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# WHITHER CORRUPTION?
# BRIBES AND OPTIMAL REFORMS IN BUSINESS STARTUP

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# Whither Corruption? Bribes and Optimal Reforms in Business Startup

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**Abstract**

This paper evaluates the effect of corruption on the entry of firms. A theoretical agency model of bribes is presented, with strategic interaction between the firm, the corruptible public sector employee and the government. This model allows to evaluate reforms targeting business startup procedures with regards to the incentives of the various actors involved in this process. Results show that corruption in equilibrium between entrant firms and public servants could be self-sustained in the absence of government intervention. When deriving the equilibrium outcomes of some reforms like performance wages, privatisation and full liberalisation of entry, results show that transaction costs related to bribes and private sector wages are central in determining the optimal reform strategy. Although liberalisation is the preferred reform option for firms, government fiscal revenues and overall social welfare, firms surprisingly would prefer performance wages implemented in public registry service rather than the privatisation of this service. This holds despite the additional tax burden on firms necessary to finance higher civil servants' wages.

**Keywords**: Corruption, Moral Hazard, Taxation, Public Sector Wages.

**JEL classification:** D8; E62; L38; J41; J45; O57.

## 1 Introduction

Everyone has a word for it: 'hongbao' in China, 'baksheesh' in Arab countries, 'matabiche' in central Africa, 'propina' in Latin America, 'pots

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de vin' in France, 'mazzetta' in Italy or just plain bribery. Corruption is defined as the phenomenon arising whenever public officials "accept payments that violate some laws in order to affect the implementation of other laws or regulations"(Becker, 2005).[1]

Corruption and bribery are pervasive and universal phenomena, although their extent, size and importance is differentiated by nations and sectors of economic activity. They represent dangerous deficiencies in the correct relationship between the public and the private sector. One of the area where corruption could be especially harmful to social welfare and growth is the start up of new businesses: the existence of corruption could constitute an additional cost of entry for new firms. Recognizing this, a number of international institutions have started to take moves to tackle bribery. In the wake of repeated scandals and the role that corruption played in the financial crises in South East Asia, the OECD launched in 1997 the Anti-Bribery Convention, the first global initiative to fight corruption in cross-border business deals. Until now it has been ratified by all 30 OECD members and six non-members. This convention makes it illegal for companies from member countries to bribe foreign government officials. The United States has had similar legislation for over 20 years: The Federal Corrupt Practices Act, adopted in 1977 in the wake of the Lockheed scandal, made the corruption of foreign officials a criminal offence. Yet these and other international conventions have not stopped local and multi-national corporations from trying to secure valuable contracts by bribing government officials in the world's emerging economies. Such practices seem widespread especially in the defense sector, public works and construction industries.

Several efforts have been also made to start quantifying the extent of corruption, especially when actors of different nationalities interact. Transparency International (TI), an international organization against corruption, released in 2002 a Bribe Payers Index (BPI) - a survey designed to measure perceptions in emerging market economies of the existence and extent of bribery performed by world companies. The survey

[1] There is a large literature that sees corruption similar to a market mechanism which helps correcting the inefficiencies brought about by excessive and/or unsound regulation. Without disregarding this Coasian view, we prefer to view bribery as a phenomenon which reduces the social welfare. This might be because, for instance, there is a lack of competition among public officials which pushes the price of bribes above the benefit that bribers receive. From a dynamic viewpoint, corruption might be harmful because the economic resources spent in the bribing activity could rather be employed in reforming the inefficient regulations which create corruption. This reform would save money to the general public and increase social welfare if and only if the benefit from corruption is smaller than its cost.

was run in 15 emerging market economies and domestic companies in developing countries are ranked on top of the BPI: local firms in emerging market economies most often offer bribes to officials to secure contracts. Next come companies from Russia and then the People's Republic of China. Companies from France, the United States, Japan and Italy - all part of the Group of Eight Industrial countries (G8) - are in the top ten of perceived bribe paying nations. Companies from Australia are seen as least likely to pay bribes (Transparency International, 2002) [14].

The results from the BPI suggest that corporate bribe-paying to "get things done" is a pervasive phenomenon especially in developing and transition countries. It distorts the allocation of resources, inflates spending on public procurement and undermines competition in the market place. It has a devastating effect on investment and then on growth and development. One possible reason why corruption seems to depress investment is that it acts as a supplementary tax on private investment (Shleifer and Vishny, 1993) [12]. An additional corroboration of this comes from the World Bank's Investment Climate Survey, a recent original database which contains, among others, indicators on firms' side payments in developing countries "to get things done". Data shows that, for instance, as much as 60 percent of surveyed firms in South Asia expected to give gifts when meeting with tax inspectors. The value of the gift expected to secure a government contract exceeds 8 percent of the contract's value in Latin America.

While research on corruption has thrived in recent years [2], work investigating its impact on business startup and private investment is still very limited. Mauro (1995) [11] finds that an aggregate institutional indicator of corruption is negatively associated with total investment in his sample of countries. Brunetti, Kisunko and Weder (1997) [5]present results from a survey of entrepreneurs suggesting that perceived unreliability of the judiciary, government instability, and corruption negatively influence cross-country differences in aggregate investment. Brunetti and Weder (1997) [4] find that among institutional factors, lack or weak rule of law and large corruption are the most detrimental to investment.

This literature has provided important insights on the role of corruption as an impediment for private investment; nevertheless it also has few drawbacks. First, in this literature corruption is measured with perception indexes, which raises concerns about perception biases. Moreover, even if they were not plagued by biases, these indexes are ordinal: their use in studies trying to establish quantitative relations seems question-

[2]See Tanzi (1998) [13] and Jain (2001) [9] for comprehensive empirical surveys, and Aidt (2003) [1] for a recent theoretical survey. Treisman (2000) [**?**] contains an interesting cross-country comparison.

able.[3] More importantly, a central feature lacking in this literature is a theoretical framework that provides a consistent framework for understanding how corruption relates to the incentives of various actors involved in the startup of businesses. In fact, most current research on the regulation of entry and its ensuing policy recommendations (Djankov et alii, 2006 [7]; World Bank, 2006 [17]) rely on a reasoning by which entry reforms always benefit firms and social welfare. Yet once government revenues, public employees welfare and the potentially beneficial role of bribes is taken into account, recommendations on what is the best reform strategy in business startups are not straightforward anymore. This paper fills this gap by elaborating a stylized theoretical model which allows for strategic incentive-based interaction among three players: the government, the public sector employee and the private entrant firm. A key result of this theoretical model is that bribery is now determined as an endogenous equilibrium and that, when setting the business tax policy, the Government anticipates the existence of bribes and decreases the optimal tax accordingly. Next we are able to identify the effect that reforms to the regulation of entry of new firms have on Government's finances and on firms' welfare. We show that reforming the start up regulation can help boosting the finances of the Government. In particular, the larger increase in Government's fiscal resources comes from a complete liberalisation of the start up process, i.e. in a radical decrease in the cost of starting up a business.[4] However we find that moving to a privatisation reform of the public sector is preferred when the savings coming from the downsizing of the public sector are larger than the losses in fiscal resources due to higher direct costs born by the firms. On the other hand implementing a performance wage reform is optimal when the additional costs following a more expensive public sector are smaller than the increases in fiscal resources received from the Firms due to the inferior direct costs born by them. Interestingly reforming the public sector might not be optimal whenever the transaction costs are small. Regarding the Firm preferences towards different scenarioes, again the optimal reform is a complete liberalisation of entry. Furthermore the firm prefers privatisation to the status-quo if the transaction costs associated to the corruption are large enough and the private sector salaries are small. Surprisingly, to the last two institutional frameworks, the Firm prefers switching to a performance wage reform although this means having to pay larger business taxes

This paper is organized as follows. In Section 2 we outline the main

[3] See Dreher, Kotsogiannis and McCarriston (2004) [8] for more on this point.

[4] For a similar result on the effect of reforming the start-up sector on GDP growth, see [7]

building blocks of our theoretical model. Section 3 discusses the theoretical results that emerge when the government has limited instruments (i.e. only confined to setting wages and taxes). Moreover we identify the change in the players' utility that could be brought about by the hiring of honest employees. In Section 4 we highlight three common policy reforms which can be used to eradicate bribery: incentive wages, privatisation and liberalisation and we derive players' utility in each one of these scenario. In Section 5 we establish the relative merits of each of the three reforms for the players' utility and with respect to the status quo. Section 6 concludes.

## 2 The Model

The stylized model we employ has three players: the Government (principal), the government Employee or the civil servant (agent), and a startup Firm. The Employee has to perform a task on behalf of the Government. Since our context is one of business start-up, we think of the task as the amount of paper-work, administrative and bureaucratic procedures that the Employee has to complete before the Firm is allowed to start operating in the market. These bureaucratic procedures generate some disutility $\delta$ for the Firm equal to their costs of completion. For instance, think of the amount of time the Firm spends to complete those procedures and deal with the bureaucracy and the non-pecuniary costs this causes. In other terms we take this variable $\delta$ to represent the costs of regulation in the start-up sector of the economy. The variable $\delta$ can assume two different values $\delta \in \{d, D\}$ with $D > d > 0$. With this simple modelling choice we want to capture the fact that in most of the bureaucratic procedures there is some amount of discretion on part of the bureaucracy that may alter the regulatory burden cost suffered by the Firm.

For example in many countries, and especially in countries where the quality of governance is low, rules are formally fixed but in reality rather flexible and discretionary; nevertheless regulation might be quite burdensome (see World Bank ch. 9 [18]). This is true in general as well as in particular in the context of business start up regulation. As a consequence, the public Employee enjoys quite a large subjective power in deciding when to allow a business to (start to) operate. In fact the array of regulation might involve rules that, if taken literally, might long delay the Firm's entry in the market. However, with another more favourable interpretation, the Firm could be given the permit to trade more quickly, so seeing reduced its overall regulatory cost.[5] Therefore we

[5] With reference to this, it is useful to read the World Bank's Doingbusiness 2006

make the hypothesis that the Employee can favour or hinder the start up of the business that has asked for the permission to begin operating.

We model this assuming that, by exerting an effort the Employee will induce the good outcome, i.e. the smaller cost $d$ rather than the larger cost $D$. Nevertheless, we find convincing to assume that the fact of one event happening rather than the other is probabilistic in nature. In fact the Employee does not control entirely the whole administrative process of the Firm entering the market. For instance there might be other procedures that affect the process of the regulatory activity and the related cost for the Firm. However these procedures are under the responsibility of other public employees left unmodelled here.

Formally, we make the assumption that the following holds:

$$\begin{aligned} \Pr(D|e=1) &= \pi_1 \\ \Pr(d|e=1) &= 1-\pi_1 \\ \Pr(D|e=0) &= \pi_0 \\ \Pr(d|e=0) &= 1-\pi_0 \end{aligned}$$

with $\Delta\pi = \pi_1 - \pi_0 > 0$.This indicates that a good outcome, i.e. a lower cost $d$ is more likely to be achieved when the agent makes an effort (the usual First Order Stochastic Dominance assumption).

Given this setting, the Employee's effort is assumed to benefit the Firm, which values positively $e = 1$. However, when exerting the positive effort, the agent incurs a disutility $-v$. i.e. $v(e = 1) = v > 0$. Obviously when the Employee does not exercise any effort, he does not bear any disutility. Without loss of generality we can set $v(e = 0) = 0$.

