Economics Letters 120 (2013) 149–154

Contents lists available at SciVerse ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Fighting corruption: To precommit or not?☆

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HIGHLIGHTS

- We model strategic interactions between a corrupted government and civil society.
- We characterize and compare pre-commitment and Markov-perfect Nash equilibria.
- We find that civil society is better off pre-committing to fighting corruption.
- We also obtain that the government prefers not to commit to repression.

ARTICLE INFO

Article history:
Received 9 January 2013
Received in revised form
28 March 2013
Accepted 11 April 2013
Available online 18 April 2013

JEL classification:
C7
H8

Keywords:
Corruption
Differential games
Commitments

ABSTRACT

We consider a differential game with a corrupt government and civil society as its players. We characterize open-loop and feedback Nash equilibria and find that, whereas it is in the best interest of the government not to commit to a repression policy, civil society is better off precommitting to fight corruption.

1. Introduction

The literature on institutional economics has highlighted that good institutions create a good environment for the development process (Rutherford, 2001; North, 1990). Several studies have found that institutions exert a strong and positive effect on growth (e.g., Acemoglu et al. (2005), Gwartney et al. (2006)). Mamoon and Murshed (2009) stated that the quality of institutions such as the rule of law, voice and accountability, political stability, regulatory quality, control of corruption and government effectiveness are all prerequisites for economic development. Morten and Malchow-Moller (2005) argued that corruption, lack of law and inconsistent rules create poor institutions, which may be the site of non-productive activities such as diversion of funds and rent-seeking resulting in low growth. These situations raise the question of how to effect institutional change, from poor to efficient institutions.

Some authors, e.g., Zak (2002), Kingston and Caballero (2009) and Bidner and François (2010), pointed out the central role of a political actor (state or government) in implementing efficient institutions while individuals or organizations are engaged in collective action to change rules for their own interests. Ngendakuriyo (2013) studied institutional change in the context where a corrupt government faces an active civil society where consumers may combine their efforts to protest against government abuse. Following Hirschman (1970) and Dowding et al. (2000), two sets of strategies were differentiated: S_1 for Civil society, with $S_1 = \{Voice, Loyalty\}$ and S_2 for Government, with $S_2 = \{Retaliate, Not\ Retaliate\}$. Two cases were solved, namely, a one-agent differential game (*Voice*, *Not Retaliate*) and a two-agent open-loop differential game (*Voice*, *Retaliate*).

A drawback of open-loop equilibrium is that it is not subgame perfect, and therefore, is conceptually less attractive than the subgame-perfect feedback equilibrium, where strategies are a function of the state (here, quality of institutions). Still, it is of

☆ Research supported by NSERC Canada. We would like to thank the reviewer for very helpful comments.

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http://dx.doi.org/10.1016/j.econlet.2013.04.025

great interest to address the following question in the context of our institutional game: are there circumstances under which the players are better off precommitting to a course of action (i.e., playing open-loop strategies) than using more sophisticated state-dependent strategies (i.e., adopting Markov-perfect or feedback strategies)? To answer this question, we characterize and compare open-loop and feedback-Nash equilibria in the game (*Voice*, *Retaliate*). This comparison will allow us to qualify the value (or disutility) of precommitment by civil society in combating corruption, and of precommitment by government to repression.

2. The economy

Consider a developing country with substantial public involvement in the production sector. The private sector is not sufficiently developed, and the government owns the firm. The economy is populated by a continuum of identical consumers who inelastically supply labor to produce output according to the following additive production function:

$$Y(t) = \alpha q(t) + \theta(t)F(L(t)), \tag{1}$$

where $L(t)$ is the amount of labor, $q(t)$ is the institutional quality, and $\theta(t)$ is the total factor productivity (TFP) at time t, with $t \in [0, \infty)$ and α is a positive parameter. The institutional quality evolves according to the linear-differential equation

$$\dot{q}(t) = bw(t) - \beta x(t), \qquad q(0) = q_0 \geq 0 \tag{2}$$

where $w(t)$ is the civil-monitoring effort, $x(t)$ is the government pressure, and b and β are positive efficiency parameters.

As in Barro (1990), we assume that corruption affects public expenditures and the output produced is shared between a corrupt agent (government) and a non-corrupt one (consumer). The government takes a share $\phi(x)$ of the public-good production, and the consumer takes $(1 - \phi(x))$, where $0 < \phi(x) < 1$, and $\phi'(x) > 0$.

