely selfish nor entirely benevolent.

This difference in modeling the government has important consequences for how tax policy is determined. For example, in James Ellis and Fender (2006) and Brevik and Gartner (2008), the selfish government is prevented from seizing the entire tax base, and giving up a chance for re-election, by a public that is willing tolerate a sufficiently high tax rate. A sufficiently high tax rate encourages the government to not behave too badly so that it can run for re-election. If an exogenous event lowers the tax base, such as an exogenous chnages that increases tax evasion, the tax rate must rise in political equilibrium to compensate the selfish government for its loss in tax revenue. In our model, we find the opposite effect from an rise in tax evasion. Greater tax evasion reduces the benefit of high tax rates and corrupt behavior, causing reductions in both.

Size and Efficiency of Government

There is a literature analyzing how different political institutions (e.g. majority voting, representative democracies, strategic competition between parties, and centralized versus decentralized public good provision) affect the size of government and the impact of government policy on economic efficiency. See Battaglini and Coate (2007) for a recent contribution and literature review. This literature has not explored how corruption, and the related political institutions that foster or discourage it, affects fiscal policy and the size of government. A more recent work by Brevik and Gartner (2008) analyzes how tax evasion may check the behavior of an entirely selfish government. As mentioned above, their theory predicts that higher tax evasion leads to higher tax rates, although lower tax revenue.

We find that the joint presence of both corruption and evasion causes a rise in tax rates, but with a decline in tax revenue and the size of government. This result is consistent with the empirical literature that finds a robust inverse correlation between corruption and tax revenue (Tanzi and Davoodi (1997), Johnson et al (1999), and Kaufmann (2010)). However, unlike Brevik and Gartner (2008), we find that institutional changes designed to reduce tax evasion alone will result in higher tax rates. In our model, tax evasion serves to reduce tax rates, corruption, and the size of government.

III. A Benchmark Economy without Corruption-Evasion

For comparative purposes, this section develops a baseline model without corruption and evasion. The model is a standard overlapping-generations model of private capital accumulation that is extended to include a government sector that raises taxes to finance the salaries of public officials and public investment projects.

1. Private Households

There are *N* young households in each period. The households are standard two-period life-cycle savers. They work to earn wages (w_t), consume (c_{1t}), and save (s_t) in the first period to finance second period retirement-consumption (c_{2t+1}). In addition to their own consumption, household's also care about the general state of the economy, which we characterize by the average level of worker productivity during both periods of their lives (y_t, y_{t+1}). The last assumption is a form of altruism. We introduce altruism so that households that become public officials have concerns about the current and future state of the economy and not only their private consumption.

Household preferences are represented by the following utility function

$$(1) \qquad \ln c_{1t} + \beta \ln c_{2t+1} + \gamma\left(\ln y_t + \beta \ln y_{t+1}\right),$$

where β and γ are parameters that gauge the relative weight placed on private future consumption and the general state of the economy relative to private current consumption. The household's lifetime budget constraint is given by

$$(2) \qquad c_{1t} + \frac{c_{2t+1}}{1+r_{t+1}} = (1-\tau_t)w_t,$$

where *r* is the rate of return to households saving, *w* is the wage rate, and τ is the tax rate on wage income.[5]

Maximizing (1) subject to (2) yields

(3a) $$c_{1t} = \frac{(1-\tau_t)w_t}{1+\beta}$$

(3b) $$c_{2t+1} = \beta(1+r_{t+1})c_{1t}.$$

The consumption equations imply that household saving can be written as

(3c) $$s_t = \frac{\beta(1-\tau_t)w_t}{1+\beta}$$

2. Public Officials

There is a fixed number of public officials that set and carry out fiscal policy (εN). The public officials are exogenously selected from the population of private sector households. The public officials have preferences that are identical to the private households, so the process through which they are selected is not important. The wage paid to public officials is proportional to the private sector wage, i.e. the public official's wage is ηw_t where η is an exogenous parameter. Public officials pay taxes on their wages at the same rate as private sector households and work only when young. In the benchmark economy the institutional parameters that characterize the government are then (i) the relative size of public employment (ε) and (ii) the relative pay of public officials (η).

The private choices of the public officials are of the same form as for private households

(4a) $$c^g_{1t} = \frac{(1-\tau_t)\eta w_t}{1+\beta}$$

(4b) $$c^g_{2t+1} = \beta(1+r_{t+1})c^g_{1t}$$

(4c) $$s^g_t = \frac{\beta(1-\tau_t)\eta w_t}{1+\beta}.$$

Collectively the public officials will also choose the current tax rate and next period's public capital (G_{t+1}) to maximize their common preferences subject to the government budget constraint,

$$\tau_t w_t (1+\varepsilon\eta)N = \eta w_t \varepsilon N + G_{t+1}N ,$$

where we assume, as in the case private capital, that public capital depreciates fully after one period. Solving the government budget constraint for the tax rate gives us

$$(5) \qquad \tau_t = \frac{\eta\varepsilon}{1+\eta\varepsilon} + \frac{G_{t+1}/N}{w_t}\frac{1+\varepsilon}{1+\eta\varepsilon} .$$

Note that because we do not include government transfers in the model, τ should be interpreted as the *net* tax rate--net of government transfers to private households.

3. Firms

Production takes place within standard neoclassical firms that combine physical capital and human capital to produce output from a Cobb-Douglas technology

$$(6) \qquad Y_t = K_t^{\alpha}(D_t N)^{1-\alpha} .$$

However, the productivity index (D) is a function of disembodied technology (A) *and* public capital per adult worker ($G/((1+\varepsilon)N)$) and is given by

$$(7) \qquad D_t = A_t^{1-\mu}\left(G_t/(1+\varepsilon)N\right)^{\mu} ,$$

where $0 < \mu < 1$ is a constant parameter. We assume that A progresses at the exogenous rate d. This specification captures the idea that public infrastructure raises the productivity of the private sector.

Firms operate in perfectly competitive factor and output markets. This implies the profit-maximizing factor mix must satisfy

$$(8a) \qquad r_t + \delta = \alpha g_t^{\mu(1-\alpha)} k_t^{\alpha-1}$$

$$(8b) \qquad w_t = (1-\alpha) A_t g_t^{\mu(1-\alpha)} k_t^{\alpha} ,$$

where δ is the rate of depreciation on physical capital, which we take to be one for simplicity, $g \equiv G / A(1+\varepsilon)N$, and $k \equiv K/AN$.