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report ([16]). Among the set of rules to allow firms to start up their operations in Belarus, Procedure 4 concerns the business registration with the State Registry. According to the details about the registration requirements, "[...]the registry also checks the background of founders and registers the company into the unified registration database. General term is 1 month. *If the register needs to make an inquiry for additional information about the founders of the Company, it can extend the term till 2 months*, in such case it should notify the founders." (*italics* ours). The details for the procedures to start a business in Belarus are accessible online at http://www.doingbusiness.org/ExploreTopics/StartingBusiness/MoreDetails.aspx?economyid=19.

Like in Belarus also in Uzbekistan the procedures to start up a business are characterized by a certain amount of discretion. According to the Doingbusiness 2006 report the firm has to require and produce a whole array of documents, permits and authorization to "[...] register with the local authority (khokimiyat) and obtain the Certificate of State Registration [...] Time to complete is from 7 days to 1 month *depending on how complicated the registration documents are*". The details for the procedures to start a business in Uzbekistan are accessible online at http://www.doingbusiness.org/ExploreTopics/StartingBusiness/MoreDetails.aspx?economyid=199

Similar features are encountered in most of the start up business procedures in the LDC, where a high degree of flexibility and discretion seems to be the norm rather than the exception.

The Government has the task of setting a business tax policy and a public sector wage policy. The business tax policy consists of two instruments: i) a fixed entry fee $F$ to allow the start-up Firm to start operating; ii) a corporate tax $\gamma$, with $\gamma \in (0,1)$ on the expected profit $\Pi > 0$ the Firm is making when entering the market. Regarding the wage policy, the government pays $w$ to the Employee to perform his job. [6]

Firm's utility is given by the net profit $(1-\gamma)\,\Pi$ minus the sum of the costs of the regulatory activity $F + \delta$. Notice that these are fixed costs that the Firm has to bear before operating in any market and are not deducted from the net profit $\Pi$. The reason for this is twofold: regarding $\delta$, this represents indirect and non-monetary costs that come out from the regulatory activity of the Government and as such cannot be substracted from the revenues of the Firm. As far as $F$ is concerned, we want to isolate the effect of these costs on the Firm's utility, in order to perform later on some simulation on the effect of changing the entry fee on players' utility (Firm and especially Government).

Together with the legal interaction between Firm and Employee mediated by the Government, an illegal direct one coexists. In fact the Firm may pay the Employee a bribe $b \geqslant 0$ to induce him to exert the effort and reduce the cost $\delta$ from $D$ to $d$. Therefore the agent's payoff is made of a legal part (the wage) and an illegal one (the bribe). For simplicity we assume that the agent's utility is linear in both wage and bribe:

$$U_E(w, b, e) = w + b - v\,(e) \tag{1}$$

Likewise Firm's utility is linear in both payments and profit, i.e.:

$$U_F(b, \gamma, F, \delta) = (1-\gamma)\Pi - F - \delta - \beta b \tag{2}$$

Notice that the Firm pays $\beta b, \beta > 1$, but the Employee receives $b$. With the introduction of the parameter $\beta > 1$, we want to model the existence of transaction costs between Firm and Employee in the illegal market for bribing. We assume that illegal transactions are harder to carry out successfully than similar transactions performed lawfully. To model in a simple way this difficulty we introduce the assumption that there are some additional costs involved in the illegal transactions, i.e.

[6] We make the implicit assumption that the not-fiscal regulatory policy, i.e. the variable $\delta$, is fixed and it is not decided upon by the Government. This is because we want to focus on the fiscal resources the Government can raise out of the start-up sector of the economy. However later in the paper we will analyse what happens when, in a liberalisation reform, the Government decides to eliminate altogether the regulatory activity, both fiscal ($F$) and not fiscal ($\delta$).

the parameter $\beta$; this makes what the Firm pays larger than what the Employee receives.

Throughout the paper the Government is assumed to be benevolent. As already said the Government chooses a corporate tax policy and a public sector wage policy to maximize the following social welfare function subject to the incentives of the players involved in the start up sector of the economy:

$$U_G = N\left(U_F^*\right)(\gamma\Pi + F) - Mw + B \tag{3}$$

In the eq. (3) the term $B$ represents the net revenues for the Government coming from the taxation of the rest of the economy, i.e. from the non-start-up sectors of the economy. Since the focus of this paper is on the start up sector, we take the term $B$, normalising to zero without any loss of generality. The net revenues from the start up sector of the economy are equal to $N\left(U_F^*\right)(\gamma\Pi + F) - Mw$, where $w$ is the wage of the public employee of the start up sector, $M$ is the number of public employees, and $N\left(U_F^*\right)(\gamma\Pi + F)$ are the fiscal resources, with $N\left(U_F^*\right)$ the number of the start up firms, depending on the Firm's net equilibrium utility $U_F^*$. We find it reasonable to assume that, the larger is the utility the Firm enjoys in the market, the larger is the number of Firms willing to enter the market itself. Formally, this means that $N'\left(U_F^*\right) \geqslant 0$. Furthermore we find it convenient to assume that there is some upper bound to the number of firms entering the market, i.e. there exists a number $\overline{N}$ s.t. $\lim_{U_F \to \Pi} N(U_F) = \overline{N}$. In order to give some regularity to the function $N(U_F)$, we can also make the hypothesis that $N''(U_F) < 0$.

So the assumptions just stated affirm that the number of firms starting up their business operations is increasing in the Firm's utility, although at a decreasing rate and that the number of firms cannot increase indefinitely when the utility of the firms approaches its maximum level ($\Pi$), but there is a limit to this number.

The Government wants to maximise its fiscal revenues because in this way it will be able to increase its resources in order to fund the supply of a public good or of a good publicly produced to the advantage of the citizens. Alternatively, we can think that the fiscal resources collected will be used to fund an income redistributive program towards the rest of the society. For simplicity of treatment, and since it is outside the focus of this paper the optimal mix between public and private good in the economy, we do not model either the offer of the public good to the society or its effect on players' utility. Finally, this modeling choice of the government maximising the fiscal revenues of the economy is common in the "corruption with a benevolent principal" stream in the litera-

ture (Aidt, 2003)[1]. In this literature, bribes arise when a benevolent principal delegates decision making power to a non-benevolent agent.

# 3 Bribes with Limited Government Instruments

We begin by assuming that the Government has limited instruments. Thus incentive wages cannot be devised and other reforms are also impossible or too costly to implement. The timing of the game is the following: first, the Government selects both a corporate income tax $\gamma$ and a fixed fee $F$ to be levied on the Firm and a (fixed) wage $w$ to be payed to the Employee; second, the Firm determines whether to bribe the Employee or not and if so, the Firm decides which "menu of bribes" $\left\{\underline{b}, \overline{b}\right\}$ to offer; third, the Employee decides whether to exert or not an effort, which is not observable; subsequent to the agent's action, the outcome $\delta \in \{d, D\}$ is realized; finally contracts are executed, the Firm earns its profit and the Government raises its fiscal resources.

The game described above illustrates a case of sequential contracting in presence of moral hazard, yet under a situation where the agent has two different principals: first it is the Government offering him the wage $w$ and then the Firm offering the bribe $b$. We have therefore to solve this dynamic game by backward induction. We begin by solving for the optimal bribe which has to be paid by the Firm to induce the Employee's effort $e = 1$.[7]

## 3.1 Firm-Employee Interaction

At the second stage, the Firm would like to interact illegally with the Employee by offering a bribe if and only if effort is valuable and she anticipates that the Employee will not exert any effort following the contract offered by the Government. In fact if the Employee exerts the effort following the Government contract, then for the Firm it will be useless to ask the Employee to do so using the bribes.

Since a positive effort decreases stochastically the Firm's regulatory burden, then the Firm would like to induce agent's effort $e = 1$ by offering the Employee a menu of bribes $\left\{\underline{b}, \overline{b}\right\}$. The payment $\overline{b}$ is being paid to the Employee if and only if the outcome is good (i.e. $\delta = d$), while $\underline{b}$ is being paid if and only if the outcome is bad (i.e. the regulatory cost is large $\delta = D$). To induce a positive effort, the Firm solves the following program:

[7] Laffont and Martimort (2002) provide an excellent exposition of principal-agent models involving moral hazard.

$$For\ \ (e=1): \underset{\left\{\underline{b},\overline{b}\right\}}{Max}(1-\gamma)\Pi - F - \pi_1\left(d+\beta\overline{b}\right) - (1-\pi_1)\left(D+\beta\underline{b}\right)] \tag{4}$$

$$s.t. \qquad w+\pi_1\overline{b}+(1-\pi_1)\underline{b}-v \geqslant w+\pi_0\overline{b}+(1-\pi_0)\underline{b} \tag{$IC_E^{br}$}$$

$$w+\pi_1\overline{b}+(1-\pi_1)\underline{b}-v \geqslant w \tag{$IR_E^{br}$}$$

$$\underline{b} \geqslant 0 \tag{$LL.a_E^{br}$}$$

$$\overline{b} \geqslant 0 \tag{$LL.b_E^{br}$}$$

The Firm therefore has to offer a bribe scheme which satisfies Employee's incentive compatibility ($IC_E^{br}$ constraint), individual rationality ($IR_E^{br}$ constraint), and limited liability ($LL.a_E^{br}$ and $LL.b_E^{br}$constraints).[8] From the ($IR_E^{br}$) and ($IC_E^{br}$) constraints it is possible to see respectively that i) the Employee's utility from participating in the bribing scheme has to be not negative; ii) the Employee's utility from exerting the effort has to be at least as large as his utility from not exerting the effort. Moreover the two ($LL._E^{br}$) constraints are natural in this setting because the bribe is by definition a nonnegative payment to the employee (i.e. no penalties can be imposed by the Firm on the civil servant if the outcome is not successful).[9]

By solving the above program we get the following result:

**Lemma 1** *The optimal bribe schedule that the Firm offers to induce the effort* $e=1$ *is:* $\underline{b}^*=0$ *and* $\overline{b}^*=\frac{v}{\Delta\pi}$.

***Proof.*** *Since paying bribes is costly for the Firm, from* ($LL.a_E^{br}$) *it is optimal to set* $\underline{b}^*=0$. *Following the same reasoning, it is optimal to have the* ($IC_E^{br}$) *binding. So from* $w+\pi_1\overline{b}+(1-\pi_1)\,0-v=w+\pi_0\overline{b}+(1-\pi_0)\,0$, *it is easy to see that* $\overline{b}^*=\frac{v}{\Delta\pi}$. *Finally we check that the solution* $\left\{\underline{b}^*,\overline{b}^*\right\}=\left\{0,\frac{v}{\Delta\pi}\right\}$ *satisfies the* ($IR_E^{br}$) *constraint with strict inequality. In fact* $w+\frac{\pi_1}{\Delta\pi}v+(1-\pi_1)\,0-v=w+\frac{\pi_0}{\Delta\pi}v>w$, *given that* $\frac{\pi_0}{\Delta\pi}v>0$. ■

In words, the Firm commits not to pay the Employee in case of a "failure" ($\delta=D$). On the other hand, in case of a "success" ($\delta=d$)

[8] As it is known, the existence of an (LL) constraint makes the optimal contract with a risk neutral agent similar to the optimal contract when the agent is risk averse.

