Can Informal Payments Increase Allocative Efficiency ?

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Abstract

In this paper, I argue that informal payments to government officials can increase allocative efficiency, because they substitute for missing tax instruments. For example, the rich are usually more successful in tax evasion. As a result, in countries with extensive tax evasion, governments might choose an inefficiently low government budget. In this way, they avoid imposing an extensive burden to the poor. In turn, this action leads to an inefficiently low provision of public goods. However, informal payments to government officials can improve things because they substitute for government salaries. Thus, they liberate resources that can be used to increase the supply of public goods. Apparently, this mechanism need not always work, since informal payments can also cause distortions. However, in the paper I discuss the success of the Greek National Health System as a case in which the benefits of informal payments outweigh the costs.

1 Introduction

This paper argues that informal payments to government officials can increase public good provision and improve allocative efficiency. Especially so, when

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tax instruments are missing. As an example consider a democratic country characterised by tax evasion, like Greece. Such countries typically care for equality and thus mostly opt for progressive taxation. However, tax evasion undermines progressive taxation, because the poor usually lack the resources and connections required to evade taxes. As a result a trade-off arises between efficiency and equality. In particular, tax evasion implies that high taxation imposes an excessive burden on the poor. In order to lighten this burden, a democratic government might choose an inefficiently low level of taxation and therefore of public good provision.

In such a situation informal payments might improve things. In particular, I use the term informal payments here to describe any kind of transfers from individuals and businesses to government officials, aiming to influence their decisions or effort. Inevitably these payments increase the income of government officials. This extra source of income substitutes for official government salaries and therefore allows their decrease. In turn, this decrease in salaries liberates government resources that can be used in order to increase public good provision. Moreover, if informal payments mainly originate from the rich, they constitute a form of "progressive taxation". Thus, they cancel the negative effects of tax evasion on allocative efficiency.

These ideas place my paper in the strand of literature which supports the efficient corruption hypothesis, also known as "grease the wheels". This hypothesis states that corruption can increase efficiency because it offsets the negative effects of weak institutions. It is true that most empirical papers agree with the conclusions of Mauro (1995) on this issue, who has rejected efficient corruption, using macroeconomic data. However, efficient corruption has a long tradition in economics that goes back to Leff (1964). Moreover, economists often provide persuasive cases that support it. For example, Aidt (2009) discusses two very interesting such cases. The first is due to Leff (1964) and it involves Chile and Brazil in the 60s and the second is due to Levy (2007) and is about Soviet Georgia.

Undoubtedly the validity of efficient corruption is an empirical issue. However, dismissing it altogether based solely on macroeconomic data might not be the best course of action. In particular, the main theoretical argument against "grease the wheels" is that public officials have the power to restrict the supply of goods and services or cause delays and distortions. As a result they use this power in order to maximize rents. Inevitably, this "monopolistic" behaviour decreases efficiency instead of increasing it. However, the extent of the public officials' power depends on many factors like laws, customs, social networks, etc, which differ significantly from case to case. Thus, efficient corruption is more likely to arise in situations, where government officials have relatively small power. I use this idea in Section 6, in which I

consider the success of the Greek health system.

I discuss these issues with the help of a simple static model with two goods, one private and one public. This economy is populated by two types of agents: the governor who represents the public sector and the citizens who stand for the private sector. Each agent starts with a different endowment in the private good. Moreover, the governor taxes the citizens in order to provide the public good and award himself a salary. His decisions maximize a political objective function which increases with the utility of all agents. Regarding taxation, I assume a lump sum tax in order to model the lack of tax instruments. Without informal payments, this setting delivers an outcome which is not Pareto efficient. This result arises because the flat tax does not allow for the efficient allocation of the tax burden across citizens.

Informal payments in this model aim to affect the choice of taxes and public good by the governor. They are paid by the citizens and increase the salary of the governor. I model this interaction between citizens and governor as a common agency and solve for truthful equilibria. This approach follows the seminal work of Bernheim and Whinston (1986) and Dixit et al. (1997). I find that introducing informal payments increases allocative efficiency because they substitute for the missing tax instruments.

The literature on efficient corruption is extensive. However, here I would like to mention Maniadis (2009) who also discusses a case from Greece and Aldt and Hwang (2008) who use similar methods to this paper. Moreover, there is a significant number of very good reviews of the issue, like Bardhan (1997), Aidt (2003) and Svensson (2005).

The rest of the paper is organized as follows. Section 2 contains the model and a benchmark case. Section 3 considers the economy without informal payments, while section 4 presents the case with informal payments. Section 5 discusses the main results and section 6 examines the role of informal payments in Greek hospitals. Finally section 7 concludes.

