# On the Timing of Separatist Conflict

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**Abstract**

We study the endogenous timing of separatist conflict, that is, a situation in which two regions fight against each other in order to force the border configuration they prefer. Assuming that incentives for secession are driven by the traditional trade-off between economies of scale and heterogeneity of preferences, we show that the only equilibrium timing of the conflict game is a sequential one, and is such that both regions are active in the conflict (i.e. there is no deterrence in equilibrium). More specifically, the separatists take the lead in an efficient union, whereas the unionists take the lead when seceding is the socially efficient outcome. In turn, the properties of total conflict intensity are very different depending on whether the union is efficient or not. The equilibrium timing of the conflict is also the one that maximizes welfare.

Keywords: Secession, conflict, heterogeneity, sequential contest, endogenous timing

## 1 Introduction

Nation boundaries have been in movement for a long time. While the emergence of some countries has in some cases been the result of peaceful separations (like the separation of Slovenia from Yugoslavia, or the breakup of Checkoslovakia), in many other cases separatist conflicts have shown a high degree of violence (like Bosnia, Croatia, or Pakistan and Bangladesh). Furthermore, secessionist movements are currently present in several countries (like Belgium, Spain or Canada). The Center for International Development and Conflict Management (CIDCM) identifies the occurrence of 148 self-determination movements in 78 countries between the 1950's and 2005 (Marshall and Gurr 2005). Among them, 71 territorially concentrated ethnic groups have waged armed conflicts for autonomy or independence at some time since the 1950's, not counting the peoples of former European colonies.

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Whether they turn to be violent or not, separatist tensions involve a waste of resources from both the group seeking separation and the one seeking to preserve the union. They generate regional lobbying expenditures on both sides, and have a tendency to divert public resources from other potentially important issues. In Belgium, separatist tensions paralyzed the government for almost two years[1], while in Spain, the never-ending tensions between Catalonia and the central government seem to become always stronger, and materialize into sterile and hostile discussions in which every side sticks to its positions.[2]

In this paper, we aim at analyzing the dynamics of separatist conflict and the resulting likelihood of a secession, provided the latter is actively resisted by the group seeking to preserve the union. We investigate the conditions under which a conflict occurs, and what drives its intensity. We consider both simultaneous and sequential contributions to the conflict —the latter opening the possibility of preemptive behaviour by the first mover— and we derive the equilibrium timing of moves in the latter. As we will see, the very fact that the only equilibrium timing of the game is a sequential one constitutes a justification to depart from the assumption of simultaneity in the regional contributions to conflict.

We set up a simple political economy model of border formation in the spirit of Alesina and Spolaore (1997), in which individuals belonging to two regions have to choose where to locate a public good, whose quantity and level is fixed, and suffer disutility from the distance between the public good and their ideal point.[3] We assume there is one large region (the "Center"), and one small region (the "Periphery"), hence the Center is decisive in deciding the location of the public good under unification.[4] The Periphery faces the standard trade-off between heterogeneity and economies of scale regarding the choice between unification and secession: by seceding, it eliminates the cost of heterogeneity (it can locate the public good at its ideal point), while losing the potential benefits in terms of economies of scale in the provision of the public good.

Given a disagreement regarding the best choice of border configuration, namely, the Periphery seeking secession and the Center seeking unification, we assume that there exists a conflict technology which allows the regions to invest resources in order to force the border configuration they prefer. We allow for both simultaneous and sequential contributions to the conflict, considering both the cases of the Center and the Periphery acting as the Stackelberg leader.