[9] In considering the optimal bribing contract to offer to the Employee, notice that the Firm takes into account the Employee's wage. However this is not going to influence the menu of bribes the Firm proposes.

the Firm will pay him the agent a bribe equal to his disutility level $v$ divided by the probability differential $\Delta\pi$. The expected Firm's utility when the effort is induced and these optimal bribes are implemented is equal to:

$$U_{Fe=1} = (1-\gamma)\Pi - F - \pi_1 d - (1-\pi_1)\, D - \beta\left(\frac{\pi_1}{\Delta\pi} v\right)$$

In order for the Firm to be willing to induce effort through bribing, it has to enjoy a positive net expected utility from bribing ($U_{Fe=1} \geqslant 0$). Moreover the utility from inducing effort through bribing has to be larger than Firm's utility when no effort is induced and no bribe is paid. In this latter case Firm's utility is equal to $U_{Fe=0} = (1-\gamma)\Pi - F - \pi_0 d - (1-\pi_0)\, D$. The condition such that the Firm's utility is larger under bribing than under no bribing, i.e. $U_{Fe=1} \geqslant U_{Fe=0}$ amounts to $-\pi_1 d - (1-\pi_1)\, D - \beta\left(\frac{\pi_1}{\Delta\pi} v\right) \geqslant -\pi_0 d - (1-\pi_0)\, D$, i.e. to the following assumption:

**Assumption 1**: $\Delta\pi(D-d) > \beta\left(\frac{\pi_1}{\Delta\pi} v\right)$

This condition shows that if the expected benefit gained from inducing effort through bribing, i.e. the reduction into the expected regulatory burden imposed to the Firm $\Delta\pi(D-d)$ is greater than the expected cost $(\beta\left(\frac{\pi_1}{\Delta\pi} v\right))$, in equilibrium bribing always takes place.

It is clear from the Assumption 1 above that bribing takes place the smaller are the transaction costs $\beta$, the less hard is the task the Employee has to perform (i.e. the smaller is the effort cost $v$), and the larger is the cost of discretionality imposed on the Firm ($\Delta\pi(D-d)$).

## 3.2 The Employee and the Government

The results from the previous section (see Lemma 1) constitute the outcome of the Firm's decision problem at node $(II)$. Now we want to show that this is in fact an equilibrium decision and that for the Firm it is optimal to bribe the Employee to induce his effort, since he would not do so without bribing. In fact at node $(IV)$ the Employee, having being offered a fixed and not contingent wage $w$ by the Government, and subject to the fact that the Firm has decided not to bribe, decides whether or not to exert the effort in the legal interaction between him and the Firm. Comparing the Employee's expected utility when exerting the effort ($U_E(e=1)$) and when not exerting it ($U_E(e=0)$), at node $(IV)$ subject to the Firm not bribing, we can establish the following Lemma:

**Lemma 2** *At node $(IV)$ the Employee's dominant strategy is not to exert any effort: $e^*_{IV} = 0$.*

**Proof.** At node $(IV)$ the Employee rationally anticipates that if he exerts an effort $e = 1$ he gets an expected payoff of: $U_E(e = 1) = w - v$. However if $e = 0$ the expected payoff is $U_E(e = 0) = w$.By comparing $U_E(e = 1)$ and $U_E(e = 0)$ above it is obvious that $U_{Ee=0} > U_{Ee=1}$. As a result Employee's dominant strategy at node $(IV)$ is to shirk. ■

Putting together all the previous results, we may state the following Lemma:

**Lemma 3** *When the Government has limited instruments, the Employee never exerts any effort at the legal stage; however he always accepts an illegal bribing contract with the Firm.*

**Proof.** Lemma 1 together with Assumption 2 above establish that the Firm's equilibrium strategy is $\underline{b}^* = 0, \overline{b}^* = \frac{v}{\Delta\pi}$ and that the Employee always exerts effort at node $(III)$, i.e. $e^*_{III} = 1$. Lemma 2 shows that the Employee's dominant strategy at node $(IV)$ is $e^*_{IV} = 0$. All these partial and previous results establish the statement above. ■

At this point we can now compute the Firm's and the Employee's equilibrium utility in this situation. We put a superscript $d$, to indicate that we are in the presence of a *dishonest* Employee in a framework of weak governance or capacity, i.e. in an institutional environment where the Government has no tools in the organization of the public sector:

$$U_F^{d^*} = (1-\gamma)\Pi - F - [\pi_1 d + (1-\pi_1) D] - \left[\beta \frac{\pi_1}{\Delta\pi} v\right] \tag{5}$$

$$U_E^{d^*} = w + \left[\frac{\pi_1}{\Delta\pi} - 1\right] v \tag{6}$$

Notice here that, in addition to his fixed and not-contingent wage, the Employee receives a positive expected bribe payment equal to $\left[\frac{\pi_1}{\Delta\pi}\right] v$, which is incurred in equilibrium by the Firm. Firm's expected utility consists of three parts: other than the positive part equal to the net profit $(1-\gamma)\Pi$, there are two factors entering with a negative sign: i.e.the part expressing the fixed (monetary) cost of the regulatory activity of the Government $-F$ and the part coming from the discretionary activity of the Employee and the Firm, i.e. $-\left([\pi_1 d + (1-\pi_1) D] + \left[\beta \frac{\pi_1}{\Delta\pi} v\right]\right)$.

We can describe this equilibrium situation as a "self-enforcing corruption mechanism": public sector employees receive bribes from firms willing to pay them in order to get a given expected benefit they are unable to receive legally. Moreover the existence of this "illegal activity" always crowds out the legal one and brings about inefficiency in the public sector, as effort is never induced legally, i.e. following the wage contract between Firm and Government. What can the Government do

in front of such a situation? From the utility equilibrium expressions of Firm and Employee it is possible to see that three variables have to be decided upon still: the equilibrium level wage $w$ and the equilibrium level of corporate tax $\gamma$ and fixed cost $F$. To find a solution for these three variables the Government has to be called upon to act: in fact the Employee is a public servant and the State is the only actor having the right (and the power) to tax and transfer. Government's decisions in terms of business tax policy and public sector wage policy are dealt with in the next subsection.

## 3.3 Government's Equilibrium Decision

At node $(I)$, the Government chooses a corporate income tax $\gamma$, a fixed entry cost $F$ and a wage level $w$ to maximize the following program:

$$\underset{\{\gamma,F,w\}}{Max}\, U_G = N\left(U_F^{d^*}\right)(\gamma\Pi + F) - Mw + B \tag{7}$$

$$s.t. \qquad U_F^{d^*} \geqslant 0 \qquad (IR_F^d)$$

$$U_E^{d^*} \geqslant w_0 - v \qquad (IR_E^d)$$

The Government has to propose a corporate tax and a fixed entry cost acceptable to the Firm and a wage scheme to the Employee. Furthermore the Government is aware of the fact that there is the possibility of bribing taking place illegally between Firm and Employee. Therefore it correctly anticipates that Firm's and Employee's utility to be considered in the program above will be the ones in equations (5) and (6). We can then rewrite the above program as it follows:

$$\underset{\{\gamma,F,w\}}{Max}\, U_G = N\left(U_F^{d^*}\right)(\gamma\Pi + F) - Mw + B$$

$$U_F^{d^*} = (1-\gamma)\Pi - F - [\pi_1 d + (1-\pi_1)D] - \left[\beta\frac{\pi_1}{\Delta\pi}v\right] \geqslant 0$$

$$U_E^{d^*} = w + \left[\frac{\pi_1}{\Delta\pi} - 1\right]v \geqslant w_0 - v$$

Notice that the expression for the Employee's utility is such that the net utility has to be larger than $w_0 - v$, where $w_0 - v$ indicates the Employee's outside option, for instance the salary that he could earn in the private sector net of the disutility from the effort.[10] Since the Government is

[10] We make the implicit assumption that the private sector is endowed with some (contractual) mechanism that induces Employee's effort. Therefore the term $w_0$ can be thought of salary in the private sector and the effort $v$ is such that the Employee's effort in the private sector is equal to Employee's effort in the public sector.

interested in maximising the fiscal resources, i.e. the sum $y = \gamma\Pi + F$, we rewrite the above program by substituting $y$ to $\gamma\Pi + F$. So the new program the Government maximises is the following:

$$\begin{aligned}
&\underset{\{y,w\}}{Max} U_G = N\left(U_F^{d^*}\right) y - Mw + B \\
&\qquad U_F^{d^*} = \Pi - y - \left[\pi_1 d + (1-\pi_1) D\right] - \left[\beta \frac{\pi_1}{\Delta\pi} v\right] \geqslant 0 \\
&\qquad U_E^{d^*} = w + \frac{\pi_0}{\Delta\pi} v \geqslant w_0 - v
\end{aligned}$$

Finally notice that the programme above is well behaved, since the two constraints are linear and the objective function is strictly concave in the variable $y$ when the fiscal burden on corporate income is not too large. Infact $\frac{\partial}{\partial y} U_G = -\ N'\left(U_F^{d^*}\right) y + N(U_F^{d^*}) \geqslant 0$ for $y \leqslant \frac{N(U_F^{d^*})}{N'\left(U_F^{d^*}\right)}$ and $\frac{\partial^2}{\partial y^2} U_G = -N''\left(U_F^{d^*}\right)(-1)y + [-N'(U_F^{d^*})] + (-1)N'(U_F^{d^*}) = N''\left(U_F^{d^*}\right) y - 2N'(U_F^{d^*}) < 0$ by assumption.

By solving the programme above we can sum up the results in the following Proposition:

**Proposition 4** *When the Government has limited instruments, the Employee is dishonest and a bribing stage is beneficial to both the Firm and the Employee, the Government pays the Employee a fixed minimum wage of* $w^d = w_0 - \frac{\pi_1}{\Delta\pi} v$ *and taxes the Firm with the amount* $y^{d^*} = \gamma\Pi + F = \frac{N(U_F^{d^*})}{N'\left(U_F^{d^*}\right)}$.

**Proof.** [In the Appendix] ■

Since the Government has limited instruments, it can only propose a fixed wage, not contingent on Employee's effort or performance. The Government cannot devise incentive wages and it has to offer a wage which is equal to the outside option the Employee has, say the wage $w_0$ offered in the private sector. However by anticipating that bribes will be offered by the Firm in equilibrium, then the Government can decrease the wage offered consequently and still attract employees.

With the results in Proposition 4 we can compute Government's utility in the case when it has limited instruments to induce the Employee's effort and an illegal market for bribes exists and it is beneficial. The Government's equilibrium welfare is then:

$$U_G^{d^*} = N\left[\Pi - (\pi_1 d + (1-\pi_1) D) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right) - y^{d^*}\right] \frac{N(U_F^{d^*})}{N'\left(U_F^{d^*}\right)} - M\left(w_0 - \frac{\pi_1}{\Delta\pi} v\right) + B$$

$$U_G^{d^*} = N\left(U_F^{d^*}\right) y^{d^*} - M\left(w_0 - \frac{\pi_1}{\Delta\pi} v\right) + B$$

We can interpret the above expression in the following way: Government's utility from the start-up sector of the economy is equal to the fiscal resources raised per start-up firm ($y^{d^*}$) times the number of starting-up firms in equilibrium ($N\left(U_F^{d^*}\right)$) minus the total wages payed to the public employees $M\left(w_0 - \frac{\pi_1}{\Delta\pi} v\right)$ plus the resources from the not-start up sector of the economy $B$. Notice that the fiscal resources raised per firm is equal to $y^{d^*} = \frac{N(U_F^{d^*})}{N'\left(U_F^{d^*}\right)}$, i.e. to the ratio between the number of Firms as a function of the Firm's utility and the derivative of this function.

