DE GRUYTER BE J. Econ. Anal. Policy 2024; 24(1): 69–96

Research Article

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Search and Matching in Political Corruption

https://doi.org/10.1515/bejeap-2023-0022
Received January 21, 2023; accepted September 22, 2023; published online October 9, 2023

Abstract: We develop a search and matching model to analyze the dynamics of the political corruption market. This model serves as a framework for evaluating the effectiveness of a set of anti-corruption policies. Contrary to expectations, conventional policies such as enhancing penalties or allocating greater resources to criminal investigations do not universally emerge as the most effective tools. For mitigating small-scale political corruption, the optimal strategy is to curtail corruption signaling, achieved, for instance, through enhancing transparency and competitiveness in the exchanges between entrepreneurs and politicians. For large-scale corruption, raising the costs of corruption signaling proves less effective as a deterrent compared to ex-post policy measures, such as improved detection effectiveness and harsher sanctions.

Keywords: political corruption; bribing; lobbying; deterrence; law enforcement

JEL Classifications: D72; D73; K42

1 Introduction

Political corruption is a topic that has attracted social scientists' attention for a long time because it can influence incentives and agents' behavior in several ways, but

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All authors contributed equally to each section of the manuscript. We are grateful to all participants to the 18th annual SIDE-ISLE Conference for helpful comments and suggestions. The usual disclaimers apply. This research was financially supported by the Italian Research Programs of National Interest (PRIN 2022), grant number 2022HLPMKN.

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especially because of the severe repercussions in the social and economic fabric. We intend political corruption as "the improper cooperation between private actors and elected politicians, which conditions the activity of representative assemblies or any other public institutional body for private gain and to the detriment of public interest" (Giannoccolo and Lisciandra 2019, pp. 485–486). In particular, the analysis of its causes and consequences has been widely studied in both political science and economics, highlighting many channels through which it operates.[1]

The existing literature primarily engages with political corruption through a principal-agent framework, analyzing the conditions that influence an agent's choice between corrupt and honest behavior.[2] Implicit in these models is the assumption that there are no search frictions between entrepreneurs offering bribes and politicians willing to accept them. However, the reality of political corruption, replete with preceding lobbying and signaling activities and ensuing bribery negotiations, necessitates an explicit consideration of search and matching dynamics (Svensson 2003).

Envision an entrepreneur striving to secure a government contract and willing to engage with corruptible politicians. The entrepreneur often utilizes personal and professional networks, including industry events and social gatherings, to identify potential political contacts. Concurrently, lobbying activities are initiated, serving as conduits for the entrepreneur's interests to reach influential individuals. These endeavors are supplemented with extensive research, gathering data from public records and political rumors to locate susceptible politicians. In covert circumstances, shadowy intermediaries, such as fixers or middlemen, may facilitate transactions, despite the activities' illegality and unethical nature. In essence, this illustrates the search and matching process between entrepreneurs and politicians in the context of corruption.

Several cases worldwide demonstrate the search and matching dynamics in political corruption. Consider, for instance, the "Operation Car Wash" scandal in Brazil, which exposed a corruption network involving politicians and construction companies. The companies actively monitored government tenders and identified politicians who could award contracts in state-owned oil company Petrobras. The negotiation of corrupt arrangements and subsequent illicit payments through money laundering schemes mirrors the search and matching dynamics. A similar

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[1] Surveys in political science include Della Porta (2004) and De Vries and Solaz (2017), while Aidt (2003), Pande (2007) and Pellegrini and Gerlagh (2008) provide a focus on the economics of political corruption.

[2] These models give rise to multiple equilibria and corruption traps: among others, see Caselli and Morelli (2004), Klašnja, Little, and Tucker (2018), Giannoccolo and Lisciandra (2019), and Stephenson (2020).

dynamic was observed in the Siemens scandal, where the German conglomerate leveraged corruption and bribery to secure global contracts.

Lambsdorff (2002) analysis, emphasizing the role of intermediaries and reputational factors in this context, provides further insights into the real-world manifestation of the search and matching process. The transaction costs associated with corruption are distinct from those of legal agreements due to the need for concealment and the mutual knowledge parties acquire about each other. Consequently, the search for a corrupt service necessitates information about the partner's capability to deliver the required service. Advertisement of such services is seldom public, necessitating alternatives such as disguised information distribution, intermediaries, or confining information within closed business circles. In mitigating exposure risk, intermediaries often serve as fronts for those offering corrupt services.

In more economic terms, the actual level of political corruption is closely tied to search or congestion externalities, depending on the density of bribers and bribees. The entry of additional potential bribers into the corruption market results in competition for the same corruption prize, leading to stochastic rationing that cannot be mitigated merely by adjusting bribes. As the ratio of bribers to corrupt politicians increases, either the probability of bribers' rationing rises or more time is needed to find a suitable politician to corrupt. Notably, Nabin and Bose (2008) address this aspect in their model, where the search nature of corruption gives rise to positive externalities and multiple equilibria. Yan and Qi (2021) further provide empirical support to our theoretical framework concerning the rational optimizing behavior of entrepreneurs who deploy their limited resources to bribe relevant government authorities.

Hence, political corruption is characterized by a complex web of information gathering, intermediation, reputation management, and guarantees usage to secure and enforce corrupt agreements. These dynamics are context-dependent, frequently covert, and intricately operationalized, leading to a variety of strategies to enact corruption.

This article addresses the aforementioned concerns and adds to the field by investigating a dynamic model of corruption persistence and pervasiveness using a search and matching setup within a political corruption framework. The modeling strategy follows an approach similar to the Diamond-Mortensen-Pissarides search and matching model of the labor market (Pissarides 2000). Our goal is to examine the effectiveness of various deterrence policies on political corruption.

The model predicts that (1) more efficient investigative resources and judiciary, (2) more transparency and competition, and (3) harsher penalties decrease the pervasiveness of corruption. We also provide some findings about the size of the bribe: bribes are expected to decrease in the first two scenarios and when harsher penalties are applied to bribers, while harsher reputational penalties to politicians increase the bribe size. The bribe size also increases as politicians gain more bargaining power vis-à-vis the bribing entrepreneurs. When analyzing the comparative policy implications of the model in deterring corruption, we find that for low rent levels, the first-best strategy is discouraging prospective bribers' entry into the corruption market. This can be accomplished by bolstering transparency and competition within both the business and political realms. For larger rent opportunities, the incentive to enter the corruption market increases; hence, enhancing the efficiency of corruption detection and boosting fines appear to be the most effective policy instruments.

The above findings are consistent with the relevant empirical literature. Damania, Fredriksson, and Mani (2004) find that judicial inefficiency and weak institutions increase political instability and, through this channel, corruption. Chang, Golden, and Hill (2010), Bhattacharyya and Hodler (2015), and Asquer, Golden, and Hamel (2020) find that improvements in transparency and press monitoring of the relationships between entrepreneurs and politicians are important deterrence tools in curbing political corruption. Bågenholm (2013) and Ecker, Glinitzer, and Meyer (2016) point to the persistence of corruption in countries where political reputation is not a major selection factor. Finally, Knack, Biletska, and Kacker (2019) and Campos et al. (2021) document that the combination of competition and transparency minimize the value of bribing and reduce corruption pervasiveness.

The remaining sections are organized as follows: Section 2 explains the model and derives the conditions for bribe bargaining, Section 3 analyzes the equilibrium, Section 4 addresses the anti-corruption policies by investigating and comparing the effects of changes in the exogenous parameters, and, finally, Section 5 draws the concluding remarks.

