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Should civil society organizations cooperate or compete in fighting a corrupt government?

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Abstract: We consider a dynamic game with a corrupt government and multiple civil society organizations as the players. We characterize feedback Stackelberg equilibria with the government as leader and two civil society organizations as the followers who can compete or cooperate when deciding their monitoring efforts. Overall, the numerical results show that a cooperation yields a higher institutional quality and output than does the competitive regime as it does for both individuals and government payoff while the players invest less efforts. In a nutshell, we found that it is in the best interest of *both* the government and civil society organizations that the latter coordinate their actions and efforts and cooperate in fight against corruption.

Keywords: Civil society, corruption, differential games, feedback Stackelberg equilibrium

Résumé :   Nous considérons un jeu dynamique avec un gouvernement corrompu et des organisations civiles comme joueurs. Le jeu est à la Stackelberg, où le gouvernement est le leader et les organisations de la société civile suivent. Ces dernières peuvant coordonner ou non leurs stratégies de surveillance. Nous caractérisons et comparons les équilibres de Stackelberg en rétroaction. Nos résultats numériques montrent que la coopération entre les organisations civiles induit plus de résultats ainsi qu'une plus grande qualité institutionnelle que la non coopération. Aussi, les joueurs obtiennent un gain plus élevé. Contrairement à l'intuition, diviser pour mieux régner n'est pas la meilleure option pour le gouvernement.

Mots clés :   Société civile, corruption, jeux différentiels, équilibre de Stackelberg en rétroaction

1 Introduction

There is a growing recognition that good governance and institutions are the key engine for growth and economic development. Recent theoretical and empirical studies (see, e.g., Easterly (2001), Acemoglu et al. (2005), De (2010) and Ngendakuriyo (2013)) have revealed that institutional quality is a crucial determinant of economic growth. In particular, De (2010) pointed out that governance and institutions can have both direct and indirect influence on growth and income levels. This author highlighted that the direct influence is related to the role of governance in reducing transactions costs, which are far higher if economic actors and agents cannot fully trust property rights or the rule of law. On the other hand, governance quality can affect growth and income levels indirectly through its impact on other determining factors such as investments, trade, infrastructure, etc. In the contrary, the factors leading to failure and poor institutions such as corruption are harmful to economic development and ultimately rise the rent-seeking activities in the economy. While the fight against corruption relies generally on the role of government and policy makers, a wider involvement of all stakeholders in the society became paramount especially in the presence of a predatory government.

In his book, Wydick (2008) notes that although the state may ultimately emerge as the guardian of property rights, sometimes the problem may be the state itself contrary to the fact that for a long time economists regarded the government rather benignly in their theoretical models by treating economic agents as shrewd, utility and profit maximizers and treating the government and its agents as subservient ministers of the people, happily and passively transforming taxes into public goods.

Bhagwati (1982) used the term *direct unproductive profit-seeking* (DUP) activities to characterize economic behaviors that represent mere transfers of surplus rather surplus creation, typically by government officials through bribes. Yet Krueger (1974) argued that the opportunity for government officials to repatriate rents from the private sector redirects labor and resources from entrepreneurial rent-creation to bureaucratic rent-seeking, thereby stifling productive activity in the economy and generating corruption-induced development trap.

This phenomenon of corruption-induced development trap shall be amplified if a government itself invests in rent-seeking that leads to the so-called institutionalized corruption, which may call upon the citizens to invest individually or collectively their efforts in anti-corruption organizations. This recalls the idea of Heyden (1997) stating that civil society organizations evolve in the response to the inability of the State to meet the needs in terms of government accountability and governance's best practices of its citizens. Further, Hutter and O'Mahony (2004) argue that civil society organizations are formed for a number of reasons, but a central motivation factor is a belief that the State, or the government, is failing is some respect.

In the same direction, Transparency International (2013) deplored the fact that civil society organizations have been excluded by governments in the revision of the United Nations Convention Against Corruption (UNCAC) before the convention celebrates its 10 years in October 2013. While highlighting that "trust in government's commitment to fight corruption is declining," Transparency International considered that the debate on the how civil society organizations interact with the governments is not closed.