This means that the Government taxes the Firm to the point where a marginal increase to the taxation $y^{d^*}$ times the decrease into the number of firms brought about by this ($N'\left(U_F^{d^*}\right)$), is equal to the number of Firms in the industry ($N\left(U_F^{d^*}\right)$) which gives the total amount of fiscal resources.

Finally notice that, throughout the paper we will assume that $y^{d^*} = \frac{N(U_F^{d^*})}{N'\left(U_F^{d^*}\right)}$ is an interior solution, i.e. that the utility of the firm is large enough, so that $U_F^{d^*}(y^{d^*}) > 0$.

## 3.4 Limited Instruments with an Honest Employee

We want now to conduct a similar analysis to the one above when the Employee is honest: in our framework this corresponds to the Employee exerting effort at the node $(IV)$, i.e. $e_{IV}^* = 1$. We can imagine that the Employee does not like to take bribes in the illegal market and then he always exercises effort at the legal stage, with no need of a wage contract contingent on his performance. [11] For instance we can think that there are cultural norms or beliefs which have a strong impact on the Employee's behaviour and then shape his actions, without the need for monetary and explicit incentives.[12] Alternatively, assume that the transaction cost parameter is very large, at limit going to infinite ($\beta = +\infty$).

[11] In this case bribes are never exchanged for any value of the transaction cost parameter $\beta$ and in particular for $\beta = 1$.

[12] Think of the "commis d'etat" tradition in the French Bureaucracy of the Grande Ecoles (for instance the ENA, (Ecole Nationale d'Administration)), where the graduated bureaucrats are and feel part of an elite which sees the service to the State as its greatest aspiration and a task worthy to be pursued per se, beyond its financial reward.

The existence of such large transaction costs makes the collusion between Firm and Employee impossible to be performed: in this case, bribes are not exchanged. The program above rewrites in the following way, with the superscript $h$ indicating the *honest* Employee case:

$$\begin{aligned} \underset{\{y,w\}}{Max} U_G^h &= N\left(U_F^h\right) y - Mw + B && (8) \\ U_F^{h^*} &= (1-\gamma)\Pi - S - \left[\pi_1 d + (1-\pi_1) D\right] - y \geqslant 0 && (IR_F^h) \\ U_E^{h^*} &= w - v \geqslant w_0 - v && (IR_E^h) \end{aligned}$$

The program rewrites in such a way that for the players (Firm and Employee) there is no illegal contracting. However in the legal interaction between Employee, Firm and Government, the possibility of success is equal to $\pi_1$, given the Employee exerts the effort with certainty. Regarding the Employee, the Government anticipates that he will exert effort for sure and then his utility must be not less than the outside option he would get in the private sector, i.e. $w_0 - v$.

Solving the program above you obtain the following Proposition:

**Proposition 5** *When the Government has limited instruments and yet the Employee is honest, the Government pays the Employee a fixed wage of* $w^h = w_0$ *and taxes the Firm with the amount* $y^{h^*} = \gamma\Pi + F = \frac{N(U_F^{h^*})}{N'\left(U_F^{h^*}\right)}$ .

***Proof.*** *To solve the program we apply the same reasoning as in the previous program with the dishonest employee. As before the Government wants to decrease the wage as much as it can and increase the tax. By making the* $(IR_E^h)$ *constraint binding we obtain the equilibrium wage* $w^h = w_0$*. In this case the salary the Government has to offer to the honest Employee is higher than in the case with the dishonest one: the Government anticipates the Employee is going to exert effort in his task with probability one and then wants to compensate him for the disutility he is going to incur. Regarding the tax, it is easy to see that* $y^{h^*} = \gamma\Pi + F = \frac{N(U_F^{h^*})}{N'\left(U_F^{h^*}\right)}$. ■

Since $U_F^h > U_F^d = U_F^h - \beta\frac{\pi_1}{\Delta\pi}v$ then $N(U_F^h) > N(U_F^d)$ and $N'(U_F^h) < N'(U_F^d)$. As a conclusion, in equilibrium $\frac{N(U_F^{h^*})}{N'\left(U_F^{h^*}\right)} = y^{h^*} > y^{d^*} = \frac{N(U_F^{d^*})}{N'\left(U_F^{d^*}\right)}$: in the honest scenario, Government's taxes optimally the Firm more than in the dishonest scenario.

In order to conduct easily the comparison between different scenarioes, we specify a functional form for the function $N(U_F)$. For simplicity we assume that $N(U_F) = \sqrt{U_F}$. Rewriting the results, we find that $y^{h^*} = \frac{\sqrt{\Pi-[\pi_1 d+(1-\pi_1)D]-y}}{\frac{1}{2\sqrt{\Pi-S-[\pi_1 d+(1-\pi_1)D]-y}}} = \frac{2}{3}(\Pi - [\pi_1 d + (1-\pi_1)D]) = \frac{2}{3}(\kappa)$, with $\kappa = \Pi - [\pi_1 d + (1-\pi_1)D]$. From this it follows easily that $U_F^{h^*} = \Pi - [\pi_1 d + (1-\pi_1)D] - y^h = \Pi - [\pi_1 d + (1-\pi_1)D] - \frac{2}{3}(\kappa) = \frac{1}{3}(\Pi - S - [\pi_1 d + (1-\pi_1)D]) = \frac{1}{3}(\kappa)$.

Following the same reasoning, it is simple to see from Prop. 4 that $y^{d^*} = \frac{\sqrt{\Pi-S-[\pi_1 d+(1-\pi_1)D]-y-\beta\frac{\pi_1}{\Delta\pi}v}}{\frac{1}{2\sqrt{\Pi-S-[\pi_1 d+(1-\pi_1)D]-y-\beta\frac{\pi_1}{\Delta\pi}v}}} = \frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)$ and that in equilibrium, $U_F^{d^*} = \frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)$. So it is straightforward to conclude that having a honest employee, although it increases the Firm's equilibrium tax, it raises also its utility. In fact, thanks to the presence of honest Employees, the Firm does not bear anymore the cost of bribing and can save a substantial share of the (transaction) costs it used to have in a less transparent scenario.

In order to complete the analysis of the two situations, it suffices to compare Government's utility in the case of the honest Employee $\left(U_G^{h^*}\right)$ and Government's utility in case of the dishonest Employee $\left(U_G^{d^*}\right)$. Simple algebra shows that $U_G^{h^*} = \sqrt{\frac{1}{3}(\kappa)}\frac{2}{3}(\kappa) - M(w_0) + B$ and $U_G^{d^*} = \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right) - M\left(w_0 - \frac{\pi_1}{\Delta\pi}v\right) + B$. From this it follows simply that $U_G^{h^*} \geqslant U_G^{d^*}$ iff

$\sqrt{\frac{1}{3}(\kappa)}\frac{2}{3}(\kappa) - \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right) \geqslant M\left[\frac{\pi_1}{\Delta\pi}v\right]$. So the Government increases its utility (i.e. its fiscal resources) if the expansion in the fiscal resources coming from more start-up firms and more tax per firm is larger than the increase in the wages $\left[\frac{\pi_1}{\Delta\pi}v\right]$ given to the honest employee. Of course this depends critically on the number of employees $M$ and transaction costs $\beta$.

We may think that having honest employees rather than dishonest is tantamount to having better hiring policies which allow the Government to employ honest Employees rather than dishonest ones. From the above comparison between the two scenarioes, such a policy is optimal only if the transaction costs $\beta$ are large enough, so that the cost saving associated to their cancelation are big. For the same reason, better hiring policies (in the above sense) are optimal, only if the number of Public Employees $M$ is not "too" large. In this case, the increase in the wage bill to be paid to the Employees does not outweigh the reduction in the cost coming from the reduced corruption.

In the previous discussion we have shown an example where the exis-

tence of corruption is not necessarily a harmful activity. We have shown that in our particular model, the Firm strictly prefers to have less corruption while the Employee is indifferent between the two scenarioes. However, we have highlighted the conditions such that the Government prefers to have dishonest Employees rather than honest ones. We have stressed that the dishonest Employee scenario is preferred to the honest one, iff the transaction cost $\beta$ are not too large and the number of public Employee $M$ is not too small.

We can highlight the fact that, for certain values of $\beta$, substituting dishonest with honest Employees might not be sufficient to make a better hiring policy an optimal one. In fact if better hiring policies consist in improving the quality and loyalty of the Employees to the Government, a reduction in $M$ might be necessary in this case to improve Governement's utility. If we interpret this reduction in the number of Employees as saying that a reduced number of Employees $M' < M$ must have a higher productivity that the larger number $M$, this means that the hiring policies have to be modulated depending on the transaction costs $\beta$. For values of $\beta$ very large, it can be be enough to substitute dishonest employees with honest ones. However when $\beta$ is not that large, it is crucial that the new Employee are both *more* honest and *more* productive.

# 4 Institutional Reforms

In this section we want to see what happens when the Government is able to devise and implement several reforms. First we describe a situation where the Government is able to devise and implement a wage contract contingent on the Employee's performance. We call this the "*performance wages*" reform *(pw)*. Next, we will analyse a reform where the Government does not hire anymore the Employee as a public servant. Rather, the Government privatises some of its functions and let Firm and Employee contract directly with each other. Now the Government has just the limited role of enforcing the contracts. We will call this scenario a "*privatisation reform*" *(pr)*. Finally we want to investigate whether a better opportunity is offered by the "*liberalization reform*": in this scenario the Government reduces some of the Firm's costs given by the various burdens imposed by the start-up procedures. The Governments gives up also some of the fiscal resources connected to the starting-up (the "entry fee" $F$) but fixes optimally the corporate tax $\gamma$.

## 4.1 Reform I: Implementing Performance Wages

The Government is now able to write contracts contingent on the dishonest Employee's performance and then to induce effort legally at node

$(III)$. The Government anticipates also that there is the possibility that an illegal contract between Firm and Employee takes place; so, through its performance wage contract, the Government wants to eradicate the bribing interaction from occuring.

