Do the Military Give Up Power? *

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This version: March 9, 2012

Abstract

We investigate the design of institutions, both economic and political, and the balance of power between the citizenry and a specialist in violence (an agent capable of enforcing the law, e.g. property rights). We take the view that violence is a particular asset in two respects. First, violence may be used by the specialist to predate on their own citizens. Second, decision rights over its use cannot truly be transferred. We study the incentives that a monopolist specialist in violence has in (i) designing social contracts and (ii) delegating decision rights to citizens/democratizing. Social contracts move the economy toward efficiency. When violence is highly effective, social contracts come along with political institutions.

Keywords: Democratization, Institutions, Property Rights.
JEL Classification Numbers: D23, D74, D78, P14.

*We are particularly indebted to Alberto Bisin, Patrick Rey and Andrei Shleifer for very useful comments and suggestions. We also thank seminar participants at Harvard University for useful discussion during this preliminary draft.

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1 Introduction

Walking through history, from ancient times, passing through the Middle Age, and finally until modern times the issue of violence, absolutism, autocracy, dictatorship and democracy (the other face of the coin) has always been present. Many scholars (economists, political scientists, and social scientists in general) have been concerned with the analysis of this phenomenon: how to keep in check State's power?

Societies are pervaded by specialists in violence. It may be argued that societies also need specialists in violence, for instance to enforce public order. In the spirit of Buchanan (1975), we take the (admittedly) stark view according to which people are divided into two categories: specialists in violence/expropriation, and specialists in production of a final output. The former owns the technology to expropriate the latter, but in order to do that, some surplus has to be created in the economy.

Then, specialists in violence recognize that employing violence has a mean to enforce property rights among economic agents (i.e. public order) contribute to surplus' creation. In the literature (Smith (1776), De Long and Shleifer (1993)) it is often argued that economic prosperity and secured property rights go hand in hand. If we take a canonical definition of property rights:

> A property right gives the owner of an asset the right to the use and benefits of the asset, and the right to exclude others from them. It also, typically, gives the owner the freedom to transfer these rights to others.

we then understand that property rights have to be secured not only in a *horizontal* dimension (i.e. public order), but in a *vertical* one also: specialists in violence have to secure property rights against their own expropriation. This point have been made by Djankov et al. (2003).

Hence, specialists in violence and economic agents may enter into a social contract, where a social contract is (*i*) the choice over the investment in violence and (*ii*) of a tribute. Then which provision of *economic institutions* (law enforcement, contract enforcement, public order) is exchanged for taxation. The question arises: who is choosing the social contract?

Since specialists in violence own the technology to expropriate/protect, they ultimately always choose their investment, i.e. violence acts as a *non-transferrable* asset. This makes the issue of delegation of decision rights over the social contract particularly hard to be tackled. If we take a broad definition of democratization as:

> Democratization means increases in the breadth and equality of relations between governmental agents and members of the governments subject populations, in binding consultation of a government subject population with respect to governmental personnel, resources, and policy, and in protection of that population (...) from arbitrary actions by governmental agents.

then for democratization to occur, we need delegation to occur. Dictatorships around the world, especially in North African and Latin American Countries, recall us how difficult is the issue of delegation and democratization, and how widespread is military rule.[1] Egypt today, even after revolution, is still stuck in a new military regime not willing to relinquish power to a democratically elected Parliament, especially on the matter of budget defense.[2]

The mere presence of a social contract, whoever is empowered to choose it, aims at solving the problem of commitment among specialists in violence and the citizenry (i.e. economic agents). Lack of commitment rests on both parties. Hence, it is not only relevant to keep in check specialists' power, but economic agents temptation to renege also.

Naturally, specialists in violence would like to increase the surplus created, so as extract it (*via* either predation, or taxation). On one hand, weak specialists tend to inefficiently over-invest in economic institutions because of economic agents' temptation to renege. Over-investment allows them in order to get stronger and extract more. On the other hand, strong specialists tend to inefficiently under-invest in order to insure participation by economic agents.

Then, the social contract allows a movement toward an efficient production in the economy. If the social contract solves commitment problems, why do we need political institutions? If political institutions are intended as means of keeping in check specialists' power, i.e. as *coercion-constraining institutions* (Greif 2005), those institutions aim at solving the same commitment problem solved by the social contract. We broadly refer to freedom of associations, of expression, of carrying weapons, and to representative assemblies and constitution also. Political institutions create a stronger countervailing power to specialists in violence, thus enhancing commitment.

[1] We want to emphasize at this point that we deal with investment in violence, and law enforcement in general. We do not investigate delegation of decision rights over other policies not affecting the military regime.

[2] See New York Times, *Muslim Brotherhood Demands Military Cede Power in Egypt*, 9th February 2012.

To answer our last question, we show that in a social contract, movements toward efficiency are always matched by higher temptation to renege on the contract (by one of the two parties). Impatient agents, or impatient strong specialists are not able to sign any social contract capable of moving allocation from the static one (without commitment). After all, Finer (1997) points out how the *coercion-extraction cycle* has been employed several times in history by despotic rulers (especially in XVI century France and Spain).

Then political institutions may serve the purpose of improving the set of sustainable social contracts. However, those institutions would be granted only in presence of an impatient strong specialists.

This result shows first that dictatorships may be efficient from an economic viewpoint. Social contracts stand-alone can solve commitment problems. Political institutions arrive when expropriation technology is overwhelmingly efficient with respect to production one, and when specialists are impatient. They serve the useful purpose of moving the economy toward efficiency. Rebellions, leading to political institutions, often blow in period of deep economic crisis indeed.

However, as our previous discussion of delegation pointed out, the military often tends to keep decision rights over the investment in violence.

1.1 Literature

Lately, the economic and political literature on the relationship between the military and the civilians has grown impressively.

We are mainly related to the strand of literature studying the theory of the State, as in Buchanan (1975). Nozick (1974) also tackles the problem of the State in its role of protective Agency. This problem also constitutes the main concern of of Przeworsky (1988) and Tilly (2004), where the problem of democratization is explicitly posed as a problem of delegation of decision rights from specialists in violence to citizens.

North (1999) highlights how pressing has been the commitment issue between rulers and subjects throughout history. The distinction between motivational and imperative credibility of commitment strongly resembles our distinction between social contract and political institutions.

North and Weingast (1989) argue how the evolution of institutions in Seventeenth-Century England led to commitment to secured property rights.

In the economic literature McGuire and Olson (1996) point out how an autocrat has an encompassing interest in the economy that leads him to moderate distortionary taxation. Unlike in our model, taxation is not a function of the investment in public good undertaken by the ruler.

Bates et al. (2002) study sustainable social contracts between specialists in violence and economic agents in an infinitely repeated game. However they did not explore the issue of political institutions or of delegation of decision rights over the social contracts.

Besley and Robinson (2010) build a model in which the military serves as an input to final output production, at the same time creating concerns about ex-post expropriation. The authors study how those two dimensions interplay both in presence and in absence of commitment by the Government over the remuneration of the military. Unlike our model, they do not endogenize political institutions and delegation of decision rights. Moreover, they do not fully stress the link between expropriation and surplus, since they limit ex-post expropriation to exogenous resources.

We strongly differentiate our model from the economic literature on democratization and enfranchisement as in Acemoglu and Robisnon (2001) and Lizzeri and Persico (2004). Unlike in their model, we investigate the passage of political power from the military to civilians, being them rich or poor.

Finally, our treatment of violence as a non.transferrable asset, link our model to models of delegation of decision rights of authority (formal versus informal) as in Grossman and Hart (1986), Aghion and Tirole (1997), and Baker et al. (1999).

2 The Model Setting

Our economy is populated by a specialist in violence P, and a representative agent A. P owns the technology of predation, whilst A is specialized in producing a final output.

Violence is a *non-transferable* asset, since it is specific to specialists. This characteristic gives rise to the question about delegation over the production/use of violence from P to A.