4. Capital Market Equilibrium and Fiscal Policy

The capital stock rented to firms in period t must be accumulated as retirement savings by the private households and government officials,

$$K_{t+1} = Ns_t + \varepsilon N s_t^g .$$

Using (3c), (4c) and (8) gives us the transition equation for private capital intensity,

$$(9) \qquad k_{t+1} = \frac{\beta}{1+\beta}\frac{(1+\eta\varepsilon)}{1+d}(1-\tau_t)(1-\alpha)k_t^{\alpha} g_t^{\mu(1-\alpha)} .$$

Using (1) applied to public officials, (8), and (9), we can write the objective function of the public officials for the purpose of selecting fiscal policy in period t as

$$(10) \qquad (1+\beta)\ln(1-\tau_t) + \beta\mu(1-\alpha)(1+\gamma)\ln g_{t+1} + \beta(\alpha - 1 + \alpha\gamma)\ln(1-\tau_t) .$$

The first expression captures the negative effect of taxation on the lifetime wages and consumption of officials. The second expression represents the two positive effects of public capital. First, public capital raises the marginal product of private capital causing an increase in the return on private saving that raises second period consumption for public officials. Second, public capital increases worker productivity in the economy in the next period, an effect that is valued by all current generation households in our model. The third expression presents the conflicting effects of private capital accumulation on the welfare of public officials. First, private capital accumulation lowers the marginal product of private capital, the rate of return on savings, and second period retirement consumption. Second, just as with

public capital accumulation, private capital raises worker productivity in the economy for the next period.

Maximizing (10) subject to government budget constraint given in (5) yields the optimal fiscal policy

$$\text{(11a)} \quad g_{t+1} = \mathrm{B}\frac{(1-\alpha)k_t^{\alpha} g_t^{\mu(1-\alpha)}}{(1+\varepsilon)(1+d)}$$

$$\text{(11b)} \quad \tau_t = \frac{\eta\varepsilon + \mathrm{B}}{1+\eta\varepsilon},$$

where $0 < \mathrm{B} \equiv \dfrac{\beta\mu(1-\alpha)(1+\gamma)}{1+\beta\mu(1-\alpha)(1+\gamma)+\beta\alpha(1+\gamma)} < 1.$

The optimal fraction of pre-tax wages invested in public capital (B) is a constant that depends positively on the productivity of public capital (μ) and the value placed on the future state of the economy ($\beta(1+\gamma)$). The optimal tax rate varies positively with the wage bill in the public sector ($\eta\varepsilon$) and the rate of investment in public capital (B).

5. Calibrating the Benchmark Economy

We now calibrate the steady state of the model so that we can make quantitative comparisons between the corruption and no-corruption economies.

To calibrate the benchmark model, we start with conventional estimates for the output elasticities of private and public capital: $\alpha = 0.33, \mu = 0.30$ (see Mourmouras and Rangazas (2009)). Assuming that each period in the model last 20 years and the annualized growth in labor productivity due to exogenous technological change is 2 percent we have $d = (1.02)^{20} - 1 = 0.4859$. We target a tax rate of 0.25 and assume that half of the tax rate finances government consumption—i.e. the wages of public officials. [6] This implies that $\eta\varepsilon/(1+\eta\varepsilon) = 0.125$ or $\eta\varepsilon = 0.1429$. Taking $\eta = 1$, initially, we have $\varepsilon = 0.1429$.

We can calibrate β by targeting an annualized rate of return to private capital in the steady sate of 7 percent. This implies $(1-\tau)\alpha g^{\mu(1-\alpha)}k^{\alpha-1} = (1.07)^{20}$.[7] Combining this with the steady state version of the transition equation for private capital, $k = \frac{\beta}{1+\beta}\frac{(1-\tau)(1+\eta\varepsilon)(1-\alpha)}{1+d}k^{\alpha}g^{\mu(1-\alpha)}$, gives us $1/\beta = \frac{(1+\eta\varepsilon)(1-\alpha)}{1+d}\frac{3.8697}{\alpha} - 1 = 5.0431$ or $\beta = 0.1983$.

Finally, the other half of the tax rate is for funding government investment, i.e. we have $(1+\eta\varepsilon)\,0.125 = \frac{\beta\mu(1-\alpha)(1+\gamma)}{1+\beta(1+\gamma)(\mu(1-\alpha)+\alpha)}$. Solving for γ gives us $\gamma = 4.7390$.

IV. An Economy with Corruption and Evasion

We now introduce the possibility that households will engage in illegal activity. Each public sector worker has the job of managing a public sector investment project. They now consider the possibility of diverting public funds, earmarked to finance investment projects, for their own private use. Each private households now considers hiding income from the government to avoid taxation. Following Slemrod (2003), households are also modeled as having some aversion to illegal activity and the aversion may vary inversely with the average level of corruption by government officials.

1. Private Choices

The preferences of private households and public officials are written as

$$\ln c_{1t} + \beta \ln c_{2t+1} + \gamma(\ln y_t + \beta \ln y_{t+1}) - \frac{\phi}{2\bar{u}_t^{\kappa}} v_t^2$$

and

$$\ln c_{1t}^{g} + \beta \ln c_{2t+1}^{g} + \gamma(\ln y_t + \beta \ln y_{t+1}) - \frac{\phi}{2\bar{u}_t^{\kappa}} u_t^2,$$

where ϕ and κ are nonnegative preference parameters. The illegal activity of private households is measure by *v*, the fraction of their income that is not reported for tax purposes. The illegal activity of public officials is measured by *u*, the fraction of the public investment

budget that is diverted for private use. The last term in each expression captures the disutility of engaging in illegal activity.[8]

Higher values of ϕ imply a stronger distaste for illegal activity. The disutility of illegal activity is also affected by the average level of corruption among government officials. The greater is the average level of corruption the less disutility an individual experiences from theri own illegal activity. We refer to this as the "culture of corruption" (COC) effect. The parameter κ allows us to turn the COC effect on and off. With $\kappa = 0$ there is no cultural effect, where with $\kappa = 1$ the average level of corruption lowers the individual's distaste for illegal conduct.

Our preference specification captures two points stressed by Slemrod (2003). First, to explain tax evasion requires households to have an aversion to illegal activity--the relatively small probability of being caught and penalized is not enough. Second, household's willingness to evade is likely influenced by their perception of government performance.

The private household maximizes utility subject to the lifetime budget constraint $c_{1t} + \frac{c_{2t+1}}{1+r_{t+1}} = (1-\tau_t)w_t(1-v_t) + \theta^\tau w_t v_t$, where θ^τ is a parameter, that lies between zero and one, reflecting the fraction of unreported income that the household can recover for private use. The parameter captures the traditional monetary deterrent to tax evasion. The more difficult it is to hide income from the government, the less of it can be recovered and used, thus lowering the benefit of evasion.

The maximization problem generates the following equation for tax evasion and private household saving

$$\text{(12a)} \quad v_t = \frac{1}{2}\left[\left(\mathrm{T}^2 + \frac{4(1+\beta)\bar{u}_t^{\kappa}}{\phi}\right)^{1/2} - \mathrm{T}\right], \quad \text{where } \mathrm{T} \equiv \frac{1-\tau_t}{\theta^\tau - (1-\tau_t)}$$

$$\text{(12b)} \quad s_t = \frac{\beta}{1+\beta}\left[1-\tau_t + \left(\theta^\tau - 1 + \tau_t\right)v_t\right]w_t .$$

Naturally, evasion is increasing in τ_t and decreasing in θ^{τ}. Evasion is also increasing in $\bar{u}$ if $\kappa \neq 0$. In fact, as $\bar{u}$ goes to zero so does *v*. If the government officials are not corrupt, then they will act in the private household best interests (since they have the same preferences), so there is no motivation for private household evade taxes.[9] The term $(1+\beta)/\phi$ is a measure of "greed" because it is a measure of the value of consumption relative to the disutility of being dishonest. Tax evasion is increasing in greed, other things constant.