We start by asking what would be the equilibrium timing of the conflict if the regions were able to declare their intention to be the leader or the follower of the conflict. If both regions

[1] As the *Spiegel* puts it in July 2011: "Belgium is the holder of an unenviable world record. For over a year, the country has not had an elected goverment. But the paralyzing conflict between the Flemish and Walloons comes with a high risk." (http://www.spiegel.de/international/topic/belgium/archiv.html)

[2] While in the last Catalan elections, parties proposing a self-determination referendum got 80% of the votes, Prime Minister Mariano Rajoy totally rejects modifying the Spanish Constitution in order to find a better relationship between Catalonia and Spain. Reforming the Constitution in order to satisfy those who will not be satisfied is a great mistake, he said referring to the citizens supporting Catalonia's independence from Spain, who represent more than 50% of Catalans according to polls. In addition, Rajoy emphasised that Spain and national sovereignty are not negotiable, closing the door to allowing an independence referendum in Catalonia." (http://www.catalannewsagency.com, November 2013)

[3] See also Goyal and Staal (2004).

[4] We borrow this terminology from Spolaore (2008).

choose the same order then the simultaneous game is played, while if they agree on the order then the sequential game is played. One may expect that it is always the region unsatisfied with the status quo (i.e., the separatists) that moves first, while the other region (i.e., the unionists) react. However, our results suggest that this is not always the case. In particular, we show that the only equilibrium timing of the game is such that the Center takes the lead in an inefficient union, while the Periphery takes the lead in an efficient union. Furthermore, there is no deterrence in equilibrium, that is, both the Center and the Periphery are always active in the conflict. As it turns out, the equilibrium timing of the conflict is also the one that maximizes total welfare. Indeed, the latter timing minimizes conflict intensity, while increasing the likelihood of the efficient outcome as compared to the simultaneous case.

We show that regardless of the timing of the conflict, the regions investing more in the conflict is the one with the highest stakes in the latter, which in turn depends on whether unification or secession is the socially efficient outcome. Whether the union is efficient, in turn, depends on whether the aggregate benefits from economies of scale more than compensate the heterogeneity costs borne by the Periphery. The Center has higher stakes than the Periphery whenever the union is efficient, whereas the Periphery has the highest stakes whenever the union is inefficient, from which it follows that a secession is more likely in an inefficient union than in an inefficient one.

While the equilibrium probability of secession has the same properties irrespective of the timing of the conflict, the intensity of the latter has very different properties depending on which region moves first. Given the equilibrium timing of the conflict (i.e., the low-stakes region moves first), this means that the properties of conflict intensity depend on whether unification or secession is the socially efficient outcome. Indeed, while conflict intensity reflects the stakes of the Center in an inefficient union, it reflects the one of the Periphery in an efficient union. In turn, this means that conflict intensity is independent of heterogeneity costs and increasing in the cost of the public good in the former case, while it is increasing in heterogeneity costs and decreasing in the cost of the public good in the latter case. However, regardless of whether the union is efficient or not, the likelihood of a secession is always higher the larger the heterogeneity costs of the union and the smaller the cost of the public good. This is consistent with the fact that empirical studies aiming at determining the relationship between separatist propensity and different measures of diversity have reached mixed and contradicting conclusions.[5]

Our analysis relates to the recent theoretical political economy literature on border formation. This literature has mainly focused on the traditional trade-off between economies of scale

[5] The empirical literature has tested the claim that "cultural pluralism within a country will increase the number of secessionist claims [...] The evidence is rather weak if not contrarian, however" (Boyle and Englebert 2006, p.7). Hale (2000) and Sorens (2005) find positive relationships between ethnic/linguistic distinctiveness and separatist propensity, Treisman (1997), Laitin (2001) and Saideman and Ayres (2000) found no evidence that ethnic antipathies or attachments to ethnic identities are important determinants of separatism. Further, Fearon and Laitin (1999) and Collier and Hoeffler (2006) observed that social fractionalization actually reduced the likelihood of identity wars and rebellions, while ethnic dominance, defined as the presence in a country of a demographically dominant group, somewhat promoted such wars and made it more likely for minority rebels to seek autonomy (Boyle and Englebert 2006, p. 7).

and heterogeneity of preferences, and then looked at the different forces likely to shape the latter, such as region size (Goyal and Staal 2004), the degree of international openness (Alesina, Spolaore and Wacziarg 2000, 2005), the degree of democratization (Alesina and Spolaore 1997; Arzaghi and Henderson 2005; Panizza 1999), the presence of mobile ethnic groups (Olofsgard 2003), or the presence of external threats (Alesina and Spolaore 2005, 2006; Wittman 2000). This literature has essentially looked at the incentives of a given region to secede peacefully and unilaterally from a union, without considering the possibility of the unionists to actively resist the secession attempt.