This leads us to the definition of decision rights: we say that a player, being it P or A, has decision rights if she has the right to design a *social contract* (SC) consisting of a pair $(\widetilde{g}, \widetilde{t})$, where:

- $g \in \Re^+$ represents P's investment in violence ,
- $t \in \Re^+$ represents taxation (from A to P).

Violence functions as an input to two different technologies:

- a final output production technology $y(g)$ owned by A, where $y(g)$ is continuously differentiable with $y_g(g) \geq 0$, $y_{gg}(g) \leq 0$ and $y(0) = 0$;[3]

- a predation technology $\gamma f(g)$, where $f(g)$ is continuously differentiable with $f_g(g) \geq 0$, $f_{gg}(g) \leq 0$, $f(0) = 0$ and $\gamma \geq 1$.

More specifically, violence is an input to production technology whenever it is used to enforce contracts among economic agents (i.e. it works as a *contract enforcement institution*) or whenever it serves as a protection device for economic agents against attacks from bandits (not modeled here).

However, violence also serves as a predatory device. The same violence employed to secure property rights among agents, can be turned by against the latter and become predation over the surplus produced. If not kept in check (i.e. in absence of *coercion constraining institutions*), violence can be destructive from the efficient allocation viewpoint.

We then distinguish *economic institutions*, i.e. institutions mainly insuring public order, from *political institutions*, i.e. institutions needed to keep specialists in check. The latter directly impacts the predation technology through the parameter γ, that can take two values: (i) $\gamma = \overline{\gamma}$ if no political institutions are granted by P, and (ii) $\gamma = \underline{\gamma}$ if political institutions are granted by P, where $1 \leq \underline{\gamma} \leq \overline{\gamma}$. The parameter γ measure the relative efficiency of predation technology with respect to the production one.

We define $\triangle\gamma = \overline{\gamma} - \underline{\gamma} \geq 0$. In what follows, whenever referring to movements in a generic γ, we hold $\triangle\gamma$ fixed, unless otherwise specified.

Political institutions functions as a constraint on P's predatory power. For instance they can be interpreted as institutions helping A to solve her internal collective action problem, as in the case of freedom of association, expression, carrying weapons. Or as in the case of Parliaments and constitutions. All those examples share the view of political institutions as a coordination device for A.[4]

We make the following Assumption:

Assumption 1 Political Institutions are everlasting, i.e. whenever P chooses $\gamma = \underline{\gamma}$, then he cannot revert to $\gamma = \overline{\gamma}$.

[3]Subscripts indicates partial derivatives when applied to functions.

[4]See Rajan and Zingales (2003) for an interpretation of the English Parliament in this direction.

This assumptions is made for simplicity, and we believe it does not affect our results. It captures in a stark way a more realistic assumption in which institutions, once set, are costly to take back.

We now present player's action space and payoffs.

Specialist in Violence: P's action space is given by $\Omega_P = \{d, \gamma, g\}$, where $d = \{P, A\}$ represent's delegation of decision rights over SC (with P passing rights to A when $d = A$). We also have $g \in \Re^+$ and $\gamma \in \{\underline{\gamma}, \overline{\gamma}\}$. With a slight abuse of notation we include the choice of SC into the choice of d. We assume:

Assumption 2 *P can delegate decision rights (i.e. set $d = A$) iff $\gamma = \underline{\gamma}$.*

This assumption does not affect our results, and it is very reasonable: delegation of decision rights may come only in presence of political institutions, as Parliaments and representative assemblies in general. Note that we do not impose that $\gamma = \underline{\gamma}$ necessarily requires $d = A$. We will comment on this restriction of P's action space in Section ?.

P's payoff is given by:

$$V = T(g) - cg \tag{1}$$

where $c > 0$, and $T(g)$ represents P's extracted surplus (through either taxation or coercive expropriation). More specifically, we have (i) $T(g) = \widetilde{t}$ if P sticks to SC, and $T(g) = \gamma f(g)$ otherwise.

Agent: A's action space is given by $\Omega_A = \{SC_d, y(g)\}$, where SC_d represents the choice of the social contracts, and it belongs to A's action set iff $d = A$. $y(g)$ represents A's participation choice, where $y(g) = 0$ represents A's choice to opt out of the formal market, and producing in an informal economy where the output is unobservable to P. The final output production choice $y(g)$ is treated in reduced form. A's payoff is given by:

$$U = y(g) - T(g) \tag{2}$$

A's reservation utility is $\underline{U} \geq 0$. This utility mainly derives from utility in an informal economy with relational contracts. It can also encompass the risk of rebelion.

Therefore, A prefers opting out from the (formal) market whenever P's extraction is too high.

Finally, A also had the choice of sticking to SC or not. In the latter case, P coercively extracts some surplus from her, i.e. $T(g) = \gamma f(g)$.

We now set some technical assumptions needed to fix a particular problem. None of those assumptions drives our results, i.e. main results in terms of efficiency and sustainability of social contracts would go through when our assumptions are reversed.

Assumption 3 $|y_{gg}(\cdot)| > |f_{gg}(\cdot)|$

Assumption 4 $\forall \gamma \geq 1 \; \exists \widehat{g}(\gamma) \geq 0 : y(\widehat{g}) = \gamma f(\widehat{g})$, where $\widehat{g}_{\gamma}(\gamma) < 0$.

Assumption 5 $\exists G > 0 : f(G) = cG$.

Assumption 3 insures that U is concave in g. Assumption 4 tells us the predatory function starts below the production one. When γ reaches very high levels, then $\overline{g}(\gamma) = 0$. Assumption 5 simply insures that the program solved by P always verifies **BC**.

Timing: The game is infinitely repeated in discrete time $\tau = 0, 1, ...$ In every period τ the timing of the game is the following:

1. P's chooses $\gamma_\tau \in \{\underline{\gamma}, \overline{\gamma}\}$ iff $\gamma_{\tau-1} \neq \underline{\gamma}$; he also chooses $d_\tau = \{P, A\}$ iff $\gamma_\tau = \underline{\gamma}$;
2. the decision-maker chooses a SC $\{\widetilde{t}, \widetilde{g}\}$;
3. P chooses the investment g_τ;
4. A produces $y_\tau \in \{0, y_\tau(g_\tau)\}$;
5. $T(g_\tau) \in \{\widetilde{t}, \gamma_\tau f(g_\tau)\}$.

We first present the results in the static (or finitely repeated) game, and we then analyze the infinitely repeated one.

3 The Static Game

We solve the game by backward induction. Let us take some $\gamma \in \{\underline{\gamma}, \overline{\gamma}\}$, some SC $\{\widetilde{t}, \widetilde{g}\}$, and some g produced by P in stage 3. From backward induction, it is straightforward to show that one of the two parties to SC renege on it whenever $\widetilde{t} \neq \gamma f(g)$. Therefore in the static game we necessarily have:

$$T(g) = \widetilde{t} = \gamma f(g) \tag{3}$$

From (3), assuming $d = P$, P's solves the following constrained optimization problem:

$$\max_{\{g\}} \gamma[f(g) - cg]$$

$$s.t.$$

$$y(g) - \gamma f(g) \geq \underline{U} \tag{4}$$

$$\gamma f(g) - cg \geq 0 \tag{5}$$

where (4) is A's Participation Constraint (**PC**), and (5) is P's Budget Constraint (**BC**). This last constraint holds by Assumption 5.

We first define the interior solution to P's problem $g^{int}(\gamma)$ as the one solving the following FOC:

$$\gamma f_g(g) = c \tag{6}$$

As γ increases, $g^{int}(\gamma)$ increases, and **PC** gets more binding. Therefore, there exists a threshold γ_1 such that, for $\gamma \geq \gamma_1$ we have:

$$g^s(\gamma) = \widehat{g}(\gamma) \leq g^{int}(\gamma)$$

where s is for *static*, where $\widehat{g}(\gamma)$ is the value of g that binds **PC**, with $\widehat{g}_\gamma(\gamma) \leq 0$.