Next we move to the behavior of the public official. In the case of uncoordinated or decentralized corruption, each public official takes the average level of corruption, the tax rate, and the total public investment budget as given when making their private choices.[10] The public official's private choices now include what fraction of their project budget to divert for their own private use. The budget allocated to each public official is $\hat{G}_{t+1}/\varepsilon N$, where $\hat{G}_{t+1}$ is the amount of recorded or planned investment and not the actual investment. The officials maximize utility subject to the public budget and their private lifetime budget constraint, $c_{1t}^{g} + \frac{c_{2t+1}^{g}}{1+r} = \eta(1-\tau_t)w_t + \theta^{g} u_t(\hat{G}_{t+1}/\varepsilon N)$, where θ^{g} is a parameter, that lies between zero and one, reflecting the fraction of diverted public funds that the official can recover for private use. The parameter captures the effect of institutional safeguards that make it difficult to steal public funds and use them openly without detection, working like the standard monetary deterrent to illegal activity.

The maximization problem generates the following equations for corruption and the public official's private saving

$$\text{(13a)} \quad u_t = \frac{1}{2}\left[\left(\Gamma^2 + \frac{4(1+\beta)\bar{u}_t^{\kappa}}{\phi}\right)^{1/2} - \Gamma\right], \quad \text{where } \Gamma \equiv \frac{(1-\tau_t)\eta w_t}{\theta^{g}(\hat{G}_{t+1}/\varepsilon N)}$$

$$\text{(13b)} \quad s_t^{g} = \frac{\beta}{1+\beta}\left[(1-\tau_t)\eta + \theta^{g} u_t \hat{G}_{t+1}/w_t \varepsilon N\right] w_t .$$

As with evasion, corruption is increasing in τ_t and decreasing in θ^{g}. The larger is the budget that the official manages, relative to his official after-tax wage, the more tempting it is

to be corrupt. This is also why corruption is decreasing in $\eta\varepsilon$ --the larger is the official wage (increasing in η) relative to the official's budget (decreasing in the number of officials or ε), the less corruption. A increase in the official's wage raises consumption and lowers the value of additional consumption gained by diverting public funds. However, the larger is the size of the public budget, the greater is the benefit of diverting a higher fraction of it. Note that, other things constant, tax evasion lowers corruption because it reduces the size of the official's budget. In this way evasion places a check on corruption.

2. Corruption and Evasion for a given Tax Rate

We now solve for the level of corruption and evasion for a given tax rate. Begin by writing out the government budget constraint to establish a connection between tax evasion, tax revenue, and the budget available for public investment,

$$(14) \qquad \hat{G}_{t+1} = \tau_t\left(w_t(1-v_t)N + \eta w_t \varepsilon N\right) - \eta w_t \varepsilon N$$

The government budget constraint implies that $\hat{G}_{t+1} / w_t \varepsilon N = \tau_t\left(\frac{(1-v_t)}{\varepsilon} + \eta\right) - \eta$.

Substituting this expression into (13a), noting that $u_t = \overline{u}_t$ in both (12a) and (13a), and then solving for u_t in (13a), gives evasion and corruption with and without the COC effect

$$(15a) \quad v_t = \frac{1}{2}\left[\left(\mathrm{T}^2 + \frac{4(1+\beta)u_t}{\phi}\right)^{1/2} - \mathrm{T}\right],$$

$$(15b) \quad u_t = \frac{1+\beta}{\phi} - \frac{\eta\varepsilon(1-\tau_t)}{\theta^g\left(\tau_t(1-v_t) - (1-\tau_t)\eta\varepsilon\right)}.$$

$$(15a') \quad v_t = \frac{1}{2}\left[\left(\mathrm{T}^2 + \frac{4(1+\beta)}{\phi}\right)^{1/2} - \mathrm{T}\right],$$

$$(15b')\ u_t = \frac{1}{2}\left[\left(\Gamma^2 + \frac{4(1+\beta)}{\phi}\right)^{1/2} - \Gamma\right].$$

These equations allow us to solve for *v* and *u* conditional on a given value for τ. Note that for a given τ, the solutions for *v* and *u* independent of time. So if the tax rate is stationary so are the rates of corruption and evasion (conditional on the institutional parameters $\eta, \varepsilon, \theta^{\tau}, \theta^{g}$)

Next, we examine the effects of corruption and evasion on the economy's growth by examining how corruption affects public and private capital accumulation. The actual investment in public capital is the accounting measure $\hat{G}_{t+1}$ minus the budget funds consumed by the government officials. Subtracting the portion of the capital budget that is consumed by government officials from (14), and de-trending by dividing by A_{t+1}, gives us the transition equation for public capital intensity in the presence of corruption and evasion,

$$(16a)\quad g_{t+1} = (1-u_t)\left(\tau_t(1-v_t+\eta\varepsilon) - \eta\varepsilon\right)\frac{(1-\alpha)k_t^{\alpha} g_t^{\mu(1-\alpha)}}{(1+d)(1+\varepsilon)}.$$

For a given tax rate, corruption and evasion both serve to shift the transition equation for public capital downward.

The private saving functions for private households and public officials, given by (12b) and (13b), can be used to derive the transition equation for private capital,

(16b)

$$k_{t+1} = \frac{\beta}{1+\beta}\left[(1-\tau_t + (\tau_t + \theta^{\tau} - 1)v_t) + \eta\varepsilon(1-\tau_t + u_t\theta^{g}(\tau_t(\tfrac{1-v}{\eta\varepsilon}+1)-1))\right]\frac{(1-\alpha)k_t^{\alpha} g_t^{\mu(1-\alpha)}}{1+d}$$

.

While corruption and evasion reduce funds available for public investment, for a given tax rate, they increase funds available for private investment. Thus, the overall effect of

corruption and evasion on growth is not clear. In addition, we have not yet determined how the presence of corruption and evasion will affect the tax rate chosen by the public officials.

3. Corruption, Evasion, and the Tax Rate

As in the benchmark economy, policy makers choose the tax rate that will maximize the representative public official's welfare. The decision is collective in the sense that the effect of the tax rate on all private choices, whether made by private households or public officials, are accounted for by the policy makers. This now includes the effects of the tax rate on both corruption and evasion.