2 Setting

2.1 Model

I consider a static economy with two goods, one private and one public. This economy is populated by $n+1$ individuals: n citizens ($i = 1, 2, ..., n$) and the governor ($i = 0$). Citizens can be interpreted as individual tax payers or as special interest groups. Similarly the governor can be thought as a monarch or as an entity representing the entire public sector (policy makers and government employees). From now on, when I refer to individuals I will

mean both the governor and the citizens.

All individuals share the same utility function. In particular, the utility of individual i, $(i = 0, 1, 2, ..., n)$ is given by a function:

$$U : R_+^2 \to R \quad \text{such that} \quad U_i = U(C_i, G)$$

in which $C_i \geq 0$ is the private good consumption and $G \geq 0$ is public good provision. The function $U(C_i, G)$ is increasing, at least twice differentiable and strictly quasi-concave with respect to both its elements. Moreover, $\lim_{C_i \to 0} \frac{\partial U}{\partial C_i} = +\infty$ and likewise for G.

All individuals have an exogenous endowment $e_i \geq 0$ in private good. Moreover, without loss of generality, I assume for the citizens, that $e_{i+1} \geq e_i$ for all $i \geq 1$.

Citizens and governor differ in their budget constraints. In particular, the budget constraint of citizen i is:

$$e_i - t_i = C_i$$

in which t_i is a tax or subsidy.

The governor though has a dual role. On the one hand he is an individual like the citizens. In this respect he has a **private budget constraint** which is:

$$e_0 + S - t_0 = C_0$$

In this equation $S \geq 0$ stands for the salary paid to the governor in exchange for his services.

On the other hand the governor has an official capacity which is to choose policy. In this case taxes t_i, public good provision G and his salary S. In order to choose policy he maximizes the political objective function:

$$F : R^{n+1} \to R \quad \text{such that} \quad F = F(U_0, U_1, ..., U_n)$$

subject to the **public budget constraint**:

$$G + S = \sum_0^n t_i$$

This budget constraint implies that the governor in his official capacity faces a balanced budget. Moreover, function F reflects the political considerations that the governor has to take into account when deciding. Indeed, in most societies individuals who have political power rarely make decisions based solely on their own interests. They also take into account other factors

like legal restrictions, re-election , the possibility of a revolution e.t.c. These issues are more important in democracies. Function F is strictly increasing, twice differentiable and quasi-concave with respect to all its elements. Henceforth, in order to avoid confusion, I will use the term governor's utility for U_0 and governor's objective for F.

The efficiency of the allocation chosen by the governor depends on possible restrictions associated with taxation. Next, I address this issue.

2.2 Benchmark case: First best and individual taxation

2.2.1 First best

Assumption 1. ***First best***
$t_i \in [-\sum_0^n e_i,\, e_i]$ and $\sum_0^n t_i \leq \sum_0^n e_i$.

This assumption states that the governor can rearrange endowments among all individuals without restrictions. Thus, since F is increasing in all its elements the governor selects an allocation which can not be Pareto improved (first best). In particular the governor's problem in this case is equivalent to the following:

$$\begin{aligned} &\max_{C_i,G} F(U(C_0,G),U(C_1,G),...,U(C_n,G)) \\ &\text{s.t.} \quad \textstyle\sum_0^n C_i + G = \sum_0^n e_i \end{aligned}$$

Following the assumptions on F and U, this problem has an interior solution. The Lagrangian takes the form:

$$L = \max_{C_i,G} F(U(C_0,G),U(C_1,G),...,U(C_n,G)) + \lambda(\sum_0^n e_i - \sum_0^n C_i - G)$$

The first order conditions for this problem are:

$$\begin{aligned} \frac{\partial F}{\partial U_i}\frac{\partial U_i}{\partial C_i} - \lambda = 0 \\ \sum_0^n \frac{\partial F}{\partial U_i}\frac{\partial U_i}{\partial G} - \lambda = 0 \end{aligned}$$

Combining the equations above yields:

$$\sum_0^n \frac{\frac{\partial U_i}{\partial G}}{\frac{\partial U_i}{\partial C_i}} = 1 \tag{1}$$

which is Samuelson's condition for efficiency in the presence of public goods. This condition states that the sum of the marginal rates of substitution between private and public good across consumers equals the marginal rate of transformation between public and private good in production, which in this case is 1.

2.2.2 Individual taxation

Assumption 2. ***Individual taxation***
$t_i \in [0,\, e_i]$.

In this case the governor can't subsidize citizens. Thus, the governor's problem need not have an interior solution (i.e. it might be that $t_i = 0$ for some i). However, if the solution to the first best problem above yields $t_i > 0$ for all i, the solution of the individual taxation problem yields the same allocation as the first best problem.

