



UNIVERSIDADE FEDERAL DE PERNAMBUCO
CENTRO DE CIÊNCIAS SOCIAIS APLICADAS
DEPARTAMENTO DE ECONOMIA

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Corruption and Political Marketing: A Game Theoretical Approach

Emmanuel Felipe Patriota de Albuquerque

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Theoretical Approach**

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Orientador: *Prof. Francisco de Sousa Ramos, PhD*
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All remaining errors are mine.

"... any attempt to construct a theory of government action without discussing the motives of those who run the government should be regarded as inconsistent with the main body of economic analysis"

—ANTHONY DOWNS (1957)

Abstract

We consider a game between a non-benevolent incumbent politician and a bureaucrat, where both can illegally appropriate public resources. The corrupt politician uses the resources to finance political campaigns and the bureaucrat to buy goods and services. Any illegal withdraw from the treasury diminishes the politician's capability to improve social welfare. Politicians care about votes, bureaucrats care about money, and voters care about social welfare and are influenced by campaigns. We analyze the role of society's educational level and of different punishing structures. We find that: i) an ill suited punishing scheme may increase *state capture* corruption; ii) the more educated the politician's constituency is, the less lenient to corruption she will be; and iii) the more sensitive to marginal increases in corruption the punishing structure is, the smaller both players' optimal illegal appropriation.

Keywords: CORRUPTION, POLITICAL CAMPAIGNS, NON-BENEVOLENCE, INCENTIVES, PUBLIC RESOURCES. JEL: D72, D73, C70.

Resumo

Propomos um jogo entre um político não benevolente e um burocrata, no qual ambos podem desviar recursos públicos ilegalmente. O político corrupto utiliza os recursos desviados para financiar campanhas políticas e o burocrata para comprar bens e serviços. Quanto maior a quantidade de recursos desviados, menos o político pode melhorar o bem-estar social. Políticos se importam com votos, burocratas se importam com dinheiro, e eleitores se importam com o bem-estar social e são influenciados por campanhas políticas. Analisamos o papel do nível educacional da sociedade e de diferentes estruturas de punição. Nossos principais resultados são: i) uma estrutura de punição mal elaborada pode aumentar corrupção do tipo *state capture*; ii) quanto mais educada a sociedade, menos o político será leniente com corrupção e menor será seu desvio ótimo; iii) quanto mais sensível a aumentos marginais de corrupção a estrutura de punição for, menor será o desvio ótimo dos jogadores.

Palavras-chave: CORRUPÇÃO, CAMPANHAS POLÍTICAS, NÃO-BENEVOLÊNCIA, INCENTIVOS, RECURSOS PÚBLICOS. JEL: D72, D73, C70.

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CHAPTER 1

Introduction

Though corruption is nothing new in most of the world, it certainly is news in great part of it, as some places more often than others are bombarded by reports of misdeeds by government officials, elected or not. It is the current case of Brazil and, though it has been so for some time, it never ceases to amaze. The new scandal - which we're unsure we can say is altogether new or even separate from the last one - is a gigantic scheme surrounding Petrobras, the also gigantic public oil company in the country. Country that, not long ago, went through the "*mensalão*" scandal, the "*mensalão mineiro*" affair, the Siemens case, and many others¹.

In many of these affairs corruption has had with the "land of the future"², the slang "*caixa dois*", meaning undeclared campaign revenue, is often present, as are the accounts about the plurality of parties involved and the intricacy of the schemes. Noticing this recurrence and being glass half full kind of people, we proposed this paper: an analysis of the incentives faced by a politician (she) who could benefit from *caixa dois*, but who also had responsibilities towards the citizenry, in a game with a second party, an (also corruptible) member of her staff.

More specifically, we analyse the incentives of a politician who wishes to be reelected through a democratic process and, thus, must convince the population to vote for her. To do that, she can use the resources at her disposal to do good work and/or to illegally buy political campaigning and advertising. However, those resources may also be illegally appropriated by a member of her staff - a bureaucrat (he) - and the more he appropriates, the less good she can do. But the plot thickens, if the bureaucrat is dishonest, the politician may punish him, but only when she is honest (otherwise she would also be punished). We then explore how their relationship changes within different institutions (i.e. different punishing schemes and educational shocks to the politicians constituency).

The relationship between a government and a bureaucrat has been analysed before. [Fabrizi and Lippert \(2012\)](#) and [Rocha et al. \(2014\)](#) both propose models of bureaucratic corruption in face of a benevolent central government. Our analysis can be seen as an expansion of their work that allows for a non-benevolent government. Regarding

¹The first two scandals are related to the purchase of political support and the latter is related to price manipulation of public purchases.

²As writer Stefan Zweig referred to Brazil in his book by the same name.

non-benevolent governments (i.e. politicians), many recent papers, such as Ferraz and Finan (2011) and Brollo et al. (2013), have analysed the incentives toward corruption and what effects it would pose on election outcomes. Our analysis takes a side route from theirs. While their focus is on the rent-seeking and pure monetary bonus of corruption, we focus on how that monetary bonus may further impact election outcomes. More specifically, we focus on what are the incentives for a corrupt politician that may only buy political marketing with it³.

Using a game theoretical approach we observe that: i) whenever the politician is dishonest, the bureaucrat appropriates at least her punishing cost⁴; ii) positive shocks in the educational level have an ambiguous effect on the appropriation by the politician; iii) and punishment by outside institutions may affect or not the optimal appropriation by the players, depending on the form of punishment and on the punishing costs incurred by the punishing institution. And, finally, whenever the politician is honest, all previous results found by Rocha et al. (2014)⁵ apply.

The remainder of this paper is organized in 4 additional sections. Below, we briefly expose the related literature. Then, in section 3, we present the model developed for this analysis. Section 4 reports our findings. Section 5 relates our findings with discussions surrounding external punishment structures and education. And, finally, section 6 brings forth our concluding remarks.

³If we analyse a recent study by Da Silveira and De Mello (2011), which shows how big an impact political advertising has on election outcomes, and then we turn to the gigantic and ever growing (declared) amounts spent in campaigning - in the 2014 Brazilian presidential campaign, more than R\$ 831 million were spent (Folha de São Paulo, 2014); and if we turn to the 2012 presidential campaign in the US, the number jumps to almost US\$ 2 billion (New York Times, 2012) -, it seems reasonable to come to the conclusion that, at least, the incentives toward political marketing spending exists.