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 is

$$L(t) + w(t) = 1. \tag{3}$$

The consumption at time t is $C(t) = (1 - \phi(x(t)))Y(t)$ and the production function becomes

$$Y(t) = \alpha q(t) + \theta(t)F(1 - w(t)). \tag{4}$$

In (4), we can distinguish two opposite effects of w on production: an indirect positive effect coming from the institutional component and a direct detrimental effect that is a direct consequence of the time-allocation constraint. To keep the model simple, without much loss of qualitative insight, we retain: an additive specification of the production function with an AK form for the second term with constant TFP, $Y(t) = \alpha q(t) + \theta L(t)$; quadratic-cost functions for the civil-monitoring effort $f(w(t)) = \frac{(w(t))^2}{2}$ and implementation of punishment mechanisms $g(x(t)) = \frac{(x(t))^2}{2}$; linear utility functions for players, corresponding to their shares in production,

$$U_G(t) = \phi(x)[\alpha q(t) + \theta(t)L(t)],$$
$$U_C(t) = (1 - \phi(x))[\alpha q(t) + \theta(t)L(t)],$$

where G stands for *G*overnment and C for *C*onsumer (or *C*ivil society). We assume a linear corruption technology $\phi(x) = \kappa x$. Denoting by ρ the common discount rate, and omitting from now on the time argument when no ambiguity may arise, the optimization problems of the Government and Consumer are as follows:

$$\Pi_G = \max_{x_t} \int_0^\infty e^{-\rho t}\left[\kappa x(\alpha q + \theta(1 - w)) - \frac{x^2}{2}\right]dt, \tag{5}$$

$$\Pi_C = \max_{w_t} \int_0^\infty e^{-\rho t}\left[(1 - \kappa x)(\alpha q + \theta(1 - w)) - \frac{w^2}{2}\right]dt, \tag{6}$$

subject to (2).

To wrap up, by (5)–(6) and (2) we defined a two-player differential game with state variable $q(t)$ and control variables $w(t)$, $x(t)$, with $0 < w < 1$ and $0 < \kappa x < 1$.

3. Equilibria

The next propositions characterize the feedback- and open-loop Nash equilibria, to which we refer by F and OL, respectively. Superscript ss refers to a steady-state value. As is usual in an infinite-horizon setting, we seek stationary strategies and focus the analysis on steady-state values.

Proposition 1. *Assuming an interior solution, the unique steady-state feedback-Nash equilibrium is given by*

$$w_F^{ss} = \frac{\beta\left(a_2 b\left(r_1\beta - \alpha\kappa\right) - \beta\left(a_1 b r_2 + r_1\theta\right) + \theta\kappa\left(a_1 b + \alpha\right)\right)}{a_1 b(b + \beta\theta\kappa) + (\beta - b\theta\kappa)(r_1\beta - \alpha\kappa)}, \tag{7}$$

$$x_F^{ss} = \frac{b\left(a_2 b\left(r_1\beta - \alpha\kappa\right) - \beta\left(a_1 b r_2 + r_1\theta\right) + \theta\kappa\left(a_1 b + \alpha\right)\right)}{a_1 b(b + \beta\theta\kappa) + (\beta - b\theta\kappa)(r_1\beta - \alpha\kappa)}, \tag{8}$$

and the institutional quality by

$$q_F^{ss} = \frac{-a_2 b(b + \beta\theta\kappa) + \theta\left(\beta\kappa\left(b r_2 + \theta + 1\right) - b\theta\kappa^2 + b\right) - r_2\beta^2}{a_1 b(b + \beta\theta\kappa) + (\beta - b\theta\kappa)\left(r_1\beta - \alpha\kappa\right)}, \tag{9}$$

where a_i and r_i, $i = 1, 2$, are the coefficients of the value functions of the consumer and government,

$$V_C(q) = \frac{a_1}{2}q^2 + a_2 q + a_0,$$
$$V_G(q) = \frac{r_1}{2}q^2 + r_2 q + r_0.$$

The above steady-state values require that $0 < w_F^{ss} < 1$, $0 < \kappa x_F^{ss} < 1$ and $q_F^{ss} > 0$.

Proof. See the Appendix. □

The quadratic value functions are a by-product of the linear-quadratic structure of the differential game. The linear strategies are as follows:

$$w_F(q) = \frac{q\left(a_1 b + \theta\kappa\left(\alpha\kappa - r_1\beta\right)\right)}{1 + \theta^2\kappa^2} + \frac{a_2 b + \theta\left(-r_2\beta\kappa + \theta\kappa^2 - 1\right)}{1 + \theta^2\kappa^2}, \tag{10}$$

$$x_F(q) = -\frac{q\left(a_1 b\theta\kappa + r_1\beta - \alpha\kappa\right)}{1 + \theta^2\kappa^2} + \frac{\theta\kappa\left(-a_2 b + \theta + 1\right) - r_2\beta}{1 + \theta^2\kappa^2}. \tag{11}$$

It can be shown that the coefficients satisfy

$$a_1 < 0, \qquad r_1 < 0, \qquad a_1 q + a_2 > 0, \qquad r_1 q + r_2 > 0.$$

This leads to

$$w_F'(q) = \frac{a_1 b + \theta\kappa\left(\alpha\kappa - r_1\beta\right)}{1 + \theta^2\kappa^2} \quad \text{is} \quad \begin{cases} \geq 0 & \text{if } \theta\kappa^2\alpha \geq \theta\kappa r_1\beta - a_1 b \\ \leq 0 & \text{if } \theta\kappa^2\alpha \leq \theta\kappa r_1\beta - a_1 b \end{cases},$$