A notable exception is Spolaore (2008), whose analysis is the most related to ours. The author models separatist conflict with simultaneous moves, and shows that conflict intensity depends on both the incentives of the Periphery to secede and the incentives of the Center to resist the secession attempt. We extend his analysis to allow for sequential moves and preemptive behaviour by the leader, and we show that the model yields very different predictions regarding the properties of conflict intensity depending on the particular timing of the conflict, and depending on whether one or two regions are active in equilibrium. As it turns out, simultaneous conflict never occurs in equilibrium.

Gershenson and Grossman (2000) analyze a model of dynamic civil wars, where the stakes of two groups are given by the (exogenous) value they attach to political dominance. Assuming that the group that enjoys initial political violence moves first, they derive the conditions under which deterrence occurs in equilibrium, and the implications for the duration of conflict. Reinterpreting their model in our context, the group being politically dominant initially is the Center, while the challenger is the Periphery (i.e., the separatists). As it turns out, endogeneizing the timing of moves challenges their results in two respects. First, it is not always the group satisfied with the status quo who moves first. Second, deterrence by the leading group never occurs in equilibrium. Referring to their analysis, this implies that in our context, civil conflict ends only when the secession attempt is successful, which, as we show, is the most likely when the union is inefficient and the order of moves is sequential.[6]

Anesi and De Donder (2013) build a model of secessionist conflict where voters may wish to accommodate the minority to prevent secession. They show the existence of a majority voting equilibrium with a government's type biased in favor of the minority. While they allow for accommodation from the part of the majority, they do not endogenize the contributions to conflict, hence the probability of secession is exogenous in their analysis.

Our analysis also relates to the more abstract field of contest theory. In particular, some authors have studied sequential moves in such contests where players have asymmetric valuations of the contested prize, and have shown that the equilibrium timing of moves is always a sequential one, and is such that the low-valuation player is the leader, while the high-valuation player follows. In turn, such a timing yields less rent dissipation than the corresponding simultaneous

[6] A number of authors have argued that the timing of state repression matters for its effectiveness (e.g., Lichbach 1987; Snyder 1976; Sullivan 2013). While we show that the order of moves in the conflict indeed matters for its outcome, however, we also address the issue of why a particular timing of intervention arises rather than another.

contest (Baik and Shogren 1992; Leininger 1993; Morgan 2003). Our results in the context of separatist conflict are clearly consistent with these findings.

The paper is structured as follows: Section 2 describes the basic setup and analyzes the costs and benefits of seceding versus unifying in both the Center and the Periphery. In Section 3, we describe the equilibrium timing of the conflict. Section 4 analyzes the properties of the conflict equilibrium depending on its particular timing. In Section 5, we discuss the implications of the presence a supra-national player who is against secession. Section 6 concludes. All proofs can be found in the Appendix.

## 2 The Model

There is a big region $C$ of size $s$ (the "Center") and a small region $P$ of size $(1-s)$ (the "Periphery"), where $s \in (1/2, 1)$, hence total population has mass one. The nation is represented by the interval [0, 1], which is also the policy line. All individuals in the Center are located at 0, and all individuals in the Periphery are located at 1, which also corresponds to their ideal point regarding the location of the public good. Individual income $y$ is the same for all individuals both within and between regions. Public policy consists in a public good $g$ whose level is fixed, with a fixed production cost $k$ which is shared equally among individuals. The location of $g$ is decided upon by majority voting, hence the Center is decisive on the location of $g$ under unification. Individuals value both private and public consumption, and incur a disutility from the distance between their ideal point and the public good. The utility of the representative individual in the Center and the Periphery under unification is given by

$$U_C^U = y + g(1 - ad_B^U) - k = y + g - k$$

$$U_P^U = y + g(1 - ad_S^U) - k = y + g(1-a) - k$$

where $d_j^U$, $j = C, P$, is the distance between the individual's location and the public good, and $a \leqslant 1$ is a parameter measuring the intensity of disutility from distance (i.e., the heterogeneity costs of unification).