We can also define a threshold $\overline{\overline{\gamma}}$ such that, for $\gamma \geq \overline{\overline{\gamma}}$, then $g^s = \widehat{g}(\gamma) = 0$. When predation gets overwhelmingly efficient with respect to final output production, no production is feasible in the formal economy.

We further define g^* as the level of input g that maximizes the vertical surplus $S(g)$ created in the economy (i.e. $S(g) = y(g) - cg$). The quantity g^* is given by the solution to the following FOD:

$$y_g(g) = c \tag{7}$$

where g^* is independent of γ.

To continue fixing a particular problem, we state the following technical assumption:

Assumption 6 $g^* < g^{int}(1) = g^s(1) < \widehat{g}(1)$.

Assumption 6 states that the least efficient predation technology insures participation of A even at the level of g that maximizes P's predatory rent (i.e. $g^{int}(1) = g^s(1)$), and that this level of input is higher than the one maximizing $S(g)$. It also implies that $\gamma_1 > 1$. It is straightforward to derive results in case Assumption 6 does not hold.

We can now define the threshold γ_2 such that, for $\gamma \geq \gamma_2$, we have $g^s(\gamma) = \widehat{g}(\gamma) \leq g^*$. Given Assumption 6 we also have $\gamma_2 > \gamma_1$. For a generic γ, P's investment is given by:

- $g^s(\gamma) = g^{int}(\gamma)$ for $\gamma \in [0, \gamma_1]$
- $g^s(\gamma) = \widehat{g}(\gamma) \geq g^*$ for $\gamma \in (\gamma_1, \gamma_2]$
- $g^s(\gamma) = \widehat{g}(\gamma) < g^*$ for $\gamma \in (\gamma_2, +\infty)$

When predation technology gets highly efficient with respect to production one, predatory power is destroying surplus, since it binds the solution to P's problem to a value lower than the efficient one.

We can now present the first Proposition:

Proposition 1 *In the static game, for a given $\triangle\gamma$, there exists a threshold γ_3 such that, $\forall\gamma \geq \gamma_3$ P prefers playing $\gamma^s = \underline{\gamma}$ in stage 1. The equilibrium SC^s is given by the investment $\widetilde{g}$ equal to:*

- $g^s(\overline{\gamma}) = g^{int}(\overline{\gamma})$ *for* $\overline{\gamma} \in [0, \gamma_1]$
- $g^s(\overline{\gamma}) = \widehat{g}(\overline{\gamma}) \geq g^*$ *for* $\overline{\gamma} \in (\gamma_1, \gamma_2]$
- $g^s(\overline{\gamma}) = \widehat{g}(\overline{\gamma}) < g^*$ *for* $\overline{\gamma} \in (\gamma_2, \gamma_3]$
- $g^s(\underline{\gamma}) = \min[g^{int}(\underline{\gamma}), \widehat{g}(\underline{\gamma})]$ *for* $\overline{\gamma} \in (\gamma_3, +\infty)$

and by $\widetilde{t}$ equal to:

- $T^s = \gamma^s f(g^s(\gamma^s))$

Moreover, when $\gamma = \underline{\gamma}$, P is indifferent between $d = A$ or $d = P$.

Proof. Almost all the proof is in the text. To show the existence of the threshold γ_3 note that, from (1) and (3), by the generalized Envelope Theorem we have:

$$V_\gamma(\gamma, g) < 0$$

when $\gamma > \gamma_2$. This also proofs that $\gamma_3 > \gamma_2$. ■

3.1 Comments

The static game naturally suffers from commitment problems on both sides. When P is relatively weak (i.e. $\gamma \in [0, \gamma_1]$), movements toward efficiency (i.e. g^*) are prevented by A's lack of commitment. Then, P prefers being strong and maximizing his predatory rent by inefficiently over-investing in violence.

As P gets stronger, participation by A is an issue. Initially, even after taking into account **PC**, P gains from being stronger (i.e. from a higher γ) since he can extract more. This happens as long as the constrained solution is not lower than the efficient one (i.e. g^*). P's highest payoff is reached when $\gamma = \gamma_2$, since the efficient quantity of input is produced, and all the surplus but the exit option is extracted from A. This result points out how a military dictator might be able to select efficient (or nearly efficient) policies even in absence of commitment.

However, when P gets overwhelmingly strong, the solution insuring participation by A is lower than the efficient one. As P's predation technology keeps getting more and more efficient, inefficient under-investment by P bounds the economy far away from efficient output production. In this case, P's lack of commitment prevents any movement toward efficiency. Political institutions are needed to create a stronger countervailing power to P, and to move the economy toward efficiency.

In the next section we analyze the infinitely repeated version of the game. Trigger strategies my be employed by players in order to sustain SC enabling movement toward efficiency. We then ask ourselves if and when political institutions are needed, and what is the role for delegation of decision rights.

4 Infinitely Repeated Game

In the infinitely repeated game let us first define the following concept:

Definition: *In every period $\tau = 0, 1, ...,$ we define:*

$$h_{\tau-1} = (\gamma_{\tau'}, d_{\tau'}, g_{\tau'}, y_{\tau'}, T_{\tau'} | \tau' = 0, 1, ..., \tau - 1)$$

as the history of plays from period 0 until period $\tau - 1$.

As we enter period τ and the dynamic game evolves within the period, we define:

Definition: *In stage 4 of every period $\tau = 0, 1, ...,$ we define:*

$$h_{\tau/1} = (h_{\tau-1}, \gamma_\tau, d_\tau, g_\tau)$$

as the history of plays from period 0 until period τ.

Moreover, in stage 5 of every period $\tau = 0, 1, ...,$ we also define:

$$h_{\tau/2} = (h_{\tau-1}, \gamma_\tau, d_\tau, g_\tau, y_\tau)$$

In stage 4, when A decides whether to participate or not in the economy, she has observed the whole history $h_{\tau-1}$ and P's period τ choices $\{\gamma_\tau, d_\tau, g_\tau\}$. In stage 5, when choosing the sharing of the surplus, both P and A have observed the whole history $h_{\tau-1}$ and period τ choices $\{\gamma_\tau, d_\tau, g_\tau, y_\tau\}$.

Hence, trigger strategies are contingent plans for each player, with the threat to revert to static allocations whenever a deviation is detected. Given a generic two-ple $\{\widetilde{g}, \widetilde{t}\}$ and $\{T_s, g_s\}$ independent of time $\tau = 0, ..., \infty$, the trigger strategy to be implemented is the following:

P's strategy: in period τ, play $g_\tau = \widetilde{g}$ in stage 3 as long as $h_{\tau-1} = (\gamma_{\tau'}, d_{\tau'}, \widetilde{g}, y(\widetilde{g}), \widetilde{t})$, for $\{\widetilde{g}, \widetilde{t}\}$ to be determined, and for $\gamma_{\tau'} \in \{\underline{\gamma}, \overline{\gamma}\}$ and $d_{\tau'} \in \{P, A\}$. Otherwise, play $\{g^s, T^s\}$ forever. Moreover, in stage 5, play $T_\tau = \widetilde{t}$ if $h_{\tau/2} = (h_{\tau-1}, \gamma_\tau, d_\tau, \widetilde{g}, y_\tau(\widetilde{g}))$ for $h_{\tau-1}$ as specified above. Otherwise, play $\{g_s, T_s\}$ forever.

A's strategy: in period τ, play (i) $y_\tau(\widetilde{g}, \widetilde{t})$ in stage 4 and (ii) $T_\tau = \widetilde{t}$ in stage 5, as long as $h_{\tau/1} = (h_{\tau-1}, \gamma_\tau, d_\tau, \widetilde{g})$, where $h_{\tau-1} = (\gamma_{\tau'}, d_{\tau'}, \widetilde{g}, y(\widetilde{g}, \widetilde{t}), \widetilde{t})$, for $\gamma_{\tau'} \in \{\underline{\gamma}, \overline{\gamma}\}$, $d_{\tau'} \in \{P, A\}$ and for $\{\widetilde{g}, \widetilde{t}\}$ to be determined. Otherwise, produce $y_\tau(g_\tau, \gamma_\tau f(g_\tau))$ according to the (predatory) extraction $T_\tau = \gamma_\tau f(g_\tau$ in period τ and in any future period.