The citizens are therefore invited to play an important role in the fight against corruption to improve the institutional quality, which enhances the economic development and thus their well-being. Ngendakuriyo (2013) characterized a permanent interaction between an active civil society and a corrupt government, where civil society may protest or not (voice or loyalty) against the government abuse and the government may retaliate or not any protest from the citizens. Further, Ngendakuriyo and Zaccour (2013) extended this work by characterizing the subgame-perfect feedback equilibria of the game (*Voice, Retaliate*) and assessed whether it is better to commit (play open-loop strategies) or not in an institutional differential game. In the latter paper, the government and the civil society play a simultaneous game and individuals are considered identical.

However, the real world is such that there are more than one civil society organization. Hutter and O'Mahony (2004) note that civil society organizations vary enormously in their focus and organization, which requires to exercise caution in treating them as if they represent a homogeneous grouping. It is thus

interesting to study how this heterogeneity in civil society organizations affects the permanent interaction between government and citizens. Wydick (2008) mentioned that one of the fundamental human dilemmas is that individuals potentially stand to gain from competition as well as cooperation with one another.

Our objective is to introduce citizens heterogeneity and sequential strategic interaction. Indeed, we retain a leader-follower game, with the government acting as leader, while civil society organizations are followers who may compete or coordinate their strategies in the fight against government corruption. In a nutshell, the paper aims at answering the following questions:

(i) Is it optimal for civil society organizations to act individually or to cooperate?

(ii) Is it better for the government to face coordinated or competitive civil society organizations?

By comparing the results of the two equilibria (competitive versus coordination), we get the insights on the way each player, i.e., civil society and government, can strengthen its commitment in this conflicting game.

The rest of the paper is organized as follows. Section 2 introduces the model and Section 3 discusses the results. Section 4 briefly concludes.

2   The economy

We slightly modify the model in Ngendakuriyo and Zaccour (2013) by introducing individuals heterogeneity. We assume that the economy is populated by two heterogeneous representative consumers (or groups of citizens) who supply labor inelastically to produce output according to the following additive production function:

$$Y(t) = \alpha q(t) + \theta(t) F(L(t)),$$

where time t is continuous, with $t \in [0, \infty)$; $L(t) = L_1(t) + L_2(t)$ is the total amount of labor that the two consumers supply; $q(t)$ is the institutional quality; $\theta(t)$ is the total factor productivity (TFP) and α is a positive parameter, measuring the external impact of the institutional quality in the economy. We assume that institutions evolve according to the following dynamics:

$$\dot{q}(t) = b_1 w_1(t) + b_2 w_2(t) - \beta x(t), \qquad q(0) = q_0, \tag{1}$$

where $w_i(t)$ is the monitoring effort of individual $i = 1, 2$ and $x(t)$ is the government pressure. The positive parameter b_i captures the efficiency of monitoring effort by citizens group $i = 1, 2$, and the positive parameter β captures the impact of government pressure. Civil society improves the institutional quality, while the consumers' participation in the civil society reduces the amount of labor devoted to the production sector. Assuming that the time available to each consumer is normalized to one, then the time-allocation constraint for consumer i is $L_i(t) + w_i(t) = 1$.

Corrupt government takes a share $\phi_i(t)$ of consumer i's output share, so the non-corrupt agent is left with $(1 - \phi_i(t))$. We straightforwardly allow for differences across consumers in the rent accaparated by the government. We assume that the government pressure affects positively its share $\phi_i(t)$, while consumers' efforts affect negatively this rent, that is,

$$\phi_i(t) = \phi_i(x(t), w_1(t), w_2(t)), \quad i = 1, 2,$$

with $\phi_i'(x) > 0$ and $\phi_i'(w_i) < 0$ for $i = 1, 2$. In the absence of corruption, heterogeneous consumers will equally share the aggregate output since they have the same marginal productivity of labor. Consequently, the level of consumption at time t is

$$C_i(t) = (1 - \phi_i(x(t), w_1(t), w_2(t))) \frac{Y}{2}(t), \quad i = 1, 2,$$

and the production function becomes

$$Y(t) = \alpha q(t) + \theta(t) F(2 - w_1(t) - w_2(t)).$$

For simplicity, we retain an additive specification of the production function with an AK form for the second term with constant total factor productivity, that is, $\theta(t) = \theta, \forall t$. Further, without loss of generality we normalize θ to one. Consequently, we have

$$Y(t) = \alpha q(t) + L(t).$$

We assume quadratic cost functions for punishment mechanism by the government and civil monitoring effort by the civil society groups, i.e.,