Under secession, the location of $g$ coincides with individuals' ideal point in both regions (i.e., 0 in the Center and 1 in the Periphery, so that $d_j^S = 0$, $j = C, P$), while the cost of providing the public good has to be shared among the individuals located in the region. The utility of the representative individual in the Center and the Periphery under secession is thus given by

$$U_C^S = y + g(1 - ad_B^S) - \frac{k}{s} = y + g - \frac{k}{s}$$

$$U_P^S = y + g(1 - ad_S^S) - \frac{k}{1-s} = y + g - \frac{k}{1-s}$$

Observe that the Center is always better off under unification, while the Periphery seeks secession if and only if

$$a > \frac{sk}{g(1-s)} = a^c$$

Therefore, a disagreement occurs whenever $a > a^c$, and is such that the Periphery wants to secede, while the Center wants to preserve the union. Furthermore, the union is efficient if and only if total welfare under unification is higher than under secession, that is, if and only if

$$a < \frac{k}{g(1-s)} = a^*$$

The stakes of the two regions are defined by what they can benefit from their preferred border configuration as compared to the alternative. Hence, the (aggregate) stakes of the Center are given by the difference between aggregate utility under unification and secession:

$$s(U_C^U - U_C^S) = k(1-s)$$

Likewise, the (aggregate) stakes of the Periphery are given by the difference between aggregate utility under secession and unification:

$$(1-s)(U_P^S - U_P^U) = ag(1-s) - sk$$

Therefore, the Center has bigger stakes than the Periphery if and only if $a < a^*$, that is, if and only if the union is efficient.

Suppose that the regions can invest resources into conflict so as to force the border configuration they prefer.[7] Formally, region $j = C, P$ can choose to devote an amount $F_j$ of resources to conflict. As it is standard in the literature, we shall assume that the contest success function (CSF) is given by[8]

$$\pi = \frac{F_P}{F_C + F_P} \tag{1}$$

We abstract from the free-riding issue regarding individual contributions to the conflict by assuming that in each region, the representative individual chooses the aggregate amount of resources invested in the conflict so as to maximize its expected utility.[9] We allow for both simultaneous and sequential regional contributions to the conflict. The equilibrium concepts are respectively Nash and subgame perfection in pure strategies.

[7]We abstract from the possibility of peaceful unilateral secessions, as well as for the possibility of transfers from the Center to the Periphery to compensate the latter for the heterogeneity costs. For more on this, see Alesina and Spolaore (2003), Haimanko et al. (2005), and Le Breton and Weber (2003)

[8]This class of contest success functions was first proposed by Tullock (1980) and later axiomatized by Skaperdas (1996). See Garfinkel and Skaperdas (2007) and the references therein for a description of the possible ways of modeling the conflict technology.

[9]For a discussion on individual contributions to conflict and intra-group cohesion, see Esteban and Ray (2011).

# 3 Equilibrium Timing of the Conflict

The question we ask here is what would be the equilibrium timing of the conflict if the regions were able to declare their intention to be the leader or the follower of the conflict. We assume that if both regions choose the same order then the simultaneous game is played, while if they agree on the order then the sequential game is played. As it turns out, if the regions are free to choose their order of moves, they will always agree on the sequential version of the conflict in which the low-stakes region moves first, while the high-stakes regions follows. Furthermore, there is no deterrence in equilibrium, that is, both the Center and the Periphery are always active in the conflict. As we will see, the equilibrium timing of the conflict is also the one that maximizes its efficiency.