We allow players to play trigger strategies that are contingent on the choice of $\{g, y, T\}$. More specifically, we do not allow players to play a strategy triggering a punishment phase contingent on some observation of $\{\gamma, d\}$. This seems to be a natural choice given that (i) we allocate all the bargaining power to P, and (ii) political institutions are ever-lasting. We discuss if and how this assumption would affect our result in the section dedicated to comments.

P and A can sign a contract $SC \equiv \{\widetilde{t}, \widetilde{g}\}$ and stick to it as long as none of them deviates. P can deviate at different stages in any single period τ: (a) at the investment stage, and (b) at the transfer/predation stage. A can deviate also at two (consecutive) stages: (a) output production stage and (b) at the transfer stage.

Temptation to deviate mainly comes at the transfer stage. A keeps believing that P would not predate on her as long as she doesn't observe (i) such a predation in previous periods, and (ii) an investment different than $\widetilde{g}$ in period τ. P keeps believing that A would not refuse the payment of the transfer as long as he observes that A (i) always complied with the contract in every previous period and, (ii) always produced an output $y_{\tau'}(\widetilde{g})$ $\forall \tau' \in [0, \tau]$.

Deviations may occur because of the difference between $\widetilde{t}$ and $\gamma f(\widetilde{g})$ for $\gamma \in \{\underline{\gamma}, \overline{\gamma}\}$. If the former is greater (lower resp.) than the latter, temptation to deviation rests on A (on P resp.). If a deviation is observed, players revert to the static game forever.

Let us name as β_i for $i = P, A$ players' discount factors. Then we can derive players' *Incentive Compatibility Constraints* (**ICC**(i)) for $i = P, A$. In period τ **ICC**(A) is given by:

$$\frac{y(\widetilde{g}) - \widetilde{t}}{1-\beta_A} \geq [y(\widetilde{g}) - \gamma_\tau f(\widetilde{g})] + \frac{\beta_A}{1-\beta_A} \max[y(g^s) - \gamma' f(g^s), \underline{U}]$$

where $\gamma' = \overline{\gamma}$ iff (i) $\overline{\gamma} \in [0, \gamma_3)$ and (ii) $\gamma_{\tau'} = \overline{\gamma}$ $\forall \tau' \in [0, \tau]$. Then **ICC**$(A)$ can be rewritten as:

$$\beta_A \geq \frac{\widetilde{t} - \gamma_\tau f(\widetilde{g})}{[y(\widetilde{g}) - \gamma_\tau f(\widetilde{g})] - \max[y(g^s) - \gamma' f(g^s), \underline{U}]} \tag{8}$$

When we deal with A's payoff from deviating, it is easy to note that temptation to deviate appears when $\widetilde{t} > \gamma_\tau f(\widetilde{g})$. It also straightforward to derive that deviation will optimally start in stage 4, since A produces an output according to $T_\tau \in \{\widetilde{t}, \gamma_\tau f(\widetilde{g})\}$ she expects to sustain in stage 5.

We now analyze **ICC(**P**)**. Depending on the difference between $\widetilde{t}$ and $\gamma_\tau f(\widetilde{g})$, a deviation for P may occur in stage 3 or in stage 5. Intuitively, if $\widetilde{t} > \gamma_\tau f(\widetilde{g})$, no deviation is profitable in stage 5. In this case, a deviation may occur in stage 3, and given the trigger strategy played by A this would be exactly as playing the static game. Then **ICC(**P_1**)** is simply given by:

$$\frac{\widetilde{t} - c\widetilde{g}}{1-\beta_P} \geq \frac{\gamma_\tau f(g^s) - cg^s}{1-\beta_P} \tag{9}$$

that is independent of β_P.

Otherwise, if $\widetilde{t} \leq \gamma_\tau f(\widetilde{g})$, a deviation is profitable in stage 5. Then **ICC(**P_2**)** is given by:

$$\frac{\widetilde{t} - c\widetilde{g}}{1-\beta_P} \geq [\min[y(\widetilde{g}, \widetilde{t}), \gamma_\tau f(\widetilde{g})] - c\widetilde{g}] + \frac{\beta_P[\gamma' f(g^s) - cg^s]}{1-\beta_P} \tag{10}$$

that can be rewritten as:

$$\beta_P \geq \frac{\min[y(\widetilde{g}, \widetilde{t}), \gamma_\tau f(\widetilde{g})] - \widetilde{t}}{[\min[y(\widetilde{g}, \widetilde{t}), \gamma_\tau f(\widetilde{g})] - c\widetilde{g}] - [\gamma' f(g^s) - cg^s]} \tag{11}$$

where $\gamma' = \overline{\gamma}$ iff (i) $\overline{\gamma} \in [0, \gamma_3)$ and (ii) $\gamma_{\tau'} = \overline{\gamma}$ $\forall \tau' \in [0, \tau]$.

In the following Lemma we show that it is always the case that one of the **ICC(**P**)** implies the other:

Lemma 1 *For $\gamma \in \{\underline{\gamma}, \overline{\gamma}\}$, if $\widetilde{t} > \gamma f(\widetilde{g})$, then **ICC(**$P_1$**)** implies **ICC(**$P_2$**)**. If the reverse inequality holds instead, i.e. $\widetilde{t} \leq \gamma f(\widetilde{g})$, then **ICC(**$P_2$**)** implies **ICC(**$P_1$**)**.*

Proof. See the Appendix. ■

In order to solve for the equilibrium of the game, we proceed as follows:

1. We first derive the equilibrium SC that maximizes P's utility in absence of political institutions (i.e. $\gamma_\tau = \overline{\gamma}$);

2. we then derive the equilibrium SC that maximizes P's utility in presence of political institutions (i.e. $\gamma_\tau = \gamma' = \underline{\gamma}$);

3. we compare the two outcomes so as to derive the equilibrium political institutions and SC;

4. finally, we analyze the decision to delegate decision rights over the choice of SC when the equilibrium calls for political institutions to be granted.

4.1 Absence of Political Institutions

Let us first consider the case in which $\gamma_\tau = \overline{\gamma}$ and $d_\tau = P$ in period τ.

In order to determine $\{\widetilde{g}, \widetilde{t}\}$, in accordance with the above-mentioned trigger strategies, P solves the following problem:

$$\max_{\{g,t\}}[t - cg]$$

$$s.t.\ \mathbf{BC},\ \mathbf{PC},\ \mathbf{ICC(}A\mathbf{)},\ \mathbf{ICC(}P_1\mathbf{)},\ \mathbf{ICC(}P_2\mathbf{)}$$

First note that **BC** is implied by $\mathbf{ICC(}P_1\mathbf{)}$. We proceed by dividing the analysis in different cases, depending on the value taken by $\overline{\gamma}$. We distinguish two main cases:

(a) $\overline{\gamma} \in [1, \gamma_2]$, i.e. $g^s = \min[g^{int}, \widehat{g}(\overline{\gamma})] \geq g^*$;

(b) $\overline{\gamma} \in (\gamma_2, +\infty)$, i.e. $g^s = \widehat{g}(\overline{\gamma}) < g^*$.

We loosely refer to case (a) as the *Weak Specialist Case*, and to case (b) as the *Strong Specialist Case*.

