The Stability of Multi-Level Governments

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Abstract

This paper studies the stability of a multi-level government. We analyze an extensive form game played between two politicians leading two levels of government. We characterize the conditions that render such government structures stable. We also show that if leaders care about electoral rents and the preferences of the constituencies at different levels are misaligned, then the decentralized government structure may be unsustainable. This result is puzzling because, from a normative perspective, the optimality of decentralized decisions via a multi-level government structure is relevant precisely when different territorial constituencies exhibit preference heterogeneity.

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1 Introduction

A government structure with more than one level is desirable for societies with heterogeneous preferences because it allows decentralized policy decisions. From a normative view the implementation of different policies in regions with different policy preferences is optimal, and from a positive view the decentralization of the policy decisions allows for catering specific regional policies targeted to

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the policy interests of each regional population. A multi-level government structure is an instrument that aims at producing an optimal policy decision in each region by decentralizing the policy decision process, and it is more appealing in societies with greater heterogeneity of preferences.

When different regions exhibit clear differences in preferences then the optimal policy decisions cannot be produced by a unique policy outcome. In this case a decentralized policy decision process is more likely to produce efficient policy outcomes because it allows implementing different policies in different regions. Thus, a government structure with decentralized powers is desirable when preferences are heterogenous. However, at the same time that preference heterogeneity makes multi level government structures more desirable, distinct electoral competitions responding to the different constituencies may themselves fuel demands that compromise the stability of the decentralized allocation of powers. In particular, the national government response to a particular policy demand arising from a regional government may be conditioned by its electoral prospects in the nation-wide constituency, and thus may be driven away from the outcome desired by the demanding region. If a region considers that the outcome obtained from the multi-level government structure is unsatisfying then incentives to try to leave the multi-level government and move to separation may arise.

In order to examine the conditions for stability of multi-level governments we construct a game theoretical model representing the interaction between two levels of government. In particular we assume that one player is the party in office in a national government while the other player is the party in office of a regional government. We consider the interaction that ensues after a regional constituency puts forward a policy demand that challenges the prevailing status quo. We assume that the regional government supports this regional demand, since its party electoral rents largely depend on support from this constituency. The final outcome will depend on the possibility of an agreement between the national and the regional governments in terms of the policy implemented. The stability of the system is guaranteed if they are able to reach an agreement, either by assuring to continue with the existing status quo, or by a consensual revision of the decision power between the two government levels. Otherwise, in disagreement, the lower government level may decide to bid for break up, leading to a conflict scenario in which maintaining the original government structure is possible only through repression, and even so it may not survive.

We analyze the strategic interaction between the different level goverments with an extensive form game. We assume that there is a policy demand by the regional government. The national government is supposed to move first, and has two possible actions: either to offer a solution in the line of accommodating the regional demand, which implies a compromise between the two governments, or to ignore the regional demand. Following the national government's action, the regional government chooses whether to acquiesce it or to disobey it. If the regional government acquiesces then the game ends, and payoffs are given by the compromise proposal made by the national government, or by the status quo if no compromise was offered. In either case the two-level government structure survives. Otherwise, following disobedience by the regional government, the national government must choose whether to accept it and let the region go in a friendly separation, or else to fight disobedience with repression [1]. Repression leads to a conflict between the two parties with an uncertain result, either in the maintenance of the status quo or the separated powers. The probability of each outcome depends on the amount of repression implemented.

Status quo payoffs prevail after the national government ignores the regional demands and the regional government acquiesces, since the actions undertaken by the two players are innocuous. When the regional government disobeys and the national government accepts the break up, then each party receives the payoffs from the separated power structure which are different from the status quo for both players. Finally, if the national government offers an accommodation and the regional government acquiesces then the status quo payoffs are modified according to the offered policy compromise. Accommodation represents a utility cost for the central government and a utility benefit for the regional government in both cases relative to the payoffs they receive in the status quo. The magnitudes of these costs and benefits may or may not be correlated with each other.

Notice that the outcomes that guarantee the stability of the multi-level government structure are either the status quo or the implementation of accommodation. We find that if there is a credible threat of a high level of repression then the status quo prevails in equilibrium for a large set of parameter values. This solution produces stability of the system, but the conditions that support it cannot be considered as highly desirable. Thus, stability of a multi-level government is better obtained through the accommodation of the regional demand by the national government.

The analysis of the game will rely on considering all possible combinations for payoffs differences between the status quo and separation. When the preferences of both parties regarding the status quo and separation are correlated, there is no conflict between the two government levels and the stability of the original government structure is trivially guaranteed. Naturally, the interesting cases arise in scenarios where the national government prefers the status quo to separated powers, and the regional government prefers separated powers over the status quo. Therefore most of the paper is devoted to detailed analysis of these scenarios, taking into account the cost and benefits of compromise and repression.

We assume that only the national government may decide whether to initiate and implement the repression[2], and that repression is costly for both players. The national government has to pay a cost to implement repression and the regional government will suffer a cost from the repression inflicted upon the region. We assume that the amount of repression implemented is a choice variable of

[1] Pierskalla (2010) analyzes the possibility of a strategic reaction to implemented repression. Moore (2000) considers a model in which repression and accommodation are substitutes.

[2] Tyson (2018) analyzes the interrelated decisions between a leader, who may initiate repression, and the members of the repressive apparatus, who are in charge of implementing it. Dragu (2017) analyzes the costs and benefits of repression and how they affect its effectiveness.

the national government and the corresponding costs for both governments are represented by increasing functions of the amount of repression implemented.

The empirical evidence about the effectiveness of repression on dissent offers a variety of results. Muller and Opp (1986) find a positive impact of repression on dissent while Hibbs (1973) finds a positive relationship. Muller and Weede (1990) find an inverted U-shape relationship and Rasler (1996) finds mixed effects. Moore (1998) and Lichbach (1987) show that repression affects the level of violence used in the protests.

In order to accommodate all these possibilities we will consider a variety of functional forms for the probability with which conflict is resolved as a function of the amount of repression implemented. In particular we consider that this function is increasing when we analyze a framework in which repression weakens the protest movement, which makes more likely the success of the status quo; and it is decreasing when we assume the possibility that repression produces a reviving of the protests which makes more likely the success of separation.

The level of repression chosen by the national government must be optimal from its point of view, and it should also be credible from the point of view of the regional government. Thus we assume that the intensity of repression maximizes the payoff of the national government, conditional on disobedience. Since it can only be implemented after the repression outcome is chosen, it is clearly the only level that is credible for the regional government.

We analyze the determinants of the size of the set of parameter values that produce the desirable stability of the government structure, that is those for which accommodation obtains as an equilibrium outcome. It is easy to see that this set would be larger the smaller is the cost of accommodation for the national government and the larger are the benefits of accommodation for the regional government.

We provide an interpretation of the equilibrium results in terms of the level of decentralization of the govenrment structure at the time that the regional protests arise. We argue that in a more decentralized government system it is more likely that a friendly separation follows a regional protest while in heavily centralized countries the status quo is more likely to survive possible protests.

In order to assess the size of the parameters that define the players payoffs it is also necessary to pay attention to the effects of electoral competition. Parties that compete for office at different government levels may receive electoral effects at different constituencies from a policy implemented in a particular one. Electoral competition may induce some internal party ideological conflicts when different constituencies demand contradicting policies, be it from the same government level or from different levels. In addition, policy proposals that appeal certain constituencies may prove to be electorally harmful for others. Thus electoral competition in a multi-level government structure has to be analyzed taking into account the non intended effects that policy proposal may have on all possible electoral encounters.

In particular, offering an accommodating solution to satisfy the demands of a certain region may produce a rejection effect from the constituencies of other regions that may translate into electoral costs for the national government party when competing for votes in those constituencies. Similarly, it is also possible that accepting a policy compromise is costly in electoral terms for the regional government, if its constituency considers that their demand has not been sufficiently satisfied. In any case, when the payoffs of the players take into account the corresponding parties' electoral rents that may be obtained at all electoral contests, then the magnitudes of these two parameters may end up not being correlated. In particular, when the policy preferences of the regional constituency are very different from those of the national constituency, offering accommodation may end up being very costly for the national government: a policy compromise away from the optimal policy of the national constituency may harm his future electoral rents at the national level. In addition, this policy compromise may also imply some electoral cost for the regional government, in which case its benefits of accepting accommodation, which imply giving up partially the original policy demands, may become negative. Therefore, if we take into account electoral rents as partly determining the payoffs of the governments, we find that when the heterogeneity of the preferences is important, the possibilities of accommodation in equilibrium can be severely reduced. Thus, the stability of the multi-level government structure in heterogenous societies may be seriously compromised.