The timing of the game is now the following: first the contract between Government and Employee is written; then the task is carried out legally and, contingent to the outcome, performance wages contracts are executed and taxes are collected. [13]

The Government solves the following program, conditional on inducing effort on the Employee legally ($e = 1$)**:**

$$\underset{\{y,\overline{w},\underline{w}\}}{Max}\, U_G^{pw} = (\sqrt{\kappa - y})y - M\left(\pi_1 \overline{w}^{pw} + (1-\pi_1)\underline{w}^{pw}\right) + B$$

$$s.t.: U_F^{pw^*} \geqslant 0 \qquad (IR_F^{pw})$$

$$\pi_1 \overline{w}^{pw} + (1-\pi_1)\underline{w}^{pw} - v \geqslant w_0 - v \qquad (IR_E^{pw})$$

$$\pi_1 \overline{w}^{pw} + (1-\pi_1)\underline{w}^{pw} - v \geqslant \pi_0 \overline{w}^{pw} + (1-\pi_0)\underline{w}^{pw} \qquad (IC_E^{pw})$$

$$\pi_1 \overline{w}^{pw} + (1-\pi_1)\underline{w}^{pw} - v \geqslant \pi_1 \overline{b}^* + (1-\pi_1)\underline{b}^* - v \qquad (NB)$$

$$\underline{w}^{pw} \geqslant 0 \qquad (LL.1_E^{pw})$$

$$\overline{w}^{pw} \geqslant 0$$

In the program above, the Government can induce Employee's effort legally by writing down the incentive contract subject to Incentive and Individual Rationality constraints. Notice that the Government cannot impose a negative wage upon an unsuccessful outcome (*i.e.* $\delta = D$). Finally notice how the constraint corresponding to eq. $(NB)$ highlights the condition such that the Government offers the Employee a wage contract which gives him a utility not inferior to the bribing contract $\left\{\underline{b}^*, \overline{b}^*\right\} \equiv \left\{0, \frac{\pi_1}{\Delta\pi} v\right\}$

Solving the above program we can summarise the findings in the following Proposition:

**Proposition 6** *In the performance wage reform scenario, the Government pays the Employee a wage equal to* 0 *in case of failure, while it pays a wage equal to* $\frac{w_0}{\pi_1}$ *in case of success; and taxes the firm with* $y^{pw^*} = \frac{2}{3}\kappa$.

Given the result above it can be established easily that the Firm's utility in this reform scenario is equal to $U_F^{pw^*} = \kappa - y^{pw^*} = \frac{1}{3}\kappa$ and

[13] For simplicity we continue to carry out our analysis with the specific functional form, $N(U_F) = \sqrt{U_F}$.

Employee's utility is equal to $U_E^{pw^*} = \pi_1 \frac{w_0}{\pi_1} + (1 - \pi_1) 0 - v = w_0 - v$. Finally, Government's utility is equal to $U_G^{pw^*} = \sqrt{\frac{1}{3}\kappa}(\frac{2}{3}\kappa) - M\left(\pi_1 \frac{w_0}{\pi_1}\right) = \sqrt{\frac{1}{3}\kappa}(\frac{2}{3}\kappa) - M(w_0) + B$.

We will use these results in the section below when discussing about the optimal policy design and optimal reform(s) in the start up sector.

## 4.2 Reform II: Privatisation of the Public Sector

In this section we introduce another possible reform scenario: now the Government is not anymore involved in hiring and paying directly the Employee; as a result the Employee is not anymore a civil servant. Instead the Government allows the Firm and the Employee to contract directly with each other. In a certain sense this is a simple formalisation of a reform scenario where the Government reduces its own role and privatises its public sector, or at least some of its functions. Such a reform would not be so different from some institutional arrangements present in countries like France, Italy or Germany and in general in countries of Civil Law, i.e. where the legal origins are Latin rather than Anglo-Saxon. In these countries a prominent role in some of the procedures connected to the starting up of business is played by the public notary, a self-employed individual performing some of the administrative acts that in other countries are routinely carried out by the public administration. As the World Bank (2004, page 27) ([15]) puts it:

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The service a notary provides---checking the identity of
company founders and company officers---is routinely
performed by public administrators for many other services.
And clerks at the business registry are as able as notaries
to confirm identity.
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What the World Bank states is certainly true in countries where the public servants are honest or can be motivated by performance wages. However in countries where the public employee are corruptible, we argue that a possible reform strategy could be that of privatising these functions. In this way the (bribing) costs born illegally by the Firm previously, could be paid now legally to the (privatised) Employee. Therefore we devise a situation where the former civil servants are now workers in the private labor market that have to contract directly with the firms to offer their services. The Government has now a minimal "law-and-order" role: it will enforce the contracts signed between parties and punish those who do not comply.

Formally the program is now the following: the principal (now the Firm) maximizes its utility and induces agent's effort subject to satis-

fying his constraints. However, contrary to the previous institutional arrangements, since now the relationship between Firm and Employee is carried out legally, there are no more the transaction costs of the previous scenarioes. This means that $\beta = 1$.The contract between Firm and Employee represents the solution to the following maximisation program:

$$\begin{aligned}
&\underset{\{\underline{w},\overline{w}\}}{Max} U_F^{pr} = \kappa - y - (\pi_1 \overline{w}^{pr} + (1-\pi_1)\underline{w}^{pr}) \\
&\quad s.t. : \pi_1 \overline{w}^{pr} + (1-\pi_1)\underline{w}^{pr} - v \geqslant \pi_0 \overline{w}^{pr} + (1-\pi_0)\underline{w}^{pr} \qquad (IC_E^{pr}) \\
&\quad\quad : \pi_1 \overline{w}^{pr} + (1-\pi_1)\underline{w}^{pr} - v \geqslant w_0 - v \qquad (IR_E^{pr}) \\
&\quad\quad : \underline{w}^{pw} \geqslant 0 \qquad (LL.1_E^{pr}) \\
&\quad\quad : \overline{w}^{pr} \geqslant 0 \qquad (LL.2_E^{pr})
\end{aligned}$$

**Lemma 7** *The optimal incentive contract in the privatisation scenario requires the Firm to offer a menu of wages which comprises a wage equal to* $\overline{w}^{pr*} = \frac{w_0}{\pi_1}$ *conditional to a successful outcome, and a wage* $\underline{w}^{pr^*}$ *equal to zero conditional to a failure.*

Notice that there is an important difference between Firm-Employee contracting relationship under the limited instruments scenario and the contracting relationship under the privatisation scenario. The "costs of illegality" have now been removed and therefore there are no transaction costs between Firm and Employee, as the transaction takes place lawfully.

Since now the Firm contracts with the Employee, the only role for the Government is to determine the optimal fiscal resources to be raised from the Firm, i.e. the sum of corporate income tax and fixed fee $y = \gamma\Pi + F$. The Government solves this simple programme:

$$\begin{aligned}
\underset{\{y\}}{Max} U_G^{pr} &= \sqrt{\kappa - y - \pi_1 \frac{w_0}{\pi_1}} y + B \\
s.t &: U_F^{pr} = \kappa - y - w_0 \geqslant 0
\end{aligned}$$

where the equilibrium Firm's utility $U_F^{pr^*} = k - y - \pi_1 \frac{w_0}{\pi_1}$ comprises the cost the Firm will pay when contracting with the Employee. Knowing this, the Government sets up the optimal tax on the Firm in order to maximise its fiscal revenues. The result of the maximisation program can be summarised in the following Proposition:

**Proposition 8** *In a privatisation reform the Government taxes the Firm with the amount* $y^{pr^*} = \frac{2}{3}(\kappa - w_0)$ *and lets the Firm and the Employee contract with each other, with the Firm offering a contract contingent on performance equal to* $\left(\overline{w}^{pr^*}, \underline{w}^{pr^*}\right) = \left(\frac{w_0}{\pi_1}, 0\right)$

**Proof.** [In the Appendix] ■

Gathering all the results from the previous Lemma and Proposition, we can easily obtain the expression for the utility of all the players in this *pr* scenario: in particular the equilibrium Employee's utility is $U_E^{pr^*} = w_0 - v$ and the equilibrium Firm's utility in this privatisation scanario is equal to $U_F^{pr^*} = \kappa - w_0 - y^{pr^*} = \frac{1}{3}(\kappa - w_0)$. Finally the Government's utility is equal to $U_G^{pw^*} = \sqrt{\frac{1}{3}(\kappa - w_0)}\frac{2}{3}(\kappa - w_0) + B$.

## 4.3 Reform III: Liberalisation of Entry

The last example of the possible reform scenarioes the Government could carry on is the one of Liberalisation of Entry where the Government reduces the entry cost of the start-up businesses. In this scenario the Government makes the entry of new firms as easy as possible. In our interpretation of a strategy of liberalisation reform this has to comprise a reduction of the pecuniary cost to enter the market, i.e. of the fixed fee $F$ which the Government receives as fiscal resource.[14] Furthermore a liberalisation reform has to reduce also the cost of the regulatory activity of the Government, i.e the non-pecuniary costs $\delta$. Reforms along these lines have been advocated, for instance, by the World Bank (2004) [15] and Djankov et alii (2006) [7] in order to promote private sector and GDP growth. However we want to see if these reforms can also improve the public finances as well as stimulating the growth of Government's fiscal resources. As we have argued above this could benefit all the individuals in the society through the financing of public goods or goods publicly produced.

To show our argument in the strongest and simplest way, we want to analyse what happens when the Government decides to allow immediate entry to any firm wanting to begin operating in the market. So we make the assumption that now the Government does not want to impose any additional fiscal cost on the Firm, other than the corporate tax on profit $\gamma$: in the context of our model this is equivalent to $F = 0$. Moreover a complete liberalisation of entry means also that any Firm that wants to enter the market can, without any additional regulatory cost to be born out. Thi means that we can set $\pi_1 d + (1 - \pi_1)D = 0$.

[14] Of course a strategy of liberalisation of entry could also comprise a reduction in the bureaucratic requirements and administrative procedures the entering firm will have to comply to in order to start operating in the market. Although we do not consider these explicitly here a previous version of the paper shows that the results found here carry on also in this alternative scenario.

Since the Government does not perform any administrative and bureaucratic check on the starting up businesses, this means that it can fire all the $M$ employees working in the start-up department of the public administration and save the cost arising from the related wage bill. However, since we make the hypothesis that the labour market is in equilibrium, then the fired former public employees can go and work for the private sector and earn a wage of $w_0$, enjoying a utility of $U_E^{lib^*} = w_0 - v$. The Government and the Firm are the only players left in this new scenario, with the former having to decide the optimal tax to impose on the latter in order to maximise the fiscal revenues. The programme the Government maximises is the following:

$$\begin{aligned} \underset{\{\tilde{y}\}}{Max} U_G^{pw} &= \sqrt{\kappa + (\pi_1 d + (1-\pi_1)D) + F}\tilde{y} + B \\ s.t &: U_F^{pr} = (1-\gamma)\,\Pi \geqslant 0 \end{aligned}$$

where $\tilde{y} = \gamma\Pi$. We can rewrite the programme as:

$$\begin{aligned} \underset{\{y'\}}{Max} U_G^{pw} &= \sqrt{\Pi - \gamma\Pi}\gamma\Pi + B \\ s.t &: U_F^{pr} = (1-\gamma)\,\Pi \geqslant 0 \end{aligned}$$

The solution of the program above is in the following Proposition:

**Proposition 9** *In the Liberalisation of Entry scenario, the Government taxes the Firm with the amount* $y^{lib^*} = \frac{2}{3}\Pi$.

We can now simply compute Firm and Government's utility following a liberalisation reform. $U_F^{lib^*} = \left(1 - \frac{2}{3}\right)\Pi = \frac{1}{3}\Pi$ and $U_G^{lib^*} = \sqrt{\frac{2}{3}\Pi}\left(\frac{1}{3}\Pi\right) + B$.

## 5 Discussion: What is the Optimal Policy Design?

In the previous sections we have analysed a situation where the public Employee suffers from moral hazard, the Government has limited instruments to induce his effort and an illegal market for bribes exists. We have seen how wages and taxes change when the Government can devise three different reforms to induce a higher effort from the Employee and eradicate corruption altogether. In this section we want to find the conditions such that each of the players sees welfare improved when going from the status quo (limited instruments scenario) to one of the three reforms. This will enable us to understand the winners and losers from each possible reform and to identify the conditions under which each of the three reforms can be implemented in order to improve social welfare.