4.1.1 Weak Specialist

We have $\overline{\gamma} \in [1, \gamma_2]$. In solving P's problem, we bind $\mathbf{ICC(}A\mathbf{)}$ and disregard every other constraint. We then control ex-post that all the disregarded constraints indeed hold. Then P solves:

$$\max_{\{g\}} \beta_A\{[y(g) - \overline{\gamma}f(g)] - [y(g^s) - \overline{\gamma}f(g^s)]\} + \overline{\gamma}f(g) - cg$$

The FOC is given by:

$$\beta_A y_g(g) + (1 - \beta_A)\overline{\gamma}f_g(g) = c \tag{12}$$

Note that the interior solution to this problem $g^r(\overline{\gamma}, \beta_A)$ (where r stands for repeated) belongs to the interval $[g^*, g^{int}(\overline{\gamma})]$. More specifically, $g^r(\overline{\gamma}, 1) = g^*$ and $g^r(\overline{\gamma}, 0) = g^{int}(\overline{\gamma})$.

The following Lemma holds:

Lemma 2 *If $\overline{\gamma} \in [1, \gamma_1]$, then:*

- $\widetilde{g} = g^r(\overline{\gamma}, \beta_A)$ *is decreasing (resp. increasing) in β_A (respectively in $\overline{\gamma}$), and*
- $\widetilde{t} = \beta_A\{[y(\widetilde{g}) - \overline{\gamma}f(\widetilde{g})] - [y(g^{int}(\overline{\gamma})) - \overline{\gamma}f(g^{int}(\overline{\gamma}))]\} + \overline{\gamma}f(\widetilde{g})$.

If $\overline{\gamma} \in (\gamma_1, \gamma_2]$, then $\exists \underline{\beta}_A$ such that $\forall \beta_A \geq \underline{\beta}_A$ we have:

- $\widetilde{g} = g^r(\overline{\gamma}, \beta_A)$, *and*
- $\widetilde{t} = \beta_A\{[y(\widetilde{g}) - \overline{\gamma}f(\widetilde{g})] - [y(g^{int}(\overline{\gamma})) - \overline{\gamma}f(g^{int}(\overline{\gamma}))]\} + \overline{\gamma}f(\widetilde{g})$

and such that $\forall \beta_A < \underline{\beta}_A$ we have:

- $\widetilde{g} = \widehat{g}(\overline{\gamma})$, *and*
- $\widetilde{t} = \overline{\gamma}f(\widehat{g}(\overline{\gamma}))$.

*In every case **PC**, **ICC(**P_1**)** and **ICC(**P_2**)** hold.*

Proof. See the Appendix. ■

4.1.2 Strong Specialist

We have $\overline{\gamma} \in (\gamma_2, +\infty)$. In solving his problem, P has to take into account **PC**. Being P very strong in predation, now **ICC(**A**)** is implied by **PC**. This opens up the possibility for P to choose the quantity that maximizes the surplus (i.e. g^*) and to extract everything from A (but the exit option $\underline{U}$). However, temptation to renege now rests on P. Formally, P now solves:

$$\max_{\{g\}} [y(g) - \underline{U}] - cg$$

$$s.t.\ \mathbf{ICC(}P_2\mathbf{)}$$

We define the constrained solution as $g^r(\overline{\gamma}, \underline{\gamma}, \beta_P)$.

Before presenting the solution to P's problem, let us introduce $\overline{g}(\gamma)$ as the value of g such that:

$$y(g) = \gamma f(g)$$

where $\overline{g}_\gamma(\gamma) < 0$ and where $\gamma \in \{\underline{\gamma}, \overline{\gamma}\}$. We can then define:

Definition: *The threshold $\gamma_{2'}$ is such that $\overline{g}(\gamma) = g^*$.*

It is straightforward to show that $\gamma_{2'} \geq \gamma_2$ for $\underline{U} \geq 0$. For the sake of crispness, we make the following assumption:[5]

Assumption 7 $\gamma_{2'} < \gamma_3$.

We can now present the following Lemma:

Lemma 3 *If $\overline{\gamma} \in (\gamma_2, \gamma_{2'}]$, then we define:*

$$\underline{\beta}_P = \frac{\underline{U} - [y(g^*) - \overline{\gamma} f(g^*)]}{[\overline{\gamma} f(g^*) - cg^*] - [\overline{\gamma} f(\widehat{g}(\overline{\gamma})) - c\widehat{g}(\overline{\gamma})]} \tag{13}$$

such that we have:

- $\widetilde{g} = g^*$ *and* $\widetilde{t} = [y(g^*) - \underline{U}]$ *if* $\beta_P \geq \underline{\beta}_P$, *and*
- $\widetilde{g} = g^r(\overline{\gamma}, \beta_P) \in [\widehat{g}(\overline{\gamma}), g^*)$ *non-increasing in* β_P, *and* $\widetilde{t} = [y(g^r(\overline{\gamma}, \beta_P)) - \underline{U}]$ *otherwise.*

If $\overline{\gamma} \in (\gamma_{2'}, \gamma_3]$, then we define:

$$\underline{\beta}'_P = \frac{\underline{U}}{[y(g^*) - cg^*] - [\overline{\gamma} f(\widehat{g}(\overline{\gamma})) - c\widehat{g}(\overline{\gamma})]} \tag{14}$$

such that we have:

- $\widetilde{g} = g^*$ *and* $\widetilde{t} = [y(g^*) - \underline{U}]$ *if* $\beta_P \geq \underline{\beta}'_P$, *and*
- $\widetilde{g} = g^r(\overline{\gamma}, \beta_P) \in [\widehat{g}(\overline{\gamma}), \overline{g}(\overline{\gamma}))$ *non-increasing in* β_P, *and* $\widetilde{t} = [y(g^r(\overline{\gamma}, \beta_P)) - \underline{U}]$ *otherwise.*

[5] This assumption does not affect our results in any major and interesting way.

Finally, if $\overline{\gamma} \in (\gamma_3 + \infty)$, then we define:

$$\underline{\beta}''_P = \frac{\underline{U}}{[y(g^*) - cg^*] - [\underline{\gamma} f(g^s(\underline{\gamma})) - cg^s(\underline{\gamma})]} \tag{15}$$

such that we have:

- $\widetilde{g} = g^*$ *and* $\widetilde{t} = [y(g^*) - \underline{U}]$ *if* $\beta_P \geq \underline{\beta}''_P$, *and*
- $\widetilde{g} = g^r(\overline{\gamma}, \underline{\gamma}, \beta_P) \in [\widehat{g}(\overline{\gamma}), \overline{g}(\overline{\gamma}))$ *non-increasing in* β_P, *and* $\widetilde{t} = [y(g^r(\overline{\gamma}, \underline{\gamma}, \beta_P)) - \underline{U}]$ *otherwise,*

where $\widetilde{g} = g^r(\overline{\gamma}, \underline{\gamma}, \beta_P) < g^r(\overline{\gamma}, \beta_P)$.

*In every case **PC**, **ICC(**P_1**)** and **ICC(**P_2**)** hold.*

Proof. See the Appendix. ■

4.1.3 Comments

In absence of political institutions acting as a check on P's predatory power, P designs SC so as to move toward an efficient production of final output in the economy. The trigger strategy may make it possible to sustain more efficient outcomes.

When P is weak, i.e. when the static solution would be higher than the efficient one, P mainly cares about A's temptation to renege on SC. As in the static case, A's temptation binds the solution away from the optimal one. However, the trigger strategy now make it possible to sustain allocations that are closer and closer to the efficient one as A gets more and more patient. Movements toward efficiency here go hand in hand with increasing temptation to deviate.

As P gets stronger (still being defined as weak), A's participation becomes an issue: when the new sustainable allocations do not satisfy **PC**, the solution is the static one that binds all the constraints. However recall that in the weak specialist case the constrained solution is moving toward efficiency, so it is the economy.

When P is strong, i.e. when the static constrained solution is lower than the efficient one, deviation by A is not anymore a concern. P can now bind **PC** and try to extract the maximal surplus. However, being very strong, now his own deviation is a concern. If the efficient allocation does not prevent temptation to deviate by P, then the latter is forced to lower his investment in violence. A highly impatient P is back to the static allocation. Once again, movements toward efficiency here go hand in hand with increasing temptation to deviate.