In the next section we describe the formal game. Section 3 describes the optimal repression level for the national government. Section 4 analyzes the equilibrium results. Section 5 studies the optimality of the equilibria results. Section 6 provides an interpretation of the results in terms of the level of decentralization of the government structure. Section 7 introduces the effects of electoral competition and section 8 offers some conclusions, some possible extensions, and some real world applications.

2 The game

We consider an extensive form game with two players N and R, which are respectively the national government and the regional government.

Player N moves first and decides whether to ignore or to accommodate a policy demand that has arisen in the constituency of player R. Knowing the choice made by N, player R has to reply to it by deciding whether to acquiesce or to disobey. If player R acquiesces the game ends; if player R disobeys then player N has to decide whether to let it go or to repress. See Figure 1.

There are three possible outcomes: status quo, accommodation, and friendly separation. Status quo obtains when N ignores and R acquiesces, accommodation obtains when it is offered by N and accepted by R, and friendly separation obtains after R disobeys and N let it go. Finally, if R disobeys and N decides to repress the outcome is uncertain: with a probability that depends on the intensity of the repression it may resolve in either the status quo or the separation.

The payoffs for the players are as follows. The status quo payoffs are denoted respectively by u_N and u_R, with u_N, $u_R > 0$. The accommodation payoffs are denoted respectively by $u_N - a_N$ and $u_R + a_R$ where $a_N > 0$ denotes N's cost of accommodation, which can be interpreted as giving up some decision power; and $a_R > 0$ denotes R's benefit from accommodation, which can be interpreted as receiving some additional decision power. The separation payoffs are denoted respectively by e_N and e_R, with e_N, $e_R > 0$. Finally, if R disobeys and N represses then the payoffs for both governments are the expected value of the ensuing conflict net of its costs.

We assume that the amount of repression is a choice made by N and it is represented as a variable denoted by r that takes values in the interval $[r_0, r_1]$ with $0 < r_0 < r_1$. Repression is costly for both: to N that implements it and to R that endures its impact. Payoffs under repression are represented by the expected utility of conflict minus the costs of the exerted or received repression. We interpret conflict as a lottery over two possible outcomes: the status quo and the separation, where $p(r)$ denotes the probability that the status quo prevails. Thus, the payoffs under a repression of level r are given by:

$$EU_N(r) = p(r)\,u_N + (1 - p(r))\,e_N - C_N(r)$$

$$EU_R(r) = p(r)\,u_R + (1 - p(r))\,e_R - C_R(r)$$

We assume that $p(r), C_N(r)$, and $C_R(r)$ are continuous and twice differentiable functions of r where $C_N(r) > 0$ represents the cost for N of implementing a repression level equal to $r > 0$; $C_R(r) > 0$ represents the cost inflicted on R by the repression r implemented by N; $p(r)$ denotes the probability that repression level r maintains the status quo, and $1 - p(r)$ denotes the probability that separation ensues, with $0 < p(r) < 1$. It is reasonable to assume that $C'_N(r) > 0$ and $C'_R(r) > 0$, that is, increasing levels of repression are more costly for N and the cost of enduring repression by R is also an increasing function of the repression effort exerted by N. We solve the game for its Subgame Perfect Nash equilibria.

We consider different cases depending on the values of the parameters u_N, u_R, e_N and e_R. First suppose that $e_R < u_R$, that is, R is better off with the status quo than with separation. In this case disobey is never a best response for R and thus ignore is the best response for N. Therefore the equilibrium outcome in this case is clearly the status quo (u_N, u_R). Next suppose that $e_R > u_R$ and $e_N > u_N$, that is, both N and R are better off with the separation than with the status quo. In this case disobey is always a best response for R and let go is the best response for N. Therefore the equilibrium outcome in this case is clearly the separation (e_N, e_R).

The interesting cases arise when $e_R > u_R$ and $e_N < u_N$, that is, N is better off with the status quo and R is better off with separation. The equilibrium outcomes in this case are different for different parameter values. We analyze this case in the remaining of the paper. Let $\Delta N = u_N - e_N$ denote the payoff differential for N between the status quo and separation and let $\Delta R = e_R - u_R$ denote the payoff differential for R between the separation and the status quo. We assume from now on that both are positive: $\Delta N > 0$ and $\Delta R > 0$. See Figure 2.

3 Optimal repression

The optimal level of repression for N, which is also the level of repression at which N can credibly commit, is the one that maximizes N's payoff upon disobedience by R. That is,

$$r^* = \arg \max_{r_0 \leq r \leq r_1} EU_N(r)$$

It is reasonable to assume that this is the level of repression that N prefers when it reaches the last stage of the game and repression has to be implemented. It is also reasonable to assume that it is the only repression level that R can credibly believe that may be implemented at that stage and therefore it is the only credible prediction.

We consider two different cases depending on whether $p(r)$ is an increasing or decreasing function of r. A non increasing $p(r)$ implies that higher levels of repression (weakly) decrease the likelihood of the status quo after conflict. This would be the case when repression feeds the regional policy demands: by increasing the numbers or intensities of the regional demands, it also increases the chances that their most preferred outcome, separation, succeeds. Notice that since we assume that N prefers the status quo to separation, for a non increasing $p(r)$ we have that $EU_N(r)$ is a decreasing function of r and the optimal repression level for N is the minimal feasible, r_0. Thus in this case we obtain a corner solution.

Proposition 1 *If* $p'(r) \leq 0$ *then* $r^* = \arg\max EU_N(r) = r_0$*.*

Proof:

The first order condition determines that $p'(r)\Delta N - C'_N(r) < 0$ because $p'(r) \leq 0$ and $C'_N(r) > 0$. Thus $EU_N(r)$ is decreasing and its maximal value is attained at $r^* = r_0$.■

First of all notice that in this case N's optimal repression level is constant for all parameter values and it is also the minimal feasible level. Since we assume that $p(r)$ is a non increasing function then we must have that the conflict sustains the status quo outcome with the largest possible probability $p(r_0)$. Clearly, when repression has a positive effect fuelling regional protests, N has no incentives to use any repression since it would worsen its own payoffs. Therefore N is better off implementing the corner solution corresponding to the minimal repression level.

Otherwise, if $p(r)$ is an increasing function of r we have that larger repression levels make the status quo a more likely outcome of the conflict and thus higher levels of repression might be beneficial for N. The next proposition characterizes the conditions under which an interior solution to the optimal repression level exists.

Proposition 2 *If* $p'(r) > 0$ *then an interior solution to* $r^* = \arg\max EU_N(r)$ *exists if and only if* $\frac{p'(r)}{C'_N(r)}$ *is a decreasing function of* r *.*

Proof:

The first order condition for an interior solution determines that $p'(r^*)\,\Delta N = C'_N(r^*)$. And the second order condition that guarantees that this solution is a maximum determines that $p''(r)\,\Delta N - C''_N(r) \leq 0$. Since $p'(r) > 0$, the first order condition implies that $\Delta N = \frac{C'_N(r^*)}{p'(r^*)}$ and the second order condition can be rewritten as $p''(r^*)\,\Delta N - C''_N(r^*) = p''(r^*)\,\frac{C'_N(r^*)}{p'(r^*)} - C''_N(r^*) \leq 0$ or $p''(r^*)\,C'_N(r^*) - p'(r^*)\,C''_N(r^*) \leq 0$ which holds if and only if the derivative of $\frac{p'(r)}{C'_N(r)}$ with respect to r is negative. ■

This proposition characterizes the necessary and sufficient conditions for an interior condition to determine the optimal level of repression. An increasing $p(r)$ is a necessary condition to have an interior optimal level of repression, since otherwise we have already shown that the optimal repression is given by a corner solution. In order to satisfy the second order condition it is also necessary that $p(r)$ is concave enough to compensate for the possible concavity of $C_N(r)$ and produce an overall concave expected payoff for N in case of conflict. Notice that a sufficient condition to have a maximal interior solution is that $p(r)$ is an increasing and concave function and $C_N(r)$ is a convex function.