2 The Model

2.1 Search and Matching Setup

In the following model, we examine the dynamic interaction between entrepreneurs, seeking bribery opportunities to boost their profits with additional rents, and politicians who may provide bribery opportunities in exchange for bribes. For simplicity, we assume that each politician can offer the entrepreneur only one opportunity. We regard both entrepreneurs and politicians as atomistic competitors seeking to maximize their respective objective functions, with no moral restraint to engage in corruption. We view them all as prospective bribe-givers and -receivers. Finding the right match is a costly process for prospective bribers, requiring a variety of efforts for “greasing the wheels” and lobbying, i.e. making the targeted politicians responsive to their requests. Likewise, politicians must possess the “proper talents” in order to persuade the bribers that they are a suitable match and provide the extra-rents they are seeking.

Consider N politicians. We assume this number as fixed and use it as the normalizing variable. The matching process is governed by a matching function that returns the number of successful one-to-one matches of bribery (μN) as a function of searching entrepreneurs (λN) and searching politicians (ωN). Thus, the number of matched politicians, which corresponds to the number of matched entrepreneurs, is $(1 - \omega)N$, while the total number of entrepreneurs in the corruption market is $(1 - \omega + \lambda)N$. The matching function maintains the standard assumption of being increasing in both arguments, concave and homogeneous of degree 1:

$$\mu N = \mu(\omega N, \lambda N) \tag{1}$$

It is useful to work in relative terms, expressing the “tightness” of the corruption market as $\eta = \frac{\lambda}{\omega}$. This variable is particularly useful because it summarizes the searching externalities that the two sides of the market cause each other: when corruption tightness is high, there is a relatively higher number of entrepreneurs searching for a bribery opportunity, matching will be easier for politicians, but more time-consuming for entrepreneurs, since there are more prospective bribers “competing” for the right bribee. In contrast, when corruption tightness is low, there are more bribery opportunities for potential bribers to choose from, making it easier for them to find the ideal match.

The above mechanism can also be described in terms of transition probabilities and mean duration of search for unmatched entrepreneurs and politicians. Since unmatched entrepreneurs and politicians randomly meet and agree to a corruption agreement, the process of changing state is Poisson with rates $\mu(\omega N, \lambda N)/\lambda N = q(\eta)$ and $\mu(\omega N, \lambda N)/\omega N = \eta q(\eta)$, respectively.[3]

Bribing is subject to an exogenous probability of being detected, π. Detection disrupts the corruption deal and also acts as the corresponding transition probability of moving back to the unmatched pool for both the briber and the bribee.

The previous considerations suggest that the variation in the mean number of unmatched politicians can be calculated as the difference between two flows: (i) the flow of corrupt politicians who are caught bribing, and (ii) the flow of unmatched

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[3] The homogeneity property of the matching function implies that the probability $q(\eta)$ is decreasing in η, while the probability $\eta q(\eta)$ is increasing in η. Thus, the mean duration for unmatched entrepreneurs and politicians to actually become bribers and bribees is the inverse of the transition probability (i.e., $1/q(\eta)$ and $1/\eta q(\eta)$).

politicians who reach a corruption agreement with a briber:

$$\dot{\omega} = \pi(1 - \omega) - \eta q(\eta)\omega \tag{2}$$

Since the purpose of our analysis is to examine the dynamic persistence and pervasiveness of corruption, it is useful to express the above equation in terms of the mean number of corrupt politicians ($\gamma = 1 - \omega$), whose variation is therefore given by the difference between the flow of unmatched politicians who match with a briber in a corruption deal and the flow of bribees who are detected:

$$\dot{\gamma} = \eta q(\eta)(1 - \gamma) - \pi\gamma \tag{3}$$

Thus, it is straightforward to interpret γ as a measure of the level of corruption pervasiveness in political institutions.

2.2 Bellman Equations

The determination of the path for corruption market dynamics follows an asset equations approach, treating both prospective bribers and bribees as optimizing and forward-looking agents. In what follows, we are going to present the characterization of the dynamic model in the steady state, while the out-of-steady-state details are presented in Appendix B. As stated previously, entrepreneurs in the corruption market can be in one of two states: (*i*) unmatched, prospective bribers in search for a politician offering a bribing opportunity, whose present discounted value is denoted by E_u, or (*ii*) actual bribers, who have reached an agreement with a politician, whose present discounted value is denoted by E_m. The entrepreneur is expected to incur a flow cost, c, while searching for corruptible politicians. We think of c as the cost of various legal (e.g. lobbying) and illegal acts, as preparatory to the canonical bribe, intended to build a "good" reputation in the corruption market that could attract the attention of politicians and ease the interaction. These costs can include the time and effort invested in networking, research, and communication; expenses related to hosting events, conferences, or meetings to facilitate connections; or costs associated with producing materials (e.g. reports, policy briefs) to capture policymakers' attention. Therefore, c is not a sum of money that is directly pocketed by individual politicians, but it serves the role of establishing networks and connections, and signaling available bribers in the corruption market. In mathematical terms and considering the steady state:

$$\rho E_u = -c + q(\eta)(E_m - E_u) \tag{4}$$

where ρ is the discount rate. We assume for entrepreneurs a free entry condition in the corruption market. Prospective bribers search for opportunities to bribe if there are profitable prospects. If everyone can enter, however, all profit opportunities would finally be exploited, and the expected utility of being a prospective briber will be driven to zero, i.e. $E_u = 0$. The implication of this assumption is that the number of entrepreneurs seeking bribery opportunities is a jump variable; that is, entrepreneurs enter or exit the corruption market instantaneously. Eventually, equation (4) can be simplified as follows:

$$E_m = \frac{c}{q(\eta)} \tag{5}$$

This condition states that the expected value of being a briber must equate the expected costs of finding the right bribery opportunity (i.e. the flow cost of searching times its mean duration).

If matching occurs, the entrepreneur becomes an actual briber and receives a rent r while paying the bribe amount b, which is determined endogenously. However, as mentioned above, a briber also faces an exogenous probability of being detected. In the event of being caught, the briber pays a fine, s, assumed proportional to the amount of the rent r and returns to the unmatched pool. The asset equation for E_m in steady state reads as follows:

$$\rho E_m = r - b + \pi(E_u - E_m - sr) \tag{6}$$

The present discounted value of being a corrupt politician is denoted by P_m, which combines the flow of returns provided by the bribe with the net expected returns of changing state: if the corruption deal is discovered, the bribee pays a reputational and pecuniary fine, p, again proportional to the amount of the rent r and returns to the unmatched pool:

$$\rho P_m = b + \pi(P_u - P_m - pr) \tag{7}$$

The assumption that the fine paid by the politician also includes a loss in political reputation implies that $p > s$.

The present discounted value of the expected income stream of the unmatched politicians, denoted by P_u, takes into account only the net value of the possibility of state change: with probability $\eta q(\eta)$ the politician may be approached by the right briber and agree to a corruption deal, thereby becoming a bribee:

$$\rho P_u = \eta q(\eta)(P_m - P_u) \tag{8}$$

Every briber-bribee match generates a surplus in terms of expected net rent and briber's savings in search costs. We assume that this surplus is split by Nash bargaining. In formal terms, the bribe is determined as follows:

$$\max_{b}(P_m - P_u)^{\beta}(E_m - E_u)^{1-\beta} \tag{9}$$

where β denotes the bargaining power of the politician.[4]

3 Corruption Equilibrium

In this section, we will determine the equilibrium in the bribery market. The dynamics of the bribery market can be fully described by the triplet (γ, η, b), where γ (i.e. the share of matched politicians) is a state variable, and η and b are two jump variables that react instantaneously to any exogenous change in the system. We describe the bribe market in the (η, b) space, where supply and demand of bribes meet, giving rise to an equilibrium bribe. In turn, the bribe market provides an equilibrium value for the tightness parameter, η. The corresponding equilibrium level of tightness is translated into a corruption pervasiveness equilibrium level, γ, which is described in the phase diagram (η, γ).

