A Formal Model of Corruption, Dishonesty and Selection into Public Service

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A Formal Model of Corruption, Dishonesty and Selection into Public Service*

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Abstract

Recent empirical studies have found that in high corruption countries, inherently more dishonest individuals are more likely to want to enter into public service, while the reverse is true in low corruption countries. In this note, we provide a simple formal model that rationalizes this empirical pattern as the result of countries being stuck in different self-sustaining equilibria where high levels of corruption and negative selection into public service are mutually reinforcing.

Experiences with corruption vary widely across countries. In some places, high levels of corruption have seemingly always been a fixture of the public sector. In other places, corruption has been practically nonexistent for many decades. A set of recent empirical studies, Hanna and Wang (2013), Banerjee, Baul, and Rosenblat (2015) and Barfort et al. (2015), have suggested that these differences may be related to cross-country differences in the propensity for dishonesty among public sector employees, as more dishonest individuals are more likely to want to enter into public service in high-corruption countries, while the converse holds in low-corruption countries.

In this note, we provide a simple formal model that rationalizes this empirical pattern. The model shows how the endogenous self-selection of more or less dishonest individuals into the public sector creates multiple, self-sustaining equilibria. When the level of corruption

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is high, more dishonest individuals find it attractive to enter the public sector and engage in dishonest behavior, thereby sustaining the high levels of corruption. Conversely, when the level of corruption is low, fewer dishonest individuals enter the public sector. This in turn sustains lower corruption levels.

For a long time, researchers have looked at the persistent differences in corruption levels across countries and concluded that multiple equilibria and vicious cycles of corruption may be at play. The exact mechanism generating multiple equilibria, however, remains unclear and has so far been empirically unfounded. Lui (1986), Andvig and Moene (1990) and Mauro (2002), assume that detection is less likely when corruption is prevalent so the decision about whether or not to engage in corruption becomes a coordination game between bureaucrats that exhibits multiple equilibria. Cadot (1987) generates multiple equilibria by assuming that if bureaucrats extract sufficiently large amounts of resources they become able to bribe their way out of punishment if detected. This creates a convexity in the the payoff from corruption. Acemoglu (1995) studies a model where people can engage either in productive entrepreneurship or a rent-seeking activity that hurts other entrepreneurs. As entrepreneurship is unattractive when most other people are rent-seeking but attractive when most other people are entrepreneurs, this model also exhibits multiple equilibria. Tirole (1996) studies a model of group reputations, where behavior of previous bureaucrats shape the public's expectations regarding current bureaucrats. In his model, bureaucrats have no incentive to be honest if the public is convinced that bureaucrats are corrupt, leading to path-dependence and multiple equilibria. None of these existing papers, however, explore the possibility that the selection of more or less dishonest individuals into public service may be a source of equilibrium multiplicity.[1]

The model we present is highly stylized but is meant to capture two main ideas: The first idea is that a key difference between working in the public sector and working in the private sector is that public sector jobs put people in positions where they can dishonestly appropriate public funds. We capture this by assuming that private sector employees have no scope for dishonesty

[1] A different strain of theoretical literature has focused on selection among elected politicians instead of bureaucrats or public service more broadly. Within this literature, Bernheim and Kartik (2014) and the working paper version of Caselli and Morelli (2004) have studied models with heterogeneity in the inherent propensity of dishonesty. The working paper version of Caselli and Morelli (2004) discusses multiple equilibria generated by the reduced form assumption that the payoff from being elected is higher when the rest of the electorate is of high quality.

but that public sector employees are responsible for collecting taxes and are able to accept bribes from individuals who wish to avoid taxation in a way analogous to the tax collection game in Besley and McLaren (1993).

The second idea is that the returns to being dishonest in the public sector maybe be higher if there are many other inherently dishonest individuals working there. Drawing on the imperfect information framework of Cadot (1987), we capture this in our model by assuming that individuals correctly anticipate the overall share of dishonest individuals in the public sector but are unable to tell whether a given individual employee is dishonest and therefore susceptible to bribes. As a result, the expected benefits of offering bribes are higher if there are many dishonest public employees. When there are more dishonest public employees, more people therefore attempt bribes, which in turn increases the value of entering the public sector for dishonest individuals who are willing to accept bribes.[2]

As we shall see, the two ideas above combine to generate multiple equilibria in the model with varying types of selection into public service and varying levels of corruption. This illustrates how a country's corruption level may in part be shaped by the country being stuck in high corruption equilibria underpinned by negative selection into public service.