In general the optimal level of repression when the solution is interior depends on the value of the parameters corresponding to N, in particular it depends on the difference between the payoff of the status quo and the payoff of separation, ΔN. Furthermore, we find that if an interior solution exists, then the optimal level of repression must be an increasing function of ΔN as shown in the next proposition:

Proposition 3 *If $r^*(\Delta N)$ is interior and unique then* $\frac{\partial r^*(\Delta N)}{\partial \Delta N} \geq 0$.

Proof:

The first order condition for an interior solution determines that

$$p'(r^*(\Delta N))\,\Delta N - C'_N(r^*(\Delta N)) = 0$$

and it holds as an identity for all ΔN. Its derivative with respect to ΔN implies that

$$\frac{\partial r^*(\Delta N)}{\partial \Delta N}\left[p''(r^*(\Delta N))\,\Delta N - C''_N(r^*(\Delta N))\right] + p'(r^*(\Delta N)) = 0.$$

Since $p' > 0$, because it is a necessary condition for an interior solution, and the second order condition holds, implying that

$$p''(r^*(\Delta N))\,\Delta N - C''_N(r^*(\Delta N)) < 0,$$

then we must have that $\frac{\partial r^*(\Delta N)}{\partial \Delta N} > 0$. ■

Since ΔN denotes the payoff differential for N between the status quo and separation, then we have that the larger the benefits of maintaining the status quo for N the larger the level of repression that N is willing to implement.

When the conditions stated in Proposition 2 are not met, that is if $p'(r) > 0$ and $\frac{p'(r)}{C'_N(r^*)}$ increases with r^*, we have that if an interior solution exists it must be a minimum, and therefore the optimal level of repression is determined by a corner solution: either $r^* = r_0$ if $EU_N(r_0) \geq EU_N(r_1)$;or $r^* = r_1$ if $EU_N(r_0) \leq EU_N(r_1)$. In this case, the optimal repression level corresponds to the minimal or maximum possible, depending on the value of ΔN. More specifically, we have that it is optimal to implement the minimal possible level of repression for low values of N's payoff differential, $\Delta N \leq \frac{C_N(r_1)-C_N(r_0)}{p(r_1)-p(r_0)}$, while for large values of this payoff differential, $\Delta N \geq \frac{C_N(r_1)-C_N(r_0)}{p(r_1)-p(r_0)}$, the optimal repression level is the maximal. This is due to the convexity of N's payoff function under repression.

We could also consider an inverted U-shaped functional form for $p(r)$. It could be interpreted as if low repression levels are successful against the protests and thus increase the probability of the conflict resolving in the status quo, while larger repression levels fuel regional protests and thus reduce the probability of the conflict resolving in the status quo. In this case the optimal repression level will be given by an interior solution lying in the set of values of r where $p(r)$ is increasing.

In order to illustrate some of the results described above we consider specific functional forms that allow an explicit computation of the optimal repression level. Suppose that $p(r) = r^\beta$ and $C_N(r) = C_R(r) = r$ with $0 < r_0 \leq r \leq r_1 < 1$. In this case the conditions for an interior optimal repression level hold for $\beta < 1$ and it is given by

$$r^* = \begin{cases} r_0 & if \quad \Delta N \leq \frac{(r_0)^{1-\beta}}{\beta} \\ (\beta \Delta N)^{\frac{1}{1-\beta}} & if \quad \frac{(r_0)^{1-\beta}}{\beta} \leq \Delta N \leq \frac{(r_1)^{1-\beta}}{\beta} \\ r_1 & if \quad \Delta N \geq \frac{(r_1)^{1-\beta}}{\beta} \end{cases}$$

The optimal repression depends on the value of ΔN and it increases with it. We also have that $\frac{\partial r^*}{\partial \beta} > 0$ if and only if $\frac{1}{e} < (\beta \Delta N)^{\frac{\beta}{1-\beta}}$. Thus,for large values of β and large values of ΔN, the optimal repression level increases with the value of β, that is, the more concave $p(r)$, the smaller the optimal repression level for N.

The probability that conflict resolves in the status quo outcome is given by

$$p(r^*) = \begin{cases} (r_0)^\beta & if \quad \Delta N \leq \frac{(r_0)^{1-\beta}}{\beta} \\ (\beta \Delta N)^{\frac{\beta}{1-\beta}} & if \quad \frac{(r_0)^{1-\beta}}{\beta} \leq \Delta N \leq \frac{(r_1)^{1-\beta}}{\beta} \\ (r_1)^\beta & if \quad \Delta N \geq \frac{(r_1)^{1-\beta}}{\beta} \end{cases}$$

The probability of remaining in the status quo after implementing an optimal repression level also depends on the value of ΔN and it increases with it. We also have that $\frac{\partial p(r^*)}{\partial \beta} > 0$ if and only if $\frac{1}{e} < (\beta \Delta N)^{\frac{1}{1-\beta}}$. Thus, for large values of β and large values of ΔN, the probability of remaining in the status quo increases with the value of β, that is, the more concave $p(r)$, the smaller the probability of remaining in the status quo.

4 Equilibrium

We solve for the Subgame Perfect Nash Equilibrium by applying backward induction. First notice that repression is more likely to be chosen by N when its payoffs at the status quo are very large relative to its payoffs upon separation. Similarly, R is more likely to disobey when its payoffs upon separation are very large relative to its payoffs at the status quo. And accommodation is more likely to be offered by N the smaller are its costs and more likely to the acquiesced by R the larger are its benefits.

First suppose that the optimal repression level is constant for all parameter values, that is, it is obtained as a corner solution as shown in the previous section. Suppose that $r^* = r_0$ (the analysis of the case for $r^* = r_1$ would be analogous) and the probability that conflict resolves in the status quo outcome is given by $p(r^*) = p(r_0)$ which corresponds to its maximal possible value. In this case the equilibrium payoffs are given in the next proposition.

Proposition 4 *If $r^* = r_0$ then the equilibrium payoffs are*

(e_N, e_R)	$if\ \Delta N \leq \frac{C_N(r_0)}{p(r_0)} \wedge (\Delta R \geq a_R \vee \Delta N \leq a_N)$
$(u_N - a_N, u_R + a_R)$	$if\ a_N < \Delta N \leq \frac{C_N(r_0)}{p(r_0)} \wedge \Delta R < a_R$ or $\Delta N \geq \max\left\{\frac{C_N(r_0)}{p(r_0)}, \frac{a_N - C_N(r_0)}{1-p(r_0)}\right\} \wedge \frac{C_R(r_0)}{1-p(r_0)} \leq \Delta R \leq \frac{C_R(r_0)+a_R}{1-p(r_0)}$
(u_N, u_R)	$if\ \Delta N \geq \frac{C_N(r_0)}{p(r_0)} \wedge \Delta R \leq \frac{C_R(r_0)}{1-p(r_0)}$
$(EU_N(r_0), EU_R(r_0))$	$otherwise$

Proof:

Notice that $EU_N(r^*) > e_N$ if and only if $\Delta N > \frac{C_N(r_0)}{p(r_0)}$. Thus repression is chosen in the last stage of the game for large values of N's payoff differential.

First we consider the case in which N chooses to repress in the last stage, $\Delta N \geq \frac{C_N(r_0)}{p(r_0)}$, and we move backwards to analyze R's decision. The expected outcome for R under repression is given by

$$EU_R(r_0) = p(r_0)\, u_R + (1 - p(r_0))\, e_R - C_R(r_0).$$

In this case we have that R decides to disobey whenever $EU_R(r_0) \geq u_R$ which is equivalent to $\Delta R > \frac{C_R(r_0)}{1-p(r_0)}$ if N ignores; and whenever $\Delta R > \frac{C_R(r_0)+a_R}{1-p(r_0)}$ if N offers accommodation. Thus we have to consider three subcases. First, for all $\Delta R > \frac{C_R(r_0)+a_R}{1-p(r_0)}$, that is when R's differential between the payoffs of separation and the status quo is very large, R will always decide to disobey independently of the initial choice of N. In this case N will be indifferent between ignoring or accommodating because in both cases the repression outcome prevails. Thus the equilibrium outcome will be $(EU_N(r_0), EU_R(r_0))$.