Interestingly, P's temptation to deviate crucially depends on A's exit option. Intuitively, a very strong specialist will be tempted to deviate from SC as this option gets higher.

When SC fails to move the economy close enough to efficiency, P might consider political institutions as an interesting option.

4.2 Political Institutions

The analysis for the case with political institutions matches the one presented in the previous subsection, the only difference being that $\gamma = \underline{\gamma} < \overline{\gamma}$. Therefore, results as in Lemma 2 and 3 continue holding.

Here granting political institutions act as a shifter in the relative efficiency of predatory technology with respect to production one. Since those institutions are ever-lasting, once granted, the same trade-offs as the ones presented in the previous subsection go through as $\underline{\gamma}$ moves from one range of values for γ to the other.

We can then move to the comparison of the two cases so as to define the equilibrium outcome.

4.3 Equilibrium Institutions

Performing the comparison between absence and presence of political institutions requires us to work per range of values for $\gamma \in \{\underline{\gamma}, \overline{\gamma}\}$. We then distinguish different cases as γ moves from low to high values.

(a) : $\Rightarrow \overline{\gamma} \in [1, \gamma_1]$. This implies that $\underline{\gamma} \in [1, \gamma_1]$. Therefore, the following Lemma holds:

Lemma 4 *If $\overline{\gamma} \in [1, \gamma_1]$, then P prefers setting $\gamma_\tau = \overline{\gamma}$.*

Proof. See the Appendix. ■

(b) $\Rightarrow \overline{\gamma} \in [\gamma_1, \gamma_2]$. Here we can distinguish two subcases, depending on $\underline{\gamma}$ being greater or lower than γ_1. However, the result proposed in the following Lemma is independent of which subcase we consider:

Lemma 5 *If $\overline{\gamma} \in [\gamma_1, \gamma_2]$, then P prefers setting $\gamma_\tau = \overline{\gamma}$.*

Proof. See the Appendix. ■

(c) $\Rightarrow \overline{\gamma} \in (\gamma_2, \gamma_3]$. Here P enters the range of values for $\overline{\gamma}$ such that surplus is destroyed in the static game. The equilibrium institutional choice is given by:

Lemma 6 *If $\overline{\gamma} \in (\gamma_2, \gamma_3]$, we also have $\underline{\gamma} \leq \gamma_2$. Then, for low enough values of β_A relative to β_P, P prefers setting $\gamma_\tau = \overline{\gamma}$. Conversely, $\exists \widetilde{\gamma} \in (\gamma_2, \gamma_3]$ such that for $\overline{\gamma} \in [\widetilde{\gamma}, \gamma_3]$ P sets $\gamma_\tau = \underline{\gamma}$.*

Proof. See the Appendix. ■

(d) $\Rightarrow \overline{\gamma} \in (\gamma_3, +\infty]$. The equilibrium institutional choice is now given by:

Lemma 7 *If $\overline{\gamma} \in (\gamma_2, \gamma_3]$, either (i) $\widetilde{\gamma} \leq \gamma_3$, and P sets $\gamma_\tau = \underline{\gamma}$, or (ii) $\widetilde{\gamma} > \gamma_3$ and P sets $\gamma_\tau = \underline{\gamma}$ for $\overline{\gamma} \in [\widetilde{\gamma}, +\infty)$.*

We also have that $\underline{\gamma} \geq \gamma_2$ implies that P sets $\gamma_\tau = \underline{\gamma}$.

Proof. See the Appendix. ■

We can now state the main proposition of the model:

Proposition 2 *For a given value of $\Delta\gamma \geq 0$, there exists a value of γ high enough so as to induce P to set $\gamma = \underline{\gamma}$. This value is increasing (respectively decreasing) in the patience of A (respectively of P).*

Proof. In the text. ■

4.3.1 Comments

Political institutions are granted when predation is distortionary enough for the economy. P mainly uses institutions to restore efficiency in the production of final output, so as to extract part or all the higher surplus.

The mere presence of a SC helps P in his attempt to maximize surplus and extraction. When SC fails to purse this scope, P grants political institutions that allows him to propose a new SC that gets closer to his objective.

Political institutions are not granted when A is the player tempted to deviate (i.e. when P is weak). Even if granting political institutions generally moves the economy toward an efficient provision of input, P does not find it profitable to grant them since this would exacerbate the problem he faces, i.e. A's temptation to deviate.

4.4 Delegation of Decision Rights

Until now we have not discussed P's choice $d = \{P, A\}$, i.e. P's decision to delegate decision rights over the choice of SC.

In our model, there is a strong argument that goes against delegation of decision rights from P to A: P can always replicate any SC proposed by A. This argument implies that P cannot be strictly better-off by playing $d = A$. We are then seeking an indifference.

From the previous analysis, we know that most of the times there are multiple equilibria, i.e. there are multiple pairs of $\{\widetilde{g}, \widetilde{t}\}$ that can be sustained by means of a trigger strategy. In this case, it is straightforward to show that A would choose SC so as to bind P's Incentive Compatibility Constraints. This choice generally results in a SC different than the one that would have been chosen by P (that maximizes his utility).

Then, in order to have indifference (and therefore delegation), we need A to be obliged to choose the very same SC that P would have chosen. We have:

Proposition 3 *For $\overline{\gamma}$ high enough such that P grants political institutions (i.e. $\gamma = \underline{\gamma}$ $\forall\tau$), then P plays $d = A$ when (i) $\widetilde{g}(\underline{\gamma}, \beta_A) = \widehat{g}(\underline{\gamma})$ for $\underline{\gamma} \leq \gamma_2$, or (ii) $\widetilde{g}(\underline{\gamma}, \beta_P) = \widehat{g}(\underline{\gamma})$ for $\underline{\gamma} > \gamma_2$.*

Proof. See the Appendix. ■

The proof mainly comes from noting that when either β_A or β_A are low enough, then the only sustainable SC binds all the constraints. Then P is indifferent between passing or not decision rights to A.

5 Conclusions

In a world divided into specialists in violence and producers, we investigate under which conditions when the former finds it profitable to (*i*) grant political institutions, and (*ii*) delegate decision rights over the choice of a social contract.

Specialists in violence, here acting as a monopolist group, own a predation technology that cannot be transferred. Once in place, they can always use coercion in order to extract surplus from producers. Specialists also recognize that the violence at their (exclusive) disposal can be used as an input to citizens' production technology: specialists can guarantee public order, i.e. they can provide economic institutions aiming at increasing the vertical surplus created in the economy.

Then, economic institutions are distinguished from political ones, where the latter are intended as means of constraining specialists' coercive power. We generically refer to them as Parliaments and Constitutions, but we more broadly encompass freedom of association and of expression.

In a static game, lack of commitment on both sides (specialists and citizens), induces weak specialists to inefficiently over-invest in violence. They find it profitable since choosing a lower investment that maximizes the surplus in the economy would exposes them to renegotiation by citizens. Strong specialists inefficiently under-invest in violence instead, since they have to insure participation by the citizenry. Even in a static game, when strong specialists destroy surplus because of their lack of commitment not to expropriate ex-post, political institutions are granted.

In an infinitely repeated game, players may sign a sustainable social contract under the threat of reverting to the nasty static world in case a deviation is observed. Social contracts generally allow a movement toward efficiency. However those movements always come along with increasing temptation to deviate from the social contract by one of the two parties. Weak specialists may move toward efficiency if citizens are patient enough. Strong specialists may move toward efficiency if they are patient enough.

Then, patient enough strong specialists do not need political institutions to increase the surplus created in the economy. Impatient ones need to complement social contracts with political institutions instead, so as to insure themselves extraction on a greater surplus.