3 The economy without informal payments

The analysis so far indicates that allocative efficiency requires individual specific taxes/subsidies. Apparently, setting a different tax rate for each tax payer is practically impossible. Instead most countries opt for a system of progressive taxation which intends to capture the key aspects of individual specific taxation.

However, this policy fails in countries with excessive tax evasion. This is so because tax evasion is not neutral with respect to income. Specifically, the rich are usually more successful than the poor in avoiding taxes. For example, the rich can afford better tax lawyers or have access to international tax havens e.t.c.

As a result tax evasion removes tax instruments from governments and introduces in practice a regressive tax system. Here, I model this situation in the simplest possible manner. Specifically, I assume that the tax is lump sum.

Assumption 3. ***Lump sum tax***
$t_i = t \in [0,\, e_1]$ for all i.

In this case the governor's problem is:

$$\max_{C_i,G,S,t} F(U(C_0,G),U(C_1,G),...,U(C_n,G))$$
s.t.
$$C_i + t = e_i \quad i = 1,2..,n$$
$$C_0 + t = S + e_0$$
$$(n+1)t = S + G$$

Rearranging the constraints yields:

$$\max_{C_i,G} F(U(C_0,G),U(C_1,G),...,U(C_n,G))$$
s.t.
$$C_i = e_i - \tfrac{C_0 - e_0 + G}{n} \quad i = 1,2..,n$$

This problem also has an interior solution. The Lagrangian takes the form:

$$L = \max_{C_i,G} F(U(C_0,G),U(C_1,G),...,U(C_n,G)) + \sum_1^n \lambda_i (e_i - \frac{C_0 - e_0 + G}{n} - C_i)$$

The first order conditions with respect to C_0, C_i and G are:

$$\frac{\partial F}{\partial U_0}\frac{\partial U_0}{\partial C_0} - \frac{1}{n}\sum_1^n \lambda_i = 0 \tag{2}$$

$$\frac{\partial F}{\partial U_i}\frac{\partial U_i}{\partial C_i} - \lambda_i = 0 \tag{3}$$

$$\sum_0^n \frac{\partial F}{\partial U_i}\frac{\partial U_i}{\partial G} - \frac{1}{n}\sum_1^n \lambda_i = 0 \tag{4}$$

Combining the first order conditions yields:

$$\frac{\frac{\partial U_0}{\partial G}}{\frac{\partial U_0}{\partial C_0}}\frac{1}{n}\sum_1^n \lambda_i + \sum_1^n \lambda_i \frac{\frac{\partial U_i}{\partial G}}{\frac{\partial U_i}{\partial C_i}} = \frac{1}{n}\sum_1^n \lambda_i \tag{5}$$

This last equation becomes identical to the Samuelson condition for efficiency (eq. 1) only if the Lagrange multipliers are equal across citizens (i.e. $\lambda_i = \lambda$ for all i). The Lagrange multiplier λ_i equals to the marginal increase of the governor's objective, due to an increase in the consumption of citizen i. In turn, this value depicts the cost of taxation imposed on citizen i. In an efficient equilibrium this cost should be equal across all citizens. If not, then there is a "better" way to allocate the last unit of tax. However, since the citizens have different endowments and face the same tax, their consumption

levels differ. This observation implies that citizens typically have different marginal utility of consumption and thus, the cost of taxation is also different among citizens[1]. As a result an inefficient outcome arises.

Next I discuss why informal payments to government officials might improve things in such a case.

4 The economy with informal payments

In this section I introduce informal payments to the economy I discuss in section 3 above.

4.1 Overview

I use the term "informal payments" to describe any informal transfer of resources intended to affect the planning or delivery of government policy. Such payments might include campaign contributions to politicians, bribes, gifts or motivational payments to government officials etc.

In the context of the present setting, I model such transactions as a two stage game between the governor and the citizens. In stage 1 the citizens offer to the governor a payment function, which assigns a payment to any possible choice of policy. In this model, the choice of policy amounts to the choice of taxes and public good provision (t, G) or equivalently to the choice of salary and public good provision (S, G). In stage 2 the governor chooses the policy and whether he wants to reject any of the corresponding payments either in part or in whole.

The governor might want to reject a payment, because he cares for the welfare of the citizens. Indeed, an increase in a payment by citizen i has two contradicting effects on the governor's objective F. On the one hand, it increases F through an increase in U_0 and on the other hand, it decreases F through a decrease in U_i. Therefore, the governor might refuse a payment which exerts excessive burden to a citizen.

Let me now turn to the details of the model.