$$g(x(t)) = \frac{(x(t))^2}{2}, \qquad f(w_i(t)) = \frac{(w_i(t))^2}{2}.$$

Further, we suppose that each player's utility function corresponds to her share of production, namely:

$$
\begin{aligned}
U_G(t) &= \sum_i^2 \phi_i(x(t), w_1(t), w_2(t)) \left(\frac{\alpha q(t) + L(t)}{2} \right), \\
U_i(t) &= (1 - \phi_i(x(t), w_1(t), w_2(t))) \left(\frac{\alpha q(t) + L(t)}{2} \right), \quad i = 1, 2,
\end{aligned}
$$

where the subscript G refers to the government. Furthermore, we retain a linear corruption technology, that is,

$$\phi_i(x(t), w_i(t), w_{3-i}(t)) = \kappa (\sigma x(t) - \eta_i w_i(t) - \varepsilon w_{3-i}(t)), \quad i = 1, 2,$$

where σ, η_i and ε are efficiency parameters, with $\eta_i > \varepsilon$, that is, own effect is larger than cross effect, and κ is a positive scaling parameter.

Denoting by ρ the common discount rate, the optimization problems of the government and consumer i are as follows:

$$
\begin{aligned}
J_G &= \max_{x(t)} \int_0^\infty e^{-\rho t} \left(U_G(t) - g(x(t)) \right) dt, \\
J_i &= \max_{w_i(t)} \int_0^\infty e^{-\rho t} \left(U_i(t) - f(w_i(t)) \right) dt,
\end{aligned}
$$

subject to the dynamics in (1). We shall omit from now on the time argument when no ambiguity may arise. Further, to save on the number of parameters, we normalize the three parameters of the corruption technology function to one, namely, $\sigma = \eta_1 = \eta_2 = 1$, for $i = 1, 2$, and consequently we have $\varepsilon \in (0, 1)$. Note that with this normalization, the two citizen groups are still asymmetric in the efficiency of their monitoring efforts b_i, which is sufficient for our purpose. Without any loss of generality, we suppose that $b_1 \geq b_2$, which allows to study both a symmetric case ($b_1 = b_2$) and an asymmetric case ($b_1 > b_2$). Substituting for the adopted functional forms, the above problems become

$$J_G = \max_{x(t)} \int_0^\infty e^{-\rho t} \left(\sum_i^n \frac{\kappa}{2} (x - w_i - \varepsilon w_{3-i})(\alpha q + 2 - w_i - w_{3-i}) - \frac{x^2}{2} \right) dt, \tag{2}$$

$$J_i = \max_{w_i(t)} \int_0^\infty e^{-\rho t} \left(\frac{1}{2} (1 - \kappa(x - w_i - \varepsilon w_{3-i}))(\alpha q + 2 - w_i - w_{3-i}) - \frac{w_i^2}{2} \right) dt, \quad i = 1, 2. \tag{3}$$

To warp up, by (2)–(3) and (1) we have defined a 3-player differential game with one control variable each, $w_i(t)$ for consumer $i = 1, 2$ and $x(t)$ for the government, and one state variable $q(t)$, with $w_i(t) \in [0, 1]$ and $x(t) \geq 0$.

3   Equilibria

We shall characterize and compare feedback Stackelberg equilibria, with the government as leader and the two civil society organizations as followers, in two scenarios. In the first scenario, the two civil society

organizations act non-cooperatively, whereas in the second they coordinate their strategies and maximize their joint payoff. We shall refer to the first scenario by $\mathcal{NC}$ and to the second by $\mathcal{C}$.

Although the game is of the linear-quadratic variety, and hence has an analytical solution, the expression of equilibrium strategies and payoffs are very large and not amenable to a qualitative analysis. We provide in the Appendix the basic steps in solving for both scenarios.

From now on, we shall focus on steady state solutions using numerical examples. After having normalized above some parameter values, the model still involves eight parameters, namely:

$$
\begin{aligned}
\text{Efficiency of institutions} &: \alpha; \\
\text{Evolution of quality of institutions} &: b_1, b_2, \beta; \\
\text{Corruption technology parameters} &: \kappa, \varepsilon; \\
\text{Discount rate} &: \rho; \\
\text{Initial institutional quality} &: q_0.
\end{aligned}
$$