1 Model setup

We consider an economy that consists of a continuum of agents of measure 1. The agents start out unemployed but may seek employment in one of the two sectors of the economy: the public sector or the private sector. The jobs in the public sector involve collecting income taxes, which will be used to provide a public good, while the jobs in the private sector involve producing output. For simplicity we assume that there is a fixed number of jobs in the two sectors. In particular there is a measure of $\frac{1}{N}$ jobs in the public sector and a measure of $1 - \frac{1}{N}$ jobs in the private sector, where N is some integer.

Time in the economy proceeds as follows:

[2]An alternative assumption that can generate a similar relationship between the number of dishonest individuals in the public sector and the returns to being dishonest in the public sector is if public sector employees somehow audit each other. In this case more dishonest individuals in the public sector will make it more likely to be audited by a dishonest individual that can be bought off, which can increase the payoff of being dishonest in the public sector.

First, agents apply to jobs and the two sectors of the economy hire. In particular, we assume that agents first decide whether to apply for a job in the public sector and that the public sector then fills all its jobs from among its applicants by selecting applicants at random. Afterwards, agents who are still unemployed find a job in the private sector.

Next, agents are paid a wage up front and begin work in their respective jobs. Each employee in the private sector produces an output of k and correspondingly is paid a wage of $w_p = k$ due to competition among private sector firms. Employees in the public sector are first paid a wage fixed exogenously at w_g and then start their work collecting taxes. Each public sector employee is assigned to collect taxes from N other agents. We assume that all agents, both public and private employees, are subject to a fixed lump sum income tax of τ.

Once each agent in the model has been assigned a public employee to collect their taxes, a small tax collection game begins between each agent and his or her tax collector. First, the tax-paying agent can either act honestly and hand over the required lump sum tax or he can act dishonestly and try to offer the public employee a bribe of a fixed size b in order to avoid taxation. If no bribe is offered, the tax collection sub game ends and the agent hands over the lump sum tax. If the bribe is offered, the public employee must choose whether to act honestly and reject the bribe or act dishonestly and accept the bribe. If the bribe is rejected, the tax collection sub game ends and the agent hands over the lump sum tax. If the bribe is accepted, the tax collection sub game ends with the public sector employee receiving b units of income but no taxes being collected. We assume that all tax collection games takes place simultaneously.[3]

After taxation has taken place, the total tax revenue (net of public sector wages) is used to provide some public good. Since no individual agent can influence the level of the public good, however, this will not affect behavior and we omit any further discussion of public good production.

When making decisions, the agents in the economy act as expected utility maximizers with a utility function that depends on the following: their own income, y, the number of dishonest actions that they take (offering and/or accepting bribes), x, and whether or not they work in the public sector, d. In particular, the preferences of agent i are assumed to be described by the

[3]The assumptions regarding preferences further below means that the choices of public employees are unaffected by the order in which taxes are collected from them and they collect taxes from other agents.

following utility function:

$$u_i(y, x, d) = \alpha_i y - \gamma_i x + \eta_i d$$

Here α_i is agents i's marginal utility of personal income, γ_i is his utility cost of engaging in dishonest behavior (either stemming from a psychic cost of dishonesty or from a (perceived) probability of getting caught and punished) and η_i is the non pecuniary utility gain from working in the public sectors. These parameters may be different for different individuals. Crucially, we assume that they are private information.

In thinking about how preference heterogeneity affects dishonesty and corruption here, it is instructive to consider the behavior of an agent who has been offered a bribe of b. Accepting the bribe will increase their income by b and increase the number of dishonest actions that they have taken by one. Given some income level without the bribe, y', a number of other dishonest actions take, x' and conditional on their sector of employment d', this agent will be willing to be dishonest and accept the bribe if:

$$u_i(y' + b, x' + 1, d') \geq u_i(y', x', d') \iff \alpha_i b \geq \gamma_i \iff b \geq \frac{\gamma_i}{\alpha_i} \tag{1}$$