The entrepreneur offers a bribe that maximizes her expected profits, which are described by equations (5) and (6). Substituting equation (5) into (6) we obtain the following equation of the bribe supply:

$$A(\eta, b): \qquad b = r(1 - \pi s) - (\rho + \pi)\frac{c}{q(\eta)} \tag{10}$$

Equation (10) is a decreasing function in the (η, b) space: an increase in η, which reflects a relative increase in the number of unmatched entrepreneurs with respect to unmatched politicians, implies an increase in the expected value of the search costs. Therefore, in order to be in equilibrium, also the expected net profits must increase, which implies a reduction in the bribe offered, b.[5]

The bribe received by the corrupt politician must cover the politician's expected loss and, according to the bargaining power, provide a share of the expected net rent as well as a portion of the savings from the search costs that the briber enjoys when a match is formed. By considering the first order condition of the Nash bargaining equation (9) and doing the relevant substitutions from the asset equations, we obtain a positive relationship between η and b:[6]

$$B(\eta, b): \qquad b = \pi p r + \beta[(1 - \pi s - \pi p)r + c\eta] \tag{11}$$

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[4] A comprehensive table listing the model's variables, parameter and functions together with their respective definitions is provided in Appendix A.

[5] Equation (10) can be rewritten as follows $r(1 - \pi s) - b = (\rho + \pi)c/q(\eta)$, where the LHS is the briber's expected profits and RHS is the expected average cost of searching for a potential bribee.

[6] Full derivation in Appendix C.

Equation (11) is an increasing function in the (η, b) space: a higher η indicates that more entrepreneurs than politicians seek for bribery opportunities. Thus, it is easier for unpaired politicians to find a suitable match, whereas for entrepreneurs the mean duration of searching increases, and so do search costs. As a result, the surplus generated when a match is formed increases allowing the politician to bargain larger bribes. In contrast, a smaller η implies lower search costs for entrepreneurs because there are more unmatched politicians than entrepreneurs, thereby reducing the mean duration of entrepreneurs' search for the right bribee. Thus, the entrepreneurs can negotiate a corruption agreement with a lower bribe. Note that, net expected rent for surplus sharing must take into account total expected losses, including politician's penalties. Since the net expected rent to be shared must be non-negative, therefore the following condition must hold:

$$\pi < \frac{1}{s + p} \tag{12}$$

Finally, the equilibrium values of b and η are determined by the intersection of the two curves $A(\eta, b)$ and $B(\eta, b)$, and are illustrated in the top-side panel of Figure 1.

For a full understanding of the dynamics in the bribery market, we need to determine the dynamics of the political corruption pervasiveness, γ, in the (η, γ) space. The equilibrium value of γ is the solution of a system with two equations: equation $\dot{\gamma} = 0$, which captures the steady-state values of the share of corrupt politicians in the system, and the equation that captures the tightness parameter η in steady state (i.e. $\dot{\eta} = 0$) resulting from the bribe market as already illustrated in the top-side panel of Figure 1.

Equation (3), evaluated when $\dot{\gamma} = 0$, reads as:

$$\gamma = \frac{\eta q(\eta)}{\pi + \eta q(\eta)} \tag{13}$$

Equation (13) is an increasing function in the (η, γ) space: a higher η implies that politicians would find matching easier. Thus, the inflow of politicians in the corruption pool would increase, while the opposite occurs when η decreases.

The $\dot{\eta} = 0$ equation results from rewriting opportunely the dynamic version of equation (6).[7] Because of the free-entry assumption, notice that η behaves as a jump variable, instantaneously adjusting after exogenous changes in the parameters. In addition, η does not depend on γ, thereby making $\dot{\eta} = 0$ a vertical line in the (η, γ) space.

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[7] Full derivation of $\dot{\eta}$ is provided in Appendix D.

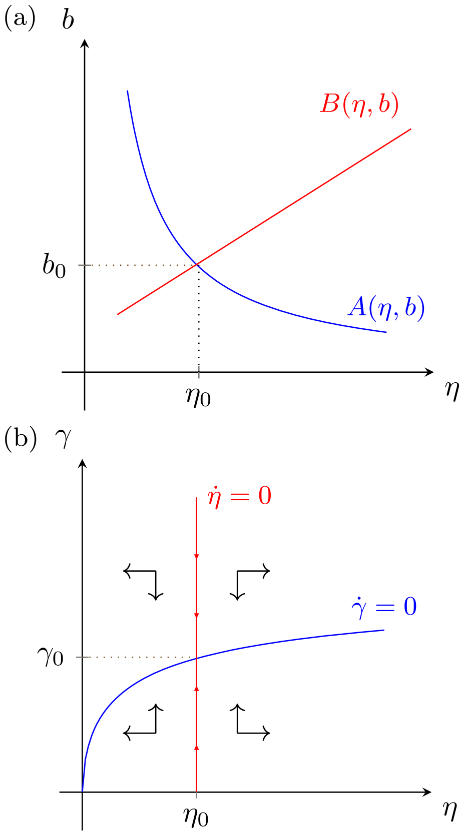

Figure 1: Equilibrium diagrams. (a) The bribe and corruption tightness equilibrium. (b) The corruption pervasiveness equilibrium.

Hence, the equilibrium value of η reported in the bribe market translates into an equilibrium value of γ, which is illustrated in the phase diagram of the bottom-side panel in Figure 1. The resulting equilibrium will be a saddle point since the determinant of the jacobian matrix is negative.

4 Policy Implications

4.1 Comparative Statics and Dynamics

We turn our attention to the analysis of the comparative statics and the relevant dynamics that are consequential to an exogenous shock affecting a parameter of the model, *ceteris paribus*.[8] An exogenous shock entails a modification of the curves (10) and (11) in the top-side panel of Figure 1, which results in a new equilibrium in the (η, b) space. The adjustment of both η and b is instantaneous. The new value of η sets in motion the dynamics in equation (3), which ultimately leads to a new value of the pervasiveness of corruption in the political system, γ.

Consider first an exogenous increase in π. A higher probability of being detected reduces the briber's expected net rent, while increasing the expected value of the search costs (see equation (10)). In the upper panel of Figure 2, this modification corresponds to an inward shift of the $A(\eta, b)$ curve. Consequently, the

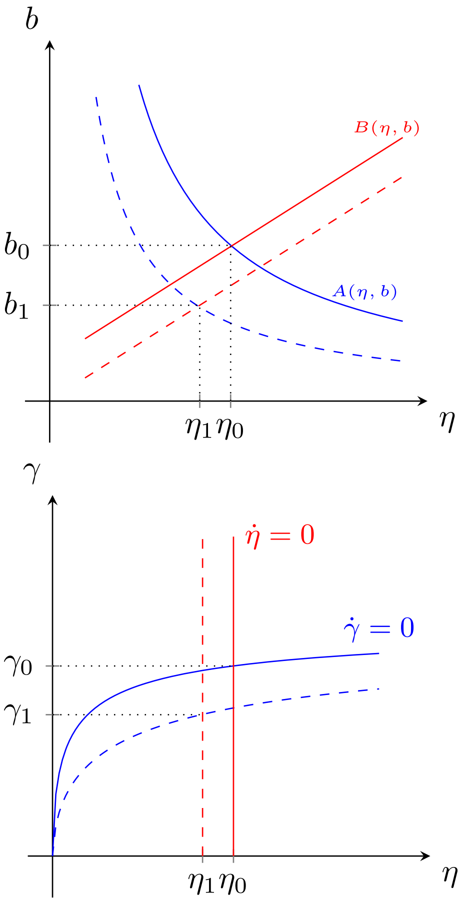

Figure 2: Comparative statics and dynamics – increase in π. Note: the upper panel illustrates the comparative statics for $\beta > 1/2$. If $\beta \leq 1/2$ then the $B(\eta, b)$ curve shifts upward. The direction of the effect on η (and γ) will remain the same.