We begin by writing out the representative government official's preferences for generation-*t*, including only those terms that are influenced by the choice of the current period tax rate, as

$$(17)\quad (1+\beta)\ln\left(1-\tau_t+\theta^g u_t\left(\tau_t\left(\frac{1-v_t}{\eta\varepsilon}+1\right)-1\right)\right)-\frac{\phi}{2}u_t^{2-\kappa}$$
$$+\beta\mu(1-\alpha)(1+\gamma)\ln\left((1-u_t)\left(\tau_t\left(\frac{1-v_t}{\eta\varepsilon}+1\right)-1\right)\right)$$
$$+\beta\left(\alpha(1+\gamma)-1\right)\ln\left(1-\tau_t+(\tau_t+\theta^\tau-1)v_t+\eta\varepsilon\left(1-\tau_t+u_t\left(\tau_t\left(\frac{1-v_t}{\eta\varepsilon}+1\right)-1\right)\right)\right).$$

The first term determines the effect of tax rates and tax revenue on the private income and consumption of the government official. The second term is the disutility of being corrupt. The third term is the effect of taxation on public investment. Next period's public capital raises the welfare of a generation-t official because it (i) raises the marginal product of private capital and the rate of return to private capital and (ii) increases next period's worker productivity, which is valued by individuals in the economy under our assumptions. The last term is the effect of taxation on private investment. Private capital has two opposing effects on the public official's welfare. Next period's private capital stock lowers welfare because it lowers the rate of return to private capital, but also raises welfare because it increases next

period's worker productivity. Note that (15) and (17) indicate that the optimal tax rate will be constant across time as in the case without corruption and evasion.

It is not possible to derive an analytical expression for the optimal tax rate. We calibrate the model and attempt to find a numerical solution. We start by focusing on a developing economy without institutional checks on corruption and evasion. In our model this is captured by assuming that $\theta^{\tau} = \theta^{g} = \eta = 1$. For parameters other than ϕ we use the calibration from the no-corruption benchmark model. We calibrate ϕ to target a value of v equal to 1/3. The target is based on the summary of estimates for the relative size of the shadow economy reported by La Porta and Shleifer (2008, Table I). Their various measures of the shadow economy as a fraction of total GDP or total income are between 20 and 43 percent for lower and middle income countries.

Once the model is calibrated, we attempt to find the optimal tax rate by first substituting (15) and (16) into (17), and then by searching over a range of tax rates to find the one that maximizes (17). For our calibration, (17) is strictly concave in the tax rate.

Our first finding is that the COC effect is needed to match the evasion target of 1/3 with reasonable tax rates. This result is depicted in Table 1 where, with $\kappa = 1$, the match to the evasion target of 1/3 requires $\phi = 1.07$ and a tax rate of 38 percent. In contrast, without a COC effect ($\kappa = 0$), a much higher value of ϕ, and a much higher tax rate of 86 percent, is required to meet the target for v.

Table 1 The Need for a Culture-of-Corruption Effect

	$\kappa = 1$	$\kappa = 0$
ϕ	1.07	7.3
τ	0.38	0.86
u	0.58	0.39
v	0.33	0.33

With no COC effect, in order to generate observed levels of tax evasion, the aversion to engage in illegal activity must be relatively high. When the aversion to engage in illegal

activity is high, evasion is not very responsive to tax rate increases and the government can set high tax rates without concerns that evasion will lower the tax base. Thus, to match the observed evasion levels requires unrealistically large tax rates.

When the COC effect is present, the level of tax evasion varies with corruption. The corruption-evasion interaction makes each variable more responsive to changes in parameters and helps target observed evasion levels without assuming a high degree of aversion to illegal activity. The corruption-evasion interaction and the lower aversion to illegal activity makes evasion more responsive to tax rates and causes the government to set much more reasonable tax rates.[11]

We can further examine the effect of ϕ on taxation by considering the Laffer Curves, relating tax rates to tax revenue, in Figure 3. Along a given Laffer Curve, when tax rates are sufficiently low, evasion and corruption are zero, resulting in a linear segment where tax revenue rises proportionally with the tax rate. Once corruption and evasion become positive, tax revenue increases less than proportionally with the tax rate as higher tax rates encourage greater evasion. Ironically, the presence of tax evasion means that the government can collect tax revenue even when the tax rate is 100 percent because private housholds can still consume and save with the unreported portion of their income.

Each Laffer Curve corresponds to a different value of ϕ . The direct effect of an increase in ϕ makes households more averse to illegal activity, lowering *u* and *v*. However, a higher ϕ causes households to be less responsive to increases in the tax rate, thereby allowing the government to gain more revenue when the tax rate increases. This can be seen in (15a). An increase in ϕ, lowers the relative impact of T, which contains the tax rates effects on evasion. As a result, in Figure 3, a higher ϕ causes the Laffer Curve to peak at higher tax rates, allowing the government to increase tax revenue at higher tax rates than when there is a lower ϕ and household are more willing to evade taxes. Note that when ϕ is sufficiently high, the Laffer Curve monotonically increases with the tax rate--a 100 percent tax rate maximizes tax revenue!

While the tax rates are lower with the culture of corruption effect than without it, the tax rate is higher than in the model without corruption. With $\kappa = 1$ and $\phi = 1.07$, the optimal tax is 38 percent, a more than 50 percent increase from the optimal tax rate in

baseline model without corruption and evasion. Corruption is substantially greater than evasion, *u* is 58 percent—more than half the investment budget is consumed by public officials. This value could be reduced by lowering θ^g, but the estimate is quite reasonable without further adjustment of parameters. Evidence from Tanzi and Davoodi (1997) suggest diverted cost overruns of almost exactly this magnitude on public investment projects in Italy. Pritchett (1996, 2000) provides evidence indicating that less than half of public investment budgets are actually invested in developing countries. Reinikka and Svensson (2004) document that about 85 percent of funds allocated for public school projects were diverted for private use.

The combination of corruption, evasion, and the higher tax rate lowers both private and public capital accumulation resulting in a negative effect on economic growth as suggested by Mauro (1995). The reduction in capital formation causes steady state worker productivity to be 22 percent lower than in the no corruption model. With much higher tax rates and much lower public investment one might expect a larger decline in output than 22 percent. However, tax evasion is also high, 33 percent of income goes untaxed. The untaxed income increases the funds available for private investment, helping to mediate the negative effects of higher tax rates and lower public investment.

Despite the higher tax rates, tax revenue falls by 16 percent, consistent with the inverse correlation between corruption and evasion found in the empirical literature (Tanzi and Davoodi (1997), Johnson et al (1999), and Kaufmann (2010)). The decline in tax revenue is caused by a decline in the tax base due to a rise in evasion and a decrease in wages as capital accumulation falls.

It should be noted that it is not necessary for the presence of corruption to cause the optimal tax rate to rise. In general, the presence of corruption could cause the optimal tax rate to be higher or lower than in the no-corruption bench mark. The result depends on the calibration of ϕ, as made clear by Figure 4. A weaker aversion to engage in illegal activity (a smaller ϕ) reduces the optimal tax rate. For sufficiently low ϕ, the optimal tax rate with corruption and evasion is lower than in the baseline case with no corruption and evasion. This again is because a greater willingness to evade taxes provides a check on the size of government. However, as displayed in Figure 4, we find that the lower tax rates that result from smaller settings for ϕ dominate the direct effect of ϕ on corruption and evasion,

resulting in a positive correlation between illegal activity and tax rates. Thus, with lower values of ϕ, and with lower tax rates, tax evasion is too low. To match the tax evasion target of 33 percent, ϕ had to be set higher, causing evasion to be less responsive to taxes, resulting in a higher optimal tax rate than in the baseline model.