From now on, we fix once for all the value of the discount rate ρ to 0.08 and the initial institutional quality q_0 to 0.5. As one can expect, the values of these parameters have only a quantitative impact on the results and do not affect much the qualitative insights that can be derived from them. For all remaining six parameters, we shall consider values in $(0, 1)$, which simplifies the comparisons. Further, we retain parameter values that lead to the existence of equilibrium in both competitive and cooperative regimes. We shall refer to the following values as the base case:

Table 1: Base case parameter values

Parameter	α	β	b_1	b_2	ε	κ
Value	0.1	0.3	0.4	0.3	0.1	0.7

Now, keeping $\alpha, \beta, \varepsilon$ and κ at their base-case values, we can determine the feasible region in (b_1, b_2)-space. The red region in Figure 1 corresponds to those values of (b_1, b_2) for which the two equilibria exist and are unique.[1]
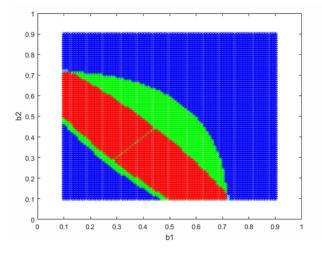

Figure 1: Admissible values in (b_1, b_2)**-space (red region)** Throughout the analysis below, we shall keep in mind that the government pressure exerts a negative impact on the institutional quality while the civil society monitoring efforts influence positively the institutional quality. Further, the civil society monitoring effort has a direct negative effect (DNE) and an indirect positive effect (IPE) on the output at the steady state. In addition, the government pressure exerts a positive impact on the government corruption while the civil society efforts influence negatively this rent.

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[1]In the parlance of differential games, the game at hand is of the linear-quadratic variety and in both $\mathcal{NC}$ and $\mathcal{C}$ mode of play, the equilibrium solution is here unique.

3.1 Sensitivity analysis

To see the impact of varying the parameter values on steady-state equilibrium results, we run a sensitivity analysis. Note that when varying a parameter, the other parameters are kept at their base-case values. Table 2 reports the results of sensitivity analysis in the asymmetric case, i.e., $b_1 = 0.4 > b_2 = 0.3$. Denote by $V_G(q)$ the value function of the government and by $V_i(q)$ the value function of consumer $i = 1, 2$. In both equilibria, the civil society monitoring efforts and the corruption rates similarly react to a change in one parameter for $i = 1, 2$ as do the individual payoff of each of the two groups. Under the cooperative regime, V is the joint payoff of the two groups.

Table 2: **Sensitivity Analysis** $(b_1 > b_2)$

	Competitive ($\mathcal{NC}$)							Cooperative ($\mathcal{C}$)						
	w_i^{ss}	x^{ss}	q^{ss}	Y^{ss}	ϕ_i^{ss}	V_i	V_G	w_i^{ss}	x^{ss}	q^{ss}	Y^{ss}	ϕ_i^{ss}	V	V_G
$\alpha \uparrow$	↓	↓	↓	↓	↓	↑	↓	↓	↓	↓	↓	↓	↑	↓
$\beta \uparrow$	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
$b_i \uparrow$	↓	↓	↓	↓	↓	↑	↓	↓	↓	↓	↓	↓	↓	↓
$\varepsilon \uparrow$	↑	↑	↑	↑	↓	↑	↓	↓	↓	↓	↓	↓	↑	↓
$\kappa \uparrow$	↓	↓	↓	↓	↑	↓	↓	↓	↓	↓	↓	↑	↓	↓

The results reported in Table 2 call for the following comments:

1. In both regimes, a higher institutional efficiency α leads to a lower civil society monitoring effort, government pressure, and corruption rate. Due to less investment in monitoring efforts, the institutional quality decreases as do the output and the corruption rates, which results in decrease of the corrupt agent's payoff while the individuals' payoff increases.

2. In both regimes, a higher β leads to higher civil society monitoring effort, government pressure, institutional quality, output and corruption rate. Further, the individual payoffs increase. The positive institutional effect (IPE) dominates the direct negative effect (DNE) on output.

3. In both equilibria, a higher b_i, $i = 1, 2$ leads to lower civil society monitoring efforts, government pressure, institutional quality, corruption rates, output and higher individual profits. As the civil society monitoring effort becomes efficient, individuals need to invest less in their monitoring efforts. The government's payoff decreases.