First we can see that in all the reforms considered the Employee enjoys the same utility in equilibrium payoff $U_E^* = w_0 - v$. This is a result of the assumptions that the labour market is always in equilibrium, that Employees can be freely hired and dismissed and that there is always an outside opportunity in the private job market where to work. However since the focus of the paper is on the relations between Government's utility and Firm's utility in various reform scenarioes, we point our attention on these two players.

It is interesting to notice that a scenario where honest employees are hired is equivalent to a scenario where the dishonest employees are motivated by performance wages. In fact, in both cases, $U_F^{h^*} = U_F^{pw^*} = \frac{1}{3}\kappa$ and $U_G^{h^*} = U_G^{pw^*} = \sqrt{\frac{1}{3}\kappa}\left(\frac{2}{3}\kappa\right) - M\left(w_0\right) + B$. In a way, Firm's and Government's welfares are the same whether better hiring policies are adopted or good incentive instruments are devised.[15] If we have to compare these two alternative reform scenarioes with the status quo of a limited instruments scenario with *dishonest* Employee, it is straightforward to see that for the Firm there is a clear improvement in switching from the status quo to a performance wage scenario, given that: $U_F^{h^*} = U_F^{pw^*} = \frac{1}{3}\kappa > \frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right) = U_F^{d^*}$

The same analysis can be repeated for the *privatisation* scenario. In this scenario the Firm pays directly the Employee for the service he supplies and this happens through a legal interaction, at market prices. In the status quo with *dishonest* Employee scenario the Firm pays for the service of the Employee too, although through an illegal interaction. If we want to conduct a comparative static analysis, we have to compare these two situations, remembering that we have assumed that $w_0 > \frac{\pi_1}{\Delta\pi}v$. However we need to distinguish whether $\beta\frac{\pi_1}{\Delta\pi}v \geqslant w_0 > \frac{\pi_1}{\Delta\pi}v$ or $w_0 \geqslant \beta\frac{\pi_1}{\Delta\pi} \geqslant \frac{\pi_1}{\Delta\pi}v$. In fact $U_F^{pr^*} = \frac{1}{3}\left(\kappa - w_0\right) \geqslant \frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right) = U_F^{d^*}$, iff $\beta\frac{\pi_1}{\Delta\pi}v \geqslant w_0$ or $\beta \geqslant \frac{1}{v}\frac{\Delta\pi}{\pi_1}w_0$. However, $U_F^{pr^*} = \frac{1}{3}\left(\kappa - w_0\right) \leqslant \frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right) = U_F^{d^*}$, iff $w_0 \geqslant \beta\frac{\pi_1}{\Delta\pi}v$ or $\beta \leqslant \frac{1}{v}\frac{\Delta\pi}{\pi_1}w_0$.

So, quite intuitively, the relative advantage of a privatisation scenario with respect to the status quo depends on the transaction costs $\beta$ and the wage $w_0$: if the transaction costs in the dishonest scenario are large enough (and the private sector salary to be paid $w_0$ is small enough), then the Firm will be better off with a privatisation reform. Otherwise, quite surprisingly, when the transaction costs $\beta$ are small enough (and the salary to be paid $w_0$ is large enough) the status quo where the corruption

[15] Of course in a more complete analysis, the choice between which of the two reforms to adopt would depend on the relative cost of implementing one policy rather than the other, given that the merits are equal.

is retained is better for the Firm than the *privatisation* scenario. This interesting result might give some foundation to the idea that, in case of a corrupt environment where the transaction costs due to the illegality are quite large, it might be better to "legalise" the illegal transaction in such a way to decrease the transaction costs for the firm. In this case, the starting up entrapreneurs could be part of a coalition in favour of reforming the public sector and privatising some of it function. However, whenever the transaction costs coming from the corruption are small or, alternatively, the factor $\frac{1}{v}\frac{\Delta\pi}{\pi_1}w_0$ is large enough, the Firm prefers a situation with corruptible public employee, rather than a privatisation scenario.

If we continue the comparison among different scenarioes, it is interesting to notice that for the Firm both the *privatisation* scenario and the status quo are always dominated by the *performance wage*:[16] in fact notice that $U_F^{h^*} = U_F^{pw^*} = \frac{1}{3}\kappa > \frac{1}{3}(\kappa - w_0) = U_F^{pr^*}$ and that

$U_F^{h^*} = U_F^{pw^*} = \frac{1}{3}\kappa > \frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right) = U_F^{d^*}$ So surprisingly we arrive at the rather counterintuitive result that in the context of our paper the Firm prefers having a "better" public sector, where public employees are motivated financially (*performance wage*) or where better hiring policies are adopted (*honest employees*), rather than having to deal directly through a market interaction with the public employees. Therefore if we had to adopt a political economy perspective the starting up entrepreneurs could be part of a coalition willing to push for reform in the public administration, rather than privatisating some of it functions or leaving unchanged the status quo.

Finally it emerges clearly that the most preferred scenario by the Firm is the *liberalisation* scenario, where the costs of start-up are reduced to zero and Firm's utility is equal to $U_F^{lib^*} = \frac{1}{3}\Pi$

Summing up the results, the following relation among the equilibrium Firm's utilities in the different reform scenarioes holds:

$$U_F^{lib^*} \geqslant U_F^{pw^*} \geqslant U_F^{pr^*} \geqslant U_F^{d^*} \qquad \text{iff} \quad \beta \geqslant \frac{1}{v}\frac{\Delta\pi}{\pi_1}w_0$$

$$U_F^{lib^*} \geqslant U_F^{pw^*} \geqslant U_F^{d^*} \geqslant U_F^{pr^*} \qquad \text{iff} \quad \beta \leqslant \frac{1}{v}\frac{\Delta\pi}{\pi_1}w_0$$

We can conduct the same analysis for the Government and verify under which reform scenario the Government maximises its utility. We start by comparing the Government's utility when a *performance wage* reform is implemented to the status quo scenario, where only dishonest

[16] Remember that the *pw* scenario is equivalent to the *h* one.

employees are working in the public sector.[17] It is simple to see that: $U_G^{h^*} = U_G^{pw^*} = \sqrt{\frac{1}{3}\kappa}\left(\frac{2}{3}\kappa\right) - M(w_0) + B \geqslant \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\left(\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)\right) - M\left(w_0 - \frac{\pi_1}{\Delta\pi}v\right) + B = U_G^{d^*}$, which is true if and only if $\sqrt{\frac{1}{3}\kappa}\left(\frac{2}{3}\kappa\right) - \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\left(\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)\right) \geqslant M\left(\frac{\pi_1}{\Delta\pi}v\right)$, i.e. when the gains from a higher taxation of each of the Firms (the difference between $\left(\frac{2}{3}\kappa\right)$ and $\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)$ )and from the increased number of the firms ($\sqrt{\frac{1}{3}\kappa} - \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}$) are larger than the additional cost coming from higher wages for the $M$ public employees, i.e. $M\left(\frac{\pi_1}{\Delta\pi}v\right)$. As already noticed in the previous discussion in section 3.4, the gain for the Government coming from switching from one scenario to the other will be larger, the larger is the transaction cost parameter $\beta$ and the smaller is the number of public employees $M$.

Furthermore it is straightforward to verify that Government's utility following a *privatisation* reform is larger than Government's utility under a *performance wage* reform, iff $U_G^{pr^*} = \sqrt{\frac{1}{3}(\kappa - w_0)}\frac{2}{3}(\kappa - w_0) + B \geqslant \sqrt{\frac{1}{3}\kappa}\frac{2}{3}\kappa - M(w_0) + B = U_G^{pw^*}$, i.e iff the reduction in cost given by the downsizing of the public sector ($M(w_0)$) is larger than the decrease in fiscal resources coming from the Firms due to a smaller number of Firms $\left(\sqrt{\frac{1}{3}\kappa} - \sqrt{\frac{1}{3}(\kappa - w_0)}\right)$ and an inferior tax rate for any Firm $\left(\frac{2}{3}\kappa - \frac{2}{3}(\kappa - w_0)\right)$.

CHECK THIS!

Finally, we can indentify the conditions such that a scenario comprising a *privatisation* reform brings about a Government's utility larger than the status quo: $U_G^{pr^*} = \sqrt{\frac{1}{3}(\kappa - w_0)}\frac{2}{3}(\kappa - w_0) + B \geqslant \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\left(\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)\right) - M\left(w_0 - \frac{\pi_1}{\Delta\pi}v\right) + B = U_G^{d^*}$, i.e. $M\left(w_0 - \frac{\pi_1}{\Delta\pi}v\right) \geqslant \sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\left(\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)\right) - \sqrt{\frac{1}{3}(\kappa - w_0)}\frac{2}{3}(\kappa - w_0)$. Here we can notice that the Government's increases its utility following a privatisation reform as compared to a limited instruments scenario if and only if the cost saving coming from the shutting down of the department dealing with the starting up enterprises and the firing of its Employees are larger than the reduction in the fiscal resources $\sqrt{\frac{1}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)}\left(\frac{2}{3}\left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)\right) - \sqrt{\frac{1}{3}(\kappa - w_0)}\frac{2}{3}(\kappa - w_0)$.

Again, the Government reaches the maximum utility when a *liberalisation* reform is implemented: in this case $U_G^{lib^*} = \sqrt{\frac{1}{3}\Pi}\frac{2}{3}\Pi + B$.

[17] Again remember that a *performance wage* scenario is equivalent to a scenario where *honest* employees are hired.

Summing up the results, and given that Government attains the maximum utility when a *liberalisation* reform is implemented, the relationship among equilibrium Government's utilities which establishes the superiority of the *privatisation* reform with respect to the other two is the following:

$$\begin{aligned} & (U_G^{lib^*} \geqslant) U_G^{pr^*} \geqslant U_G^{pw^*} \\ \text{if} \quad & M(w_0) \geqslant \sqrt{4/27}\left[k^{3/2} - (k-w_0)^{3/2}\right] \qquad (9) \\ & (U_G^{lib^*} \geqslant) U_G^{pw^*} \geqslant U_G^{d^*} \\ \text{if} \quad & \sqrt{4/27}\left[k^{3/2} - (k-\beta\frac{\pi_1}{\Delta\pi}v)^{3/2}\right] \geqslant M\left(\beta\frac{\pi_1}{\Delta\pi}v\right) \qquad (10) \\ & U_G^{pr^*} \geqslant U_G^{d^*} \\ & M\left(w_0 - \beta\frac{\pi_1}{\Delta\pi}v\right) \geqslant \sqrt{4/27}\left[(k-w_0)^{3/2} - (k-\beta\frac{\pi_1}{\Delta\pi}v)^{3/2}\right] \\ & \qquad (11) \end{aligned}$$

where the eq. 9 establishes the condition such that Government's utility from *privatisation* reform is larger than its utility from a *performance wage* scenario; instead the eq. 10 establishes the condition such that Government's utility from *performance wage* is larger than its utility in the status quo and the last eq.11 finds the condition when Government's utility from *privatisation* is larger than his utility from the status quo.