[1]This argument is correct in general but in certain cases it does not apply. For example if $F = \kappa U_0 + (1-\kappa)(U_1 + U_2 + ... + U_n)$ and $U_i = C_i G^a$ then $\lambda_i = (1-\kappa)G^a$ for all i which implies that the solution to the problem with lack of policy instruments is efficient. The same is true if one models lack of policy instruments as proportional taxation and $U_i = C_i^a G^b$

4.2 Setting

Budget constraints
The introduction of informal payments alters the budget constraints of the citizens and the private budget constraint of the governor. In particular, the budget constraint of citizen i becomes:

$$e_i - t - (b_i - r_i) = C_i \tag{6}$$

In this constraint, $b_i \in [0, e_i - t]$ is the informal payment to the governor[2] and $r_i \in [0, b_i]$ is the part of the payment that is rejected by the governor. Henceforth, I use the symbol r to describe the vector $(r_1, r_2, ..., r_n)$.

In a similar manner, the private budget constraint of the governor becomes:

$$e_0 + S - t + \sum_{1}^{n}(b_i - r_i) = C_0 \tag{7}$$

Payment functions
The introduction of informal payments also changes the behaviour of the citizens who now choose a payment for every possible choice of policy by the governor.

In this respect, define the set A as the set of all policy choices that satisfy assumption 3. Formally, $A = \{(S, G) \in R^2_+ : \frac{S+G}{n+1} < e_1\}$. Then, each citizen chooses a function

$$b_i : A \to [0, e_i] \quad \text{such that} \quad b_i = b_i(S, G)$$

Henceforth, I will use the symbol $b_i(\cdot)$ when I refer to this function, the symbol $b(\cdot)$ when I refer to the vector $(b_1(\cdot), b_2(\cdot), ..., b_n(\cdot))$ and the symbol $b_{-i}(\cdot)$ in the usual manner.

Feasibility
The definition which follows introduces the concept of feasibility.

Definition. ***Feasibility:***
a) (S, G) is feasible if $(S, G) \in A$.
b) $b_i(\cdot)$ is feasible if $b_i(S, G) \in [0, e_i - t]$ for all $(S, G) \in A$. Likewise, $b(\cdot)$ is feasible if all $b_i(\cdot)$ in it are feasible.
c) The triplet $(b(\cdot), r, (S, G))$ is feasible if $b(\cdot)$ and (S, G) are feasible and $r_i \in [0, b_i(S, G)]$ for all i.

Next, I turn to the definition and characterization of equilibrium.

[2]The symbol b comes from the word bribe. I have decided not to use the more suitable letter p for payments because of its association with prices.

4.3 Equilibrium and results

Before I continue with the definition of equilibrium, let me first define three functions that I will use later on. Specifically, I can substitute the individual budget constraints (equations 6 and 7) in the respective utility functions and define:

$$U_i^*(S, G, b_i(S, G), r_i) = U(e_i - \frac{S+G}{n+1} - (b_i(S, G) - r_i), G)$$
$$U_0^*(S, G, b(S, G), r) = U(e_0 + S + \sum_1^n (b_i(S, G) - r_i), G)$$
$$F^*(S, G, b(S, G), r) = F(U_0^*, U_1^*, ..., U_n^*)$$

The game in this section belongs in the family of common agency games or menu auctions. The definition of equilibrium which follows is typical in such games.

Definition. ***Equilibrium:***
A feasible triplet $(b^o(\cdot), r^o, (S^o, G^o))$ is an equilibrium if:
a) $(S^o, G^o, r^o) \in arg \max_{S,G,r} F^*(S, G, b^o(S, G), r)$ and
b) There does not exist a feasible triplet $((b_i^*(\cdot), b_{-i}^o(\cdot)), r^*, (S^*, G^*))$ such that $(S^*, G^*, r*) \in arg \max_{S,G,r} F^*(S, G, b_i^*(S, G), b_{-i}^o(S, G), r)$ and $U_i^*(S^*, G^*, b_i^*(S^*, G^*), r_i^*) > U_i^*(S^o, G^o, b_i^o(S^o, G^o), r_i^o)$.

This definition extends the idea of subgame perfect Nash equilibria to common agency games. It states two things. First, that the governor chooses the policy which maximizes his objective, given the payment functions of the citizens. Second, each citizen chooses the payment function which maximizes his utility, given the payment functions of the other citizens and the optimizing behaviour of the governor.

Usually there are many equilibria in common agency games because of the freedom in choosing off equilibrium payments. Here, I follow Bernheim and Whinston (1986) and Dixit et al. (1997) and consider equilibria in truthful strategies. The following definitions describe truthful strategies and truthful equilibria in the context of my model.