An agent will accept the bribe only if the gain from doing so $\alpha_i b$ is greater than the cost γ. As a result, for a given level of the bribe, b, the likelihood that an agent engages in dishonest behavior and accepts the bribe therefore depends only on the ratio $\frac{\gamma_i}{\alpha_i}$. In line with the empirical results in Barfort et al. (2015), we will focus on the case that dishonest individuals are characterized by particularly by placing more weight on their own income. We will therefore generate heterogeneity in dishonesty by assuming that α_i differs across individuals but that γ_i is constant, $\gamma_i = \gamma$. Specifically we will make the assumption that α_i takes on two different values in the population $\overline{\alpha}, \underline{\alpha}$, where $\overline{\alpha} > \underline{\alpha}$. With this assumption, individuals with $\alpha_i = \overline{\alpha}$, place a higher value on their own income and as a result are more likely to behave dishonestly when this increases their own income. As a result, we will say that an agent is *dishonest* if they have $\alpha_i = \overline{\alpha}$ and that they are *honest* otherwise. We let π denote the share of the population who are dishonest.

As for the preference parameter η_i measuring non-pecuniary motivations for working the public sector, we will simply assume that it is distributed uniformly on $[\underline{\psi}, \overline{\psi}]$ and is independent of the dishonesty parameter, α_i. Of course, it is possible that non-pecuniary motivations for working in the public sector are positively or negatively correlated with dishonesty in a given population, which would tend to generate a trivial self-selection of honest or dishonest individuals into the public sector. We thus focus on the case of independence because we want to emphasize that positive or negative self-selection might arise endogenously in equilibrium even if there are no inherent differences in sector preferences across honest and dishonest individuals.

This completes the model setup. Figure 1 and 2 summarizes and shows the decision tree for both the main model flow (main game) and the taxation sub game.

2 Model equilibria

Before deriving the model equilibria, we invoke some restrictions that rule out trivial or uninteresting cases and ease the exposition. First of all, we assume that the magnitude of the possible bribe is such that some but not all people in the economy would accept bribes:

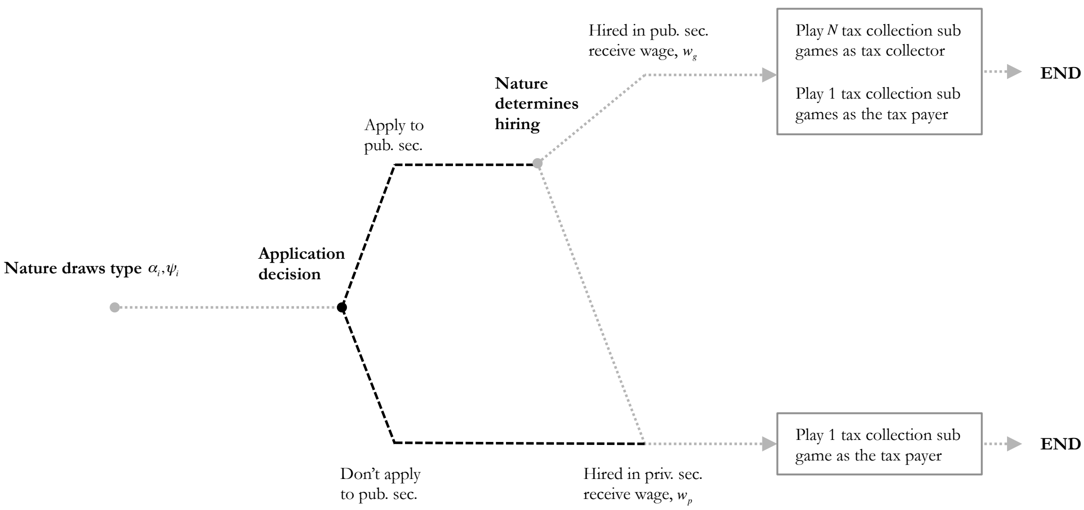
$$\frac{\gamma}{\overline{\alpha}} < b < \frac{\gamma}{\underline{\alpha}} \tag{2}$$

Second we focus attention on the empirically relevant case where the private sector pays a higher (formal) wage than the public sector but that the wage gap is small enough that the public sector still fills all of its jobs:

$$0 \leq (w_p - w_g) \leq \frac{\overline{\psi} - \frac{\overline{\psi} - \underline{\psi}}{N}}{\pi\overline{\alpha} + (1-\pi)\underline{\alpha}}$$