⁴A result that contrasts with the benevolent principal model proposed by Rocha et al. (2014), where the bureaucrat appropriated at most the punishing cost.

⁵See the Related Literature section for more.

CHAPTER 2

Related Literature

There are several ways to think theoretically about corruption, and those different approaches can be distributed in four intersecting groups (Aidt, 2003). The first group sees corruption as a facilitator, that improves resource allocation and promotes the better functioning of markets, as a grease to ease the way through government failures. The second group proposes that corruption emerges because a benevolent principal (an incumbent politician), that must delegate state functions to corruptible bureaucrats, weighs the costs and benefits of fighting it, whilst seeking to optimize social welfare. The third assumes a non-benevolent principal and proposes that corruption arises because those principals do not seek social welfare maximization, but instead act in their own best interest. And lastly, the fourth group views corruption as a self-reinforcing process that, given the institutional setting, depends on history; roughly, in other words, if we had less corruption yesterday, we would have less corruption today.

All four groups of theoretical approaches have made valuable contributions to the literature¹, as we now better understand what government failures and structures are more easily greased by corruption; or which institutional arrangements should be implemented by a benevolent principal to minimize the costs of corruption; and how it could be beneficial in the long run to cause a downward shock in the corruption level, even if short-run costs exceed benefits. However, we see that focusing on non-benevolent principals and how the incentive structures of different institutional settings affect them is how we could best contribute to the development of a positive theory of corruption. Or, as Aidt (2003) put it:

”... a positive theory of corruption is required and in developing such a theory one would be ill-advised to treat the benevolent planner as anything but an illusion. Only by taking seriously the possibility of self-interest at all levels of government, as advocated by *The Grabbing Hand*, can real progress be made in developing a satisfactory positive theory of corruption.” (Aidt, 2003, p. F649)

Regarding the topic of benevolence and non-benevolence of governments, Frye

¹with examples such as Leff (1964); Beck and Maher (1986); Lui (1985) for the first group; Rose-Ackerman (1975); Acemoglu and Verdier (1998, 2000) for the second group; Shleifer and Vishny (1992, 1993, 1994a,b) for the third group; and Acemoglu (1995); Lui (1986) for the last group.

and Shleifer (1997) proposed an interesting conceptualization. According to it, there are mainly three types of relationships between governments and the rest of society. In the *invisible-hand* model of governance, government is well organized, generally uncorrupt, and relatively benevolent. It plays a minimal role in society, leaving most allocative decisions to the private sector. In the *helping-hand* model, government is more present in allocative decisions than before, helping firms it deems worthy and killing off others, with close ties with the entrepreneurial sector. There is corruption, but it is relatively limited and organized. In the *grabbing-hand* model, government intervention is just as present as in the *helping-hand*, but government is less organized and the bureaucracy functions without leading directives, with every bureaucrat following their own agendas independently. All models are ideal types and every real government is a combination of the three.

When we dwell a bit on that conceptualization, it seems that Aidt's critique only rings more true. For, if what Frye and Shleifer (1997) proposes is correct, how is it that every country in the world has non-benevolent governments (at least in part) and we will understand the mechanisms surrounding corruption by analysing only how benevolent governments work and how to optimize institutional parameters? Perhaps this line of reasoning will never end, as we ask ourselves "who is the principal after all?". Is it the politician or is it society as a whole? Perhaps every constituency is to their representative, and every representative to every bureaucrat under him/her. Nonetheless, it seems that, whatever the case, every principal would be non-benevolent and self-interested. Even in Frye and Shleifer's *invisible-hand* model, and even if the entire government functions as a benevolent principal by force of law, all agents that together form such government are surely non-benevolent and corruption always arises from those agents in spite of those laws.

All in all, inspired as we were by Aidt's argument, our decision to model the principal as non-benevolent and how to model it was mainly influenced by Anthony Downs' work, who already in 1957, in his seminal paper (Downs, 1957), departed from the mainstream welfare economics' assumption of a benevolent principal and developed an incentive structure for political parties and voters in a democratic setting. We follow him twice. First, as said before, we too assume a non-benevolent principal, seeing political agents as human beings or collectives of human beings, subject to incentives. Second, and mainly, the incentive structure we develop for the principal takes to heart his paper's central hypothesis, presented in his words below:

"... political parties in a democracy formulate policy strictly as a means of gaining votes. They do not seek to gain office in order to carry out certain preconceived policies or to serve any particular interest groups; rather they formulate policies and serve interest groups in order to gain office. Thus their social function - which is to formulate and carry out policies when in power as the government - is accomplished as a by-product of their private

motive - which is to attain the income, power, and prestige of being in office.

This hypothesis implies that, in a democracy, the government always acts so as to maximize the number of votes it will receive. In effect, it is an entrepreneur selling policies for votes instead of products for money..." (Downs, 1957, p. 137)

If on one hand we are indebted to Downs (1957) when modelling the principal, on the other we are indebted to Rocha et al. (2014)², with respect to much of the rest of our model. Their paper's setting consists of a principal-agent game between government and bureaucrat, where the government is benevolent and the bureaucrat is self-interested. The bureaucrat is hired by the government and has access to public funds, which he can illegally appropriate or not. The government, all-knowing, observes the bureaucrat's actions and can punish him whenever he takes public money, incurring in a punishing cost. The initial results of the paper are that the government will punish the bureaucrat as long as he takes more than the punishing cost, and the bureaucrat, anticipating it, will steal exactly the punishing cost. The paper's main result is that, whenever the bureaucrat is uncertain about the costs of punishment, he will appropriate weakly less and the government will be weakly better off.

Our setting, on the other hand, while still consisting of a principal-agent game between government and bureaucrat, has the added feature that the government can also illegally appropriate public funds, and, while it can still punish the bureaucrat, it can only do it if it has not taken any money illegally. And, although, in their paper, Rocha et al. (2014) focused in the punishing costs and its effects on the relation between principal and bureaucrat, in our paper we focus on the non-benevolence of the government and on how it affects the relationship between principal and agent.