In addition to considering the role of ϕ, we also examined how the optimal tax rate varies with the altruism parameter γ. Surprisingly, we found that the optimal tax rate was almost invariant to changes in γ. This implies that the optimal tax rate is essentially determined by the private considerations of government officials reflected in the first two terms of the objective function given in (17). These terms give the effect of the tax rate on the public official's private income and the disutility the public official experiences from any associated change in corrupt activity. The optimal tax rate is approximately determined by maximizing just over these two expressions.

The last two terms in (17) include the welfare effects from the public official's concern for the future state of the economy. These two terms yield small welfare effects because households discount the future heavily (β is relatively low) and the worker productivity effects of both public ($\mu(1-\alpha)$) and private (α) capital accumulation are relatively weak. Thus, even though public officials are altruistic, the optimal tax rate is essentially determined by their private considerations.

4. The Effects of Institutional Change

Having demonstrated the substantial negative effects of corruption and evasion on fiscal policy and growth, we now examine how changes in institutions might improve the situation. The initial calibration was for a situation with no particular safeguards against corruption and evasion—public officials are able to fully utilize whatever funds they divert, tax evaders can do the same with their unreported income, and public officials receive the same pay as those in the private sector. Table 2 considers the steady state effects of changing laws so as to discourage corruption and evasion. In particular, we consider new laws and enforcements that make it more difficult to keep diverted and unreported income hidden, causing θ^{τ} and θ^{g} to fall by 10 percent, and a new policy that raises the pay of public officials by 10 percent.

Increasing the Public Official's Wage

A 10 percent in increase in the government official's wage lowers corruption and, through the COC effect, tax evasion falls as well. Despite the increase in pay to officials, the tax rate only rises slightly. This is due to the decline in corruption, which allows government investment to rise without an increase in taxation. The rise in investment causes worker productivity to rise by about 4 percent in the long-run.

Table 2 Comparative Steady States

Parameter Changes	$\%\Delta u$	$\%\Delta v$	$\%\Delta \tau$	$\%\Delta REV$	$\%\Delta y$
rise in η	-9.1	-6.9	0.8	4.9	4.0
fall in θ^g	-7.6	-7.2	0.5	1.9	4.0
fall in θ^τ	11.1	-11.3	2.1	5.8	-4.5

Notes: The table gives the percentage in the variable associated with a 10 percent change in the parameter indicated.

In the approaches based on Becker and Stigler (1974), wage premiums will only encourage good behavior by officials if they are accompanied by monitoring (e.g. Di Tella and Schrgrodsky (2003)). The bad behavior is deterred by high wages only if the official faces a threat of being caught and fired. In our model the high wages increase consumption and lower the benefit of gaining additional consumption through corrupt behavior. This reduces the utility gain from corruption without lowering the utility loss associated with illegal actions. Thus, higher wages reduce corruption without the need for monitoring

The fact that a rise in public sector wages has positive effects on worker productivity naturally leads to the possibility of an optimal public sector wage premium. Figure 5 plots the steady state utility of private households and public officials as a function of the public sector wage premium, η.

A public wage premium of about 2 drives corruption and evasion to zero. After this point, further increases in the public wage premium serve only to raise tax rates and lower

private household's welfare. The public officials continue to gain from further wage premium increases beyond the value that maximizes private welfare. Thus, while a wage premium can be justified, there is also a possibility that the wage premium will be set too high by the public officials.[12]

Reducing the Benefits of Illegal Activity

We can also examine the effects of lowering θ^{τ} and θ^{g} -- although the model does not specify the costs of these changes, so the analysis cannot be as complete as for the policy of raising public sector wages.

A 10 percent decline in the official's ability to use diverted funds lowers corruption and evasion as well. In addition, in part because there is no explicit cost associated with reducing θ^{g}, the optimal tax remains approximately constant. The resulting increase in output per worker is 4.0 percent. If reducing θ^{g} is associated with a one-time cost, say investing in a new accounting system that improves the tracking of public funds, then this may be a less expensive than permanently raising the wages of public officials.

Figure 6 shows how worker productivity and tax revenue vary over the entire range of θ^{g} values. One can imagine a cross-section of governments with different institutional quality--the higher the θ^{g}, the lower the quality. Consistent with empirical estimates, the model predicts that worker productivity and tax revenue fall with decreases in government quality.

In our model, tax revenue falls will declines in government quality because increases in corruption causes significant increases in tax evasion. This result depends critically on the presence of the COC effect, When we set κ to zero and eliminate the COC effect, tax evasion shows little response to changes in corruption and tax rates. This leads to the counterfactual prediction that tax revenue rises with corruption.

Turning to θ^{τ} we see that a ten percent decline in the private household's ability to use unreported income causes a more than unitary elastic *decline* in evasion. The reduction in the "fiscal discipline" provided by evasion causes corruption and tax rates to rise. The rise in tax rates and in corruption reduce capital accumulation and cause steady state output to fall by 4.5 percent. The rise in corruption reduces public investment and the increased taxation

reduces private investment. So cracking down on evasion is a bad idea without also cracking down on corruption because evasion provides a check on the selfish motives of public officials.

The negative outcome from reducing the benefits of tax evasion creates a link between corruption and the shadow economy similar to that suggested by Choi and Thum (2005). They argue that entrepreneurs may avoid the need to pay bribes to public officials by moving to the unregulated underground economy. The threat of exit to the underground economy places a constraint on bribes that public officials attempt to collect. We show that, in a similar way, tax evasion can constrain the corrupt behavior of public officials and the tax rates chosen by the government. Thus, in both cases the shadow economy plays a useful role in constraining government behavior.

V. Conclusion

This paper provides an introductory theoretical analysis of how the presence of grand corruption and tax evasion interacts with the setting of fiscal policy in developing countries. Our focus is on the determination of the labor income tax rate and the level of public investment. Corruption tends to force the tax rate up, because corrupt officials want to divert government revenue earmarked for investment for their own private use. Evasion tends to force the tax rate down by circumscribing the government's ability to raise revenue at higher tax rates. We find that when the model is calibrated to match typical evasion levels found in developing countries, along with other macroeconomic characteristics, the combined presence of both corruption and evasion causes the labor income tax rate to be significantly higher than in a baseline model with no corruption and evasion.

The presence of grand corruption causes tax rates to rise and government revenue actually invested in public capital to fall when compared to a benchmark model without corruption and evasion. Higher tax rates reduce private investment, causing a significant drop in worker productivity. Despite higher tax rates, the decline in worker productivity and the rise in tax evasion dramatically reduce the tax base and tax collections when there is a culture of corruption. In the absence of a culture of corruption, tax evasion would not rise

sufficiently with tax rates and tax revenue would rise as well--a prediction that is inconsistent with empirical estimates.

The paper also considered various changes aimed at reducing corruption and evasion. We find that reducing the ability of the private households to evade taxation is a bad idea if corruption is not simultaneously addressed. Cracking down on evasion does succeed in raising tax revenue; but it also enlarges the budgets of public officials and makes them more corrupt. A larger fraction of the budget is diverted for private use, public investment declines and worker productivity falls.