To prove that both regions favor a sequential timing over a simultaneous one, we solve in the appendix for the two regions' optimal choices when (1) the conflict game is a simultaneous one, (2) when the Center is the first mover and (3) when the Periphery is the first mover. Comparing the players' payoffs under the different scenario yields the following result:

**Proposition 1.** *Suppose that $a > a^c$, hence the Periphery seeks to secede from the Center. The equilibrium timing of the conflict is such that the Periphery takes the lead in an efficient union ($a < a^*$), whereas the Center takes the lead in an inefficient union ($a > a^*$). Furthermore, there is no deterrence in equilibrium.*

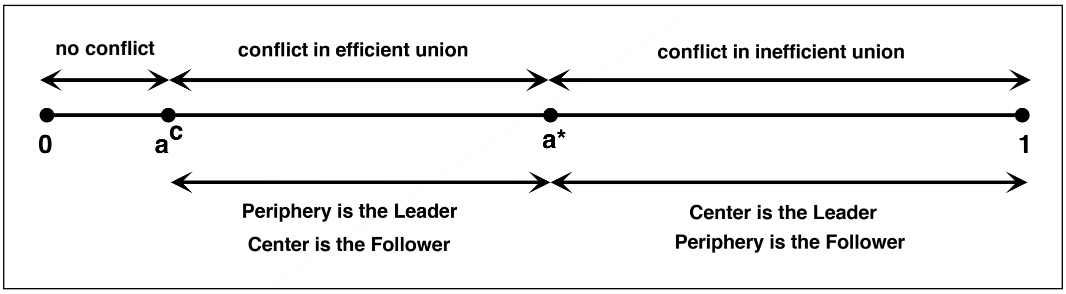


Figure 1: Equilibrium timing of the conflict

The above proposition thus implies that, when there is a disagreement, both regions always prefer to play sequentially over playing simultaneously, and it is always the region with the lowest stakes which moves first.[10] Furthemore, there is no deterrence in equilibrium, that is, both the Center and the Periphery are always active in the conflict.

# 4 Conflict Characteristics

Now that we know how the two regions will play the game, we can go beyond this finding and examine, among other things, (1) how the timing of the moves impacts on the determinants of the regional conflict efforts and thus conflict intensity; and (2) how the characteristics of the conflict and the economy impact on the equilibrium probability of secession.

[10]This last finding is in line with similar findings in contest theory (Baik and Shogren 1982; Leininger 1993).

Starting with conflict efforts, we have:

**Proposition 2.** *Suppose that $a > a^*$ (i.e., the union is inefficient). The Center moves first, equilibrium conflict efforts are given by*

$$F_C^* = \frac{[k(1-s)]^2}{4\,[ag(1-s)-sk]}$$

$$F_P^* = \frac{k(1-s)}{2} - \frac{[k(1-s)]^2}{4\,[ag(1-s)-sk]} = \frac{k(1-s)}{2} - F_C^*$$

*and the Periphery invests more than the Center.*

**Proposition 3.** *Suppose that $a < a^*$ (i.e., the union is efficient). The Periphery moves first, equilibrium conflict efforts are given by*

$$F_C^* = \frac{ag(1-s)-sk}{2} - \frac{[ag(1-s)-sk]^2}{4k(1-s)} = \frac{ag(1-s)-sk}{2} - F_P^*$$

$$F_P^* = \frac{[ag(1-s)-sk]^2}{4k(1-s)}$$

*and the Center invests more than the Periphery.*

Turning to the conflict intensity and the probability of secession, we have:

**Proposition 4.** *Suppose that $a > a^*$ (i.e., the union is inefficient), hence the Center moves first. Total conflict intensity is given by*

$$F_C^* + F_P^* = \frac{k(1-s)}{2} = (1-\pi^*)\,[ag(1-s)-sk]$$

*and the equilibrium probability of secession is given by*

$$\pi^* = 1 - \frac{k(1-s)}{2\,[ag(1-s)-sk]}$$

**Proposition 5.** *Suppose that $a < a^*$ (i.e., the union is efficient), hence the Periphery moves first. Total conflict intensity is given by*

$$F_C^* + F_P^* = \frac{ag(1-s)-sk}{2} = k(1-s)\pi^*$$

*and the equilibrium probability of secession is given by*

$$\pi^* = \frac{ag(1-s)-sk}{2k(1-s)}$$

Observe that conflict intensity reflects the stakes of the first mover in both an efficient and inefficient union. In turn, this implies that whether the Center or the Periphery moves first has very different implications for the properties of total conflict intensity. In both cases, the conflict is more wasteful the larger the size of the Periphery. However, while conflict intensity is increasing in the intensity of the heterogeneity costs when the Periphery is the leader, it is independent of this cost when the Center is the Leader. Furthermore, the intensity of the conflict increases with the cost of the public good when the Center moves first, while it is the opposite if the Periphery moves first. Therefore, we have that in an efficient union, the conflict is more intense the higher the heterogeneity costs and the lower the cost of the public good. Conversely, in an inefficient union, heterogeneity has no effect on the intensity of the conflict, while a rise in the cost of the public good leads to an increase in the amount of resources wasted in the latter. As conflict intensity reflects the stakes of the first mover, if the union is efficient, the conflict is more intense the higher the incentives for secession ($a$ high and/or $k$ low), while if the union is inefficient, the conflict is more intense the higher the incentives to resist secession ($k$ high).

Observe that even though the properties of total conflict intensity crucially depend on the particular order of moves of the two regions, the properties of the equilibrium probability of secession are always the same regardless of the latter. This finding is summarized in the following proposition:

**Proposition 6.** *The equilibrium probability of secession is strictly greater than* $1/2$ *in an inefficient union, and strictly smaller than* $1/2$ *in an efficient union. Furthermore,* $\pi^*$ *is increasing in heterogeneity costs and the size of the Periphery, and decreasing in the cost of the public good.*

Thus, which region invests more in the conflict solely depends on which region has the highest stakes in the latter. In particular, if the union is efficient and there is a conflict ($a^c < a < a^*$), the Center has the highest stakes, hence it invests more than the Periphery, so that $\pi^* < 1/2$. If the union is inefficient ($a > a^*$), the Periphery has the highest stakes, and thus $\pi^* > 1/2$. In other words, a secession is always more likely in an inefficient union than in an efficient one.

Also, we have that difference between the two regions' optimal conflict efforts is the highest and in favor of the region with the highest stakes when it is that same region which is the leader in the conflict. Said in other words, the socially efficient outcome is most likely when it is the party with the highest stakes which moves first. Furthermore, this particular order of moves is also the one that maximizes conflict intensity.

**Proposition 7.** *The socially efficient outcome is the most likely, and conflict intensity is the highest, when the region with the highest stakes is the leader.*

One implication of Proposition 6 is that from a welfare perspective, there is a trade-off between the likelihood of the socially efficient outcome and the amount of resources wasted in the conflict. As it turns out, the separatist conflict is the most efficient when the region with the lowest stakes moves first, that is, when the Center is the leader in an inefficient union, and the Periphery is the Leader in an efficient one. Such a timing of moves allows to minimize total conflict intensity, while increasing the probability of the socially efficient outcome as compared to the simultaneous case.

**Proposition 8.** *The equilibrium timing of the game is the one that maximizes total welfare.*

## 5 Conclusion

We have shown that the equilibrium timing of a separatist conflict between a Center and a Periphery —which is driven by the trade-off between economies of scale and heterogeneity of preferences— is such that the Periphery is the leader in an efficient union, while the Center is the leader in an inefficient union. In turn, the equilibrium timing of the conflict (i.e., the low-stakes region moves first) is the most efficient from a welfare perspective. The probability of secession is the highest when the union is inefficient, while obeying the same properties regardless of the timing of the conflict. In contrast, the properties of conflict intensity reflect the stakes of the first mover, hence they are very different depending on whether the union is efficient or not.