The main contribution of our paper - and, so far as we know it, it is a novel contribution - is the form which corruption is performed, to what end it is performed and what are its costs for the politician herself. We assume, as said above, that the only objective of an incumbent politician is to acquire votes, and, to do that, she may do good work, fulfilling the social mandate given by society, or she may appropriate resources to buy political marketing³ (or, more crudely, to buy votes). However, with every dollar appropriated, by her or by the bureaucrat, she has less resources left to do good work. We examine how different institutional structures outside the politician's control can affect the players' actions.

This tradeoff between political stance towards the voters and campaigning resources has been examined before. Ben-Zion and Eytan (1974); Welch (1974); Brock and Magee (1978); Clark and Thomas (1995) produced models where interest groups

²Who initially derived their model from Fabrizio and Lippert (2012).

³Da Silveira and De Mello (2011) has found a large and significant effect of political TV advertising on election outcomes.

would make campaign contributions to politicians that would favor their interests. The politicians then had to weigh the benefits of favoring such groups against the costs of deviating from the average voter's stance. Our model has the political agent facing a similar tradeoff, in the sense that the more he invests in campaigning, the more he will deviate from the optimal service to the voters.

CHAPTER 3

The Model

The proposed game relates the actions of two players, an incumbent politician and a bureaucrat. Both have access to public resources T and may appropriate funds for other purposes than executing their social mandates. The politician occupies an elective seat and is only interested in his political image, either with the purpose of getting reelected to the same office or with the purpose of attempting another office. The bureaucrat, on the other hand, is a paid employee with whom the politician must deal and to whom she must delegate functions, thus allowing access to state resources.

The game starts off with the politician and the bureaucrat sequentially deciding, in that order, whether or not to illegally appropriate resources. When the politician chooses honesty and the bureaucrat chooses dishonesty, the game goes on and the politician decides whether or not to punish the bureaucrat.

Assumption 1: the politician is interested only in his electoral image, which can be affected by the quality of his management and by political marketing.

Assumption 2: when the bureaucrat is punished, the treasury recovers all that was appropriated and incurs in the punishing cost ρ .

The first assumption highlights the focus of our paper, which is to analyse the tradeoff faced by a politician between building his electoral image through social welfare oriented political work or through electoral campaigns financed at the expense of social welfare.

In assumption 2, ρ can be understood as the punishment's level of efficiency. If one wishes to hypothesize that part of the appropriated resources is not recovered, one can add that part to the punishing cost and define, with minor loss of generality, $\rho' > \rho$.

The bureaucrat's payoff U_b is a function of his wage w ; of the amount of money he appropriates from the state $d_b \in [0, T - \bar{d}_g]$; and, if he is dishonest (i.e. chooses $d_b > 0$), of the politician's choice of punishing him or not, $\gamma \in \{N, P\}$; and has the following structure:

$$U_b(d_g, \gamma, d_b) = \begin{cases} 0, & \text{if } d_b > 0, d_g = 0, \gamma = P; \\ w + d_b, & \text{otherwise.} \end{cases} \quad (3.1)$$

with the following possible outcomes: if he chooses not to embezzle ($d_b = 0$), regardless of what the politician does, he guarantees his wage w and has payoff $w + 0$; if he embezzles ($d_b > 0$) and the politician has also done so ($d_g > 0$), he has a payoff of $w + d_b$; and, finally, if he embezzles ($d_b > 0$) and the politician does not ($d_g = 0$), the latter may choose to punish him or not for misappropriating resources, leaving him with 0, if punished ($\gamma = P$), and with $w + d_b$, if not ($\gamma = N$)¹.

The politician's payoff U_g , on the other hand, is a function of the amount of money available in the state's treasury net of the bureaucrat's appropriation ($T - d_b$), of the amount of money she herself appropriates from the treasury $d_g \in [0, T]$ and of her choice of punishment γ , within the following structure:

$$U_g(d_g, \gamma; d_b) = \begin{cases} S(T - \rho) + C(0), & \text{if } d_b > 0, d_g = 0, \gamma = P; \\ S(T - d_b - d_g) + C(d_g), & \text{otherwise.} \end{cases} \quad (3.2)$$

where $S(\cdot)$ is a strictly increasing and strictly concave function in its parameters and relates the electoral benefits, for the politician, of fulfilling her social mandate; and $C(\cdot)$ is a function that relates the electoral benefits of political marketing expenditures, with $C(\cdot)$ being strictly increasing and concave in d_g ².

In summary, the game has the following timeline, also exhibited by the game tree in figure A.1:

- The politician decides how much to illegally appropriate ($d_g \geq 0$);
- The bureaucrat decides how much to illegally appropriate ($d_b \geq 0$);
- If the politician chooses honesty ($d_g = 0$) and the bureaucrat chooses dishonesty ($d_b > 0$), the politician decides whether or not to punish the bureaucrat, retrieving the bureaucrat's appropriation d_b and withdrawing the punishing cost ρ from the public treasury when punishing.

¹See that, given the structure proposed for the game, whenever the politician misappropriates $d_g > 0$, the decision node for γ is never reached, and, even if he chooses $\gamma = P$, no punishment occurs.

²We modelled $C(0) \neq 0$ to allow for different levels of pre-game electoral capital (i.e. if a member of the Kennedy family decides to run for office, he/she would already have a stronger political image than most and would, thus, face different incentives).

CHAPTER 4

Discussion

Initially, notice that the structure of the game - a sequential game with complete information, with concave utility functions over compact domains - allows us to ensure the existence of maximization points to our utility functions and to solve the game by backward induction, reaching subgame perfect Nash equilibria.

We, thus, begin at the end, with the politician's decision of whether or not to punish a thieving bureaucrat. Given that only a politician that chooses $d_g = 0$ gets to punish, her payoff would be $U_g = S(T - \rho)$, when she punishes, and $U_g = S(T - d_b)$, otherwise; thus, given that $S(\cdot)$ is strictly increasing, she would be indifferent between the two if and only if:

$$d_b = \rho \tag{4.1}$$

meaning that the politician will prefer not to punish a bureaucrat that appropriates $d_b < \rho$ and will be indifferent whenever $d_b = \rho$, choosing:

$$\gamma = \begin{cases} P, & \text{if } d_g = 0, d_b > \rho; \\ N, & \text{otherwise.} \end{cases} \tag{4.2}$$

a result that is in agreement with the model of benevolent government developed by [Rocha et al. \(2014\)](#), where independently of the punishment cost ρ , it is optimal for the bureaucrat to appropriate $d_b = \rho$, whenever ρ is public information.