We find that raising the pay of public officials serves to reduce corruption and evasion, with only a slight increase in the tax rate. Better-paid public officials are less corrupt. The reduction in corruption and evasion increases the government revenue for a given tax rate. This effect frees enough government revenue to pay for the increase in public sector wages with only a slight increase in the tax rate. With the decline in corruption, funds available for public investment are increased. The rise in public sector investment causes an increase in worker productivity and this effect dominates the increase in the tax rate, causing the welfare of private households to rise in steady state. But while the result provides some welfare justification for offering a public sector wage premium, officials will choose a wage premium that is too high from the perspective of private households—public sector pay will be too high when officials have the power to set their wages.

In future work, we plan to extend the analysis by including an expanded set of fiscal policy variables. This will include public debt and the taxation of capital income. These extensions also increase the motivation for extending the analysis from a closed economy setting to one that allows for international borrowing by the government and for private capital flows across countries.

FOOTNOTES

1. The evidence for a "culture of corruption" effect is also present at the individual level within countries. We run regressions of tax evasion on "confidence in government" at the individual level for each country and each year. Out of 138 country-year pairs, the estimate of the association between "cheating on taxes" and "no confidence in governmen"t is positive and significant in 82 cases. Only in 19 cases is the point estimate negative, just 6 of these are significant. The association is strongest in Croatia (0.85) and Belarus (0.81) for Europe, China (0.45) and Viet Nam (0.39) in Asia, Mali (0.38) and Uganda (0.34) in Africa, Peru (0.21) and Argentina (0.18) in Latin America.

2. In practice it may be difficult to decompose the negative effects of total corruption according to whether the corruption is bribes to bureaucrats or grand corruption associated with high public officials and policy makers. Bribes, diversion of public funds for private use, and policy choices are likely to be interconnected.

3 Mauro (2002) discusses possible effects of average corruption on individual corruption that works through the probability of being caught and punished. Our effect works independently of the probability that corruption or evasion is detected. There is also a new literature on the intergenerational transmission of values in general that could be used to further endogenize the willingness to engage in illegal activities (see Tabellini (2008) and the references therein).

4. There is a separate literature that introduces tax evasion into growth theory in the absence of corruption (Chen (2002) and Dzhumashev and Gahramanov (2010)).

5. We assume that interest income is not taxed to avoid the problem of time inconsistency when choosing the optimal tax on capital income (Kydland and Prescott (1977)). We plan to address capital taxation in future work.

6. An exact calibration of the public wage bill is difficult because the public officials in our model are those responsible for managing and implementing public sector investment projects, not *all* public employees.

7. Note that in estimating β we are using the after-tax return to capital assuming that the actual tax rate on capital income is the same as the tax rate on labor income chosen for the model. Since we do not actually have capital income taxation in the model, it may be more natural to target a before-tax return to capital. Targeting an after-tax return to capital, when assuming a 25 percent tax rate, is equivalent to targeting a before-tax annual return of 8.6 percent. This is within the range of estimates for the pre-tax marginal product of capital in the rich countries (Caselli and Feyrer (2007, Table II).

8. We assume that the fraction of money stolen generates the disutility rather than absolute amount. This specification will generate fractions of income that go unreported and fraction of public budgets that are diverted for private use that are independent of the level of income. This allows us to focus on institutional determinants of corruption because increases in income alone will not alter the rate of illegal activity.

9. We also considered a preference specification that allowed for some tax evasion when corruption is zero. This approach did not alter our main conclusions.

10. We did not consider the case of centralized corruption, where both corruption and tax rates are chosen jointly by all public officials, but this might be an interesting extension.

11. The relatively low responsiveness of evasion to corruption and tax rates without a COC effect creates a second counterfactual prediction--tax revenues increase with the level of corruption. We discuss this more below.

12. Increasing the number of public officials, and thereby reducing the size of the budget under the control of any one official, would have an effect on corruption similar to increasing a given official's wage. In both cases, the relative value of the income gained through corrupt

actions would fall leading to a reduction in corruption (see (13a)). However, increasing the number of officials is more costly to the economy because it lowers the relative size of the work force engaged in production. A decrease in the relative size of the productive work force reduces output per person, public investment per person, and , indirectly, private capital per worker. To see this, note that the transition equation for public capital per person is a decreasing function of ε for a given value of $\eta\varepsilon$. For this reason attacking corruption by offering higher wages is clearly superior to increasing the number of officials and reducing their individual responsibilities.

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Figures for "The culture of corruption, tax evasion, and optimal tax policy"

October 2, 2010

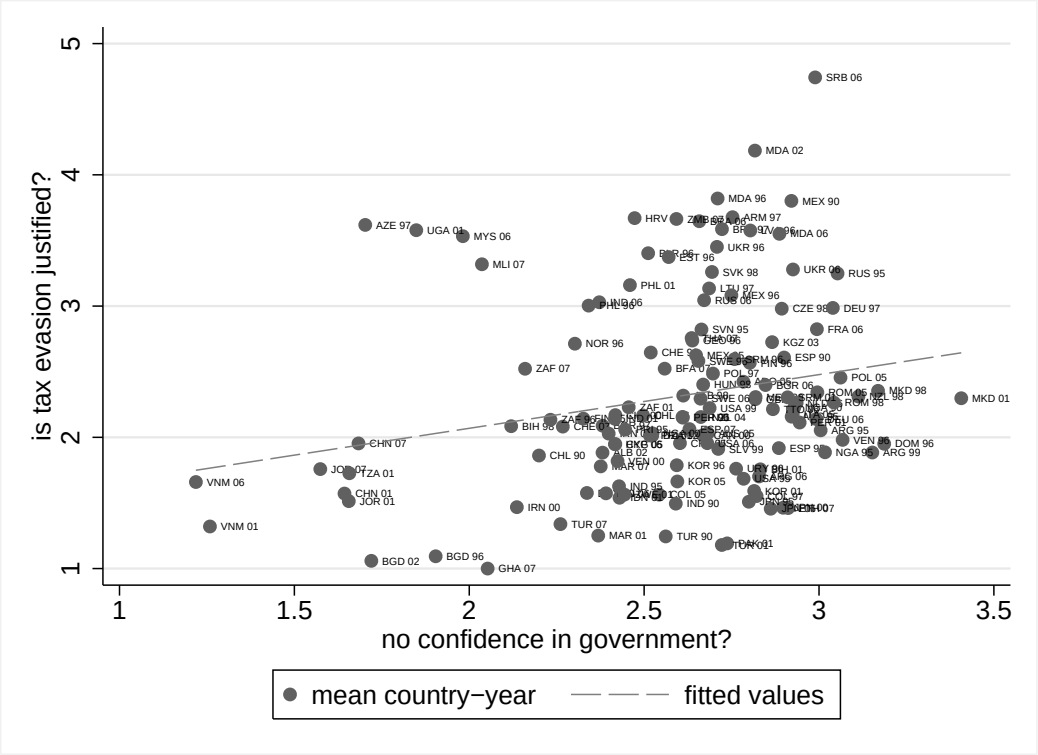

Figure 1: Tax evasion vs. confidence in government

Note Datasource - World Values Survey, Waves 1-5 (years 1980-2007). *Y-axis*: country-year average individual responses on question "Do you think cheating on taxes can always be justified, never be justified, or something in between?" (answers: "1" - never justifiable, "2" ... "9", "10" - always justifiable). *X-axis*: country-year average individual responses on question "How much confidence do you have in government?" (answers: "1" - a great deal, "2" - quite a lot, "3" - not very much, "4" - none at all) Circles denote corresponding points in the dataset, dashed grey line is the trend line (fitted values). Slope coefficient of trend line is 0.51 (statistically significant at 1% level).