Once political institutions are granted, the question of delegation of decision rights over the choice of the social contract arises. In our model, specialists can always replicate the contract proposed by the citizenry. Therefore they cannot be strictly better-off by delegating decision rights. Hence, they would be willing to delegate decision rights when they are indifferent between the two options. This situation occurs when, after granting political institutions, players are still stuck in a (new improved) static solution.

The bundle of political institutions and delegation strongly resembles the definition of democracy proposed by Tilly (2004). In fact, it contains the two main elements of democratization: binding consultation of the citizenry in matter of policies, and no arbitrary behavior by governmental agents.

However, the issue of delegation of decision rights recalls us how difficult it is for the citizenry to get control over the investment in violence to be made by specialists. This situation strongly resembles the current one in Egypt.

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Appendix

Proof. **Lemma 1**: Assume $\widetilde{t} > \gamma f(\widetilde{g})$. Assume also $\min[y(\widetilde{g}), \gamma f(\gamma\widetilde{g})] = \gamma f(\gamma\widetilde{g})$. Then:

$$[\gamma f(\widetilde{g}) - c\widetilde{g}] + \frac{\beta_P}{1-\beta_P}[\gamma f(g^s) - cg^s] < [\widetilde{t} - c\widetilde{g}] + \frac{\beta_P}{1-\beta_P}[\gamma f(g^s) - cg^s]$$

Moreover, from **ICC(**P_1**)** we also have:

$$[\widetilde{t} - c\widetilde{g}] + \frac{\beta_P}{1-\beta_P}[\gamma f(g^s) - cg^s] \leq \frac{[\widetilde{t} - c\widetilde{g}]}{1-\beta_P}$$

then, by merging the two inequalities we finally get:

$$[\gamma f(\widetilde{g}) - c\widetilde{g}] + \frac{\beta_P}{1-\beta_P}[\gamma f(g^s) - cg^s] < \frac{[\widetilde{t} - c\widetilde{g}]}{1-\beta_P}$$

that is we recover **ICC(**P_2**)**.

When $\min[y(\widetilde{g}), \gamma f(\gamma\widetilde{g})] = y(\widetilde{g})$, it is straightforward to show that our inequalities continue to hold.

Conversely, consider the case in which $\widetilde{t} \leq \gamma f(\widetilde{g})$ instead. Assume also $\min[y(\widetilde{g}), \gamma f(\gamma\widetilde{g})] = \gamma f(\gamma\widetilde{g})$. Then if **ICC(**$P_2$**)** holds we have:

$$\frac{[\widetilde{t} - c\widetilde{g}]}{1-\beta_P} \geq [\gamma f(\widetilde{g}) - c\widetilde{g}] + \frac{\beta_P}{1-\beta_P}[\gamma f(g^s) - cg^s] \geq [\widetilde{t} - c\widetilde{g}] + \frac{\beta_P}{1-\beta_P}[\gamma f(g^s) - cg^s]$$

that finally gives:

$$[\widetilde{t} - c\widetilde{g}] \geq [\gamma f(g^s) - cg^s]$$

that is we recover **ICC(**P_1**)**.

When $\min[y(\widetilde{g}), \gamma f(\gamma\widetilde{g})] = y(\widetilde{g})$, it is straightforward to show that our inequalities continue to hold.

■

Proof. **Lemma 2**: In order to proof the first part of the Lemma, i.e. when $\overline{\gamma} \in [1, \gamma_1]$, we need to show that all the constraints hold. We start with **PC**, that is given by:

$$y(\widetilde{g}) - \beta_A\{[y(\widetilde{g}) - \overline{\gamma}f(\widetilde{g})] - [y(g^{int}(\overline{\gamma})) - \overline{\gamma}f(g^{int}(\overline{\gamma}))]\} - \overline{\gamma}f(\widetilde{g}) \geq \underline{U}$$

This can further be rewritten as:

$$(1 - \beta_A)[y(\widetilde{g}) - \overline{\gamma}f(\widetilde{g})] + \beta_A[y(g^{int}(\overline{\gamma})) - \overline{\gamma}f(g^{int}(\overline{\gamma}))]\} \geq \underline{U}$$

that holds, since the first component in square brackets on the LHS is higher than the second one (since $\widetilde{g}$ is closer to g^* than $g^{int}(\overline{\gamma})$), that in turn is greater than $\underline{U}$ (since we are considering $\overline{\gamma} \in [1, \gamma_1]$).

To show that $\mathbf{ICC}(P_1)$ holds, we employ a revealed preferences argument. P might have chosen $g^{int}(\overline{\gamma})$ that satisfies $\mathbf{ICC}(P_1)$, then if he prefers investing $\widetilde{g} = g^r(\overline{\gamma}, \beta_A) \leq g^{int}(\overline{\gamma})$ it has to be the case that he gets a higher payoff. This implies that $\mathbf{ICC}(P_1)$ holds.

Finally, from Lemma 1, since $\widetilde{t} \geq \overline{\gamma}f(\widetilde{g})$, it also follows that $\mathbf{ICC}(P_2)$ holds, that proves the first part of the Lemma.

Take now the case in which $\overline{\gamma} \in (\gamma_1, \gamma_2]$. Then **PC** is rewritten as:

$$(1 - \beta_A)[y(\widetilde{g}) - \overline{\gamma}f(g^{int}(\overline{\gamma}))] + \beta_A\underline{U}\} \geq \underline{U}$$

implying that **PC** holds iff $\widetilde{g} \leq \widehat{g}(\overline{\gamma})$. Then two cases can arise:

- $g^r(\overline{\gamma}, \beta_A) \leq \widehat{g}(\overline{\gamma})$, and therefore $\widetilde{g} = g^r(\overline{\gamma}, \beta_A)$ and all the proof proceeds as in the previous case; or

- $g^r(\overline{\gamma}, \beta_A) > \widehat{g}(\overline{\gamma})$, then in order to verify **PC** P optimally sets $\widetilde{g} = \widehat{g}(\overline{\gamma})$.

In the second case, it is straightforward to establish that all the constraints hold as equalities. To finally proof the Lemma, the fact that $g^r(\overline{\gamma}, \beta_A)$ is decreasing in β_A whilst $\widehat{g}(\overline{\gamma})$ is independent of β_A establishes the presence of the threshold $\underline{\beta}_A$. ■

Proof. Lemma 3: Consider first the case in which $\overline{\gamma} \in (\gamma_2, \gamma_{2'}]$. We start by deriving the threshold in (13). Since $\overline{g}(\overline{\gamma}) \geq g^*$, we know that $\min[y(g^*), \overline{\gamma}f(g^*)] = \overline{\gamma}f(g^*)$. Then, from the RHS in (11) and from **PC** we get (13).

In this case, when P binds **PC**, the solution $\widetilde{g} = g^*$ verifies $\mathbf{ICC}(P_2)$ if (13) holds.

Assume this is not the case (i.e. $\beta_P < \underline{\beta}_P$) instead. Then from (10), since $y_g(g) < \overline{\gamma}f_g(g)$ for $g \in [0, g^{int}(\overline{\gamma})]$, all else equal the LHS is decreasing less than the RHS.

This implies that, starting from g^*, P decrease the his incentive to deviate distorting $\widetilde{g}$ downward. For very low values of β_P the only solution is $\widehat{g}(\overline{\gamma})$.

This shows that $g^r(\overline{\gamma}, \beta_P)$ is decreasing in β_P.

Consider then the case in which $\overline{\gamma} \in (\gamma_{2'}, \gamma_3]$. We start by deriving the threshold in (14). Since $\overline{g}(\overline{\gamma}) < g^*$, we know that $\min[y(g^*), \overline{\gamma} f(g^*)] = y(g^*)$. Then, from the RHS in (11) and from **PC** we get (14).

We can perform the same analysis as in the previous case. The only difference being that we consider (14) instead of (13) as the relevant threshold. More specifically, for $g \in [\overline{g}(\overline{\gamma}), g^*]$ we have $\min[y(g), \overline{\gamma} f(g)] = y(g)$. Then, if (14) does not hold at g^*, then in order to lower his temptation to deviate now P has to move below $\overline{g}(\overline{\gamma})$.