4. In the competitive equilibrium, a higher ε leads to a higher civil society monitoring effort, government pressure, institutional quality, output and civil society's payoff. The corrupt agent pays the price as the corruption rate decreases as well as her payoff. In the cooperative regime, a higher ε leads to a lower civil society monitoring effort, government pressure, institutional quality, and output. The civil society's payoff increases while corruption rates and the government payoff decrease. In both equilibria, the indirect positive effect (IPE) dominates the direct negative effect (DNE) on output.

   The Cross-effort effect is different in competitive and cooperative regime. As one group becomes more efficient with possibility to invest less in the monitoring effort, the other group also invests less monitoring effort if the two groups cooperate while under competition the competing groups still invest more monitoring efforts.

5. In both equilibria, an increase of the share κ in the output of the corrupt agent leads to a lower civil society monitoring effort, government pressure, institutional quality and a lower output. The indirect positive institutional effect (IPE) dominates the direct negative effect (DNE) on output. Consequently, both the civil society and government payoffs decrease. However, the corruption rates increase in the cooperative regime and decrease under competitive equilibrium.

In both equilibria, the effect of the government pressure on the corruption rate dominates the effect of the civil society monitoring effort except after an increase in the cross-effort parameter.

We now look at the symmetric case, i.e., $b_1 = b_2$, which will shed a light on the impact on the results of having asymmetric monitoring efficiencies. In this fully symmetric setting, we have at steady state $w_1^{ss} = w_2^{ss} = w^{ss}$, $\phi_1^{ss} = \phi_2^{ss} = \phi^{ss}$, and $V_1 = V_2 = \bar{V}$.

Table 3: Sensitivity Analysis $(b_1 = b_2 = 0.4)$

	Competitive ($\mathcal{NC}$)							Cooperative ($\mathcal{C}$)						
	w^{ss}	x^{ss}	q^{ss}	Y^{ss}	ϕ^{ss}	$\bar{V}$	V_G	w^{ss}	x^{ss}	q^{ss}	Y^{ss}	ϕ^{ss}	V_C	V_G
$\alpha \uparrow$	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
$\beta \uparrow$	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
$b \uparrow$	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
$\varepsilon \uparrow$	↑	↑	↑	↑	↓	↑	↓	↓	↓	↓	↓	↓	↑	↓
$\kappa \uparrow$	↓	↓	↓	↓	↑	↓	↓	↓	↓	↓	↓	↑	↓	↓

Comparing the results in Table 3 to those in Table 2, we conclude that the impact, qualitatively speaking, on strategies and outcomes of varying either of the corruption technology parameters (κ, ε) or the government pressure parameter β is the same in both scenarios, i.e., same or different values for monitoring efficiency. The results for the two other parameters are quite similar in general, with the only following exceptions: (i) In both equilibria, a higher α increases (decreases) the payoffs of civil society organizations when they are asymmetric (symmetric) in monitoring efficiency. (ii) In the competitive equilibrium, a higher b_i increases (decreases) the payoffs of civil society organizations when they are asymmetric (symmetric) in monitoring efficiency.

3.2 Comparison

The following comparisons are valid for the whole red region in Figure 1, that is, the region where the parameters $\varepsilon, \alpha, \kappa$ and β are kept at their base-case values and b_1 and b_2 take different values. For each parameter values constellation, we retrieve the steady state values for the two regimes. Table 4 illustrates the kind of results we get in the base case.

Table 4: Results at steady state in the base case

	w_1	w_2	x	Y	ϕ_1	ϕ_2	q	V_1	V_2	$V_1 + V_2$	V_G
$\mathcal{NC}$	0.4731	0.4733	1.1040	2.1916	0.4086	0.4084	11.3792	6.7024	6.7031	13. 4055	3.5719
$\mathcal{C}$	0.4653	0.4554	1.0757	2.6676	0.3954	0.4017	15.8828			17.4058	6.0578

We summarize our results in a series of claims and answer by the same token our research questions.