Second, for all $\Delta R < \frac{C_R(r_0)}{1-p(r_0)}$, that is when R's differential between the payoffs separation and the status is very small, R will always acquiesce independently of the initial choice of N. In this case N will always prefer to ignore since $u_N > u_N - a_N$. Thus the equilibrium outcome will be the status quo (u_N, u_R).

Finally, for all $\frac{C_R(r_0)}{1-p(r_0)} \leq \Delta R \leq \frac{C_R(r_0)+a_R}{1-p(r_0)}$, that is when R's differential payoffs between separation and the status quo is moderate, R will decide to acquiesce if accommodation is offered by N, but R will decide to disobey if N chooses to ignore the protests. In this case N prefers to ignore whenever $\frac{a_N - C_N(r_0)}{1-p(r_0)} > \Delta N$ because it implies $EU_N(r_0) > u_N - a_N$. The equilibrium outcome will be $(EU_N(r_0), EU_R(r_0))$ for small values of ΔN and $(u_N - a_N, u_R + a_R)$ for large values of ΔN.

Now we consider the case in which N will choose to let go in the last stage, $\Delta N \leq \frac{C_N(r_0)}{p(r_0)}$, and we move backwards to analyze the decision of R. If N has initially ignored then R will always decide to disobey because $e_R > u_R$. If N has offered accommodation then R decides to disobey whenever $\Delta R > a_R$. Therefore we have that for $\Delta R > a_R$ N is indifferent between ignoring and accommodating because R is always disobeying and the equilibrium outcome is (e_N, e_R). Otherwise, N prefers to accommodate whenever $\Delta N > a_N$ and to ignore otherwise. The equilibrium in this case is $(u_N - a_N, u_R + a_R)$ whenever $\Delta R < a_R$ and $\Delta N > a_N$; and $(EU_N(r_0), EU_R(r_0))$ whenever $\Delta R < a_R$ and $\Delta N < a_N$.■

There is a clear difference between the equilibria obtained for small and large values of N's payoff differential relative to the costs of repression. When the payoff differential is small then separation is the only equilibrium outcome, except for the cases in which accommodation is cheap enough for N and beneficial enough for R, in which cases accommodation is offered by N and accepted by R. Otherwise, the threat of repression conditions the decision by R, who will choose to risk repression when its payoff differential is large enough and to acquiesce when its payoff differential is very small. For middle range values of the payoff differential R will accept accommodation whenever it is offered by N, and accommodation will be offered by N whenever its costs are small enough. When that is not the case, repression will obtain in equilibrium. See Figure 3.

Notice that as the cost of offering accommodation increases for N, the set of parameters for which accommodation obtains in equilibrium shrinks and the equilibrium outcome is replaced by repression. See Figure 4.

Now suppose that $p'(r) > 0$ and the optimal level of repression is uniquely given by an interior solution. In this case we have that the optimal repression depends on the parameters of the model, in particular on the value of $\Delta N = u_N - e_N$, and we know that the optimal value of repression will be larger for larger the value of ΔN. Again we start by solving the decision of N between repressing or letting go. We have that N will always choose to repress whenever $EU_N(r^*) > e_N$. In general we have that N prefers to let go for small values of ΔN, and N prefers to repress for large values of ΔN because $EU_N(r^*) > e_N$ if and only if $\Delta N \geq \frac{C_N(r^*)}{p(r^*)}$. The next proposition states the conditions under which repression will prevail for all parameter values.

Proposition 5 *If* $r^* = \arg\max EU_N(r)$ *is an interior solution then N chooses* *repression if and only if* $\frac{p(r)}{C_N(r)}$ *is a decreasing function of* r *.*

Proof:

We have that for N repression is better than letting go whenever $EU_N(r^*) - e_N > 0$ or $p(r^*)\Delta N - C_N(r^*) > 0$. Since an interior solution has to satisfy $p'(r^*)\Delta N = C_N'(r^*)$ the previous condition can be rewritten as $p'(r^*)C_N(r^*) - p(r^*)C_N'(r^*) < 0$ which holds whenever $\frac{p(r)}{C_N(r)}$ is a decreasing function of r .■

This proposition characterizes the necessary and sufficient conditions for repression to be a dominant strategy for N for all parameter values when the optimal level of repression is an interior solution. Since an increasing $p(r)$ is a necessary condition to have an interior optimal level of repression, we need $C_N(r)$ to be increasing faster than $p(r)$ in order for repression to be preferred to let go by the national government. If repression is a dominant strategy for N for all parameter values, then separation cannot be an equilibrium outcome. We have that repression obtains in equilibrium for relative large values of ΔR and the status quo obtains in equilibrium for relative small values of ΔN. Accommodation can only obtain when a_R is large enough, a_N is small enough, and ΔN is also large enough.

Otherwise, when the parameter values are such that N prefers to let go in the final stage, we have that R always prefers to disobey when N ignores, because $e_R > u_R$; and R prefers to disobey when N accommodates for large enough values of ΔR relative to the benefits of accommodation.

The equilibrium payoffs when the optimal repression level is an interior solution are described in the next proposition.

Proposition 6 *If* $r^* = \arg\max EU_N(r)$ *is an interior solution then the equilibrium payoffs are*

(e_N, e_R)	$if\ \Delta N \leq \frac{C_N(r^*)}{p(r^*)} \wedge (\Delta R \geq a_R \vee \Delta N \leq a_N)$
$(u_N - a_N, u_R + a_R)$	$if\ a_N < \Delta N \leq \frac{C_N(r^*)}{p(r^*)} \wedge \Delta R < a_R$ *or* $\Delta N \geq \max\left\{\frac{C_N(r^*)}{p(r^*)}, \frac{a_N - C_N(r^*)}{1-p(r^*)}\right\} \wedge \frac{C_R(r^*)}{1-p(r^*)} \leq \Delta R \leq \frac{C_R(r^*)+a_R}{1-p(r^*)}$
(u_N, u_R)	$if\ \Delta N \geq \frac{C_N(r^*)}{p(r^*)} \wedge \Delta R \leq \frac{C_R(r^*)}{1-p(r^*)}$
$(EU_N(r^*), EU_R(r^*))$	*otherwise*

Proof:

First we consider the case in which N chooses to repress in the last stage, $\Delta N \geq \frac{C_N(r^*)}{p(r^*)}$, and we move backwards to analyze the decision of R. The expected outcome for R under repression is given by

$$EU_R(r^*) = p(r^*)u_R + (1 - p(r^*))e_R - C_R(r^*).$$

In this case we have that R decides to disobey whenever $EU_R(r^*) \geq u_R$ which is equivalent to $\Delta R > \frac{C_R(r^*)}{1-p(r^*)}$ if N ignores, and for $\Delta R > \frac{C_R(r^*)+a_R}{1-p(r^*)}$ if N offers accommodation. Thus we have to consider three subcases. First, for all $\Delta R > \frac{C_R(r^*)+a_R}{1-p(r^*)}$, that is when the differential between the payoffs of separation and the status quo for R is very large, R will disobey independently of the initial choice of N. In this case N will be indifferent between ignoring or accommodating because in both cases the repression outcome is expected. Thus the equilibrium outcome will be $(EU_N(r^*), EU_R(r^*))$.

Second, for all $\Delta R < \frac{C_R(r^*)}{1-p(r^*)}$, that is when the differential between R's payoffs of separation and the status quo is very small, R will acquiesce independently of the initial choice of N. In this case N will always prefer to ignore since $u_N > u_N - a_N$. Thus the equilibrium outcome will be the status quo (u_N, u_R).

Finally, for all $\frac{C_R(r^*)}{1-p(r^*)} \leq \Delta R \leq \frac{C_R(r^*)+a_R}{1-p(r^*)}$, that is when the differential between the payoffs of the separation and the status quo for R is moderate, R will acquiesce if accommodation is offered by N, but R will disobey if N does not accommodate. In this case N prefers to ignore whenever $\frac{a_N - C_N(r^*)}{1-p(r^*)} > \Delta N$ because it implies $EU_N(r^*) > u_N - a_N$. The equilibrium outcome will be $(EU_N(r^*), EU_R(r^*))$ for small values of ΔN and $(u_N - a_N, u_R + a_R)$ for large values of ΔN.