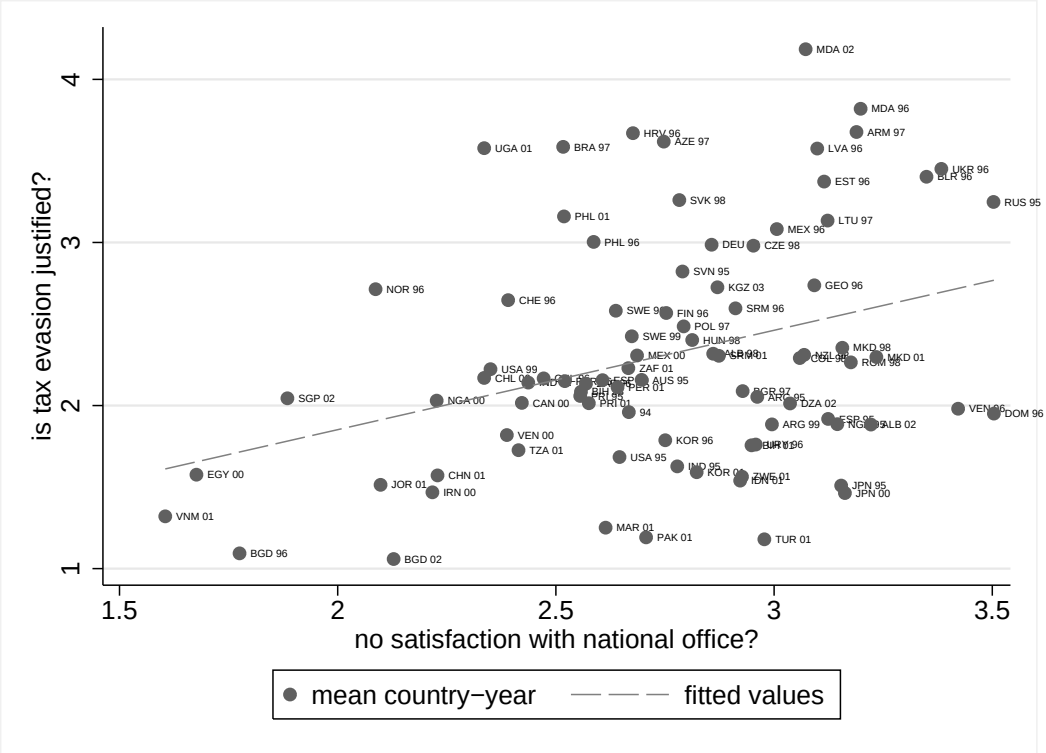

Figure 2: Tax evasion vs. satisfaction with government

Note Datasource - World Values Survey, Waves 1-5 (years 1980-2007). *Y-axis*: country-year average individual responses on question "Do you think cheating on taxes can always be justified, never be justified, or something in between?" (answers: "1" - never justifiable, "2" ... "9", "10" - always justifiable). *X-axis*: country-year average individual responses on question "How satisfied are you with the way the people now in national office are handling the country's affairs?" (answers: "1" - very satisfied, "2" - fairly satisfied", "3" - fairly dissatisfied, "4" - very dissatisfied). Circles denote corresponding points in the dataset, dashed grey line is the trend line (fitted values). Slope coefficient of trend line is 0.61 (statistically significant at 1% level).

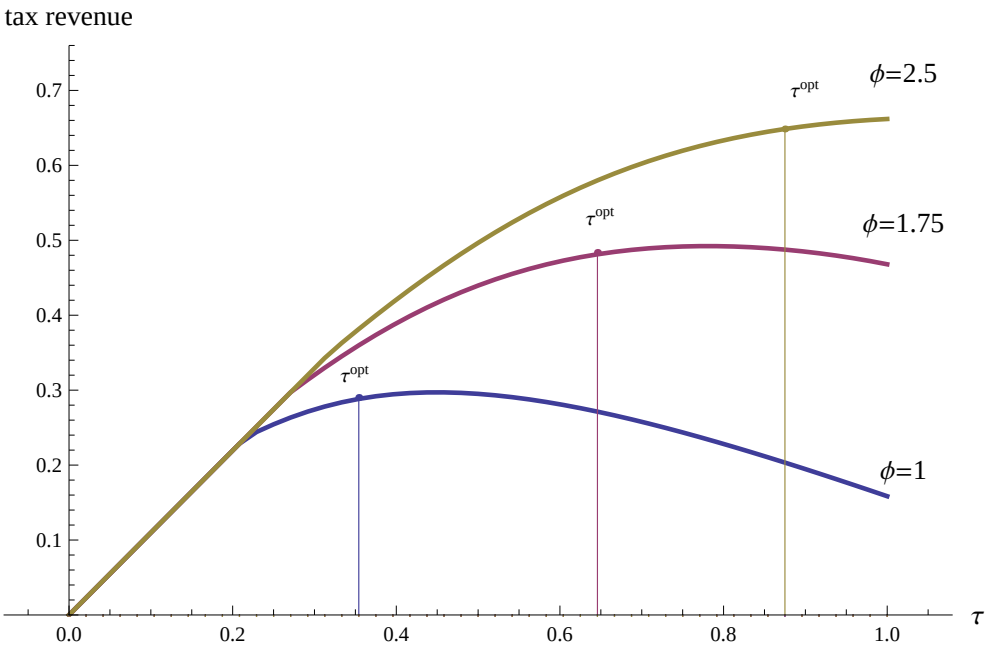

Figure 3: Laffer curves for different values of ϕ

Note The figure shows relation between tax revenue and tax rate for different levels of ϕ - distaste for illegal activities. The computations are based on the following values for the model's parameters: $\kappa = 1$ ("culture-of-corruption" effect is on), $\theta^{\tau} = 1$, $\theta^{g} = 1$, $\eta = 1$, $\epsilon = 0.14$, $\alpha = 0.33$, $\mu = 0.3$, $d = 0.49$, $\beta = 0.2$, $\gamma = 4.76$.