Let $\bar{u_i} \in R$ and set $\bar{u_i} = U(e_i - \frac{S+G}{n+1} - b_i, G)$. Consider this last expression as an equation with respect to b_i. Because the utility function is continuous and strictly monotonous with respect to consumption, it follows that this

equation always has a unique solution. For given $\bar{u}_i$ and e_i, this solution is a function of S and G. Define this solution as $\Phi(S, G; \bar{u}_i, e_i)$.

Definition. ***Truthful strategy:***
A feasible payment function $b_i^T(S, G)$ is truthful relative to the constant $\bar{u}_i$, if:

$$b_i^T(S,G) = \begin{cases} \Phi(S, G; \bar{u}_i, e_i) & \text{if} \quad \Phi(S, G; \bar{u}_i, e_i) \geq 0 \\ \\ 0 & \text{if} \quad \Phi(S, G; \bar{u}_i, e_i) < 0 \end{cases}$$

This definition implies that when positive, truthful payments reflect exactly the shifts in the utility of citizens caused by a change in policy.

Definition. ***Truthful equilibrium:***
A truthful equilibrium is an equilibrium in which all payment functions are truthful relative to the equilibrium utility of each citizen.

Truthful equilibria are relatively easy to solve for, since they reduce the functional problem of finding the equilibrium payment functions to a much easier problem of finding a set of constants $(\bar{u}_i)$. Moreover, there is no cost in concentrating only in these equilibria. This is so, because for every set of payment functions chosen by the other citizens, there is always a truthful payment function which maximizes the utility of citizen i[3].

Let me now proceed to the main result of the paper.

Proposition 1. ***Results:***
In any truthful equilibrium of the model with informal payments the following hold:
a) The objective of the governor takes a value which is greater or equal to the case without informal payments.
b) There does not exist a set of informal payments to the governor and a choice of policy which satisfies the public budget constraint, that Pareto improve the allocation implemented by the equilibrium.
c) If in the equilibrium $b_i > 0$ and $r_i = 0$ for all i, the resulting allocation satisfies Samuelson's condition for efficiency (equation 1) and is therefore, first best.
Proof:

[3]Dixit et al. (1997) made this point for a governor's objective which is strictly increasing in payments by citizens. Boultzis (2015) extends this result to a setting which allows for rejections of payments.

a) If not the governor can reject all payments. In this case his problem becomes identical to the case without informal payments.
b) It follows directly from proposition 2 in Boultzis (2015).
c) See Appendix A.1.

Part (a) of this proposition states that the value of the governor's objective increases with the introduction of informal payments. Thus, to the extent the the governor's objective reflects social preferences, informal payments might be socially desirable. Part (b) states that there does not exist a policy and a set of payments from the citizens to the governor that can Pareto improve the equilibrium allocation. This observation also includes zero payments, as is the case in the economy of section 3. Thus, the introduction of informal payments extends the utility possibility set of the economy without informal payments and implements an allocation on the efficient frontier of the new extended set. Finally, part (c) states that if the equilibrium is interior and the governor does not reject any payments the outcome is first best. The numerical example in 4.4 below depicts such a case.

Overall, the proposition above makes a simple point. In the absence of informal payments the governor lacks tax instruments. Thus, the allocation of resources is inefficient. However, informal payments substitute, at least in part, for the missing instruments and thus, they increase allocative efficiency.

Still, in this general model, it is not possible to determine whether the introduction of informal payments increases or decreases public good provision. Likewise it is difficult to identify the set of individuals who gain from such a change. These outcomes crucially depend on the distribution of endowments and the governor's objective F.

Next, I provide a specific example with relatively small inequality in endowments and a governor who cares equally for all citizens. This example yields an outcome which further elaborates the benefits of informal payments.

4.4 Numerical example

Consider an economy with two citizens. Also let $U_i = C_i^a G^{(1-a)}$ and $F = U_0 + \kappa \sum_1^n U_i$. This governor's objective implies that all citizens have the same political influence. Moreover, under these assumptions there is a unique level of public good provision in every first best allocation. In particular, Samuelson's condition for efficiency (equation 1) in this case implies $G = (1-a)\sum_0^n e_i$.

In order to proceed with a numerical example, I set $a = 0.5$, $\kappa = 1$, $e_1 = 0$, $e_2 = 0.45$ and $e_3 = 0.55$. For this values the first best supply of public good is $G = 0.5$.

I solve for the case without informal payments using the respective first order conditions (equations 2-4) and for the case with informal payments using proposition 3 in Dixit et al. (1997) appropriately adapted for this setting. I provide all relevant details in appendix A.2. Table 1 below reports the outcome of this numerical exercise. The case without informal payments appears in the first line of the table (NB in the regime column) and the case with informal payments in the second line (B in the regime column).