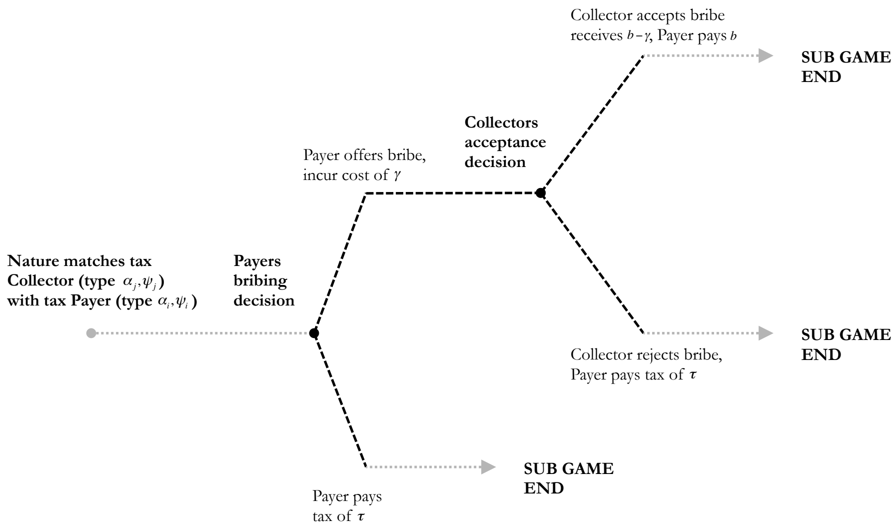
Third, we assume that there is enough variation in the preferences for public sector work that some agents will always prefer the public sector and some agents will always prefer the private sector among both the honest and dishonest agents:

Figure 1: Decision tree for main game



The figure shows the flow and decision tree for the main game. Black long-dashed lines correspond to agents decisions, while gray short-dashed lines correspond to random events (*Nature*) and deterministic progression.

Figure 2: Decision tree for taxation sub game



The figure shows the flow and decision tree for the taxation subgame. Black long-dashed lines correspond decisions for the two agents (*Collector*, index j, and *Payer*, index i), while gray short-dashed lines correspond to random draws (*Nature*) and deterministic progression.

$$
\begin{aligned}
\overline{\psi} \geq & \overline{\alpha}(w_p - w_g) \\
\underline{\psi} \leq & \underline{\alpha}(w_p - w_g), \overline{\alpha}(w_p - w_g) - N(\overline{\alpha}b - \gamma)
\end{aligned}
$$

We make these restrictions purely for expositional purposes as they rule out complications related to corner solutions.

In terms of solution concept, we focus on Perfect Bayesian Equilibria in pure strategies and impose the normalization that agents always choose to be honest if they are indifferent between behaving honestly and dishonestly, and always choose to apply to the public sector if they are indifferent between the public and private sector.

To solve for the possible equilibria of the model, we note that agents make three potential decisions in the model that we need to analyze: 1) Agents have to decide whether to apply to the public sector, 2) they have to decide whether to offer a bribe to their assigned tax collector and 3) they (may) have to decide whether to accept a bribe if one is offered to them as a public employee. Analyzing decision 3) is trivial since restriction (2) implies that dishonest individuals will always accept a bribe if offered one, while honest individuals will always reject. Below we analyze decisions 2) and 1).

2.1 The decision to offer a bribe

Consider the decision of agent i about whether or not to offer a bribe to whichever public employee is collecting taxes from him in the tax collection sub game. Since agent i can not observe the type of the public employee who is collecting his taxes, there is uncertainty about the whether bribe will be accepted so we let p^a denote the expected probability that the bribe is accepted if offered. It now follows that the agent will offer the bribe if and only if the expected gain from doing so is greater than the cost:[4]

[4]Note that the additive preferences means that the the choice of offering a bribe does not affect potential later decisions about accepting bribes, which is why we can analyze the bribe decision separately.