Now we consider the case in which N will choose to let go in the last stage, $\Delta N \leq \frac{C_N(r^*)}{p(r^*)}$, and we move backwards to analyze the decision of R. If N has initially ignored then R will disobey because $e_R > u_R$. If N has offered accommodation then R disobey whenever $\Delta R > a_R$. Therefore we have that for $\Delta R > a_R$ N is indifferent between ignoring and accommodating because R is always disobeying and the equilibrium outcome is (e_N, e_R). Otherwise, N prefers to accommodate whenever $\Delta N > a_N$. The equilibrium in this case is $(u_N - a_N, u_R + a_R)$ whenever $\Delta R < a_R$ and $\Delta N > a_N$; and $(EU_N(r^*), EU_R(r^*))$ whenever $\Delta R < a_R$ and $\Delta N < a_N$.■

As in the previous case with a constant repression level, here separation obtains in equilibrium for small values of ΔN, unless the costs of accommodation are very small for N and its benefits are large enough for R in which case the accommodation payoffs obtain in equilibrium. For large values of ΔN the possible equilibrium outcomes are either repression, accommodation or the status quo. The set parameter values for which each equilibrium outcome is produces depends on the specific functional form of $p(r^*)$.

Notice that when N is close to indifferent between the status quo and separation, then repression never obtains in equilibrium. Either accommodation is offered and accepted, and that happens when N's cost of accommodation is low enough; or separation is implemented. However, when the payoff differential is important for N, repression is a very likely equilibrium outcome. Notice that the larger N's payoff differential is, the larger the amount of repression that it is willing to implement. In this case, the status quo obtains in equilibrium due to the large threat of repression that N can credibly commit to.

When N chooses to repress in the last stage, the equilibrium strategies for R are to acquiesce for low values of ΔR, to disobey for high values of ΔR, and R will accept accommodation if offered for some middle values of ΔR. In equilibrium N will offer accommodation only for large values of ΔN. When N chooses let go in the last stage, R always disobeys and N let's go except when the cost of accommodation is low enough and its benefits are high enough. The next table describes the equilibrium strategies:

{any, disobey, let go}	$if\ \Delta N \leq \frac{C_N(r^*)}{p(r^*)} \wedge \Delta R > a_R$
{ignore, disobey, let go}	$if\ \Delta N \leq \min\left\{\frac{C_N(r^*)}{p(r^*)}, a_N\right\} \wedge \Delta R \leq a_R$
{accommodate, acquiesce}	$if\ a_N < \Delta N \leq \frac{C_N(r^*)}{p(r^*)} \wedge \Delta R < a_R$ or $\Delta N \geq \max\left\{\frac{C_N(r^*)}{p(r^*)}, \frac{a_N - C_N(r^*)}{1-p(r^*)}\right\} \wedge \frac{C_R(r^*)}{1-p(r^*)} \leq \Delta R \leq \frac{C_R(r^*)+a_R}{1-p(r^*)}$
{ignore, acquiesce}	$if\ \Delta N \geq \frac{C_N(r^*)}{p(r^*)} \wedge \Delta R \leq \frac{C_R(r^*)}{1-p(r^*)}$
{ignore,disobey, repress}	$if\ \Delta N \geq \frac{C_N(r^*)}{p(r^*)} \wedge \Delta R > \frac{C_R(r^*)+a_R}{1-p(r^*)}$
{accommodate,disobey, repress}	$if\ \frac{C_N(r^*)}{p(r^*)} \leq \Delta N \leq \frac{a_N - C_N(r^*)}{1-p(r^*)} \wedge \frac{C_R(r^*)}{1-p(r^*)} \leq \Delta R \leq \frac{C_R(r^*)+a_R}{1-p(r^*)}$

4.1 Example

To illustrate the results described above we consider specific functional forms that allow an explicit computation of the equilibrium. Suppose that $p(r) = \sqrt{r}$ and $C_N(r) = C_R(r) = r$ with $0 < r \leq 1$. In this case the conditions for an interior optimal repression level hold and it is given by

$$r^* = \begin{cases} \left(\frac{\Delta N}{2}\right)^2 & if \quad \Delta N \leq 2 \\ 1 & if \quad \Delta N > 2 \end{cases}$$

Notice that the optimal repression level increases with N's payoff differential. The probability that conflict resolves in the status quo outcome is given by

$$p(r^*) = \begin{cases} \frac{\Delta N}{2} & if \quad \Delta N \leq 2 \\ 1 & if \quad \Delta N > 2 \end{cases}$$

This implies that $EU_N(r^*) > e_N$ for all ΔN. Thus repression is a dominant strategy for all parameter values in the last stage of the game. The equilibrium outcome will be

$(u_N - a_N, u_R + a_R)$	$if\ (\Delta N)^2 - 4\Delta N + 4a_N \leq 0 \wedge \frac{\left(\frac{\Delta N}{2}\right)^2}{1-\frac{\Delta N}{2}} \leq \Delta R \leq \frac{\left(\frac{\Delta N}{2}\right)^2 + a_R}{1-\frac{\Delta N}{2}}$
(u_N, u_R)	$if\ \Delta R \leq \frac{\left(\frac{\Delta N}{2}\right)^2}{1-\frac{\Delta N}{2}} \vee \Delta N > 2$
$(EU_N(r^*), EU_R(r^*))$	$otherwise$

Notice that $(\Delta N)^2 - 4\Delta N + 4a_N \leq 0$ can only hold for $a_N < 1$ and for $2 - 2\sqrt{1-a_N} < \Delta N \leq 2$.

Since, under the present specification, the optimal repression is an increasing function of ΔN, repression is more likely to obtain for relative low values of N's payoff differential (because they produce lower repression levels) and for relative high values of R's payoff differential. And the status quo is the most likely outcome for large values of N's payoff differential. This is so because for those values the credible amount of repression is also very large and thus it poses an important threat on R in case of disobedience. Finally, accommodation may only obtain when its costs for N are small enough relative to ΔN and for middle range values of ΔR.

Notice that in this example the separation outcome never obtains in equilibrium becasue the level of repression is allowed to be as small as wanted. However, if we fix a minimal amount of repression, or a fix cost is added to the cost of implementing repression for N, we would obtain that separation obtains in equilibrium for low values of ΔN. See figures 5 and 6.

5 Optimal government system

The optimal government structure depends on the specific values that the players derive from the different alternative systems. Here we characterize the Pareto efficient outcomes.

First of all notice that if $a_N > a_R$ then accommodation cannot be optimal since it is Pareto dominated by the status quo ($u_N + u_R > u_N - a_N + u_R + a_R$). In this case we have that the status quo Pareto dominates separation for all parameter values such that $e_N + e_R \leq u_N + u_R$, that is, whenever the overall utility is larger in the status quo than under separation. Otherwise separation Pareto dominates the status quo.

Instead, if we assume that $a_N \leq a_R$ then $u_N - a_N + u_R + a_R \geq u_N + u_R$, we have that accommodation Pareto dominates the status quo for all parameter values; therefore the status quo is never optimal. Accommodation Pareto dominates separation ($u_N - a_N + u_R + a_R > e_N + e_R$) whenever R's payoff difference is not very large relative to N's payoff difference ($a_R - a_N > \Delta R - \Delta N$). Otherwise, if ΔR is large enough relative to ΔN, separation Pareto dominates accommodation.

Finally, notice that the expected outcome from repression is never optimal because it is always worse than a convex combination of the status quo and separation for both players. Thus, we have that whenever the status quo Pareto dominates separation it also Pareto dominates the expected outcome from repression, and otherwise, whenever separation Pareto dominates the status quo it also Pareto dominates the expected outcome from repression.

We can conclude that the only possible efficient outcomes are either the status quo, separation and the modified status quo through accommodation. When the benefits of accommodation for R (a_R) are larger than the costs it implies for N (a_N), then accommodation is the optimal solution for a large set of parameter values, except for those in which the payoff differential between separation and the status quo is very large for R, in which case separation is optimal. Otherwise, when R's benefits of accommodation (a_R) are smaller than N's costs (a_N), then accommodation is inefficient. In this case the optimal solution is the status quo whenever N's payoff differential between the status quo and separation is large enough, and it is separation in the complementary. The next table summarizes of the optimal outcomes for all parameter values.