TABLE 1
Numerical example

Regime	**t**	**G**	**F**	U_1	U_2
NB	0.3271	0.4926	0.8596	0.2460	0.3313
B	0.3130	0.5000	0.8596	0.2617	0.3362

The governor's objective implies that he likes equality among citizens. Thus, he is inclined to tax the rich citizen 2 heavier than the poor citizen 1. In the case without informal payments though, this action is not possible, due to the lump sum tax. Thus, the governor collects less taxes than he would in his first best policy. Otherwise, the additional tax would impose an excessive burden to the poor citizen. As a result, public good provision in the case without informal payments is inefficiently small ($G = 0.4926$).

However, informal payments can solve this problem. Specifically, in such a case the governor can substitute his official salary with the informal payments from the rich. In turn, this fact allows the governor to increase public good provision without increasing taxes. Thus, informal payments finance public good provision and therefore, can increase the utility of both citizens rich and poor. Indeed, table 1 indicates that introducing informal payments decreases taxes from 0.3271 to 0.3130, increases public good provision from 0.4926 to 0.5 and the utility of both citizens from 0.2460 and 0.3313 to 0.2617 and 0.3362 respectively[4].

In Section 6 I consider the role of this mechanism in the success of the Greek Health System.

Next, I discuss my main assumptions and their effects on the results of my model.

[4]The first best outcome in the case with informal payments ($G = 0.5$) is in accordance with part (c) of proposition 1. In this particular case, the relatively small inequality in endowments guarantees that both b_i are positive while $e_0 = 0$ guarantees that $r_i = 0$

5 Discussion

The main result of this paper is that informal payments can increase efficiency in an economy which lacks tax instruments. This result does not depend on the use of truthful equilibria or the common agency model. To see this consider the numerical example above with bargaining instead of common agency[5]. In particular, assume that bilateral bargaining between the governor and the rich individual determines policy and informal payments. In such a case, the two bargaining parties can mutually benefit from an increase in public good in exchange for an informal payment.

Therefore, in a bargaining equilibrium, public good and the values of F, U_2 and possibly U_1 increase. Thus, even with bargaining, informal payments increase efficiency. However, the distribution of welfare in such a case might differ from that in Table 1, or the first best outcome might not arise.

However, the assumption that citizens offer informal payments in order to affect the provision of a public good is more important. In this respect, the main theoretical objection to efficient corruption is that public officials exert monopoly power. In particular, the argument is that these officials ration the quantity of the good they control so as to maximize their rents. However, this strategy does not work in the case of a public good, since if a paying citizen gets the public good, everybody else also gets it.

Still, this last observation generates doubts regarding the applicability of my model, since many goods provided by governments are not pure public goods. For example, think of a patient bribing a doctor in order to jump queue in a hospital. It is hard to see how such an action can improve the welfare of the other patients, as implied by my model[6].

Apparently in such cases my model fails. However, in this regard, I would like to raise two points. First, the production or consumption of most goods provided by the government usually creates some sort of positive externality. Otherwise the government would not have a reason to supply them. Second, in certain cases formal or informal institutions might strip government officials from their monopoly power.

For example, think that the only option open to the corrupt doctor above, in order to collect the bribe, is to create an extra slot for treating the paying patient, e.g., by increasing his effort. In this case, the welfare of the paying customer and the doctor increase. Moreover, if the skills of the doctor

[5]For a similar approach see Felli and Merlo (2006) who use bilateral bargaining in a model with payments to officials

[6]Lui (1985) argues that in such cases efficiency increases as well, because a rare hospital bed is awarded to the individual with the greatest willingness to pay. However, the point I make here is different.

increase with each patient he treats, the welfare of the average patient also increases.

In the next section I consider the Greek Health System as an example of an organization in which these ideas apply.

6 Example: Informal payments in Greek hospitals

In 1983 the center-left government of Greece launched a major health reform. This reform aimed to provide universal health coverage of the population, through a national health system financed by general taxation. Although this reform did not fully achieve its targets, it led to a significant improvement in most healthcare quality indices (life expectancy, child mortality etc.). Moreover, this success came at a relatively small cost, indicating a high efficiency of the Greek health system. Indeed, in 2000 the World Health Organization published an evaluation of the efficiency of health provision around the world. In this evaluation Greece ranked fourteenth among 191 countries[7]. This success is hard to explain, given the level of tax evasion, corruption and low government effectiveness which characterise Greece[8].