In our scenario, however, we wish to examine how the existence of a non-benevolent politician might change the behavior of the bureaucrat, in relation to what happens in an environment with a benevolent principal. We know that the bureaucrat guarantees his wage w if he chooses not to embezzle $d_b = 0$ and that, as long as it does not get him punished, it is always profitable for him to misappropriate as much as possible. Which, translating to his best response function, becomes:

$$d_b(\bar{d}_g) = \begin{cases} \rho, & \text{if } \bar{d}_g = 0; \\ T - \bar{d}_g, & \text{otherwise.} \end{cases} \tag{4.3}$$

we see, then, that, whenever the threat of punishment lies over the bureaucrat's head, he

appropriates only the punishing cost ρ . However, when the politician decides to take $d_g > 0$, the threat is gone and the bureaucrat is able to take all that is left in the treasury (i.e. $T - \bar{d}_g$).

The politician anticipates the bureaucrat's reaction and incorporates his best response function into her calculations, which culminate with the following best response function:

$$d_g(d_b(\bar{d}_g)) = \begin{cases} 0, & \text{if } \nexists d_g \in [0, T] | S(0) + C(d_g) > S(T - \rho) + C(0); \\ T, & \text{otherwise.} \end{cases} \quad (4.4)$$

The game solution, thus (and it is natural that it does), hinges on the characteristics of the players' utility functions; more specifically on the characteristics of the politician's utility and on the condition displayed in equation 4.5, to which we shall refer to henceforth as the corruptibility condition:

$$\exists d_g \in [0, T] | S(T - d_b(d_g) - d_g) + C(d_g) \geq S(T - \rho) + C(0). \quad (4.5)$$

If there exists such a d_g , it is optimal for the politician to appropriate the whole of the treasury¹; if not, it is optimal that she chooses $d_g = 0$ and punish the bureaucrat if he chooses $d_b > \rho$. So, now, we have reached two possible equilibria. If the corruptibility condition in inequality 4.5 is satisfied, the strategy profile becomes $(d_g, \gamma; d_b) = (T, N; 0)$. In the opposite case, the equilibrium would be $(0, N; \rho)$.

¹Given that $\frac{\partial C(\cdot)}{\partial d_g} > 0$ and that the treasury will be emptied by the bureaucrat if the politician does not empty it herself.

CHAPTER 5

Further analysis

We do not take the equilibria we have found at face value and we recognize the departures from reality made in our model and realize the infeasibility of the results reported above. You might argue that there are surreal aspects in our model, mostly: i) the nonexistence of a punishing institution out of the politician's control that could punish the corrupt (such as a FBI or a *Polícia Federal* or *Controladoria Geral da União* in Brazil); and ii) the amount of access to the treasury and apparent ease with which both players get to steal from it.

In this section, we experiment a bit with the proposed model. We begin imposing the existence of an institution outside of the bureaucrat's and incumbent politician's control that can punish them if they misappropriate resources. We will examine two different settings: in the first, we assume a punishing mechanism that manifests itself through a probability distribution α , which is exogenously defined; and in the second, we assume that the mechanism's probability is endogenously defined as a function of the proportion of resources appropriated with regard to the amount initially available in the treasury in the form of two probability functions $\beta\left(\frac{d_b}{T-d_g}\right)$ and $\phi\left(\frac{d_g}{T}\right)$.¹

Both settings should be readily observable in real world institutional structures. In Brazil, for instance, CGU audits are an example of exogenously defined probability of punishment, as the municipalities being audited are chosen through a lottery. The second scenario should also be easy to imagine, as most penal systems around the world take harsher crimes more seriously and allocate more resources to punish the perpetrators.

Lastly, still in this section, we add a third assumption to our model, which introduces education as a parameter in the decision making process of the politician.

5.1 Case 1: exogenously defined probability of punishment

In this subsection, both agents take the existing punishing structure at face value, before choosing their actions. Both of them believe there is a fixed probability α of

¹Notice that those changes turn the utility functions of our players into Von Neumann-Morgenstern utility functions.

being punished, in case they choose to deviate.

We follow the same script as in last section. First, since the decision by the politician to punish the bureaucrat remains the same as before, we move on to comparing the bureaucrat's expected payoffs. His two choices are: first, not embezzling and guaranteeing his salary w ; or, second, embezzling and incurring the probability of punishment, with an expected payoff of $(1 - \alpha)(w + d_b)$. As such, it follows that he would be indifferent between the two if they yielded the same payoff and that he would only choose to embezzle if his second choice had a higher yield. It follows, then, that there is a lower bound to the value he would embezzle. We will call that boundary value d_b^l and the bureaucrat will be indifferent between misappropriating resources or not whenever:

$$(1 - \alpha)(w + d_b^l) = w$$

and solving for d_b^l ,

$$d_b^l = \frac{\alpha}{1 - \alpha} w \quad (5.1)$$

In equation 5.1, as the literature predicts, we see that, the bigger the probability of punishment, the bigger crime's payoff must be, in proportion to total payoff, so that a crime is committed. Then, if α is small enough and if the politician leaves enough money in the treasury, such that $T - \bar{d}_g \geq \rho \geq d_b^l$, it follows that the bureaucrat finds himself with the same incentives as in the previous section, where every increase in d_b is optimal and only the politician's punishment can dissuade him from appropriating extra resources. Since we know that the politician only punishes the bureaucrat when he embezzles more than it costs to punish him (i.e. $d_b \geq \rho$), if the bureaucrat is not dissuaded by the current probability of punishment α , he has no incentives to misappropriate *less* than the punishing cost ρ and always chooses to embezzle $d_b \geq \rho$. All in all, his best response function takes the following form:

$$d_b(\bar{d}_g) = \begin{cases} \rho, & \text{if } d_b^l \leq \rho \text{ and } \bar{d}_g = 0; \\ T - \bar{d}_g, & \text{if } d_b^l \leq T - \bar{d}_g \text{ and } \bar{d}_g > 0; \\ 0, & \text{otherwise.} \end{cases} \quad (5.2)$$