Claim 1 *The two steady-state equilibrium values compare as follows:*

$$\text{Monitoring and pressure efforts}: \omega_i^{NC} > \omega_i^{C}, \qquad x^{NC} > x^{C},$$
$$\text{Production and share of government}: Y^{NC} < Y^{C}, \qquad \phi_i^{NC} > \phi_i^{C},$$
$$\text{Quality of institutions}: q^{NC} < q^{C},$$
$$\text{Payoffs}: V_i^{NC} < \frac{1}{2}V^{C}, \qquad V_G^{NC} < V_G^{C}.$$

The steady-state equilibrium results shows that the cooperative regime yields a much higher institutional quality and output than does the competitive regime. However, both government and individuals invest more in their efforts leading to a much higher corruption rate in competitive regime than under cooperation. Consequently, individuals obtain higher payoffs when they cooperate and the government payoff is also higher when individuals cooperate than when they act individually. This answers to our research questions. The fact that the civil society organizations achieve a better result when they cooperate is intuitive. In the case of government, this might sound as a counter factual result as one shall expect that a predatory government prefers facing uncoordinated civil society organizations. This result can be interpreted as follows: When the

two followers cooperate, a rational government will anticipate that they invest less monitoring efforts and allocate a significant proportion of their labor to productive activities. Consequently, this will increase the output and the government rent as share of the consumers' output diverted from corruption.

Claim 2 *When the two civil society organizations compete, the steady-state equilibrium values compare as follows:*

$$\omega_1^{NC} < \omega_2^{NC}, \qquad \phi_1^{NC} > \phi_2^{NC}, \qquad V_1^{NC} < V_2^{NC}; \qquad V_i^{NC} > V_G^{NC}, \qquad i = 1, 2.$$

Claim 3 *Within the cooperative regime, the steady-state equilibrium values compare as follows:*

$$\omega_1^C > \omega_2^C, \qquad \phi_1^C < \phi_2^C, \qquad V > V_G, \qquad with\ V = V_1 + V_2.$$

In the competitive equilibrium, the most efficient civil society organization invests less monitoring effort in fighting against corruption but pays the price as the corrupt agent takes a large proportion of her output and consequently she obtains less amount of payoffs compared to the relatively inefficient group. Further, in competitive regime, individually and thereafter collectively, the payoffs of the two groups are higher than the payoff of the corrupt government.

In cooperative regime, the most efficient group slightly invests more efforts than the inefficient one and consequently looses a small proportion of her output compared to the inefficient group. The joint payoff of the consumers is also greater than the corrupt agent's payoff.

4   Conclusion

Taking cognizance that good governance and institutions are the key engine of growth and economic development, this paper investigates the role of the citizens in improving the institutional quality through the fight against government corruption.

As the citizens shall invest their efforts in anti-corruption organizations while a predatory government invests in retaliation mechanisms, our research questions were as follows; (i) Is it optimal for civil society organizations to act individually or to cooperate?, and (ii) Is it better for the government to face coordinated or competitive civil society organizations? To answer these questions, we characterized and compared feedback Stackelberg equilibria, with the government as leader and the two civil society organizations as followers who can cooperate or compete. The analytical expressions of the equilibrium strategies and payoffs being very large and not amenable to a qualitative analysis, we focused on the steady state solutions using numerical examples.

Our numerical results show that the two groups will be better off if they coordinate their actions and efforts and cooperate in fight against government corruption as they invest less efforts in monitoring activities and obtain higher playoffs. Further, a corrupt government will be better off if the two civil society organizations cooperate. The cooperation of the civil society organizations improves the institutional quality which yields to higher output as in Easterly (2001), Acemoglu et al. (2005) and Ngendakuriyo (2013) who pointed out that institutional quality is a crucial cause of the economic growth. Although the happiness of a predatory government facing coordinated civil society organizations may sound as a counter factual result, a rational corrupt government shall prefer to see citizens allocating significant proportion of their time to productive activities, which will subsequently increase the government payoff.

Some subsequent research avenues are of interest: (i) the analysis of the game where the government and the civil society agree to set up a cooperative framework that is Pareto-improving and which prevents the government to cheat and deviate from the cooperation platform; (ii)the characterization of an optimal switching time where the equilibrium moves from a regime with corruption to a free-corruption regime. Here the idea implies a two-stage analysis where government corruption persists in the first stage while questioning the level of efforts to be invested by the society to remove completely the government corruption in the second stage.