However, here I attempt to provide a possible explanation for this puzzling development, based on the ideas of my model. This explanation exploits informal payments to government hospital doctors. Specifically, in Greece there is a small number of private hospitals, which mostly care for the rich and have a small overall effect on the health indices of the population. On the contrary, the vast majority of the population is treated in government hospitals. In these hospitals informal payments to doctors are very widespread. In particular, about one third of hospital patients in Greece use informal payments in order to obtain a better quality of care[9]. Moreover, according to Nikolentzos and Mays (2016) these payments on average make up 25% of the total income of doctors.

These informal payments benefit public health in two ways. First, they partially finance the Greek health system by complementing the relatively

[7]see Tandon et al. (2000)

[8]Vellutini et al. (2019) states that Greece ranks 5th among the 28 EU members in international tax evasion, while Artavanis et al. (2016) show that self-employed in Greece hide 43% of their earnings from the tax authorities. Moreover, Greece ranks 23rd in the corruption perception index of Transparency International and 26th in the government effectiveness index of the word bank among the 28 EU members

[9]see Siskou et al. (2008), Liaropoulos et al. (2008) and Souliotis et al. (2016).

low salaries of government doctors[10]. This informal income is critical for the adequate staffing of the health system since physicians are internationally scarce. For example, according to Ifanti et al. (2014) the number of doctors emigrating from Greece increased by about 5 times between 2007 and 2012, following a 40% decrease in government hospitals' salaries due to the economic crisis of 2008-12. Apparently, providing the required resources through the government budget might be quite costly, due to the substandard tax collecting system and the inefficient methods of public administration in Greece.

Second, informal payments provide incentives to doctors, who have the motive to increase their effort in order to make a name for themselves and collect more informal payments in the future[11]. Such incentives are very important for the efficiency of health systems in general, as argued by Wranik (2012), but especially so in Greece, which lacks formal mechanisms monitoring effort in the health sector[12]. For example Economou et al. (2010) find that hospital productivity in Greece compares very well with that of the OECD countries and attribute this fact to advances in clinical practice. This finding indicates well motivated doctors and thus, provides an example of how informal payments might increase the quality of healthcare.

Nevertheless, empirical research from third world and former communist countries indicates that informal payments have adverse effects on the health of the population[13]. In this regard, the relevant literature provides two possible explanations[14]. The first explanation is that informal payments can lead to substandard service or even denial of treatment for the poor. If this practice is extensive, it eventually affects public health. The second explanation is that doctors themselves create shortages, delays and other distortions in order to extract more money from patients. In turn, these distortions deteriorate the quality of treatment and eventually the health of the population.

However, there is no evidence that doctors in Greece try to increase their earnings through artificial shortages and barriers for patients. Moreover, the quality of public health in the country indicates that if such practices exist, they are limited. A possible reason for this "benevolent" behaviour by doctors is the structure of the health system in Greece, which promotes competition between medical specialists. In particular, there are two characteristics of the Greek health system which foster competition. The first

[10]For the low salaries of government doctors see Economou et al. (2010)

[11]see García-Prado and Gonzalez (2007)

[12]see Mossialos et al. (2005a), Economou et al. (2010) and Nikolentzos and Mays (2016)

[13]see Gupta et al. and Schaaf and Topp (2019)

[14]For a review of theoretical arguments against the "grease the wheels hypothesis" see Aidt (2009) and Kaufmann (1997)

is the lack of a referral system. In practice, any patient can appear at the door of any government hospital and expect to be treated. The second is the number of specialist doctors in Greece. In particular, Greece has the highest number of specialists per 1000 inhabitants in the OECD[15]. Although both these characteristics on their own can be sources of inefficiency, in the presence of informal payments they undermine the monopoly power of the doctors and thus, the scope for creating bottlenecks[16]. As a result, doctors mainly opt for an increase in quality as the safest way to collect informal payments.

Still, my analysis has not explained why informal payments to hospital doctors are illegal. Legalizing such payments can eradicate the possible cost of secrecy which under certain conditions is extensive[17]. In this respect, Spain and Italy, which have a health system very similar to that of Greece[18], might serve as an example. In these countries, government hospitals reserve a number of beds for the private patients of their doctors. Following this example, many health economists suggest the legalisation of informal payments in Greece. So far, any attempts to implement such a reform, had little success. It seems that the problem lies with tax evasion and hospital fees, since the doctors do not want to share their revenues with the government or their hospitals[19].

7 Conclusions

This paper makes a contribution to the efficient corruption literature. In particular, the paper argues that informal payments to public officials might substitute for missing tax instruments and thus, enhance allocative efficiency.