Thus, in this new institutional setting, with an exogenously defined α , there are three possible scenarios: *i*) when the probability of punishment is low enough, such that $d_b^l \leq \rho$, the bureaucrat will always embezzle, choosing $d_b = \rho$, whenever $\bar{d}_g = 0$, and choosing $d_b = T - \bar{d}_g$, whenever $\bar{d}_g > 0$; *ii*) when $T - \bar{d}_g \geq d_b^l > \rho$, the bureaucrat only misappropriates if he can take $d_b > \rho$ and not be punished by the politician (i.e. the politician must also misappropriate, with $d_g > 0$); and *iii*) either when $d_b^l > T - \bar{d}_g$ or when $T - \bar{d}_g \geq d_b^l > \rho$ and $\bar{d}_g = 0$, the bureaucrat never embezzles.

It is noteworthy that, like in our past section, whenever dishonest ($d_b \geq d_b^l$), it is always optimal for the bureaucrat to appropriate as much resources as the politician, honest or not, allows him to.

The interpretation from the scenarios above follows from the structure of the bureaucrat's expected utility function, that characterize him as a risk neutral agent. As such, in his decision process, it will only be advantageous to be dishonest, if the share of his total revenue that pertains to corruption is bigger than the probability of punishment for being corrupt (i.e. there is some feasible d_b above his lower bound value d_b^l).

Now we turn to the politician and we can observe that for each scenario described above for the bureaucrat, the politician will be faced with a different corruptibility condition (CC). In the first scenario, where $d_b^l \leq \rho$, the condition will be similar to the one in section 4, discounted for the probability of punishment, i.e:

$$\exists d_g \in (0, T] | (1 - \alpha)[S(0) + C(d_g)] > S(T - \rho) + C(0)$$

In the second scenario, where $\rho < d_b^l \leq T - d_g$, the condition will be:

$$\exists d_g \in (0, T] | (1 - \alpha)[S(0) + C(d_g)] > S(T) + C(0)$$

Note that, since the bureaucrat has a lower bound greater than the punishment cost for the politician, he only misappropriates when the politician is dishonest. Hence the first term to the right in the inequality is not discounted for ρ .

And, lastly, in the third scenario, where $T - d_g < d_b^l$, the condition will be:

$$\exists d_g \in (0, T] | (1 - \alpha)[S(T - d_g) + C(d_g)] > S(T) + C(0)$$

Note that the bureaucrat will choose not to embezzle funds, even when the politician has herself embezzled. This restraint from the bureaucrat allows the politician to find the best value to embezzle within $(T - d_b^l, T]$ and, thus, it is possible that she chooses not to empty the treasury, choosing to misappropriate some value d_g' . This will happen whenever:

$$\exists d_g' \in (T - d_b^l, T) | (1 - \alpha)[S(T - d_g') + C(d_g')] > (1 - \alpha)[S(0) + C(T)]$$

an inequality which we will call the parsimonious condition (PC). It may even be the case that, if there is a misappropriation amount $d_g^* \in (T - d_b^l, T)$ such that $C_1(d_g^*) = S_1(T - d_g^*)$, the politician will be given the opportunity to choose her preferred level of corruption, where expenditures in social welfare and in political campaigning have equal marginal returns.

Now we sum up those conditions and scenarios in the politician's best response function:

$$d_g(d_b(\bar{d}_g)) = \begin{cases} 0, & \text{if } CC \text{ fails;} \\ d'_g, & \text{if } CC \text{ and } PC \text{ hold, for } T - d'_g < d_b^l; \\ T, & \text{otherwise.} \end{cases} \quad (5.3)$$

In sum, we get different equilibria, depending on the probability of punishment and on the satisfaction of the corresponding corruptibility and parsimonious conditions. We summarize below:

$$(d_g, \gamma; d_b) = \begin{cases} (0, N; \rho), & \text{if } CC \text{ fails, for } d_b^l \leq \rho; \\ (0, N; 0), & \text{if } CC \text{ fails, for } \rho < d_b^l; \\ (d'_g, N; 0), & \text{if } CC \text{ and } PC \text{ hold, for } T - d'_g < d_b^l; \\ (T, N; 0), & \text{otherwise.} \end{cases}$$

We now get different corruptibility conditions for different probabilities of punishment. Moreover, in every scenario, we have that the bigger the probability of punishment α , the bigger the rents of corruption must be for the players to illegally appropriate public resources and the bigger the chances that the bureaucrat finds himself unwilling to embezzle. That being said, we can see that a bigger α coupled with an honest bureaucrat could produce two opposite effects: first, an intuitive and counter corruption effect, with both sides of the corruptibility conditions coming closer together - on one side, all payoffs with illegal appropriations are discounted by $(1 - \alpha)$ and, on the other side, when a bureaucrat is dissuaded from embezzling, the politician who chose not to misappropriate would get $S(T) > S(T - \rho)$; and, second, a counter-intuitive effect, for, if an increase in α is such that it dissuades the bureaucrat from stealing, but not the politician, it enables the latter to search for an inner solution, so that an increase in punishment probability might improve the politician's payoff, putting him even further away from an indifference position.

Expanding on the second effect, we could, at first glance, imagine that corruption has decreased. After all, an embezzlement of d'_g is smaller than one of T . However, there could be a downside to that decrease. In a World Bank report, [Hellman et al. \(2000\)](#) differentiated between *administrative* and *state capture* types of corruption. The first type relating to corruption in the implementation of the rules of the game (i.e. an officer granting an illicit permit or a doctor selling a hospital bed), and the second type relating to corruption in the elaboration of the rules of the game (i.e. permits and hospital beds being made preferential for certain interest groups).

As such, it is possible that our setting - where the politician misappropriates public resources in favor of political marketing, possibly by favoring interest groups in

exchange for political contributions (as in the Brazilian *Car Wash* scandal²) - instead of showing a reduction in all corruption in response to an increase in law enforcement, is indeed showing an increase in state capture.