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[8] For mathematical details about this section, please see Appendix E.

entrepreneur will provide a lower bribe for every given level of corruption tightness. An increased detection probability simultaneously changes the $B(\eta, b)$ curve.[9] Using the implicit function theorem, we demonstrate that η will unambiguously decrease in equilibrium, while for a large spectrum of parameters the value of b diminishes. As a result, matching becomes more difficult as fewer entrepreneurs seek bribery opportunities, indirectly reducing the number of politicians who enter the corruption pool.

To capture the effect of a change in π on the level of corruption pervasiveness, we need to analyze the new equilibrium in the (η, γ) space, which is illustrated in the bottom-side panel of Figure 2. The $\dot{\eta} = 0$ line shifts leftward reflecting the reduced new equilibrium of η. The $\dot{\gamma} = 0$ curve shifts downward in response to an increase in the outflow from the corruption pool subsequent to a larger π as clearly inferred from equation (3). Therefore, the final effect of both inflows and outflows of politicians in the corruption pool results in a lower level of corruption pervasiveness. In sum, if we consider a rise in π to be the result of a more efficient judiciary, the model predicts a decline in the political corruption levels.

Differently from the case analyzed above, any modifications in any other exogenous parameters affect the level of corruption pervasiveness only indirectly, through their effect on corruption tightness and, as a consequence, the politician's matching probability. In other words, only the inflow of politicians in the corruption pool is affected, while no outflow takes place. We can fully describe the mechanics of the comparative statics by looking at the shifts of the curves in the top-side panel of Figure 1. In the bottom-side panel of Figure 1, the equilibrium level of γ emerges from the shift of the $\dot{\eta} = 0$ line, while the $\dot{\gamma} = 0$ curve remains unchanged. Hence, in the subsequent analysis, we will mainly focus on the effects on corruption tightness and omit the simple graphical representation of the comparative statics.

An exogenous increase in s has the effect of reducing both b and η, since politicians can extract lower bribes (i.e. $B(\eta, b)$ shifts downward), and entrepreneurs face a reduction in the expected net rents from bribing (i.e. $A(\eta, b)$ shifts inward). Similarly, an exogenous increase in p will also reduce η, but unlike the penalty s, the equilibrium bribe will increase since politicians will demand a higher risk premium to engage in a corruption agreement. A larger bribe makes entrepreneurs more reluctant to enter the corruption market. Graphically, the $B(\eta, b)$ curve would shift upward, whilst the $A(\eta, b)$ curve would remain unaltered. In sum, for both types of sanctions, the reduction of η implies fewer matches and, consequently, a lower share of corrupt politicians.

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[9] In particular, for $\beta > 1/2$ the $B(\eta, b)$ curve shifts downward, while for $\beta \leq 1/2$ the $B(\eta, b)$ curve shifts upward. The latter case necessarily implies a reduction in the η level.

By increasing market competition and accountability in government decision-making, it becomes more difficult for corrupt actors to establish and maintain relationships with politicians, which translates in the context of our model into an exogenous increase in search and signaling costs c. This can include policies such as mandatory public disclosure of lobbying activities, campaign finance reporting, and asset declarations by public officials. The main effect of such an increase is an inward shift of the $A(\eta, b)$ curve because the entrepreneur needs to offer a lower bribe to offset the increased costs. At the same time, the savings from search costs once a match occurs will increase, thereby inducing an upward shift of the $B(\eta, b)$ curve. Both b and η will decrease as a result of the new equilibrium level. Thus, if increased search (and signaling) costs reflect greater transparency and competition we can expect a reduction in corruption levels (Campos et al. 2021; Knack, Biletska, and Kacker 2019; Strîmbu and González 2018).

The effect of an exogenous increase in the discount rate is similar to the case of an increase in search costs, where both b and η decrease. This is not surprising because the discount rate applies to the time in which entrepreneurs search for corruption opportunities. Specifically, the $A(\eta, b)$ curve shifts downward, while the $B(\eta, b)$ curve remains unchanged. The finding of an inverse relationship between discounting and corruption levels is confirmed by Helland and Sørensen (2012) in the context of electoral dynamics with political corruption. Furthermore, if a rise in ρ is directly correlated with a higher real interest rate, for example, due to a lower inflation rate, then the model shows a direct relationship between inflation and corruption pervasiveness. This last finding is supported by empirical evidence (Al-Marhubi 2000; Braun and Di Tella 2004).

An exogenous increase in the politician's bargaining power results in a reduction of η and an increase in b, since β has a direct positive effect in the Nash bargaining condition (11). Thus, if larger βs signal political regimes with stronger military and poorer civil rights, the model predicts larger bribes and lower corruption rates (Cheung, Rau, and Stouraitis 2012; Svensson 2003).

Finally, an exogenous increase in the rent value from corruption will clearly induce more entrepreneurs to search for corruption opportunities, resulting in an outward shift of the $A(\eta, b)$ curve. As a result, η would increase. From a Nash bargaining perspective, there is a larger expected net surplus to be shared, which graphically implies an upward shift of the $B(\eta, b)$ curve. The result is larger bribes with more corruption.

All the above cases are summarized in Table 1 and in the following proposition.

Proposition 1. *An increase in the deterrence parameters π, s and p, the search cost c, the discount rate ρ, and the politicians' bargaining power β, reduces corruption market tightness η and corruption pervasiveness γ. Conversely, an increase in the value of the rent from corruption r, increases both η and γ.*

Table 1: Comparative statics of an exogenous increase in parameters.

	b	η	γ
π	+/−	−	−
s	−	−	−
ρ	−	−	−
c	−	−	−
β	+	−	−
p	+	−	−
r	+	+	+

4.2 Comparative Policy Analysis

The results of comparative statics outlined in Table 1 do not provide enough information in terms of which policy is most effective in curbing corruption. In this section, we compare the effectiveness of different policies in reducing corruption according to its relative scale. For instance, we can obtain some insights from the comparison of the elasticity of γ with respect to each available policy instrument, i.e. the percentage change in γ after a unit percentage increase in the designated deterrence policy. Consider the impact of the following deterrence policies: (1) increasing detection efficiency; (2) raising penalties from detection; (3) increasing the briber's search costs. For example, when assessing the relative effectiveness of detection efficiency and severity of briber's penalty, if $\varepsilon_{\gamma,\pi} > \varepsilon_{\gamma,s}$ then improving detection efficiency is a more effective tool in curbing corruption than imposing harsher penalties to bribers.[10]

The policy implications are summarized by the ranking of the following elasticities:

$$\begin{aligned}
&\varepsilon_{\gamma,c} > \varepsilon_{\gamma,\pi} > \varepsilon_{\gamma,p} > \varepsilon_{\gamma,s} \quad \text{iff} \quad r < r_L\\
&\varepsilon_{\gamma,\pi} > \varepsilon_{\gamma,c} > \varepsilon_{\gamma,p} > \varepsilon_{\gamma,s} \quad \text{iff} \quad r_L < r < r_M\\
&\varepsilon_{\gamma,\pi} > \varepsilon_{\gamma,p} > \varepsilon_{\gamma,c} > \varepsilon_{\gamma,s} \quad \text{iff} \quad r_M < r < r_H\\
&\varepsilon_{\gamma,\pi} > \varepsilon_{\gamma,p} > \varepsilon_{\gamma,s} > \varepsilon_{\gamma,c} \quad \text{iff} \quad r_H < r
\end{aligned}$$

For relatively small-scale political corruption (i.e. $r < r_L$), an intervention on search costs appears to be the most effective anti-corruption measure. Increasing transparency levels in lobbying operations and establishing greater competition in

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[10] Full details of calculations are provided in Appendix E.2.

public procurement would raise the search/signaling costs of corruption opportunities to the point where they are no longer profitable. As the rent from corruption increases (i.e. $r > r_L$), the impact of search costs diminishes, particularly for relatively large-scale corruption rents (i.e. $r > r_H$). With relatively larger rents, increasing search/signaling costs does not effectively discourage entry in the corruption market. When the stakes are higher, the most effective deterrent strategy changes from inhibiting the bribers' entry signal into the corruption market to ex-post policy instruments such as especially investing in investigative resources and judicial efficiency, but also applying harsher fines.