$$p^a \alpha_i (\tau - b) > \gamma$$

We know from above that an offered bribe is accepted if and only if the public employee assigned to collect the tax is of the dishonest type. The probability that the assigned public employee is dishonest is simply equal to the share of dishonest types working in the public sector, which we will denote by s. Since in equilibrium the expected probability that a bribe is expected must equal the true probability, it follows that agents in equilibrium will offer a bribe if and only if:

$$\alpha_i > \frac{\gamma}{s(\tau - b)}$$

Based on the distribution of dishonesty in the population, we can now define a function that gives the fraction of agents offering bribes to their tax collector in equilibrium, f, as a function of the equilibrium share of dishonest agents in the public sector, s:

$$f(s) \equiv \begin{cases} 0 & \text{if} \quad \frac{\gamma}{s(\tau-b)} \geq \overline{\alpha} \\ \pi & \text{if} \quad \overline{\alpha} > \frac{\gamma}{s(\tau-b)} \leq \underline{\alpha} \\ 1 & \text{if} \quad \underline{\alpha} > \frac{\gamma}{s(\tau-b)} \end{cases} \tag{3}$$

Equation (3) shows that the fraction of agents offering bribes is an increasing function of the share of dishonest individuals in the public sector, s: When there are very few dishonest individuals working in the public sector, the probability of a bribe being accepted is so low that no-one offers bribes. Conversely, everybody offers bribes when there are many dishonest individuals in the public sector. Finally, there is an in-between case where the probability of a bribe being accepted is such that only dishonest individuals offer bribes.

2.2 The decision to apply for the public sector

Consider the choice of agent i about whether or not to apply for a job in the public sector. From the preceding analysis we see that an agent's decision about whether or not to bribe his tax collector is unaffected by his sector choice. When analyzing sector choice, we can therefore simply examine the wage paid in the two sectors, the potential utility cost and income from accepting bribes and the non-pecuniary returns from working in the public sector.

We first consider honest agents. As these will never accept bribes, an honest agent i, will apply to the public sector if and only if:

$$\underline{\alpha} w_g + \eta_i \geq \underline{\alpha} w_p \iff \eta_i \geq \underline{\alpha}(w_p - w_g)$$

Turning next to dishonest agents, who will always accept bribes if offered, the expected gain from working in the public sector will include the expected value of any bribes offered by the N tax payers that they are assigned to meet with. Since public employees are assigned to tax people at random, the expected probability of being offered a bribe must in equilibrium be equal to the actual fraction of agents who offer bribes to their tax collector, f. An agent i, who is dishonest, will therefore apply to the public sector if and only if:

$$\overline{\alpha} w_g + \eta_i + Nf(\overline{\alpha} b - \gamma) \geq \overline{\alpha} w_p \iff \eta_i \geq \overline{\alpha}(w_p - w_g) - Nf(\overline{\alpha} b - \gamma)$$

Finally we can solve for the equilibrium share of agents who work in the public sector, s. Since the public sector hires at random from the pool of applicants, s will simply as the number of dishonest applications to the public sector divided by the total number of applicants:

$$s = \frac{\pi P\left(\eta_i \geq \overline{\alpha}(w_p - w_g) - Nf(\overline{\alpha} b - \gamma)\right)}{\pi P\left(\eta_i \geq \overline{\alpha}(w_p - w_g) - Nf(\overline{\alpha} b - \gamma)\right) + (1-\pi) P\left(\eta_i \geq \underline{\alpha}(w_p - w_g)\right)}$$

Plugging in for the distribution of η_i, we can finally define a function $s(f)$, which expresses the equilibrium share of dishonest individuals in the public sector, s, as a function of the equilibrium share of agents who offer a bribe to their tax collector f:

$$s(f) \equiv \pi \frac{\overline{\psi} - \overline{\alpha}(w_p - w_g) + Nf(\overline{\alpha} b - \gamma)}{\overline{\psi} - \pi\overline{\alpha}(w_p - w_g) + (1-\pi)\underline{\alpha}(w_p - w_g) + \pi Nf(\overline{\alpha} b - \gamma)} \tag{4}$$

Equation (4) shows that the fraction of dishonest people choosing to work the public sector is increasing in the fraction of people who offer bribes to their tax collectors in equilibrium: Because dishonest people accept and benefit when being offered bribes, relatively more dishonest agents are willing to work in the public sector if many bribes are being offered.