A Appendix

A.1 Competitive civil society organizations

Recall that the objective functionals are given by

$$
\begin{aligned}
J_G &= \max_{x(t)} \int_0^\infty e^{-\rho t} \left(\sum_i^n \frac{\kappa}{2} \left(x - w_i - \varepsilon w_{3-i} \right) \left(\alpha q + 2 - w_i - w_{3-i} \right) - \frac{x^2}{2} \right) dt, \\
J_i &= \max_{w_i(t)} \int_0^\infty e^{-\rho t} \left(\frac{1}{2} \left(1 - \kappa \left(x - w_i - \varepsilon w_{3-i} \right) \right) \left(\alpha q + 2 - w_i - w_{3-i} \right) - \frac{w_i^2}{2} \right) dt, \ i = 1, 2,
\end{aligned}
$$

and the state dynamics by

$$
\dot{q}(t) = b_1 w_1(t) + b_2 w_2(t) - \beta x(t), \quad q(0) = q_0.
$$

Denoting by $V_i(q)$ the value function of player $i = 1, 2, G$, the Hamilton-Jacobi-Bellman equations of the three players are given by:

$$
\rho V_i(q) = \max_{w_i} \left\{ \frac{1}{2} \left(1 - \kappa \left(x - w_i - \varepsilon w_{3-i} \right) \right) \left(\alpha q + 2 - w_i - w_{3-i} \right) - \frac{w_i^2}{2} \right.
$$
$$
\left. + V_i'(q) \left(b_i w_i + b_{3-i} w_i - \beta x \right) \right\}, \quad i = 1, 2, \quad (4)
$$

$$
\rho V_G(q) = \max_x \left\{ \frac{\kappa}{2} \left(2 - w_1 - w_2 + \alpha q \right) \left(\left(2x - \left(1 + \varepsilon \right) \left(w_1 + w_2 \right) \right) \right) - \frac{x^2}{2} + V_G'(q) \left(b_1 w_1 + b_2 w_2 - \beta x \right) \right\} \quad (5)
$$

Assuming interior solution, maximizing the right-hand side of the HJB equations in (4) yields:

$$
\frac{1}{2} \left(1 + \kappa \right) \left(\alpha q + 2 - w_1 - w_2 \right) - \frac{1}{2} \left(1 - \kappa \left(x - w_1 - \varepsilon w_2 \right) \right) - w_1 + V_1' b_1 = 0,
$$
$$
\frac{1}{2} \left(1 + \kappa \right) \left(\alpha q + 2 - w_2 - w_1 \right) - \frac{1}{2} \left(1 - \kappa \left(x - w_2 - \varepsilon w_1 \right) \right) - w_2 + V_2' b_2 = 0.
$$

Solving the above equations gives the following reaction functions of the two civil organizations:

$$
\begin{aligned}
w_1(q, x) &= \frac{\left(\left(1 + \kappa \right) \alpha q + 2 \left(1 + \kappa \right) - 1 + \kappa x + 2 V_2' b_2 \right)}{\left(\kappa \varepsilon + 4 + 3\kappa \right)} + \frac{2 \left(V_1' b_1 - V_2' b_2 \right)}{\kappa \left(1 - \varepsilon \right)} \left(\frac{3 + 2\kappa}{\kappa \varepsilon + 4 + 3\kappa} \right) \\
w_2(q, x) &= \frac{1}{\left(\kappa \varepsilon + 4 + 3\kappa \right)} \left(\left(1 + \kappa \right) \left(2 + \alpha q \right) - 2 \left(V_1' b_1 - V_2' b_2 \right) \left(\frac{1 + \kappa + \kappa \varepsilon}{\kappa \left(1 - \varepsilon \right)} \right) - 1 + \kappa x + 2 V_2' b_2 \right)
\end{aligned}
$$

The next step is to insert the above reaction functions in the government HJB equation to obtain

$$
\rho \tilde{V}_G(q) = \max_x \left\{ \frac{1}{2} \left(\frac{\left(2 + q\alpha \right) \left(\kappa \left(1 + \varepsilon \right) + 1 \right) + 2 \left(1 - x\kappa \right) - 2q \left(b_1 V_1' + b_2 V_2' \right)}{3\kappa + \kappa \varepsilon + 1} \right) \times \right.
$$
$$
\left(\kappa \left(\frac{x \left(1 + \kappa \right) - x\kappa\varepsilon - 2 \left(2\kappa + q \left(b_1 V_1' + b_2 V_2' \right) + q\alpha\kappa - 1 \right) \left(1 + \varepsilon \right)}{3\kappa + \kappa \varepsilon + 1} \right) \right) - \frac{x^2}{2} + \quad (6)
$$

$$
\frac{\tilde{V}_G'(q) b_1}{\left(3\kappa + \kappa\varepsilon + 1 \right) \left(\kappa - \kappa\varepsilon + 1 \right)} \left(-1 + \kappa \left(1 + \varepsilon \right) + \kappa \left(x + q\alpha \right) + \right. \quad (7)
$$