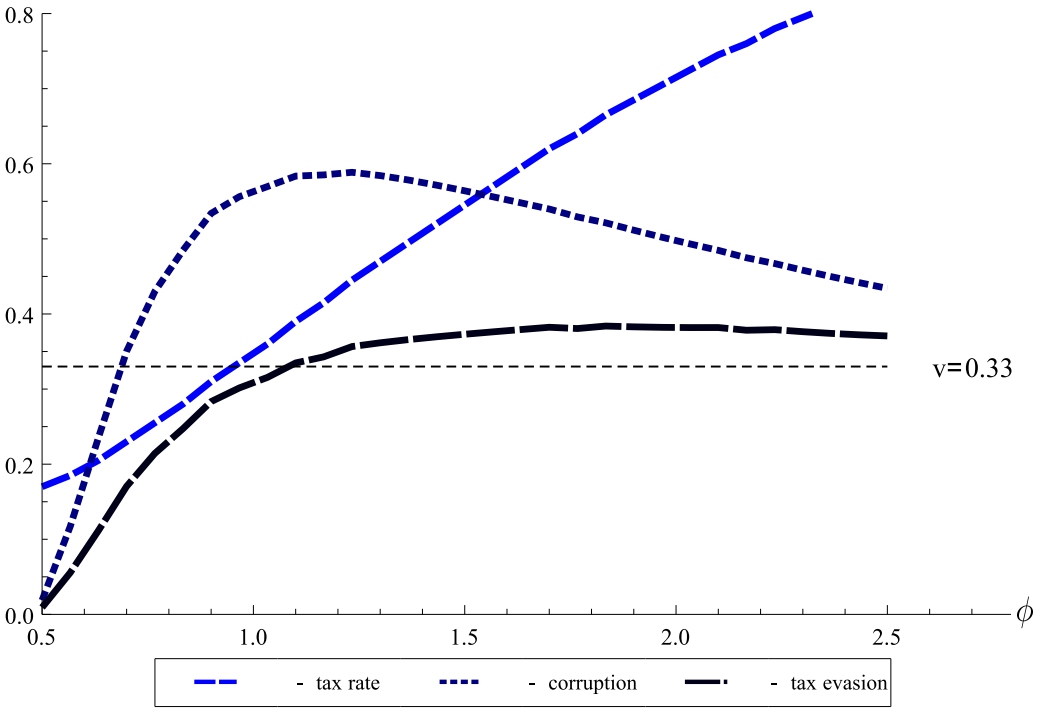

Figure 4: "Culture-of-corruption" effect and distaste for illegal activities

Note The figure shows equilibrium values of tax rate, corruption, and tax evasion for different values of ϕ - distaste for illegal activities. The computations are based on the following values for the model's parameters: $\kappa = 1$ ("culture-of-corruption" effect is on), $\theta^{\tau} = 1$, $\theta^{g} = 1$, $\eta = 1$, $\epsilon = 0.14$, $\alpha = 0.33$, $\mu = 0.3$, $d = 0.49$, $\beta = 0.2$, $\gamma = 4.76$.

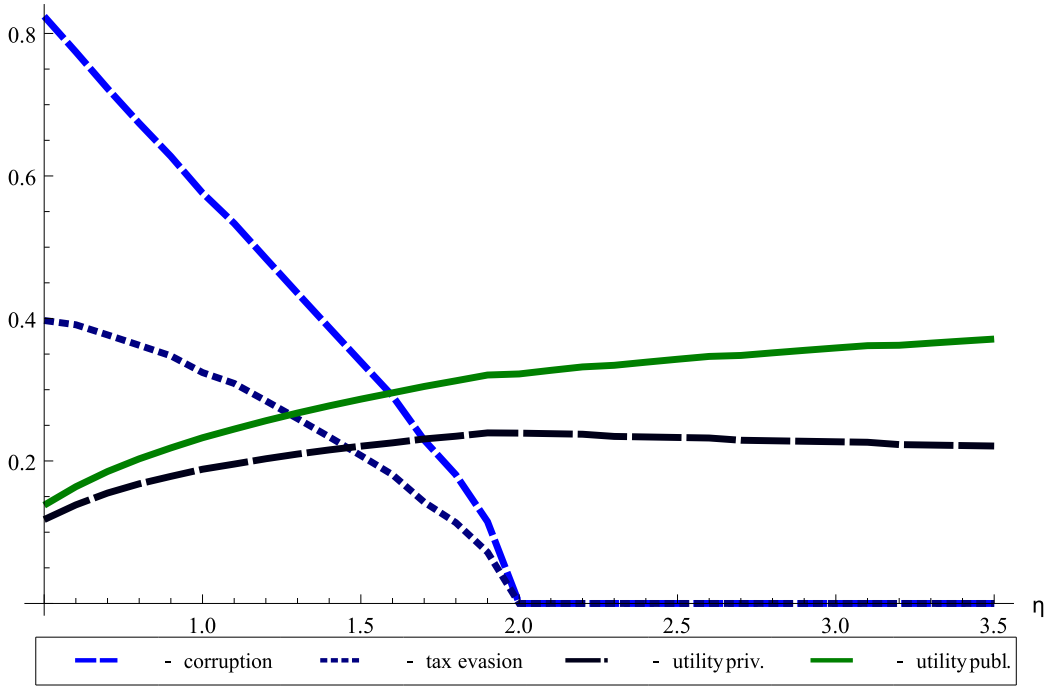

Figure 5: Changes in wage markup for public officials

Note The figure shows equilibrium values of corruption, tax evasion, steady state utility of private households, and steady state utility of public officials for different values of wage markup for public officials. The computations are based on the following values for the model's parameters: $\theta^{\tau} = 1$, $\theta^{g} = 1$, $\phi = 1.07$, $\epsilon = 0.14$, $\alpha = 0.33$, $\mu = 0.3$, $d = 0.49$, $\beta = 0.2$, $\gamma = 4.76$.

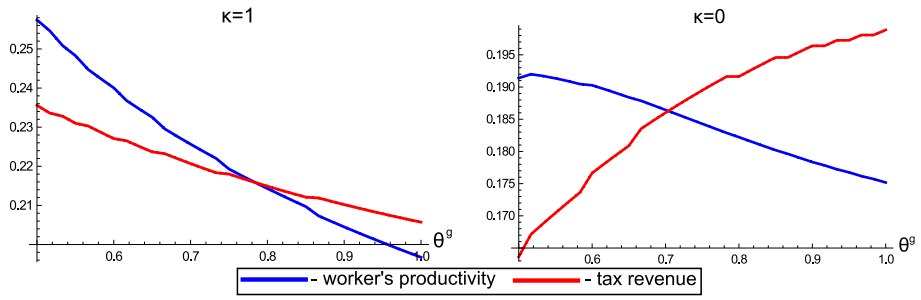

Figure 6: Change in institutional checks on corruption

Note Both figures show steady state equilibrium values of worker's productivity and tax revenue for different values of θ^g - institutional checks on corruption. The higher is θ^g the cheaper is the illegal activity. On the left - the computations when the "culture-of-corruption" effect is on ($\kappa = 1$), on the right - when "culture-of-corruption" effect is off ($\kappa = 0$). The computations are based on the following values for the model's parameters: $\theta^\tau = 1$, $\phi = 1.07$, $\eta = 1$, $\epsilon = 0.14$, $\alpha = 0.33$, $\mu = 0.3$, $d = 0.49$, $\beta = 0.2$, $\gamma = 4.76$.