5.2 Case 2: endogenously defined probability of punishment

Now we turn to our second case, where the probability of punishment is defined endogenously (i.e. it is defined according to the appropriation choices of the players) and $\beta(\cdot)$ and $\gamma(\cdot)$ are two strictly increasing functions of each player's ratio of misappropriations by the amount he/she could take from the treasury, so that we have $\beta(\frac{d_b}{T-\bar{d}_g})$ and $\phi(\frac{d_g}{T})$. We simplify our analysis defining β and ϕ as linear probability functions of the ratios, i.e. $\frac{d_b}{T-\bar{d}_g}$ and $\frac{d_g}{T}$.

Again, we begin looking at the bureaucrat's optimal strategy. We see that, differently from the previous sections (without punishment and with an exogenously defined punishment probability), his maximization problem no longer is to simply appropriate as much as possible, given that it avoids punishment by the politician, but also to weigh the tradeoff between the marginal gain of a greater appropriation and the marginal cost of a greater probability of punishment. We find his first order condition:

$$\max_{d_b} (1 - \frac{d_b}{T - \bar{d}_g})(w + d_b)$$

$$d_b^* = \frac{T - w - \bar{d}_g}{2}$$

and see his best response function take the following form:

$$d_b(\bar{d}_g) = \begin{cases} \min\{\rho, \frac{T-w}{2}\}, & \text{if } \bar{d}_g = 0; \\ \frac{T-w-\bar{d}_g}{2}, & \text{if } 0 < \bar{d}_g \leq T-w; \\ 0, & \text{otherwise.} \end{cases} \quad (5.4)$$

We can see that, now, the bureaucrat may choose an inner solution to his misappropriation problem, instead of just 'the more the merrier'. It is also interesting to note that, as the literature has often stated, the implementation of an *efficiency wage* decreases the bureaucrat's optimal appropriation.

The politician, in turn, anticipating the bureaucrat's best response function, has three alternative strategies: first, she may choose not to misappropriate, to what the

²Brazilian contractors, allegedly, placed campaign contributions in exchange for political favor (Financial-Times, 2016).

bureaucrat would respond embezzling the minimum between ρ and $\frac{T-w}{2}$ - note that he has no incentive to take more than his optimum $\frac{T-w}{2}$ and, if he takes more than ρ , he will be punished; second, the politician may choose to misappropriate some value between in the interval $(0, T-w]$, to which the bureaucrat would respond embezzling $\frac{T-w-\bar{d}_g}{2}$; and third, the politician may choose to take more than $T-w$, in which case the bureaucrat will restrain himself from misappropriating.

The politician, then, will compare the payoff from her three possible choices. The framework for this comparison will be the same as before, where an appropriation could satisfy both a corruptibility condition and a parsimonious condition. The *CC* will take the following form, with two inequalities:

$$\max_{d_g^* \in (0, T-w]} \frac{T-d_g^*}{T} [S(\frac{T+w-d_g^*}{2}) + C(d_g^*)] \geq S(T - \min\{\rho, \frac{T-w}{2}\}) + C(0)$$

or

$$\max_{d_g^{**} \in (T-w, T]} \frac{T-d_g^{**}}{T} [S(T-d_g^{**}) + C(d_g^{**})] \geq S(T - \min\{\rho, \frac{T-w}{2}\}) + C(0)$$

note that the three alternative payoff structures are represented in the *CC* above. On the right side of both inequalities, we present the payoff of a politician who chooses not to embezzle. Then we compare it with the values on the left side, which represent the politician's payoffs when she chooses to embezzle. Here, only if both inequalities fail, the *CC* fails and the politician will choose not to misappropriate.

In the case that the corruptibility condition is satisfied, we will need to sort out which of the alternatives of positive embezzlement is best suited for the politician. The *PC*, below, serves that purpose.

$$\begin{aligned} \max_{d_g^* \in (0, T-w]} \frac{T-d_g^*}{T} [S(\frac{T+w-d_g^*}{2}) + C(d_g^*)] \\ \geq \\ \max_{d_g^{**} \in (T-w, T]} \frac{T-d_g^{**}}{T} [S(T-d_g^{**}) + C(d_g^{**})] \end{aligned}$$

To the left of the inequality, the politician must acknowledge the bureaucrat's response function and discount the amount he would appropriate. To the right, the politician anticipates that the bureaucrat would restrain himself if she misappropriates more than $T-w$. With some notational abuse, we will denote the argument that maximizes the payoffs above by, d_g^* and d_g^{**} , respectively.

The politician's best response function, then, will be:

$$d_g(d_b(\bar{d}_g)) = \begin{cases} 0, & \text{if } CC \text{ fails;} \\ d_g^*, & \text{if } CC \text{ and } PC \text{ hold;} \\ d_g^{**}, & \text{if } CC \text{ holds and } PC \text{ fails.} \end{cases} \quad (5.5)$$

In sum, we get different equilibria, depending on the probability of punishment and on the satisfaction of the corresponding corruptibility and parsimonious conditions. We summarize below:

$$(d_g, \gamma; d_b) = \begin{cases} (0, N; \min\{\rho, \frac{T-w}{2}\}), & \text{if } CC \text{ fails;} \\ (d_g^*, N; \frac{T-w-d_g^*}{2}), & \text{if } CC \text{ and } PC \text{ hold;} \\ (d_g^{**}, N; 0), & \text{otherwise.} \end{cases}$$

It is important to remark that, differently from the previous sections, the incidence of an increasing probability of punishment changes the optimal misappropriation values for both players³. In our first and second scenarios, without external punishment and with exogenously defined punishment, the optimal outcome for the bureaucrat would be to take all that he could, and for the politician to take any d'_g such that $\frac{\partial C(d'_g)}{\partial d_g} = \frac{\partial S(T-d_b(d'_g)-d'_g)}{\partial d_g}$. With an endogenous probability of punishment, though, their preferred outcomes change: for the bureaucrat, to $\frac{T-w-d_g}{2}$, which is smaller than $T-d_g$; and, for the politician, to any d''_g such that $\frac{\partial C(d''_g)}{\partial d_g} = \frac{\partial S(T-d_b(d''_g)-d''_g)}{\partial d_g} + \frac{S(T-d_b(d''_g)-d''_g)+C(d''_g)}{T-d''_g}$, which entails a smaller embezzlement than before⁴.