Consider now the third case, i.e. $\overline{\gamma} \in (\gamma_3, +\infty)$. In order to derive the threshold in (15), we perform the same reasoning as in the second case. The only difference is that, upon observing a deviation, P sets $\gamma_{\tau'} = \underline{\gamma}$ for $\tau' = \tau + 1, ...$ Note that we have $\underline{\beta}''_P > \underline{\beta}'_P$.

Then the new solution to P's problem that binds **ICC**(P_2) also depends on $\underline{\gamma}$. From (10) we have that $g^r(\overline{\gamma}, \underline{\gamma}, \beta_P) < g^r(\overline{\gamma}, \beta_P)$. More specifically, this happens because the RHS in (10) increases when $\gamma = \underline{\gamma}$, therefore for every given level of β_P, P can make a smaller movement toward efficiency (and away from $\widehat{g}(\overline{\gamma})$).

In order to finally show that those outcomes are indeed the solution to this game (without political institutions), we need to verify if the disregarded constraint hold.

We first check for **ICC**(A). By binding **PC**, **ICC**(A) is given by:

$$y(\widetilde{g}) - \underline{U} \leq \beta_A\{[y(\widetilde{g}) - \overline{\gamma} f(\widetilde{g})] - \underline{U}\} + \overline{\gamma} f(\widetilde{g})$$

that can be rewritten as:

$$y(\widetilde{g}) - \overline{\gamma} f(\widetilde{g}) \leq \underline{U}$$

that holds for $\widetilde{g} \geq \widehat{g}(\overline{\gamma})$. Then, since the solution lies within the interval $[\widehat{g}(\overline{\gamma}), \widetilde{g} = g^*]$, **ICC**$(A)$ holds.

Finally, by Lemma 1 we have that **ICC**(P_1) also holds. ■

Proof. Lemma 4: Note that we have:

$$y_g \frac{\partial g}{\partial \gamma} - \gamma f_g \frac{\partial g}{\partial \gamma} < 0$$

since $g^{int}(\gamma) > g^*$ and $g^{int}(\overline{\gamma}) > g^{int}(\underline{\gamma})$.

Then, by the Envelope Theorem the result follows. ■

Proof. Lemma 5: To show the result, we analyze the worst possible case for P, i.e. we consider the case in which $\underline{\gamma} \in [1, \gamma_1]$.

From (12), it is easy to observe that $g^r(\underline{\gamma}, \beta_A) < g^r(\overline{\gamma}, \beta_A)$. Then, if it happens those to be the solutions to the two subgames (with and without political institutions), then the same reasoning as in Lemma 4 tells us that P prefers $\gamma_\tau = \overline{\gamma}$.

Assume that $\widetilde{g}(\overline{\gamma}) = \widehat{g}(\overline{\gamma})$ instead. Consider still the case in which $\widetilde{g}(\underline{\gamma}) = g^r(\underline{\gamma}, \beta_A)$. Then, to show that P still prefers $\gamma_\tau = \overline{\gamma}$, note that P can set $\gamma_\tau = \overline{\gamma}$ and choose the allocation $g^r(\underline{\gamma}, \beta_A)$ with a transfer:

$$\widetilde{t}(\overline{\gamma}) = \beta_A\{[y(g^r(\underline{\gamma}, \beta_A)) - \overline{\gamma} f(g^r(\underline{\gamma}, \beta_A))] - [y(\widehat{g}(\overline{\gamma})) - \overline{\gamma} f(\widehat{g}(\overline{\gamma}))]\} + \overline{\gamma} f(g^r(\underline{\gamma}, \beta_A))$$

that binds **ICC(**A**)**, and that is higher than the corresponding $\widetilde{t}$ when $\gamma_\tau = \underline{\gamma}$. The disregarded **PC** also holds, otherwise it would be a contradiction with the fact that $\widehat{g}(\overline{\gamma})$ is the solution to P's problem when $\gamma = \overline{\gamma} \in (\gamma_1, \gamma_2]$.

Hence, a simple revealed preference argument shows that P prefers $\gamma_\tau = \overline{\gamma}$.

The further subcase to be considered, i.e. $\underline{\gamma} \in (\gamma_1, \gamma_2]$, then cannot make P better-off when setting $\gamma_\tau = \underline{\gamma}$. Then P still prefers setting $\gamma_\tau = \overline{\gamma}$, that finally proofs the Lemma. ■

Proof. Lemma 6: We start by showing that $\overline{\gamma} \in (\gamma_2, \gamma_3]$ implies $\underline{\gamma} \leq \gamma_2$. Recall that γ_3 is defined as the value of γ such that P prefers setting $\gamma = \underline{\gamma}$ in the static game. Then we know that P would choose $\gamma = \underline{\gamma}$ in the static game whenever $\underline{\gamma} \geq \gamma_2$, since this choice choice allows him get closer to the efficient production ant to extract everything.

Then it has to be the case that at $\overline{\gamma} = \gamma_3$ we also have $\underline{\gamma} \leq \gamma_2$.

Then to show the second part of the Lemma, consider $\overline{\gamma} = \gamma_3$. We then show that it can be the case that P prefers playing $\gamma_\tau = \overline{\gamma}$. In $\overline{\gamma} = \gamma_3$ it is true that:

$$y(\widehat{g}(\overline{\gamma})) - c\widehat{g}(\overline{\gamma}) - \underline{U} \leq y(g^s(\underline{\gamma})) - cg^s(\underline{\gamma}) - \underline{U} \tag{16}$$

where the strict inequality holds if $\underline{\gamma} \in [1, \gamma_1)$.

We know that, in the repeated game, for high enough values of β_P, P can set $\gamma_\tau = \overline{\gamma}$

and sustain an allocation $g^r(\overline{\gamma}, \beta_P)$ such that:

$$V_\tau(\overline{\gamma}, \beta_P) = y(g^r(\overline{\gamma}, \beta_P)) - cg^r(\overline{\gamma}, \beta_P) - \underline{U} \tag{17}$$

for ever, and that is greater or equal that the LHS in (16).

Moreover, we also know that for low enough values of β_A, P can set $\gamma_\tau = \underline{\gamma}$ and sustain an allocation $\widetilde{g}(\underline{\gamma}, \beta_A) = g^s(\underline{\gamma})$ such that his payoff is given by the infinitely discounted sum of the RHS in (16).

This finally proofs the Lemma. ■

Proof. Lemma 7: Part (i) of the Lemma is straightforward given that we fix $\Delta\gamma$.

Then, the same proofs as in Lemma 6 may be applied to establish part (ii).

Finally, to prove the last part of the Lemma, note that, as soon as $\underline{\gamma} \geq \gamma_2$, then it is true that $g^r(\overline{\gamma}, \beta_P) \leq g^r(\underline{\gamma}, \beta_P) \leq g^*$.

Then, since P binds **PC**, he strictly prefers playing $\gamma_\tau = \underline{\gamma}$. ■

Proof. Proposition 3: First, given Assumption 2, we need P to set $\gamma = \underline{\gamma}$ in order to study delegation.

Consider the case in which $\underline{\gamma} \leq \gamma_2$. If β_A is low enough so as to imply $\widetilde{g}(\underline{\gamma}, \beta_A) = \widehat{g}(\underline{\gamma})$, then $\widehat{g}(\underline{\gamma})$ is the only sustainable provision of input in the economy. Then P is indifferent between playing $d = A$ or $d = P$.

Consider now the case in which $\underline{\gamma} > \gamma_2$. In this case still we have $\gamma = \underline{\gamma}$, and the same reasoning as before shows that P is indifferent between playing $d = A$ or $d = P$ when β_P is low enough to induce $\widetilde{g}(\underline{\gamma}, \beta_P) = \widehat{g}(\underline{\gamma})$.

■