2.3 Model equilibria

Together, equations (3) and (4), characterize the equilibria of the model. Conditional on the share of dishonest individuals in the public sector, s, equation (3) characterizes the equilibrium behavior of agents in terms of their decision to offer bribes. Conditional on the share of agents offering bribes, f, equation (4) characterizes the equilibrium behavior of agents in terms of their decision to try and enter the public sector. Any pair of values s, f that solves (3) and (4) thus corresponds to an equilibrium of the model and vice versa. Analyzing the equations in turn shows that the model may exhibit multiple equilibria:

Proposition 1 (Multiple equilibria) *The model has at least one equilibrium but may have up to three.*

Proof In the appendix.

To analyze how much corruption occurs in the different equilibria, we measure the *corruption level*, C, by the number of offered and accepted bribes in equilibrium. From above it follows that this is simply the share of agents offering bribes times the share of dishonest individuals in the public sector, $C = f \cdot s$. We can then characterize how corruption and selection differs across different equilibria:

Proposition 2 (Selection and corruption) *Let A and B be two different equilibria of the model. Let C_A and C_B be the corresponding corruption levels and let s_A and s_B the corresponding shares of dishonest individuals in the public sector. One of the following statements then holds:*

1. $s_A > s_B$ *and* $C_A > C_B$

2. $s_B > s_A$ *and* $C_B > C_A$

Proof In the Appendix.

Propositions 1 and 2 show that the model may have multiple equilibria and that the different equilibria differ systematically in their level of corruption and the type of selection that occurs into the public sector: some equilibria have few dishonest individuals selecting into the public sector and low corruption, others have many dishonest individuals in the public sector and high levels of corruption.

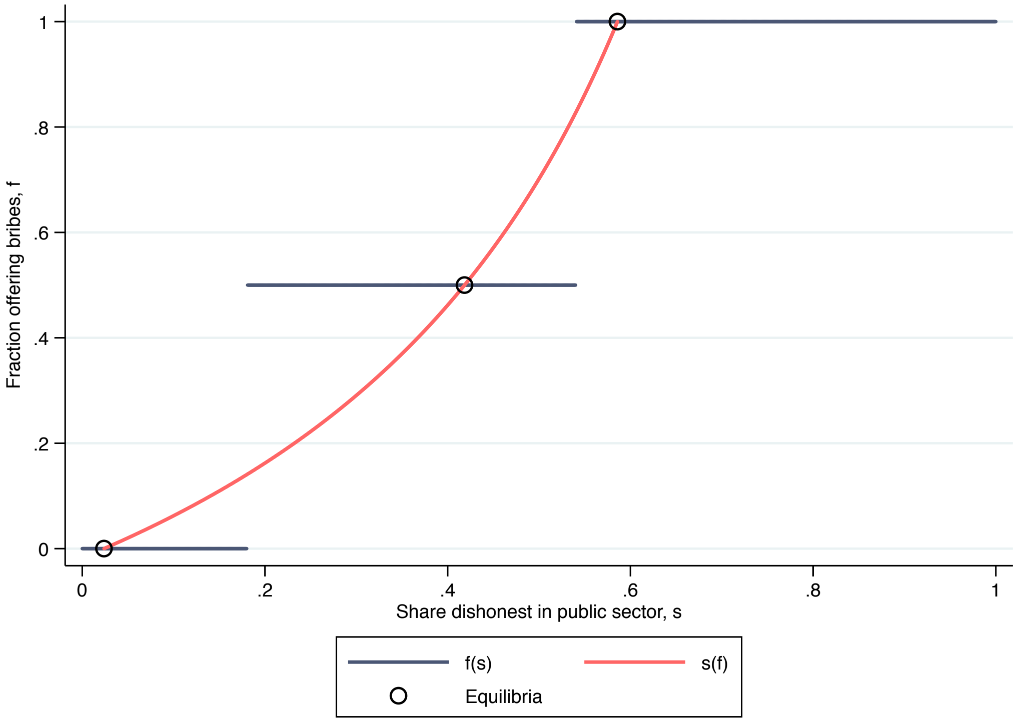
Figure 3 illustrates the two propositions by plotting $f(s)$ and $s(f)$ in (s, f)-space. Any intersections between the two curves is an equilibrium so here there are three equilibria: Two extreme ones where either nobody or everybody attempts to bribe their tax collector and an in-between one where some fraction of people offer bribes. Underpinning these multiple equilibria are stark differences in the self-selection of honest/dishonest-types into the public sector: When many people are offering bribes to public sector employees, it becomes disproportionately profitable for dishonest individuals to choose the public sector, which in turn makes it very attractive to offer bribes in the first place. Conversely, when few people offer bribes, dishonest individuals prefer the higher formal wage in the private sector, which in turn makes it very unattractive to attempt bribes as the public sector contains mostly honest individuals.