(u_N, u_R)	$if\ a_N > a_R\ and\ \Delta R \leq \Delta N$
$(u_N - a_N, u_R + a_R)$	$if\ a_N \leq a_R\ and\ \Delta R - \Delta N \leq a_R - a_N$
(e_N, e_R)	$otherwise$

See Figures 7 and 8. Optimal outcomes and the equilibria characterized in the previous section coincide only for a small set of parameter values. We have to consider two cases. If accommodation is not efficient because its cost for N is larger than its benefit for R, $a_N > a_R$, we can still have accommodation in equilibrium: whenever the cost for N is not very large or the benefit for R is not very small. In this case we have that when separation obtains in equilibrium it is often Pareto efficient and the same happens with the status quo.

Otherwise, if accommodation is efficient because its cost for N is smaller than its benefit for R, $a_N < a_R$, accommodation holds in equilibrium only for a very small set of parameter values: whenever the cost for N is not very large. In this case we have that when separation obtains in equilibrium it is often Pareto efficient, however the status quo obtains in equilibrium for a large set of parameter values and it is always inefficient.

More importantly the repression outcome which is never optimal obtains for a large set of parameter values. Otherwise, when $a_N \leq a_R$, in equilibrium accommodation only holds for a very small set of parameter values, while again the repression outcome which is never optimal obtains for a large set of parameter values.

6 Decentralization

In this section we use the decentralization level of the country as an explanatory variable of the payoffs of the players in our game. If we consider the level of decentralization of the two level government structure as a state variable, it makes sense to think that the payoffs of both governments at the different possible outcomes are functions of the existing level of decentralization. That is, in a very centralized country one should expect that the payoffs obtained in the status quo are very different from those that both governments may obtain under separation, because large centralization implies that most of the policy decisions are in the hands of the national government, thus his payoffs should be very large compared to those under separation, where he would have lost all decision power regarding the region. Similarly, large centralization implies that the regional government has almost no decision power, thus his payoffs should be very small compared to those under separation, where he would have complete decision power regarding the region. Instead, in a very decentralized country one should expect that the payoffs obtained in the status quo are very similar to those that both governments may obtain under separation, because large decentralization implies that most of the policy decisions are in the hands of the regional government already, thus his payoffs should be very similar to those that the region would have under separation, where he would have complete decision power. Similarly, large decentralization implies that the national government has almost no decision power over the region, thus his payoffs should be very similar to those he would obtain under separation.

Let $d \in [0,1]$ denote the level of decentralization, with $d = 0$ representing a situation in which the region has no decision power, that is a fully centralized country, and $d = 1$ representing a situation in which the region has separated, that is, it has all the decision power. Then the payoffs of both governments can be represented as functions of d, $\pi_N(d)$ and $\pi_R(d)$ with $\frac{\partial \pi_N(d)}{\partial d} < 0$ and $\frac{\partial \pi_R(d)}{\partial d} > 0$, that is, more decentralization decreases the national government payoffs and increases the regional government payoffs as the decision power changes from the central government to the region. And since maximal decentralization implies separation we must have that $\pi_N(1) = e_N$ and $\pi_R(1) = e_R$.

Let's assume that the protests start at some given level of decentralization $d \in (0,1)$. Then we can write the payoff differential for the national government as a function of the decentralization level as follows: $\Delta N(d) = \pi_N(d) - \pi_N(1)$; and similarly we can write the payoff differential for the regional government as $\Delta R(d) = \pi_R(1) - \pi_R(d)$. Thus we have that both ΔN and ΔR are decreasing functions of d; and any decentralization level d determines the pair of corresponding payoff differentials for N and R. Thus we can compute $\Delta R(\Delta N) = \Delta R\left(\Delta N^{-1}(d)\right)$ and produce the corresponding differential payoffs for N and R for any possible decentralization level. The function $\Delta R(\Delta N)$ is an increasing function because $\frac{\partial \Delta R(\Delta N)}{\partial \Delta N} = \frac{\Delta R'\left(\Delta N^{-1}(d)\right)}{\Delta N'(\Delta N^{-1}(d))} > 0$. If we compute the equilibrium outcomes for these parameter values we find that the stability of the multi-level government structure is very likely to obtain for any decentralization level whenever this function is convex. The condition for its convexity is

$$\Delta R''\left(\Delta N^{-1}(d)\right)\Delta N'\left(\Delta N^{-1}(d)\right) < \Delta R'\left(\Delta N^{-1}(d)\right)\Delta N''\left(\Delta N^{-1}(d)\right).$$

A sufficient condition for its convexity is that ΔN is concave and ΔR is convex.

Otherwise, whenever $\Delta R(\Delta N)$ is a concave function, repression is more likely to obtain as an equilibrium outcome, and accommodation may also obtain for some moderate decentralization levels.

Combining these results to the equilibria we found before, we can argue that in general for large levels of decentralization the most likely equilibrium outcome is a friendly separation because large decentralization implies that both ΔN and ΔR ara rather small, and thus it does not pay for any party to risk conflict. As in Gibilisco (2016) more decentralization induces less willigness to repress by the national government.

7 Electoral competition

We have seen that the parameters that are most relevant to obtain accommodation as an equilibrium outcome are the costs and benefits associated with it. We have shown that the larger are the costs of accommodation for N the less likely accommodation may obtain in equilibrium, because when accommodation is very costly N will offer it only for very large values of ΔN. Similarly, the smaller are R's benefits of accommodation the less likely accommodation may obtain in equilibrium, because when the benefits of accommodation are very small, R will only decide to accept it for very small values of ΔR.

If the costs and benefits of accommodation are only based on the consequences of the transfer of decision power from the national government to the regional one, then it is reasonable to think that the two magnitudes will be correlated: a large (small) power transfer implies large (small) costs for the national government and large (small) benefits for the regional government. However, since the players are not only incumbents in government but also party leaders, their payoffs should include not only the rewards they receive as politicians in office but also those that may be obtained as party leaders when competing in future elections. On the one hand, the decision to offer some accommodation by the national government to the regional one may have an electoral effect on future elections. At the national level this effect could be negative if the transfer of more decision power to one region is seen as negative from the national constituency point of view. On the other hand, the decision to accept some accommodation by the regional government from the national one may have an electoral effect on future elections as well. At the regional level this effect could be negative if it is seen as giving up on the demands of the regional constituency.

The combination of these two effects may imply larger accommodation costs for the national government and smaller accommodation benefits for the regional government. Both effects imply a severe reduction of the set of parameter values for which accommodation obtains as an equilibrium outcome and increases the set of parameter values for which repression obtains in equilibrium. Thus in this case, the effects of electoral competition may reduce the chances of solving the problem originated by the demands of the regional constituency with an agreement between the national and the regional governments, and as a result renders the multi-level government structure unstable. See figures 9 and 10.

In order to illustrate these arguments, let's suppose that electoral competition takes place on the decentralization dimension. We consider that both parties care about their own future electoral prospects and also about the level of decentralization implemented. We assume that both parties have ideal points on the decentralization dimension. It is reasonable to assume that the ideal point of the national government is $d_N = 0$, that is, full centralization; and the ideal point of the regional government is assumed to be $d_R = 1$, that is, full decentralization. Similarly, it is also reasonable to assume that the distributions of the national and regional constituencies are different, and that the ideal point of the median voter of the national constituency is smaller than the ideal point of the median voter of the regional constituency, that is, $m_N < m_R$.

Suppose that the game is played at a given d and that if an accommodation of a is offered and accepted then the decentralization level would move to $d+a$.

If we start with a d such that $m_N < d < m_R$ then any accommodation implies an increase decentralization to $d+a$ and thus it worsens the payoffs for N both in terms of policy and in terms of electoral prospects, because it moves the policy outcome away from the median's ideal point of its main constituency. Similarly, it improves the payoffs for R in terms of policy and it also improves R's payoffs in terms of electoral prospects, as long as the accommodation is not very large, that is, $a < 2(m_R - d)$.

If we start with a d such that $m_N > d$ then any accommodation worsens the payoffs for N in terms of policy and it improves N's electoral prospects as long as $a < 2(m_N - d)$, because it moves the policy outcome closer to the median's ideal point of its main constituency. On the other hand, it improves the payoffs for R in terms of policy and it also improves R's payoffs in terms of electoral prospects, as long as the accommodation is not very large, that is, $a < 2(m_R - d)$.