$$
\left(1 - \varepsilon \right) \kappa^2 \left(2 + x + q\alpha \right) - 2q\kappa b_2 V_2' \left(1 + \varepsilon \right) + 2q b_1 V_1' \left(1 + 2\kappa \right) \right) + \quad (8)
$$

$$
\frac{\tilde{V}_G'(q) b_2}{\left(3\kappa + \kappa\varepsilon + 1 \right) \left(\kappa - \kappa\varepsilon + 1 \right)} \left(-1 + \kappa \left(1 + \varepsilon \right) + \kappa \left(x + q\alpha \right) + \left(1 - \varepsilon \right) \kappa^2 \left(2 + x + q\alpha \right) \quad (9)
$$

$$
\left. -2q\kappa b_1 V_1' \left(1 + \varepsilon \right) + 2q b_2 V_2' \left(1 + 2\kappa \right) \right) - \tilde{V}_G'(q) \beta x \right\} \quad (10)
$$

Differentiating the right-hand side with respect to x and equating to zero yields the government policy, that is, $x(q)$. Next, we substitute for $x(q)$ in $w_1(q,x)$ and $w_2(q,x)$ to get the policies $w_1(q)$ and $w_2(q)$, and next in the HJB equations. Since the dynamic game is of the linear-quadratic variety, we make the informed guess that the HJB equations are quadratic and given by

$$\tilde{V}_1(q) = \tilde{a}_{11} + \tilde{a}_{12}q + \frac{\tilde{a}_{13}}{2}q^2,$$
$$\tilde{V}_2(q) = \tilde{a}_{21} + \tilde{a}_{22}q + \frac{\tilde{a}_{23}}{2}q^2, \tag{11}$$
$$\tilde{V}_G(q) = \tilde{a}_{31} + \tilde{a}_{32}q + \frac{\tilde{a}_{33}}{2}q^2,$$

where $\tilde{a}_{kl}, k, l = 1, 2, 3$ are the unknown value-function coefficients, which can be identified by replacing $\tilde{V}_1(q), \tilde{V}_2(q), \tilde{V}_G(q)$ as well as their first derivatives in the problem (4)-(5). We do not give the expressions of $\tilde{a}_{kl}, k, l = 1, 2, 3$ because they are extremely long and of no qualitative interest.

The steady state is obtained by setting $\dot{q}(t) = 0$ in

$$\dot{q}(t) = b_1 w_1(t) + b_2 w_2(t) - \beta x(t), \qquad q(0) = q_0, \tag{12}$$

and solving.

A.2   Collusive civil society organizations

Now, the leader (Government) faces two civil society organizations that maximize the sum of their payoffs. Consequently, the Hamilton-Jacobi-Bellman equations are as follows:

$$\rho \bar{V}_C(q) = \max_{w_1, w_2} \left\{ \frac{1}{2} \left(\theta(2 - w_1 - w_2) + \alpha q \right) \left(2 - \kappa(2x - w_1 - w_2 + \varepsilon(w_1 + w_2)) \right) \right.$$
$$\left. - \frac{w_1^2}{2} - \frac{w_2^2}{2} + \bar{V}_C'(q)(b_1 w_1 + b_2 w_2 - \beta x) \right\} \tag{13}$$

$$\rho \bar{V}_G(q) = \max_{x} \left\{ \frac{1}{2} \left(\theta(2 - w_1 - w_2) + \alpha q \right) \left(\kappa(2x - w_1 - w_2 + \varepsilon(w_1 + w_2)) \right) \right.$$
$$\left. - \frac{x^2}{2} + \bar{V}_G'(q)(b_1 w_1 + b_2 w_2 - \beta x) \right\} \tag{14}$$

where w_1 and w_2 are the reaction functions of the followers. We proceed as in the previous problem and end up with the following expressions for the value functions:

$$\bar{V}_C(q) = \bar{a}_{11} + \bar{a}_{12}q + \frac{\bar{a}_{13}}{2}q^2 \tag{15}$$

$$\bar{V}_G(q) = \bar{a}_{21} + \bar{a}_{22}q + \frac{\bar{a}_{23}}{2}q^2 \tag{16}$$

where $\bar{a}_{kl}, k = 1, 2, l = 1, 2, 3$ are the unknown value-function coefficients, which are determined by identification.

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