Note that, differently from [Rocha et al. \(2014\)](#), the bureaucrat is no longer restricted to appropriating at most p .

Another interesting thing to see, given the possibility of an inner solution and that marginal returns to expenditure are decreasing both in C and in S , is that, the bigger T is, the bigger the likelihood that a corruptibility condition is satisfied. Interesting because, assuming that every constituency would demand some positive amount of social work, only those with a treasury big enough to satisfy the corruptibility condition would have corrupt politicians.

Also, we find that an increase in resource availability T enhances the overall electoral image of a politician through two possible channels. First, if the politician has chosen not to embezzle any money, a rise in T increases the amount of social work she can do through the function S . In the other hand, if she has chosen to embezzle all of the resources, her electoral image is also improved due to a larger expenditure in political campaigning. Moreover, if she embezzles some intermediate amount, different from T or *zero*, an increase in T would affect her electoral image through both channels simultaneously,

Corruption and changes in the amount of treasury resources T were explored by

³For d_g values bigger than zero and smaller than T .

⁴Since both functions, $C(\cdot)$ and $S(\cdot)$, are concave and the second term to the right is positive, $\frac{\partial C(d''_g)}{\partial d_g}$ is bigger than $\frac{\partial S(T-d_b(d''_g)-d''_g)}{\partial d_g}$. It must follow, then, that $d''_g < d'_g$ OR $T-d_b(d''_g)-d''_g > T-d_b(d'_g)-d'_g$.

Brollo et al. (2013), a publication that focused on the effects of an exogenous influx of resources in Brazilian municipalities on corruption and electoral outcomes, and, through a model of career concerns, came to the conclusion that a rise in T reduces the average quality of the opposition and, thus, increases the chances of an incumbent reelection. They examined the role played by official campaign contributions at their discontinuity threshold, in a well designed fashion, and found it insignificant. However, two considerations are in order: firstly, they only examine the mayoral terms between 2005-2009, meaning one mayoral election; and, more importantly, nothing is said about unofficial campaign expenditures, which, we posit, are the fruits of corruption for an incumbent politician and is a determinant of her electoral image.

5.3 Education

To begin, the central question we wish to explore is: if more enlightened voters are less easily influenced by campaigning, how education would affect the behavior of our political player and how would the model deal with it?

Recent research seems to favor the view that a more educated electorate is more likely to identify and punish corruption, as in Galston (2001); Adsera et al. (2003); Glaeser and Saks (2006). On the other hand, with data from Brazilian audits, Ferraz and Finan (2008) found that education had no statistically significant impact on corruption.

Eicher et al. (2009) develop an overlapping-generations model to analyse growth paths with different educational and institutional starting points, with the feature that educational attainment influences institutional development, which was proxied by the corruption level. They find that corrupt rulers face a tradeoff regarding their investments in human capital: with a lower educational level, output lowers and corruption rents go down with it, and, with a higher educational level, elite-challenging behavior and monitoring rises and decreases expected corruption rents.

In fact, regarding the behavior of corrupt rulers in Eicher et al. (2009), an important caveat in our analysis is the shortsightedness of incumbent politicians in the sense that they do not account for their influence on future educational levels during their decision making process, i.e. they do not sabotage education attainment in their constituency. That may happen because she does not believe that she will be in power when that future arrives, because she has a high intertemporal discount rate, because the current institutional settings would not allow it or any conjunction of the three. In the end, we chose this structure, first, to make our analysis of the one stage game between the bureaucrat and the politician tractable, and, mainly, because our focus is on the immediate incentives faced by the players.

Now, we present the third assumption of our model:

Assumption 3: more educated constituents are less easily deceived by electoral campaigns.

With assumption 3, we included in the model the notion that changes in the educational level may alter the constituency's relation with political marketing and, thus, also alter the politician's expenditure return structure and her allocative decisions. Here, we attempt to model the relation between education and political campaigning as the relation between a sprinter and his training parachute: an equal amount of effort without the parachute would take the runner much further than with it. We believe education hinders a politician's attempt to influence the electorate much in the same manner: expenditures in marketing will still take her in the direction she wishes to go, but not as far.

We introduce education in our model through a parameter θ , which changes the politician's objective function to the following⁵:

$$U_g(d_g, \gamma; d_b) = \begin{cases} S(T - \rho) + C(0), & \text{if } d_b > 0, d_g = 0, \gamma = P \\ S(T - d_b - d_g) + C(d_g, \theta), & \text{otherwise.} \end{cases} \quad (5.6)$$

Continuing with our analysis from the last section, we are ready to present our first proposition, which relates changes in the educational level to changes in illegal appropriations.

Proposition 1: *Whenever marginal returns to campaign expenditures is greater (smaller) than the marginal return for social welfare expenditures, the politician will appropriate more (less) for every increase in education.*⁶

Proof: To prove the proposition, we analyse the problem with regard to the politician's indifference curves for U_g . Taking the total derivative and setting it equal to zero, we get:

$$U_g(d_g, \gamma; d_b) = \left(\frac{T - d_g}{T} \right) [S(T - d_b(d_g) - d_g) + C(d_g, \theta)]$$

$$dU_g = \frac{\partial U_g}{\partial T} dT + \frac{\partial U_g}{\partial d_g} dd_g + \frac{\partial U_g}{\partial \theta} d\theta = 0$$

⁵Where $\frac{\partial C(\cdot)}{\partial \theta} < 0$ e $\frac{\partial C(\cdot)}{\partial d_g \partial \theta} < 0$.

⁶If $S''(T - d_b - d_g) < 0$, $C_1''(d_g, \theta) < 0$ and $d_g^* = \{d_g \in (0, T - d_b) \mid S_{11}(T - d_b - d_g) = C_{11}(d_g, \theta)\}$, exogenous increases in θ , *ceteris paribus*, cause a reduction in d_g^* by the politician. Also, if $C_g'(\cdot) < S'(\cdot)$, exogenous increases in the education level will lead the politician to reduce d_g ; and, if $C_g'(\cdot) > S'(\cdot)$, exogenous increases in the education level will lead the politician to increase d_g .