3 Conclusion

This note presents a simple model that illustrates how differential selection of honest or dishonest types into the public sector may generate different, self-sustaining equilibria with varying levels of corruption. When many dishonest individuals are self-selecting into the public sector, agents interacting with a public official anticipate that there is a high likelihood that the official is corruptible and therefore is more likely to try and engage the official in corrupt behavior. This creates more opportunities for corrupt behavior for public officials, which in turn makes the public sector particularly attractive for more dishonest individuals and sustains the self-selection of dishonest agents into the public sector.

The model highlights the potential importance of public sector selection in shaping the level of corruption in a country. In particular, the model shows that selection in the dishonesty dimension may be one factor that can create a vicious cycle and keep some countries stuck in

Figure 3: Illustration of multiple equilibria



The figures illustrates the existence of multiple equilibria by plotting the two functions $f(s)$ and $s(f)$ against each other in (s, f)-space. Intersections between graphs correspond to equilibria of the model. The figure corresponds to the following model parameters: $\overline{\psi} = 6.2$, $\underline{\psi} = 0$, $N = 3$, $\pi = 0.5$, $\overline{\alpha} = 3$, $\underline{\alpha} = 1$, $\gamma = 2.1$, $w_p = 9$, $w_g = 7$, $\tau = 3$ and $b = 1.3$

a ‘corruption trap’. This suggests a role for ‘big push’ policies that aim to break the existing selection pattern and shift countries to a better equilibrium. In designing such policies, the model framework above may serve as a useful starting point for theoretical and empirical analysis.

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A Appendix

A.1 Proof of propositions

Proof of Proposition 1 From (3) it is clear that f can take on at most three different values in equilibrium. Since $s(f)$ is strictly increasing this implies that s can also take on at most three values, showing that there is at most three equilibria. Figure 3 provides an example of a set of parameters for which the model actually has three equilibria. To see that there is at least one equilibrium, let $[\underline{s}, \overline{s}]$ denote the image of $s(f)$ and define the inverse $g(x) = s^{-1}(x)$. Now g is a continuous, strictly increasing function that maps $[\underline{s}, \overline{s}]$ into $[0, 1]$. If $\underline{s}$ satisfies $\frac{\gamma}{\underline{s}(\tau - b)} \leq \overline{\alpha}$ then $(s, f) = (\underline{s}, 0)$ jointly solves (3) and (4) and so corresponds to an equilibrium. Alternatively, if $\overline{s}$ satisfies $\underline{\alpha} > \frac{\gamma}{\overline{s}(\tau - b)}$ then $(s, f) = (\overline{s}, 1)$ jointly solves (3) and (4) and so corresponds to an equilibrium. If neither of these two conditions hold then $f(s)$ is constant equal to π on $[\underline{s}, \overline{s}]$. Applying the continuous value theorem to g there then exists some $s^* \in [\underline{s}, \overline{s}]$ such that $g(s^*) = \pi$. Accordingly $(s, f) = (s^*, \pi)$ jointly solves (3) and (4) and so corresponds to an equilibrium in this case. ∎

Proof of Proposition 2 Define the inverse $g(x) = s^{-1}(x)$ and note that g is then a strictly increasing function. From (4) it follows that the share of agents that offer bribes in equilibrium A and B satisfy $f_A = g(s_A)$ and $f_B = g(s_B)$. Now if $s_A = s_B$ then $f_A = f_B$. This contradicts that A and B are different equilibria so either $s_A > s_B$ or $s_B > s_A$. Because g is strictly increasing, $s_A > s_B$ implies $g(s_A) > g(s_B)$ which further implies $f_A > f_B$. Thus if $s_A > s_B$ then $C_A = f_A \cdot s_A$ is strictly larger than $C_B = f_B \cdot s_B$. The same argument shows that $s_B > s_A$ implies $C_B > C_A$. ∎