The intuition behind this result is straightforward: given a certain level of search costs, an increase in these costs would have a more considerable impact on the matching surplus to split on smaller than larger rents, when compared to an enhancement in judicial efficiency or the imposition of stricter sanctions.[11] This outcome depends on the functioning of c compared to π or s or p, since c is akin to a lump sum deducted from the total rent, while π, s and p would diminish the expected value of the rent. As with any lump sum, when the rent is relatively small, an increase in the value of the lump sum could render the rent-seeking activity unsustainable due to its direct impact on the matching surplus. In contrast, an increase in π, s or p would only indirectly reduce the surplus, primarily through its impact on anticipated rents. The underlying principle aligns with the role of fixed and variable costs in firms' entry decisions. When marginal revenues are comparatively low, an increase in fixed costs may significantly influence firms' decision to enter the market more than an increase in variable costs. Conversely, when marginal revenues are relatively high, the impact of an increase in fixed costs is distributed over a larger revenue base, thereby exerting a lesser influence on firms' entry decisions.

The model also predicts that reputational penalties for politicians have a greater impact on corruption than normal fines. In other words, the larger the role of reputational costs in the objective function of politicians, the more significant the impact of harsher sanctions on corrupt politicians relative to bribers.

To enhance our comprehension of these results, we should recognize that as the intensity of common deterrence tools (namely, π, s, and p) escalates, *ceteris paribus*, the rent thresholds decline, thereby diminishing the effectiveness of adopting c as an anti-corruption policy across a broad spectrum of corruption activities. Conversely, if the magnitude of c is significantly high, it would elevate the rent

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[11] If we accept multiple matches, i.e., if we allow politicians to collect more than one bribe at the same time, the effectiveness of judicial efficiency or sanctions would likely be enhanced, as the likelihood of detection would rise. However, we reserve research on this model extension for the future.

thresholds, thus rendering any policy aimed at boosting transparency and signaling costs more effective. This outcome might initially appear counterintuitive when juxtaposed with the law of decreasing marginal returns prevalent in various economic variables. Nevertheless, every policy possesses a threshold beyond which it can effectively deter criminal behavior. In other words, in a theoretical framework, if an anti-corruption policy surpasses a certain threshold, bribers no longer derive any positive net benefit from corruption.[12]

We can now state the following proposition that summarizes the results of the comparative policy analysis.

Proposition 2. *The policy tool c (increase in search and signaling costs) is most effective in curbing relatively small-scale corruption activities, whereas the policy tool π (increase in detection efficacy) is most effective for curbing relatively large-scale corruption activities. The impact of reputational penalties p surpasses that of ordinary fines s. As π, s, and p intensify, rent thresholds decrease, diminishing the effectiveness of c as an anti-corruption policy; conversely, as c intensifies, rent thresholds increase, enhancing policies that foster transparency and heighten signal costs.*

Identifying empirical instances where more stringent policies on lobbying and other signaling costs are preferred for relatively small-scale corruption activities can be challenging. Nevertheless, Campos and Giovannoni (2017) provide cogent evidence supporting the increased likelihood of lobbying, as a precursor to corruption, being markedly more prevalent in smaller electoral districts, which serve as a proxy for relatively small-rent levels, compared to larger ones. The underlying rationale is the amplified incentives for firms to establish political connections when: (1) there are fewer officials to be elected, thereby enhancing the efficacy of the corruption signal, and (2) the cost to attract the attention of politicians and foster interaction is relatively lower. Consequently, policies explicitly aimed at mitigating reputation-building and curtailing undue interactions between entrepreneurs and local politicians warrant comprehensive consideration.

Similarly, identifying real-world examples of policies explicitly aimed at either major or minor corruption cases can also be a complex undertaking. This challenge primarily stems from the fact that high-profile cases are predominantly the ones garnering substantial media attention. Once a scandal breaks, the tendency is to implement anti-corruption policies across the board. For instance, in the aftermath

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[12] Importantly, the effectiveness of an anti-crime policy should not be confused with its efficiency, which pertains to a cost-benefit analysis of the policy. When an anti-crime policy has already been widely and extensively implemented, the primary concern may relate to the policy's marginal costs, which have not been considered in the current model, rather than its marginal returns.

of the 2014 Operation Car Wash scandal in Brazil, the 2016 Law on the Responsibility of Federal State Companies was instituted, mandating several measures (Costa, Lima, and Goldschmidt 2020): (1) Implementation of codes of conduct; (2) Establishment of statutory audit committees; (3) Overhaul of the appointment procedures for board members and senior management; (4) Enhancement of procurement process transparency; (5) Intensification of monitoring and enforcement.

In real-world settings, the adoption of anti-corruption policies necessitates a comparative assessment of the costs associated with each deterrence strategy, an element not accounted for in our analysis. For example, streamlining procedures and bolstering transparency, which demand coordinated interventions across multiple levels, often present a more politically complex challenge than the symbolic demonstration of a "firm hand". In other words, the implementation of conventional anti-corruption policies designed to elevate the anticipated cost of crime, such as the increase of penalties, often proves to be more straightforward. From a media standpoint, such strategies may offer enhanced political benefits for politicians.

5 Concluding Remarks

In this study, we have presented a simple model explicitly taking into account the search and matching nature of political corruption.[13] Due to the heterogeneity of agents and informational flaws, achieving a successful corruption transaction is a time-consuming and costly process. Such search frictions require a certain amount of resources to find the right match.

In such a context, the model predicts that corruption decreases in response to improvements in detection efficiency and transparency, as well as the implementation of harsher sanctions, especially reputational ones. In addition to these standard results, we also find that the most effective deterrence strategy for minor political corruption involves increasing bribers' search and signaling costs. When these costs are viewed as an entry fee into the corruption market, it is preferable to limit corruption signaling, such as by enhancing transparency in the exchanges between entrepreneurs and politicians, paired with the competitiveness of their associated

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[13] Although the model primarily focuses on political corruption, it can also be adapted to represent bureaucratic corruption with some modifications. Specifically, setting the penalty s equal to p can reflect the absence of reputational penalties for bureaucrats. Moreover, by minimizing the role of c, the model can capture the less prevalent lobbying efforts typically associated with bureaucrats. These adjustments allow the model to align more closely with traditional portrayals of bureaucratic corruption, while still maintaining its original purpose of depicting the dynamics of search and matching within corruption networks.

markets – namely, the business and political spheres. This prediction is consistent with the evidence provided by Knack, Biletska, and Kacker (2019), Campos et al. (2021), and Jiménez, Hanoteau, and Barkemeyer (2022). Increasing the efficiency of detection in order to increase the risk of being caught would be the second-best anti-corruption policy option if entry in the corruption market nevertheless occurs. Of course, the adoption of sanctions is still a feasible deterrence strategy for small-scale political corruption, but it is not as effective. In contrast, large rents are a significant inducement to entry and match, and increasing search and signaling costs become a less effective deterrence tool, but ex-post policy instruments such as improving detection efficiency and increasing fines remain highly relevant. In sum, when the stakes of corruption can be high, it is highly desirable to implement procedures that help uncover criminal behavior, such as conflicts of interest and whistleblowing.

The implications of the model are broadly consistent with the relevant empirical literature. Specific model extensions could provide even stronger support to policy implications. For example, the model would benefit from endogenizing corruption detection since widespread corruption can impair the detection efficiency of the investigative and court system. Furthermore, given the decentralized approach intrinsic to the model's search and matching structure, we ignored all the problems entailed by the hierarchical structure of parties, whose leaders may permit or prevent corruption of their members based on a number of incentives (e.g. the selection of more loyal elected officials to secure a stronger grip on the party). Similarly, the model does not account for the effects of political corruption on election dynamics and voter turnout. These pending issues are left for future research.[14]

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[14] Future studies might also consider the prospect of "optimal corruption" and its associated trade-offs to deepen insights into corruption dynamics. These explorations could either expand upon the existing framework used in our study or introduce a new model that places a greater emphasis on the social welfare implications of corruption.