From the above condition it emerges that moving to a *privatisation* reform from one of the other two scenarioes is the optimal policy when the cost savings achieved from the reduced wage bills following the downsizing of the public sector (LHS in eqq. 9 and 11) are larger than the losses in fiscal resources (RHS in eqq. 9 and 11) due to higher

direct costs born by the firms.

Finally we can write down the condition such that a *privatisation* reform is better than a *performance wage* scenario and this is better than the status quo of a limited instruments scenario:

$$\begin{aligned} & (U_G^{lib^*} \geqslant) U_G^{pr^*} \geqslant U_G^{pw^*} \geqslant U_G^{d^*} \\ \text{iff} \quad & M(w_0) \geqslant \sqrt{4/27}\left[k^{3/2} - (k-w_0)^{3/2}\right] \geqslant \sqrt{4/27}\left[k^{3/2} - (k-\beta\frac{\pi_1}{\Delta\pi}v)^{3/2}\right] \geqslant M(\beta\frac{\pi_1}{\Delta\pi}v) \\ & \qquad (12) \end{aligned}$$

The same exercise can be conducted if we want to establish the condition under which a *performance wage* reform is superior to the other two scenarioes:

$$(U_G^{lib^*} \geqslant) U_G^{pw^*} \geqslant U_G^{pr^*}$$

$$\text{if} \qquad \sqrt{4/27}[\kappa^{3/2} - (\kappa - w_0)^{3/2}] \geqslant M(w_0) \tag{13}$$

$$(U_G^{lib^*} \geqslant) U_G^{pw^*} \geqslant U_G^{d^*}$$

$$\text{if} \quad \sqrt{4/27}[\kappa^{3/2} - \left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)^{3/2}] \geqslant M\left(\frac{\pi_1}{\Delta\pi}v\right) \tag{14}$$

$$(U_G^{lib^*} \geqslant) U_G^{pr^*} \geqslant U_G^{d^*}$$

$$M\left(w_0 - \beta\frac{\pi_1}{\Delta\pi}v\right) \geqslant [(\kappa - w_0)^{3/2} - \left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)^{3/2}] \tag{15}$$

where the eq. 14 identifies the conditions when moving to a *performance wage* scenario is better for the Government than the status quo; similarly eq. 15 establishes the conditions such that the *privatisation* of the public sector improves the Government's finance as opposed to the status quo scenario.

From the equation above it emerges that moving to a *performance wage* reform from one of the other two scenarioes is optimal when the additional costs born following a more expensive public sector (RHS in eqq. **??** and**??**) are smaller than the increases in fiscal resources (LHS in eqq.**??** and **??**) received from the Firms thanks to the inferior direct costs born by them.

Again we can write down the condition such that a *performance wage* reform is better than a *privatisation* scenario and this is better than the status quo of a limited instruments scenario:

$$(U_G^{lib^*} \geqslant) U_G^{pw^*} \geqslant U_G^{pr^*} \geqslant U_G^{d^*}$$

$$\text{iff} \quad \sqrt{4/27}\left[k^{3/2} - (k - w_0)^{3/2}\right] \geqslant M(w_0) \geqslant M(\beta\frac{\pi_1}{\Delta\pi}v) \geqslant \sqrt{4/27}\left[k^{3/2} - (k - \beta\frac{\pi_1}{\Delta\pi}v)^{3/2}\right] \tag{16}$$

Finally we can determine the condition such that a status quo will be preferred to reforming the start-up sector of the economy according to a *performance wage* reform or a *privatisation* reform. The condition such that the former holds is equal to

$M\left(\frac{\pi_1}{\Delta\pi}v\right) \geqslant \sqrt{4/27}\left[\kappa^{3/2} - \left(\kappa - \beta\frac{\pi_1}{\Delta\pi}v\right)^{3/2}\right]$, i.e. whenever the increase in the wage bills needed to reform the public sector is larger than the fiscal resources gained from the firms and whenever the the values of $\beta$ is small, in particular for values of $\beta \leqslant \frac{\Delta\pi}{\pi_1}\frac{1}{v}\left\{\kappa - \left[(\kappa)^{3/2} - M\frac{\pi_1}{\Delta\pi}\frac{v}{\sqrt{4/27}}\right]^{2/3}\right\}$.

Furthermore the status-quo of a not reformed public sector is preferred to a *privatisation* reform whenever $\sqrt{4/27}\left[\left(\kappa-\beta\frac{\pi_1}{\Delta\pi}v\right)^{3/2}-(\kappa-w_0)^{3/2}\right]\geqslant M(w_0-\frac{\pi_1}{\Delta\pi}v)$ i.e. whenever the decrease in the wage bills obtained thanks to the privatisation of the public sector is smaller than the fiscal resources lost by privatising the public sector dealing with start-up procedures. Again this is true also for values of $\beta$ small enough and in particular whenever $\beta\leqslant\frac{\Delta\pi}{\pi_1}\frac{1}{v}\left\{\kappa-\left[\left[(\kappa-w_0)\right]^{3/2}+\frac{1}{\sqrt{4/27}}M\left(w_0-\frac{\pi_1}{\Delta\pi}v\right)\right]^{2/3}\right\}$.

So when the transaction costs due to the corruption are not so important, leaving the status quo scenario with a positive amount of corruption is better than reforming the start up department of the public sector.

# 6 Conclusion

This paper has shown that a simple agency model of bribes involving three players (the Firm, the civil service Employee and the Government) can help explain the persistent corruption and bribery, especially in countries which have a limited capacity of running the public sector, and the perverse effects this has on business startup. The findings show that in a situation where the Government has limited instruments, public sector wages must provide some sort of insurance to the Employee and bribes cannot be eradicated completely. However a benevolent Government, which has a limited ability in managing the public sector, limits the extent of business taxation as it anticipates that Firms will have to pay an additional tax in form of bribes in order to be able to start operating quickly in the market.

We have analysed three possible reforms to improve the functioning of the public sector regarding business start up: performance wages, privatisation and liberalisation. The theoretical findings show that the Employee is indifferent among the reforms proposed and the status quo. However, the Firm might want to see privatisation to be implemented instead of the status-quo. This will be true if the transaction costs associated with the illegal dealings between firm and employee are large enough and/or the private sector wage the Firm has to pay directly now to the employee is small. Therefore if transaction costs are small or private sector wage is large, the Firm prefers the corruption status-quo scenario. Quite interestingly the Firm always prefers switching to a performance wage reform although this means having to pay larger business taxes. The most preferred reform of them all is, however, a complete liberalisation of entry.

Furthermore we have compared the Government's welfare under several reform scenarios and highlighted the relative merits of the three

reforms and of the status quo from a social welfare point of view. Again complete liberalisation of the business startup emerges as the best reform from a social welfare perspective. However we have found that moving to a privatisation reform is the optimal policy when the savings following the downsizing of the public sector are larger than the losses in fiscal resources due to higher direct costs born by the firms. On the other hand implementing a performance wage reform is optimal when the additional costs born following a more expensive public sector are smaller than the increases in fiscal resources received from the Firms due to the inferior direct costs born by them.

Finally we have highlighted how also for the Government the status quo scenario with limited instruments is the preferred option whenever the transaction costs coming form the existence of the corruption are not so large.

# 7 Appendix

**Proof.** of Proposition (4). To solve the program above, let us write the Lagrangian and the associated constraint of the Kuhn-Tucker program. The expression for the Lagrangian is obviously the following $L = N\left(U_F^{d^*}\right) y - Mw + B + \lambda_1 \left[\Pi - y - \left(\pi_1 d + (1-\pi_1) D\right) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)\right] + \lambda_2 \left[w + \frac{\pi_0}{\Delta\pi} v - w_0 + v\right]$. To solve the program, as usual, it is necessary to solve the following system:

$$\begin{gathered} \frac{\partial L}{\partial y} = 0 \\ \frac{\partial L}{\partial w} = 0 \\ \lambda_1 \left[\Pi - y - \left(\pi_1 d + (1-\pi_1) D\right) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)\right] = 0 \\ \lambda_2 \left[w + \frac{\pi_0}{\Delta\pi} v - w_0 + v\right] = 0 \end{gathered}$$

By computing the partial derivatives, the above system of equations is equivalent to the one below:

$$-N'\left(U_F^{d^*}\right) y + N\left(U_F^{d^*}\right) - \lambda_1 = 0 \tag{17}$$

$$-M + \lambda_2 = 0 \tag{18}$$

$$\lambda_1 \left[\Pi - y - \left(\pi_1 d + (1-\pi_1) D\right) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)\right] = 0 \tag{19}$$

$$\lambda_2 \left[w + \frac{\pi_0}{\Delta\pi} v - w_0 + v\right] = 0 \tag{20}$$

From eq. (18) it immediately follows that $\lambda_2 = M$. This is enough to insure that the the constraint associated with the Employee's utility is binding. Infact since the eq. (20) holds with equality and given $\lambda_2 = M$, then it is necessary and sufficient that $w = w_0 - v - \frac{\pi_0}{\Delta\pi} v$.From eq. (17) we can obtain an expression for $\lambda_1 = -N'\left(U_F^{d^*}\right) y + N\left(U_F^{d^*}\right)$. Then let us plug the expression for $\lambda_1$ in eq. (19).We obtain then the following equation in the variable $y$: $\left[-N'\left(U_F^{d^*}\right) y + N\left(U_F^{d^*}\right)\right] \left[\Pi - y - \left(\pi_1 d + (1-\pi_1) D\right) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)\right] =$

0. To make the problem interesting we assume that $\frac{N\left(U_F^{d^*}\right)}{N'\left(U_F^{d^*}\right)} \neq \Pi - (\pi_1 d + (1-\pi_1) D) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)$. This means that either $y \neq \frac{N\left(U_F^{d^*}\right)}{N'\left(U_F^{d^*}\right)}$ and $y = \Pi - (\pi_1 d + (1-\pi_1) D) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)$ *or* $y = \frac{N\left(U_F^{d^*}\right)}{N'\left(U_F^{d^*}\right)}$ and $y < \Pi - (\pi_1 d + (1-\pi_1) D) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)$. Since we want to assure that there is a positive number of firms starting up, then we require the utility of the firm $U_F^{d^*} > 0$ and the solution to be $y^d = \frac{N\left(U_F^{d^*}\right)}{N'\left(U_F^{d^*}\right)} < \Pi - (\pi_1 d + (1-\pi_1) D) - \left(\beta \frac{\pi_1}{\Delta\pi} v\right)$. ■

**Proof.** of Proposition (6).

To solve the above program, as usual, first write down the Lagrangian: then to find the system, take the derivatives of the Lagrangian with respect to the instruments and solve the system composed of these plus the associated constraints.