Assuming $dT = 0$, we get

$$\frac{dd_g}{d\theta} = \frac{(T - d_g)C_2(d_g, \theta)}{[S(T - d_b - d_g) + C(d_g, \theta)] + [(1 + d_{b1})S_1(T - d_b - d_g) - C_1(d_g, \theta)](T - d_g)}$$

The numerator is negative by assumption and the denominator reflects the first order condition for an optimal appropriation by the politician and, thus, it's sign is uncertain, depending on the size of d_g relative to d_g^* . So, whenever $d_g < d_g^*$ increments in θ will cause increases in d_g , so that the politician may remain in the same indifference curve. And, whenever $d_g > d_g^*$, increments in θ will cause decreases in d_g , also so that the politician remains in the same indifference curve. ■

If we take into account that the politician only misappropriates less than her optimum, when the corruptibility condition is not satisfied, we can safely posit that increases in education decreases the amount embezzled. Furthermore, since education only affects the left hand side of a corruptibility condition, we can also safely posit that increases in education make it harder for the corruptibility condition to be satisfied.

Thus, we have that increases in education cause a reduction in the optimal level of corruption by the politician and, in equilibrium, also in the bureaucrat's optimal level. A result that is in line with what common sense would have us believe. We have found that the politician's indifference relation between education and corruption is non-monotonic, as, whenever the politician is deviating below her optimal level, increases in education will cause her to increase corruption to remain in the same indifference curve, and, whenever she is deviating above her optimal level, increases in education will cause her to decrease corruption. One way to think of this last assertion is to imagine that, if the politician is already overspending in political marketing ($d_g > d_g^*$), an increase in education will deepen the difference between d_g and d_g^* , taking her to a lower indifference curve. To return to the same utility level, she would have to get d_g closer to d_g^* , thus decreasing her appropriation.

CHAPTER 6

Conclusion

In this paper we analyse the incentive structure of a politician who wishes to be reelected through a democratic process and, thus, must convince her constituency to vote for her. To convince the voters, she can use the public resources at her disposal to do good work and/or to illegally buy political campaigning and advertising. Moreover, we analyse how the relationship between this politician and a member of her staff, who could also be corrupt and diminish her capacity to do good, evolved through different institutional settings, more specifically different punishing structures.

To do that we developed a game between this non-benevolent politician and a bureaucrat and analysed the logical ramifications of the assumptions made early on.

We found that punishing institutions play two important roles in this matter. First, a certain probability of punishment, irrespective of the quantity appropriated, discourages corruption of players that are close to their honesty vs. dishonesty indifference threshold, but has no effect on those that are afar. To those, only punishment that varies marginally with the amount appropriated has an effect and influences them towards diminishing their optimal appropriations. A conjunction of the two would bring those afar closer to their threshold and then discourage their misbehavior. However, further inquiries towards the incentives of those behind these institutions would be just as justified as the inquiry made here.

Analysing the role played by education, we found that more educated constituencies, in the sense of being less gullible and vulnerable to political marketing, force their representatives to be less corrupt and also to be less lenient towards corruption within their staff. In equilibrium, increases in education force both the politician and the bureaucrat to reduce their appropriations.

We also found that increases in the amount of public resources available enhance the politicians electoral image both through her capacity to do good deeds and through illegally financed political marketing. Thus, increased resources would increase the chances of an incumbent reelection. A finding that poses a viable alternative to the mechanism proposed by [Brollo et al. \(2013\)](#), through which increased resources, increase corruption rents, which decrease the average quality of the incumbent's opposition, and thus increase the chances of her reelection.

The biggest caveat relating to our analysis is that we force the politician to care only about his electoral image, which is a much too strong assumption. In future re-

search, we shall relax it and allow for the politician to also choose which amounts to use to purchase other goods and services. Other features which could be explored in future research are the competition among politicians and the allowance that politicians may use legal money in their campaigns.

All in all, we believe that the mechanism we have explored in this paper is a strong source of the incumbents advantage when corruption is an option. Sadly, data on corruption and specially on what is done with its proceeds is quite difficult to come by.

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APPENDIX A

Appendix A

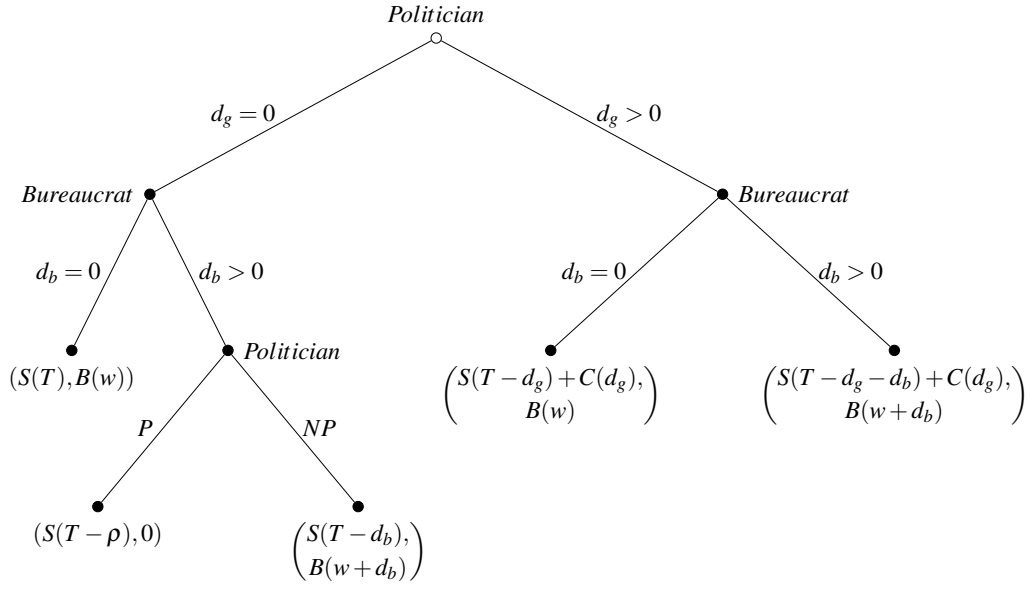


Figure A.1: The game tree

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