Appendix A Definitions of the model's Variables, Parameters, and Functions

See Table A.1.

Table A.1: Model's variables, parameters and functions.

		Definition
Variables	μ	Number of corruption matches as share of total number of politicians
	ω	Share of unmatched politicians "searching" for a corruption deal
	N	Total number of politicians in the economy
	λ	Share of unmatched entrepreneurs "searching" for a corruption deal
	η	"Tightness" of the corruption market: relative number of searching entrepreneurs to searching politicians
	b	Flow value of the bribe paid when the corruption match is formed
Functions	$q(\eta)$	Poisson rate of the transition matching probability of searching entrepreneurs to become actual bribers
	$\eta q(\eta)$	Poisson rate of the transition matching probability of searching politicians to become actual bribees
	E_u	Present discounted value of expected payoff for a searching entrepreneur
	E_m	Present discounted value of expected payoff for a matched entrepreneur
	P_u	Present discounted value of expected payoff for a searching politician
	P_m	Present discounted value of expected payoff for a matched politician
Parameters	γ	Share of politicians matched into a corruption deal
	ρ	Discount rate
	π	Exogenous corruption detection probability
	c	Unmatched entrepreneurs' flow cost of search of a corruption deal
	r	Flow value of the rent from corruption accruing to the matched entrepreneurs
	s	Rent share of the monetary fine paid by the detected matched entrepreneur
	p	Rent share of the monetary and reputational fine paid by the detected matched politician
	β	Matched politician relative bargaining power

Appendix B: Derivation of Asset Equations

To derive the asset equations we proceed first by discretizating over a small time interval Δt and then taking the limit as $\Delta t \to 0$. We first start by the derivation of (7).

$$P_m(t) = b\Delta t + (1 - \rho\Delta t)\{(1 - \pi\Delta t)P_m(t + \Delta t) + \pi\Delta t[-pr + P_u(t + \Delta t)]\} \quad \text{(B.1)}$$

Subtracting $P_m(t + \Delta t)$ on both sides yields:

$$\begin{aligned} P_m(t) - P_m(t + \Delta t) = b\Delta t &+ (1 - \rho\Delta t)(1 - \pi\Delta t)P_m(t + \Delta t) \\ &+ (1 - \rho\Delta t)\pi\Delta t[-pr + P_u(t + \Delta t)] \\ &- P_m(t + \Delta t) \end{aligned} \quad \text{(B.2)}$$

$$\begin{aligned} = b\Delta t &+ (1 - \rho\Delta t)\pi\Delta t\big[-pr + P_u(t + \Delta t) \\ &- P_m(t + \Delta t)\big] + (1 - \rho\Delta t)P_m(t + \Delta t) \\ &- P_m(t + \Delta t) \end{aligned} \quad \text{(B.3)}$$

$$\begin{aligned} = b\Delta t &+ (1 - \rho\Delta t)\pi\Delta t\big[-pr + P_u(t + \Delta t) \\ &- P_m(t + \Delta t)\big] - \rho\Delta t P_m(t + \Delta t) \end{aligned} \quad \text{(B.4)}$$

Dividing both sides by Δt and taking the $\lim_{\Delta t \to 0}$ simplifies to:

$$\begin{aligned} \frac{P_m(t) - P_m(t + \Delta t)}{\Delta t} = \frac{b\Delta t}{\Delta t} &- \frac{\rho\Delta t}{\Delta t}P_m(t + \Delta t) \\ &+ \frac{(1 - \rho\Delta t)\pi\Delta t}{\Delta t}\big[-pr + P_u(t + \Delta t) \\ &- P_m(t + \Delta t)\big] \end{aligned} \quad \text{(B.5)}$$

$$\begin{aligned} \lim_{\Delta t \to 0}\frac{P_m(t) - P_m(t + \Delta t)}{\Delta t} = b &- \lim_{\Delta t \to 0}\rho P_m(t + \Delta t) + \lim_{\Delta t \to 0}(1 - \rho\Delta t) \\ &\cdot \lim_{\Delta t \to 0}\pi[-pr + P_u(t + \Delta t) - P_m(t + \Delta t)] \end{aligned} \quad \text{(B.6)}$$

$$-\dot{P_m}(t) = b + \pi[-pr + P_u(t) - P_m(t)] - \rho P_m(t) \quad \text{(B.7)}$$

Assuming that $P_m(\cdot)$ is differentiable and suppressing time for the ease of exposition, it can be rearranged to obtain the out-of-steady-state version of equation (7). The other asset equations can be derived similarly. For equation (8):

$$P_u(t) = (1 - \rho\Delta t)\{(1 - \eta q(\eta)\Delta t)P_u(t + \Delta t) + \eta q(\eta)\Delta t P_m(t + \Delta t)\} \tag{B.8}$$

Subtracting $P_u(t + \Delta t)$ on both sides yields:

$$\begin{aligned} P_u(t) - P_u(t + \Delta t) = {} & (1 - \rho\Delta t)(1 - \eta q(\eta)\Delta t)P_u(t + \Delta t) \\ & + (1 - \rho\Delta t)\eta q(\eta)\Delta t P_m(t + \Delta t) - P_u(t + \Delta t) \end{aligned} \tag{B.9}$$

$$\begin{aligned} & = (1 - \rho\Delta t)\eta q(\eta)\Delta t[P_m(t + \Delta t) - P_u(t + \Delta t)] \\ & \quad + (1 - \rho\Delta t)P_u(t + \Delta t) - P_u(t + \Delta t) \end{aligned} \tag{B.10}$$

$$\begin{aligned} & = (1 - \rho\Delta t)\eta q(\eta)\Delta t[P_m(t + \Delta t) - P_u(t + \Delta t)] \\ & \quad - \rho\Delta t P_u(t + \Delta t) \end{aligned} \tag{B.11}$$

Dividing both sides by Δt and taking the $\lim_{\Delta t \to 0}$:

$$\begin{aligned} \frac{P_u(t) - P_u(t + \Delta t)}{\Delta t} = {} & -\frac{\rho\Delta t}{\Delta t}P_u(t + \Delta t) + \frac{(1 - \rho\Delta t)\eta q(\eta)\Delta t}{\Delta t} \\ & \cdot [P_m(t + \Delta t) - P_u(t + \Delta t)] \end{aligned} \tag{B.12}$$

$$\begin{aligned} \lim_{\Delta t \to 0}\frac{P_u(t) - P_u(t + \Delta t)}{\Delta t} = {} & -\lim_{\Delta t \to 0}\rho P_u(t + \Delta t) + \lim_{\Delta t \to 0}(1 - \rho\Delta t) \\ & \cdot \lim_{\Delta t \to 0}\eta q(\eta)[P_m(t + \Delta t) - P_u(t + \Delta t)] \end{aligned} \tag{B.13}$$

$$-\dot{P}_u(t) = \eta q(\eta)[P_m(t) - P_u(t)] - \rho P_u(t) \tag{B.14}$$

For equation (6):

$$\begin{aligned} E_m(t) = {} & (r - b)\Delta t + (1 - \rho\Delta t)\{(1 - \pi\Delta t)E_m(t + \Delta t) \\ & + \pi\Delta t[-sr + E_u(t + \Delta t)]\} \end{aligned} \tag{B.15}$$