$L = \sqrt{\kappa - y} y - M\left(\pi_1 \overline{w}^{pw} + (1-\pi_1)\underline{w}^{pw}\right) + B + \lambda_1[\kappa - y] + \lambda_2[\pi_1\left(\overline{w}^{pw} - \underline{w}^{pw}\right) + \underline{w}^{pw} - w_0] + \lambda_3[\Delta\pi\left(\overline{w}^{pw} - \underline{w}^{pw}\right) - v]$
$+\lambda_4[\pi_1\left(\overline{w}^{pw} - \underline{w}^{pw}\right) + \underline{w}^{pw} - \frac{\pi_1}{\Delta\pi} v] + \lambda_5[\underline{w}^{pw}] + \lambda_6[\overline{w}^{pw}]$
$\frac{\partial L}{\partial y} = 0; -\frac{y}{2\sqrt{\kappa - y}} + \sqrt{\kappa - y} - \lambda_1 y = 0$
$\frac{\partial L}{\partial \overline{w}} = 0; -M\pi_1 + \lambda_2\pi_1 + \lambda_3\Delta\pi + \lambda_4\pi_1 + \lambda_6 = 0$
$\frac{\partial L}{\partial \underline{w}} = 0; -M(1-\pi_1) + (1-\pi_1)\lambda_2 - \lambda_3\Delta\pi + (1-\pi_1)\lambda_4 + \lambda_5 = 0$
$\lambda_1[\kappa - y] = 0$
$\lambda_2[\pi_1\left(\overline{w}^{pw} - \underline{w}^{pw}\right) + \underline{w}^{pw} - w_0] = 0$
$\lambda_3[\Delta\pi\left(\overline{w}^{pw} - \underline{w}^{pw}\right) - v] = 0$
$\lambda_4[\pi_1\left(\overline{w}^{pw} - \underline{w}^{pw}\right) + \underline{w}^{pw} - \frac{\pi_1}{\Delta\pi} v] = 0$
$\lambda_5[\underline{w}^{pw}]$
$\lambda_6[\overline{w}^{pw}]$

As in previous programme, it is easy to verify that, given $\kappa - y > 0$, otherwise $\frac{1}{2\sqrt{\kappa - y}}$ would not be defined, then $\lambda_1 = 0$. It follows simply that $y^{pw^*} = \frac{2}{3}\kappa$.

We can already see that $\overline{w}^{pw} > \underline{w}^{pw}$ and then that $\lambda_6 = 0$. In fact if $\underline{w}^{pw} \leqslant \overline{w}^{pw}$, then $\underline{w}^{pw} - \overline{w}^{pw} \leqslant 0$ and $\Delta\pi\left(\overline{w}^{pw} - \underline{w}^{pw}\right) \leqslant 0$. From here it would follow that $\Delta\pi\left(\overline{w}^{pw} - \underline{w}^{pw}\right) - v < 0$ which is impossible given constraint in eq. $(IC_E^{pw})$.

Moreover remember from the scenario with limited instrument and dishonest employee, that the legal wage offered by the Government was $w_0 - \frac{\pi_1}{\Delta\pi} v$. We make the assumption that $w_0 - \frac{\pi_1}{\Delta\pi} v \geqslant 0$ and therefore $w_0 \geqslant \frac{\pi_1}{\Delta\pi} v$. This will induce the $(IR_E^{pw})$ to be binding. Alternatively, if $w_0 - \frac{\pi_1}{\Delta\pi} v \leqslant 0$ it would be the $(IC_E^{pw})$ to bind. Results will change, but with the little realistic assumption of the Employee being offered a negative wage $w_0 - \frac{\pi_1}{\Delta\pi} v \leqslant 0$ by the Government.

From this it follows that since $\pi_1\overline{w}^{pw}+(1-\pi_1)\underline{w}^{pw}-\frac{\pi_1}{\Delta\pi}v \geqslant \pi_1\overline{w}^{pw}+(1-\pi_1)\underline{w}^{pw}-w_0 \geqslant 0$, then if the optimal solution $\left(\overline{w}^{pw^*},\underline{w}^{pw^*}\right)$ satisfies the constraint $\pi_1\overline{w}^{pw}+(1-\pi_1)\underline{w}^{pw}-w_0$, then it will satisfy the constraint $\pi_1\overline{w}^{pw}+(1-\pi_1)\underline{w}^{pw}-\frac{\pi_1}{\Delta\pi}v$. From this we can disregard this last constraint in the problem.

To simplify even more the program disregard the constraint in eq. $(IC_E^{pw})$ and the associated multiplier. Once we find the solution, we will check that the solution satisfies this constraint.

So given the system of equation above reduces to this one:

$$\frac{\partial L}{\partial \overline{w}} = 0; -M\pi_1 + \lambda_2\pi_1 = 0 \tag{21}$$

$$\frac{\partial L}{\partial \underline{w}} = 0; -M(1-\pi_1) + \lambda_2(1-\pi_1) + \lambda_5 = 0 \tag{22}$$

$$\lambda_2[\pi_1\overline{w}^{pw} + (1-\pi_1)\underline{w}^{pw} - w_0] = 0 \tag{23}$$

$$\lambda_5[\underline{w}^{pw}] = 0 \tag{24}$$

From the eq.(21) it follows that $\lambda_2 = M$. So the constraint in equation $(IR_E^{pw})$ is binding, i.e. $\pi_1\overline{w}^{pw}+(1-\pi_1)\underline{w}^{pw}-w_0 = 0$. From equation (22) it follows easily that $\lambda_5 = 0$. So we have solved the system for all the constraints $\lambda_i$, $i \in [0,1,...,5,6]$ and for the value of the fiscal resources $y^{pw}$.

It remains to determine the value for the wages. We guess that the solution for $\underline{w}^{pw*} = 0$ and from equation $(IR_E^{pw})$ that $\overline{w}^{pw^*} = \frac{w_0}{\pi_1}$ and we check that this solution for the optimal wage contract satisfies the remaining constraint associated to the multipliers $\lambda_3$ and $\lambda_4$, given the assumption $w_0 \geqslant \frac{\pi_1}{\Delta\pi}v$. Simple algebra shows that they do.

Notice that the solution $(\underline{w}^{pw*},\overline{w}^{pw*}) = \left(0, \frac{w_0}{\pi_1}\right)$ is such that satisfies the constraint in eq. $(IC_E^{pw})$. In fact:

$$\begin{aligned}
\pi_1\overline{w}^{pw^*} + (1-\pi_1)\underline{w}^{pw^*} - v &\geqslant \pi_0\overline{w}^{pw^*} + (1-\pi_0)\underline{w}^{pw^*} \\
\pi_1\frac{w_0}{\pi_1} + (1-\pi_1)0 - v &\geqslant \pi_0\frac{w_0}{\pi_1} + (1-\pi_0)0 \\
w_0 &\geqslant \pi_0\frac{w_0}{\pi_1} \\
\pi_1 &> \pi_0
\end{aligned}$$

Notice how in this case, the solution obtains by making binding the constraint in eq. $(IR_E^{pw})$, i.e. the one associated to the Individual Rationality of the Employee.

As an extra check, notice that if we had to guess the solution for $\overline{w}^{pw^*}$, by making the eq. $(IC_E^{pw})$ such that $\overline{w}^{pw^*} = \frac{v}{\Delta\pi}$, then this solution would not satisfy the remaining constraints. ■

**Proof.** of Lemma 7.

The proof is similar to the one in Proposition (6). Again disregard the constraint in eq.$(IC_E^{pr})$ and, once the solution is found, check that the solution satisfies this constraint. To solve the problem, again write the Lagrangian for the Employee: $L = \kappa - y - (\pi_1 \overline{w}^{pr} + (1-\pi_1)\underline{w}^{pr}) + \lambda_1[\underline{w}^{pr} + \pi_1 (\overline{w}^{pr} - \underline{w}^{pr}) - w_0] + \lambda_2[\underline{w}^{pr}] + \lambda_3[\overline{w}^{pr}]$.

First notice that it must be that $\overline{w}^{pr} > \underline{w}^{pw} \geqslant 0$. In fact if it was $\overline{w}^{pr} - \underline{w}^{pw} \leqslant 0$, then $\Delta\pi (\overline{w}^{pr} - \underline{w}^{pw}) \leqslant 0$ and then $\Delta\pi (\overline{w}^{pr} - \underline{w}^{pw}) - v < 0$,which is impossible given the constraint in equation $(IC_E^{pr})$. Then from the above result it follows that it must be $\lambda_3 = 0$.

Now, in order to find the system to be solved, take the partial derivatives of the Lagrangian with respect to the instruments and put them equal to zero and then associate to these equations the ones given by the constraints.

We obtain then the following system of equations:

$$\begin{gathered}
\frac{\partial L}{\overline{w}^{pr}} = -\pi_1 + \lambda_1 \pi_1 + \lambda_3 = 0 \\
\frac{\partial L}{\underline{w}^{pr}} = -(1-\pi_1) + \lambda_1 (1-\pi_1) + \lambda_2 = 0 \\
\lambda_1[\pi_1 \overline{w}^{pr} (1-\pi_1) \underline{w}^{pr} - w_0] = 0 \\
\lambda_2[\underline{w}^{pr}] = 0 \\
\lambda_3[\overline{w}^{pr}] = 0
\end{gathered}$$

Since $\lambda_3 = 0$, then it follows easily that $\lambda_1 = 1$ and then the Individual Rationality Constraint is binding. From the second equation, we can see that $\lambda_2 = 0$. Again to solve for the optimal contract solution $\left(\overline{w}^{pr^*}, \underline{w}^{pr^*}\right)$, we guess that $\underline{w}^{pr^*} = 0$ and that $\overline{w}^{pr^*} = \frac{w_0}{\pi_1}$. It is straightforward to check that the contract having this characteristic satisfies also the Incentive Constraint we disregarded previously. ■

**Proof.** of Proposition 8

We have derived in the Lemma above the optimal contract between Firm and Employee. To derive the solution to the Government's maximisation programme as usual write down the Lagrangian for the Government's maximisation program: $L = \sqrt{\kappa - y - w_0}y + B + \lambda_1[\kappa - y - w_0]$.To solve the program, derive the Lagrangian with respect to $y$ and equate to zero, i.e. $\frac{\partial L}{\partial y} = -\frac{y}{\sqrt{\kappa - y - w_0}} + \sqrt{\kappa - y - w_0} = 0$; then associate to this equation, the one coming from the complementary slackness condition $\lambda_1[\kappa - y - \pi_1 \frac{v}{\Delta\pi}] = 0$. Since for the expression $\frac{y}{\sqrt{\kappa - y - w_0}}$ to be defined, it cannot be that $\kappa - y - w_0 = 0$, then it must be that $\kappa - y - w_0 > 0$ and $\lambda_1 = 0$. It follows that $-y + \kappa - y - w_0 = 0$ and then, solving for the optimal $y^{pr^*} = \frac{1}{2}(\kappa - w_0)$. ■

**Proof.** of Proposition 9.

As usual, let us write down the Lagrangian and take the partial derivate with respect to the instrument $y$ and put equal to zero. The other equation is given by the associated complementary slackness.

$L = \sqrt{\Pi - \gamma\Pi}y + B + \lambda_1[(1-\gamma)\,\Pi]$. Then the system of equations is given by the following:

$$\frac{\partial L}{\partial y} = -\frac{\gamma\Pi}{\sqrt{\Pi - \gamma\Pi}} + \sqrt{\Pi - \gamma\Pi} = 0$$
$$\lambda_1[(1-\gamma)\,\Pi] = 0$$

Again since it cannot be $\Pi - \gamma\Pi = 0$, in order for $-\frac{\gamma\Pi}{\sqrt{\Pi-\gamma\Pi}}$ to be defined, then it must be that $\Pi - \gamma\Pi > 0$. From here it follows that $\lambda_1 = 0$. Finally it is straightforward to see that from the first equation $\gamma = \frac{1}{2}$ and then $y = \frac{1}{2}\Pi$ ■

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