In general, the relevance of efficient corruption is disputed. In particular, many economists maintain that informal payments distort the incentives of public officials, thus causing more harm than good. Although this critique might be valid in certain cases, it need not always be true. This is so, because the trade-off between the cost and the benefits of corruption depends on a large number of factors, which differ from case to case.

In this respect, identifying all possible channels through which corruption can increase efficiency is important. Although such channels might not always work, they can be useful in certain cases. Specifically, under certain

[15]see Economou et al. (2010)
[16]in this respect see Banerjee (1997)
[17]see Shleifer and Vishny (1993)
[18]see García-Prado and Gonzalez (2007)
[19]see Mossialos et al. (2005a) and Nikolentzos and Mays (2016)

conditions they might offer an explanation to empirical observations that it is difficult to explain otherwise, like the success of the Greek Health System.

A Appendix

A.1 Proof of proposition 1(c)

Let $\overline{u}_i = U(C_i, G)$ where $\overline{u}_i$ is the equilibrium utility level. Then, because the utility function is continuous and strictly increasing with respect to consumption, I can solve with respect to consumption and write $C_i = \varphi(G, \overline{u}_i)$. Then, the equilibrium payment function is $b_i = e_i - \frac{S}{n+1} - \frac{G}{n+1} - \varphi(G, \overline{u}_i)$. Then $C_0 = e_0 + S - \frac{S}{n+1} - \frac{G}{n+1} + \sum_1^n b_i = \sum_0^n e_i - G - \sum_1^n \varphi(G, \overline{u}_i)$. Since all payments are positive , then around equilibrium the utility of the citizens is constant along their payment functions. Thus, the problem of the governor becomes $\max_G U(\sum_0^n e_i - G - \sum_1^n \varphi(G, \overline{u}_i), G)$. The first order condition for this problem yields: $\frac{\partial U_0}{\partial C_0}(-1 - \sum_1^n \frac{dC_i}{dG}) + \frac{\partial U_0}{\partial G} = 0$. Moreover, in equilibrium $\overline{u}_i = U(C_i, G)$ and since $\overline{u}_i$ is constant it follows that $\frac{dC_i}{dG} = \frac{\frac{\partial U_i}{\partial C_i}}{\frac{\partial U_i}{\partial G}}$. Rearranging terms in the first order condition yields equation 1.

A.2 Solution of numerical example

I will guess and verify that in equilibrium $r_i = 0$ for both citizens. In order to determine the equilibrium payment functions I must determine the equilibrium utility levels $\overline{u}_i$. I do that in a series of steps.

Step 1: ***Increasing inf. payments***

Define F^* the value of the governor's objective in the case without informal payments.

If the poor citizen offers a greater informal payment than the rich, then the governor will reject all payments and choose the same policy as in the case without informal payments. This is so, because the combination of functions F and U imply that ceteris paribus the governor likes equality between all individuals. Let t, b_1 and b_2 be the tax and payments offered, with $b_1 > b_2$. In such a case $U_2 > U_1$. Then, the governor can reject all payments and set a new tax $t' = t + \frac{b_1 + b_2}{2}$. In this case S and G can remain the same while U_1 increases, U_2 decreases and still $U_2 > U_1$. As a result F increases and therefore the governor will choose the same policy as in the case without informal payments since F^* is even greater.

Step 2: ***The poor can not be the only one offering an informal payment***

This is a special case of step 1, for $b_1 = 0$.

Step 3: ***The poor need not offer an informal payment in equilibrium***

Let t, b_1 and b_2 be the tax and payments offered. Since $b_1 > b_2$ the governor can always set a new tax $t' = t + b_1$. This action has no effect in the equilibrium allocation. The consumption of each individual and the public good provision remain the same. The only change is that b_2 decreases by an amount equal to the increase in tax.

Step 4: ***Determination of the equilibrium utility level*** $\overline{u}_2$

Following the rationale of proposition 3 in Dixit et al. (1997) citizen 2 has the motive to decrease his payment (increase $\overline{u}_2$), until the objective of the agent reaches his outside option. This outside option is the value of the agent's objective when citizen 2 offers no payment at all. It follows from the steps above that this value is F^*.

Following the definition of truthful equilibria $b_2(S, G; \overline{u}_2) = e_2 - \frac{S+G}{n+1} - \frac{\overline{u}_2^2}{G}$. Then, $\overline{u}_2$ satisfies:

$$\max_{S,G}[U_0(S, G; \overline{u}_2) + U_2(S, G) + \overline{u}_2] = F^*$$

I report the results that follow from this expression in table 1 in the main text.

Step 5: $r_2 = 0$

The results in table 1 indicate that in the suggested equilibrium $U_0 < U_2$. If $r_2 > 0$ the difference between U_0 and U_2 will increase further and thus F will decrease.

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