Subtracting $E_m(t + \Delta t)$ on both sides yields:

$$\begin{aligned} E_m(t) - E_m(t + \Delta t) = {} & (r - b)\Delta t + (1 - \rho\Delta t)(1 - \pi\Delta t)E_m(t + \Delta t) \\ & + (1 - \rho\Delta t)\pi\Delta t[-sr + E_u(t + \Delta t)] - E_m(t + \Delta t) \end{aligned} \tag{B.16}$$

$$\begin{aligned} & = (r - b)\Delta t + (1 - \rho\Delta t)\pi\Delta t\big[-sr + E_u(t + \Delta t) \\ & \quad - E_m(t + \Delta t)\big] + (1 - \rho\Delta t)E_m(t + \Delta t) - E_m(t + \Delta t) \end{aligned} \tag{B.17}$$

$$= (r-b)\Delta t + (1-\rho\Delta t)\pi\Delta t\big[-sr + E_u(t+\Delta t) - E_m(t+\Delta t)\big] - \rho\Delta t E_m(t+\Delta t) \tag{B.18}$$

Dividing both sides by Δt and taking the $\lim_{\Delta t\to 0}$:

$$\frac{E_m(t)-E_m(t+\Delta t)}{\Delta t} = \frac{(r-b)\Delta t}{\Delta t} - \frac{\rho\Delta t}{\Delta t}E_m(t+\Delta t) + \frac{(1-\rho\Delta t)\pi\Delta t}{\Delta t}\big[-sr + E_u(t+\Delta t) - E_m(t+\Delta t)\big] \tag{B.19}$$

$$\lim_{\Delta t\to 0}\frac{E_m(t)-E_m(t+\Delta t)}{\Delta t} = (r-b) - \lim_{\Delta t\to 0}\rho E_m(t+\Delta t) + \lim_{\Delta t\to 0}(1-\rho\Delta t) \cdot \lim_{\Delta t\to 0}\pi[-sr + E_u(t+\Delta t) - E_m(t+\Delta t)] \tag{B.20}$$

$$-\dot{E}_m(t) = (r-b) + \pi[-sr + E_u(t) - E_m(t)] - \rho E_m(t) \tag{B.21}$$

For equation (4):

$$E_u(t) = -c\Delta t + (1-\rho\Delta t)\{(1-q(\eta)\Delta t)E_u(t+\Delta t) + q(\eta)\Delta t E_m(t+\Delta t)\} \tag{B.22}$$

Subtracting $E_u(t + \Delta t)$ on both sides yields:

$$E_u(t) - E_u(t+\Delta t) = -c\Delta t + (1-\rho\Delta t)(1-q(\eta)\Delta t)E_u(t+\Delta t) + (1-\rho\Delta t)q(\eta)\Delta t[E_m(t+\Delta t)] - E_u(t+\Delta t) \tag{B.23}$$

$$= (1-\rho\Delta t)q(\eta)\Delta t[E_m(t+\Delta t) - E_u(t+\Delta t)] + (1-\rho\Delta t)E_u(t+\Delta t) - E_u(t+\Delta t) - c\Delta t \tag{B.24}$$

$$= (1-\rho\Delta t)q(\eta)\Delta t[E_m(t+\Delta t) - E_u(t+\Delta t)] - \rho\Delta t E_u(t+\Delta t) - c\Delta t \tag{B.25}$$

Dividing both sides by Δt and taking the $\lim_{\Delta t\to 0}$:

$$\frac{E_u(t)-E_u(t+\Delta t)}{\Delta t} = -\frac{c\Delta t}{\Delta t} - \frac{\rho\Delta t}{\Delta t}E_u(t+\Delta t) + \frac{(1-\rho\Delta t)q(\eta)\Delta t}{\Delta t}[E_m(t+\Delta t) - E_u(t+\Delta t)] \tag{B.26}$$

$$\lim_{\Delta t \to 0} \frac{E_u(t) - E_u(t+\Delta t)}{\Delta t} = -c - \lim_{\Delta t \to 0} \rho E_u(t+\Delta t) \lim_{\Delta t \to 0}(1-\rho\Delta t) \cdot \lim_{\Delta t \to 0} q(\eta)[E_m(t+\Delta t) - E_u(t+\Delta t)] \tag{B.27}$$

$$-\dot{E}_u(t) = -c + q(\eta)[E_m(t) - E_u(t)] - \rho E_u(t) \tag{B.28}$$

Appendix C: Derivation of the Bribe from Nash Bargaining

Taking logs of equation (9):

$$\beta \ln(P_m - P_u) + (1-\beta)\ln(E_m - E_u) \tag{C.29}$$

The first order condition with respect to b yields:

$$\frac{\beta}{P_m - P_u} - \frac{1-\beta}{E_m - E_u} = 0 \tag{C.30}$$

Considering the free entry assumption (i.e. $E_u = \dot{E}_u = 0$):

$$P_m - P_u = \frac{\beta}{1-\beta} E_m \tag{C.31}$$

Since bribes are renegotiated continuously, then:

$$\dot{P}_m - \dot{P}_u = \frac{\beta}{1-\beta} \dot{E}_m \tag{C.32}$$

Subtracting (B.14) from (B.7), then:

$$\dot{P}_m - \dot{P}_u = [\rho + \pi + \eta q(\eta)](P_m - P_u) - b + \pi pr \tag{C.33}$$

Substituting (C.33) and (B.21) in (C.32):

$$[\rho + \pi + \eta q(\eta)](P_m - P_u) - b + \pi pr = \frac{\beta}{1-\beta}[(\rho+\pi)E_m - (r - b - \pi sr)] \tag{C.34}$$

Finally, substituting equation (5) and taking into account (C.31):

$$[\rho + \pi + \eta q(\eta)]\frac{\beta}{1-\beta}E_m - b + \pi pr = \frac{\beta}{1-\beta}[(\rho+\pi)E_m - (r - b - \pi sr)] \tag{C.35}$$

$$\eta q(\eta)\frac{\beta}{1-\beta}\frac{c}{q(\eta)} - b + \pi pr = \quad -\frac{\beta}{1-\beta}[r - b - \pi sr] \tag{C.36}$$

$$\eta\beta c - (1-\beta)b + (1-\beta)\pi pr = \quad -[\beta r(1-\pi s) - \beta b] \tag{C.37}$$

which yields equation (11) in the text.

Appendix D: Derivation of Corruption Tightness Dynamic Equation

Differentiating equation (5) with respect to time:

$$\dot{E}_m = -cq(\eta)^{-2}q'(\eta)\dot{\eta} \tag{D.38}$$

$$= -\frac{c}{q(\eta)}\frac{q'(\eta)}{q(\eta)}\dot{\eta} \tag{D.39}$$

$$= -\frac{c}{\eta q(\eta)}\frac{\eta q'(\eta)}{q(\eta)}\dot{\eta} \tag{D.40}$$

$$= -\frac{c}{\eta q(\eta)}\varepsilon(\eta)\dot{\eta} \tag{D.41}$$

where $\varepsilon(\eta) = -\frac{\eta q'(\eta)}{q(\eta)} > 0$ is the elasticity of $q(\eta)$ with respect to η.

Substituting equations (5) and (D.41) in (B.21) yields:

$$\frac{c}{\eta q(\eta)}\varepsilon(\eta)\dot{\eta} = (\rho + \pi)\frac{c}{q(\eta)} - [r(1-\pi s) - b] \tag{D.42}$$

$$\dot{\eta} = (\rho + \pi)\frac{c}{q(\eta)}\frac{\eta q(\eta)}{c\varepsilon(\eta)} - [r(1-\pi s) - b]\frac{\eta q(\eta)}{c\varepsilon(\eta)} \tag{D.43}$$

which eventually yields:

$$\frac{\dot{\eta}}{\eta} = \frac{\rho + \pi}{\varepsilon(\eta)} - \frac{q(\eta)}{c\varepsilon(\eta)}[r(1-\pi s) - b] \tag{D.44}$$

Combining the above equation with the Nash bargaining solution (11):

$$\frac{\dot{\eta}}{\eta} = \frac{\rho + \pi}{\varepsilon(\eta)} - \frac{q(\eta)}{c\varepsilon(\eta)}[(1-\beta)(1 - \pi s - \pi p)r - \beta c\eta] \tag{D.45}$$

which does not depend upon γ.