If we start with a d such that $m_R < d$ then any accommodation worsens the payoffs for N both in terms of policy and in terms of electoral prospects. On the other hand, it improves the payoffs for R in terms of policy and it worsened R's payoffs in terms of electoral prospects.

These results imply that the overall cost for N of implementing a certain level of accommodation a is larger for large values of d, this means that in very decentralized systems it is less likely that accommodation is offered by N because it is much more costly that for more centralized systems.

And they also imply that the overall benefit for R of implementing a certain level of accommodation a is smaller for large values of d, this means that in very decentralized systems it is less likely that accommodation is accepted by R.

8 Conclusions, extensions, and applications

We have analyzed a model of bargaining over the allocation of power between a national government and a regional government, and we have explored the likelihood of different outcomes such as separation, repression, accommodation, and the status quo. We find a unique Subgame Perfect Nash Equilibrium for any set of parameter values, and we also have that any possible outcome can be obtained as a Subgame Perfect Nash Equilibrium for a given set of parameter values.

Thus, even though we consider a model of complete information, we obtain that conflict is chosen in equilibrium for some parameter values. This result appears to be in contrast with several theories of secession based only on economic incentives, such as Anesi (2012), Anesi and de Donder (2013) and Le Breton and Weber (2003) consider only economic incentives as well, where they find that accommodation always obtains in equilibrium. On the other hand, this result complements the theory proposed by Esteban et al. (2018) where conflict emerges from the mismatch between the relative size of the players and their relative surplus contribution.

We have also found that the existing level of decentralization and the effects of electoral competition may impose some bounds on the incentives of the national government to offer enough accommodation and thus to avoid repression[3].

We have assumed that the payoffs if repression are the same independently of whether the national government has offered accommodation or has ignored the regional protests. This assumption could be weaked and the results obtained would not change qualitatively. Indeed, it is reasonable to assume that after N ignores the demands, the response of the regional constituency to the repression will be more intense the larger the level of repression implemented and that should reduce the chances that the status quo may survive. On the other hand, after N offers accommodation, the response of the regional constituency to the repression should be milder, and thus increasing repression is more likely to re-establish the status quo outcome. Thus different shapes of $p(r)$ could be assumed to determine the payoffs of repression after each one of N's initial response which would imply that the optimal repression level is different in each one of the cases.

Suppose that $p_a(r)$ denotes the probability that the status quo obtains after conflict in case accommodation has been offered and the level of repression is equal to r ; similarly suppose that $p_i(r)$ denotes the probability that the status quo obtains after conflict in case the N has ignored the protests and the level of repression is equal to r . One could think that $p_a'(r) > 0$ because repression after accommodation is more likely to soften the protests and $p_i'(r) < 0$ because repression after ignoring is more likely to increase the intensity of the protests. In this case we would have that the optimal repression after ignoring is constant for all parameter values and equal to the smallest feasible repression level, r_0; while the optimal repression after accommodation, r^*, depends on the parameter values and may be larger than r_0 and possibly increase with ΔN. The equilibrium outcome will depend on whether $p_a(r^*)$ is larger or smaller than $p_i(r_0)$. If $p_i(r_0) > p_a(r^*)$ we have that $EU_N(r^*) < EU_N(r_0)$ thus N is more likely to implement repression after accommodation is offered, since $r_0 < r^*$ and R is more or less likely to disobey after accommodation since in this case R suffers a larger cost because of the larger repression level but it is more likely that R's best outcome after conflict occurs because it is less likely that the status quo remains. Otherwise, if $p_i(r_0) < p_a(r^*)$ we have that $EU_R(r^*) < EU_R(r_0)$ thus R is less likely to disobey after accommodation is offered, since $r_0 < r^*$ and N is more or less likely to implement repression after accommodation since in this case N suffers a larger cost because of the larger repression level but it is more likely that N's best outcome after conflict occurs.

Similarly we could think that the costs of implementing repression for N and those of suffering repression for R are different after accommodation is offered than after the protests are ignored. In this case the analysis would be similar to

[3] Bolton and Roland (1997), Goyal and Staal (2004) and Gradstein (2003) analyze the incentives for secession and unification that are based only on economic factors.

the previous one, because the optimal amount of repression depends on the first derivative of the cost function, but the decision of N to implement it depends on the value of the cost at the optimal level of repression.

In general the specific shape of the probability functions and the cost functions will only determine the specific sets of parameter values for which each one of the possible outcomes obtain in equilibrium, but will not affect qualitatively the results obtained here.

Gibilisco (2018) shows that in a two level government structure, large levels of decentralization make the national government more tolerant with respect to regional protests and less willing to implement repression. Combining this argument with our results, we can conclude that if the repression costs of the national government are higher in more decentralized multi-level government structures, then they are also more likely to be stable.

The recent conflict between the Spanish and the Catalan governments can be explained with the game presented. In this case we have observed that the conflict between the two governments has resulted in repression. The equilibrium strategies used in this case are: ignore the Catalan protests by the Spanish government, disobey the Spanish law by the Catalan government and repress the Catalan society and the Catalan government by the Spanish government and the Spanish justice system. Thus we can induce that the benefits of the union for Spain (ΔN) were large and the benefits of the separation for Catalonia (ΔR) were also large. In addition, the costs of offering accommodation for Spain (a_N) were relatively large, and the benefits of accepting accommodation for Catalonia (a_R) were relatively small.

The negotiations between the British and Scottish governments over the Scottish independence protests can also be explained with our results. In this case the equilibrium outcome obtained was accommodation. The equilibrium strategies were: the British government offers accommodation (maximal devolution and a referendum on the secession of Scotland) and the Scottish government and society decided to acquiesce the offer made by the British government. Thus we can induce that the benefits of the union for UK (ΔN) were moderately large and the benefits of the separation for Scotland (ΔR) were also moderately large. In addition, the costs of offering accommodation for UK (a_N) were relatively small, and the benefits of accepting accommodation for Scotland (a_R) were relatively large.

The Brexit conflict can also be analyzed with our game. In this case the players are the government of the EU, in the role of N, and the British government, in the role of R. The outcome obtained in this case appears to be a friendly separation. The equilibrium strategies that are being used seem to be: first, the EU offers some accommodation which is rejected by the British government and society, and then the EU decides to let the UK go. Thus we can induce that the benefits of maintaining the UK in the union for EU (ΔN) were rather small and the benefits of the separation for UK (ΔR) were also rather small. In addition, the costs of offering accommodation for EU (a_N) were relatively small, and the benefits of accepting accommodation for UK (a_R) were also relatively small. In this case, one can think that the small benefits of accommodation for the UK may be determined, at least partially by the effects of an strong electoral competition in the UK.

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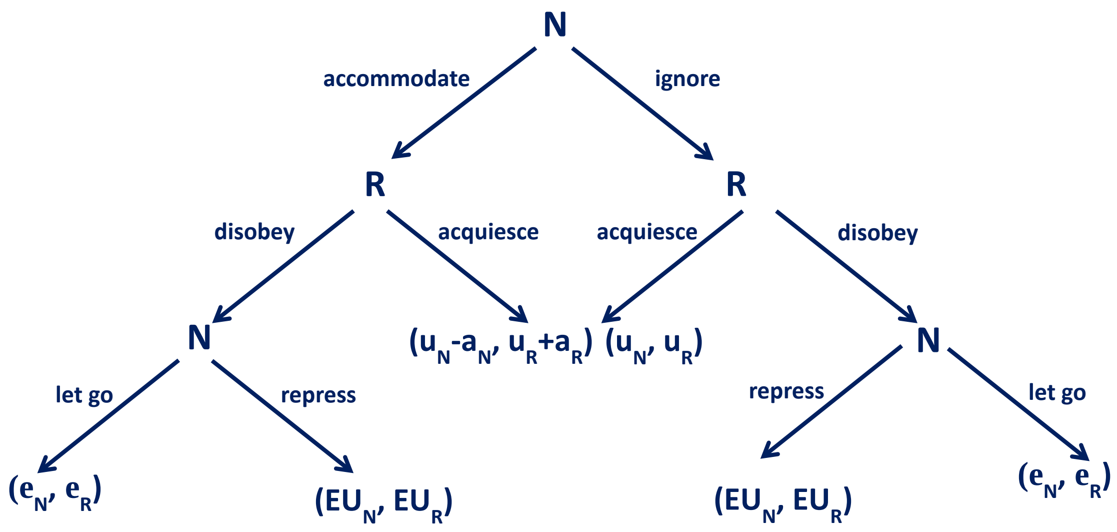