Appendix E: Detailed Comparative Statics for Corruption Tightness

E.1 Equilibrium Shifts

The comparative statics for the equilibrium level of corruption tightness are derived using the implicit function theorem. We first work out the function yielding the equilibrium value η^* by equating equations (10) and (11):

$$H(\eta^*, k): \qquad (1-\pi s)r - (\rho+\pi)\frac{c}{q(\eta^*)} = (1-\beta)\pi pr + \beta[(1-\pi s)r + c\eta^*] \tag{E.46}$$

where $k = (\pi, s, p, \rho, \beta, r, c)$. Then, compute the following partial derivatives of $H(\cdot)$:

$$H_{\eta^*} = -\beta c - \alpha\frac{c}{\eta^* q(\eta^*)}(\pi+\rho) < 0 \tag{E.47}$$

$$H_\pi = -\frac{c}{q(\eta^*)} - (1-\beta)(p+s)r < 0 \tag{E.48}$$

$$H_s = -(1-\beta)\pi r < 0 \tag{E.49}$$

$$H_p = -(1-\beta)\pi r < 0 \tag{E.50}$$

$$H_\rho = -\frac{c}{q(\eta^*)} < 0 \tag{E.51}$$

$$H_c = -\beta\eta^* - \frac{\pi+\rho}{q(\eta^*)} < 0 \tag{E.52}$$

$$H_\beta = -c\eta^* - r[1-\pi(p+s)] < 0 \tag{E.53}$$

$$H_r = (1-\beta)[1-\pi(p+s)] > 0 \tag{E.54}$$

where the last two inequalities hold iff $1 - \pi(p+s) > 0$, an assumption we make in condition (12).

Finally, using the implicit function theorem we get the following comparative statics:

$$\frac{\partial\eta^*}{\partial\pi} = -\frac{H_\pi}{H_{\eta^*}} < 0 \tag{E.55}$$

$$\frac{\partial\eta^*}{\partial s} = -\frac{H_s}{H_{\eta^*}} < 0 \tag{E.56}$$

$$\frac{\partial\eta^*}{\partial p} = -\frac{H_p}{H_{\eta^*}} < 0 \tag{E.57}$$

$$\frac{\partial\eta^*}{\partial\rho} = -\frac{H_\rho}{H_{\eta^*}} < 0 \tag{E.58}$$

$$\frac{\partial \eta^*}{\partial c} = -\frac{H_c}{H_{\eta^*}} < 0 \tag{E.59}$$

$$\frac{\partial \eta^*}{\partial \beta} = -\frac{H_\beta}{H_{\eta^*}} < 0 \tag{E.60}$$

$$\frac{\partial \eta^*}{\partial r} = -\frac{H_r}{H_{\eta^*}} > 0 \tag{E.61}$$

E.2 Elasticities

In what follows, we compute the elasticities of changes in equilibrium corruption tightness η^*, to understand which policy intervention may have more impact in curbing political corruption.

Using (E.46) and the implicit function theorem, elasticities can be calculated as:

$$\varepsilon_{\eta^*,k} = \frac{\partial \eta^*/\eta^*}{\partial k/k} = \frac{\partial \eta^*}{\partial k}\frac{k}{\eta^*} = -\frac{H_k}{H_{\eta^*}}\frac{k}{\eta^*} \tag{E.62}$$

where $k = (\pi, s, p, c)$.

To calculate relative effects, we compute relative elasticities and see if the ratio is greater or smaller than 1. For instance, when quantifying the relative effect of π with respect to s, we get:

$$\frac{\varepsilon_{\eta^*,\pi}}{\varepsilon_{\eta^*,s}} = \frac{-\frac{H_\pi}{H_{\eta^*}}\frac{\pi}{\eta^*}}{-\frac{H_s}{H_{\eta^*}}\frac{s}{\eta^*}} = \frac{H_\pi}{H_s}\frac{\pi}{s} > 1 \tag{E.63}$$

By the same token, in the case of the other policy tools we obtain:

$$\frac{\varepsilon_{\eta^*,\pi}}{\varepsilon_{\eta^*,p}} = \frac{H_\pi}{H_p}\frac{\pi}{p} > 1 \tag{E.64}$$

$$\frac{\varepsilon_{\eta^*,p}}{\varepsilon_{\eta^*,s}} = \frac{H_p}{H_s}\frac{p}{s} > 1 \tag{E.65}$$

$$\frac{\varepsilon_{\eta^*,\pi}}{\varepsilon_{\eta^*,c}} = \frac{H_\pi}{H_c}\frac{\pi}{c} > 1 \quad \text{iff} \quad r > r_L = \frac{\beta c \eta^* + \frac{c}{q(\eta^*)}\rho}{(1-\beta)(p+s)\pi} \tag{E.66}$$

$$\frac{\varepsilon_{\eta^*,s}}{\varepsilon_{\eta^*,c}} = \frac{H_s}{H_c}\frac{s}{c} > 1 \quad \text{iff} \quad r > r_H = \frac{\beta c \eta^* + \frac{c}{q(\eta^*)}(\pi+\rho)}{(1-\beta)\pi s} \tag{E.67}$$

$$\frac{\varepsilon_{\eta^*,p}}{\varepsilon_{\eta^*,c}} = \frac{H_p}{H_c}\frac{p}{c} > 1 \quad \text{iff} \quad r > r_M = \frac{\beta c \eta^* + \frac{c}{q(\eta^*)}(\pi+\rho)}{(1-\beta)\pi p} \tag{E.68}$$

To calculate relative elasticities of corruption pervasiveness, we first substitute η from equation (13) into (E.46), in order to rewrite it as a function of γ^*:

$$K(\gamma^*, k): \qquad (1-\pi s)r - (\rho+\pi)\frac{c}{q(f^{-1}(\gamma^*))} = (1-\beta)\pi pr + \beta[(1-\pi s)r + cf^{-1}(\gamma^*)] \tag{E.69}$$

where $f^{-1}(\gamma)$ denotes the inverse of function of $\gamma = f(\eta)$ in (13), which is an increasing function in γ.

Then we compute the elasticities and the relative effects in the same way as before. In particular, we obtain:

$$\frac{\varepsilon_{\gamma^*,\pi}}{\varepsilon_{\gamma^*,s}} = \frac{K_\pi}{K_s}\frac{\pi}{s} > 1 \tag{E.70}$$

$$\frac{\varepsilon_{\gamma^*,\pi}}{\varepsilon_{\gamma^*,p}} = \frac{K_\pi}{K_p}\frac{\pi}{p} > 1 \tag{E.71}$$

$$\frac{\varepsilon_{\gamma^*,p}}{\varepsilon_{\gamma^*,s}} = \frac{K_p}{K_s}\frac{p}{s} > 1 \tag{E.72}$$

$$\frac{\varepsilon_{\gamma^*,\pi}}{\varepsilon_{\gamma^*,c}} = \frac{K_\pi}{K_c}\frac{\pi}{c} > 1 \quad \text{iff} \quad r > r_L \tag{E.73}$$

$$\frac{\varepsilon_{\gamma^*,s}}{\varepsilon_{\gamma^*,c}} = \frac{K_s}{K_c}\frac{s}{c} > 1 \quad \text{iff} \quad r > r_H \tag{E.74}$$

$$\frac{\varepsilon_{\gamma^*,p}}{\varepsilon_{\gamma^*,c}} = \frac{K_p}{K_c}\frac{p}{c} > 1 \quad \text{iff} \quad r > r_M \tag{E.75}$$

which implies the ranking of inequalities provided in the text.

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