Figure 1: Extensive form game

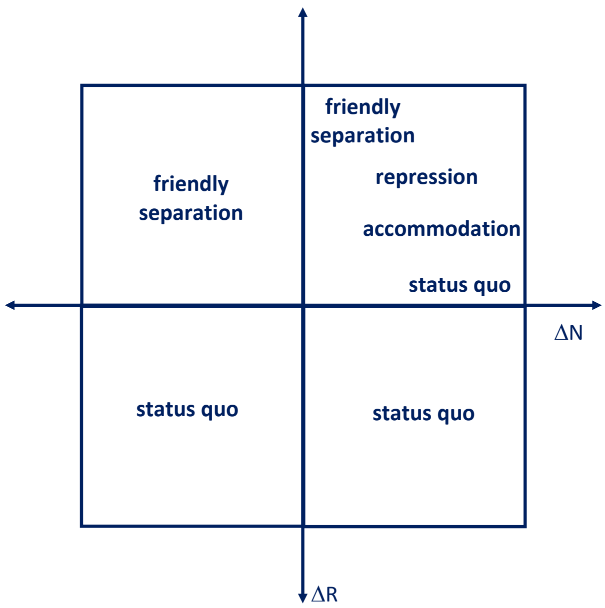

Figure 2: Non-trivial game for ΔN, $\Delta R > 0$

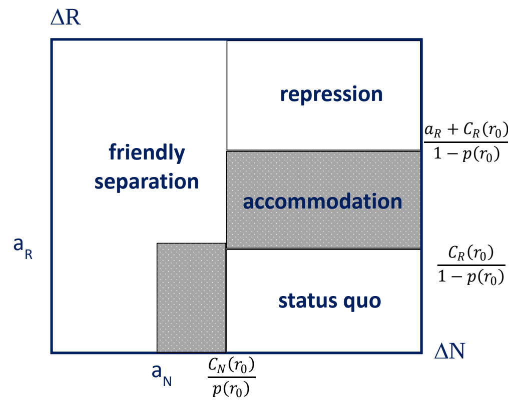

Figure 3: Equilibria for $r^*=r_0$ and small a_N

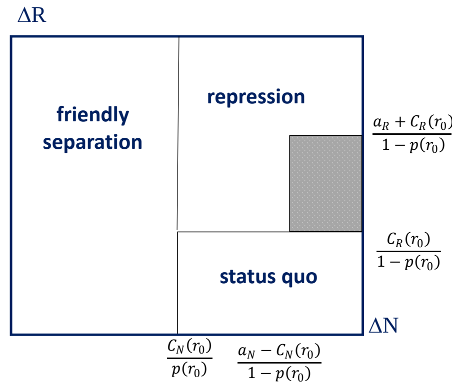

Figure 4: Equilibria for $r^*=r_0$ and large a_N

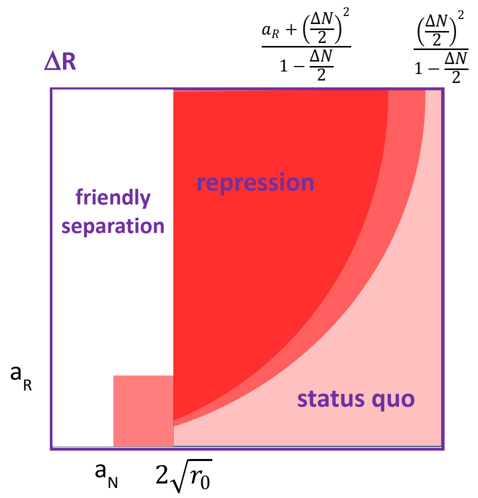

Figure 5: Equilibrium outcomes for $p(r)=r^{1/2}$, $C_N(r)=r_0+r$, $C_R(r)=r$ and small a_N.

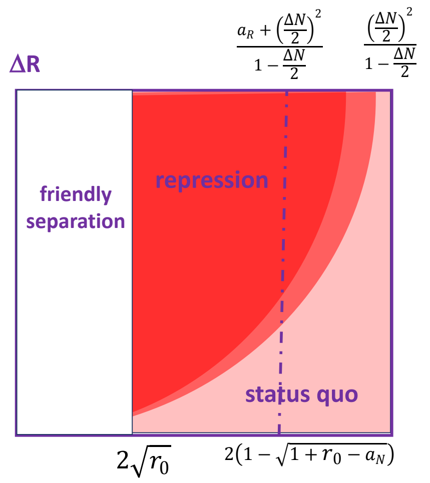

Figure 6: Equilibrium outcomes for $p(r)=r^{1/2}$, $C_N(r)=r_0+r$, $C_R(r)=r$ and large a_N.

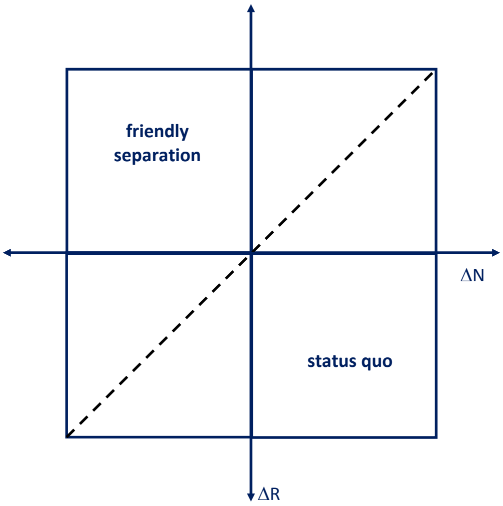

Figure 7: Pareto optimal outcomes if $a_N > a_R$

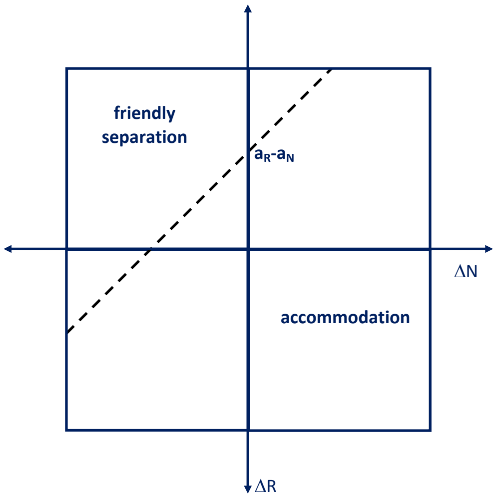

Figure 8: Pareto optimal outcomes if $a_N < a_R$

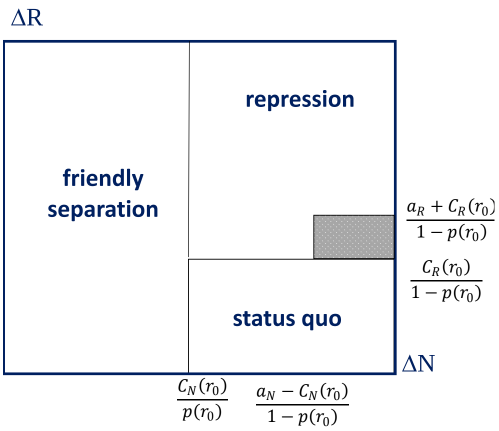

Figure 9: Equilibria for $r^*=r_0$ large a_N and small a_R

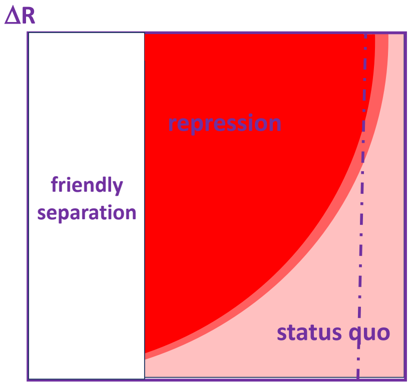

Figure 10: Equilibrium outcomes for $p(r)=r^{1/2}$, $C_N(r)=r_0+r$, $C_R(r)=r$ large a_N and small a_R.