We made the somewhat strong assumption that the costs of heterogeneity within a union only concern preferences regarding the public good, hence the majoritarian region bears no such costs in the union. Another possibility, however, is that besides the cost of heterogeneity in terms of preferences, there is an additional diversity cost under unification, stemming only from the fact that individuals dislike interacting with the people of the other region to some extent (Desmet et al. 2011). In such case, the majoritarian region also faces some cost of diversity under unification. In turn, this would increase further the likelihood of secession, while affecting conflict intensity in all possible timings regarding the contributions to the conflict. In any case, however, whether conflict intensity reflects the stakes of the Center to the Periphery would still crucially depend on the particular timing of the interaction between the two regions.

We have abstracted from separatist claims stemming (at least partially) from economic reasons, that is, the ones arising from income disparities between regions.[11] While both the incentives for secession and the ones to resist the latter would clearly depend on the extent of interregional income inequality, our main conclusion would remain unaffected: The only equilibrium timing of the game is such that the low-stakes region moves first, while the low-stakes region (actively) follows. In turn, the equilibrium timing of the conflict is also the one that maximizes its efficiency. Furthermore, conflict intensity reflects the stakes of the leader in the conflict.

[11] See, for instance, Bolton and Roland (1997) and Buchanan and Faith (1987).

# 6 Appendix

## 6.1 Simultaneous Conflict

Suppose that both regions choose the resources they want to invest in the conflict in a simultaneous fashion ($S$). In that case, the representative individual in the Center and the Periphery chooses $F_C$ and $F_P$, respectively, so as to maximize his expected utility, which is given by[12]

$$EU_C^S = \pi U_C^S + (1-\pi)U_C^U - \frac{F_C}{s}$$

$$EU_P^S = \pi U_P^S + (1-\pi)U_P^U - \frac{F_P}{1-s}$$

The FOC for this problem yield the regions' best responses:

$$F_C(F_P) = \sqrt{F_P k(1-s)} - F_P \tag{2}$$

$$F_P(F_C) = \sqrt{F_C\left[ag(1-s) - sk\right]} - F_C \tag{3}$$

Equilibrium conflict efforts are thus given by

$$F_C^* = \frac{\left[k(1-s)\right]^2\left[ag(1-s) - sk\right]}{\left[k(2s-1) - ag(1-s)\right]^2}$$

$$F_P^* = \frac{k(1-s)\left[ag(1-s) - sk\right]^2}{\left[k(2s-1) - ag(1-s)\right]^2}$$

Which region invests more resources in the conflict depends on which region has the highest stakes in the latter, which, as we saw, depends on whether secession or unification is the socially efficient outcome. If $a < a^*$, the Center has the highest stakes, hence it invests more in the conflict than the Periphery. If $a > a^*$, the opposite holds. Finally, we obtain the equilibrium probability of secession:

$$\pi^* = \frac{ag(1-s) - sk}{ag(1-s) - k(2s-1)}$$

As expected, the higher the heterogeneity costs and the lower the cost of the public good, the more likely that the secession attempt by the Periphery is successful. Furthermore, the equilibrium probability of secession is increasing in the size of the Periphery, which results from the interaction of three distinct effects. First, an increase in the size of the Periphery increases both the Periphery's incentives to secede and the Center's incentives to resist the latter secession attempt, with a potentially ambiguous effect on the probability of secession. However, a more numerous Periphery also means that conflict effort is cheaper (while it is more expensive in the Center), which in turn ensures that a decrease in $s$ unambiguously raises the likelihood of a

[12] The analysis of the simultaneous case is essentially the same as the one in Spolaore (2008)

secession.

Total conflict intensity is given by

$$F_C^* + F_P^* = \frac{k(1-s)\left[ag(1-s) - sk\right]}{ag(1-s) - k(2s-1)} = k(1-s)\pi^*$$

Total conflict intensity is increasing in heterogeneity costs and in the size of the Periphery. Indeed, more heterogeneity costs means higher incentives for secession, while leaving the stakes of the Center unaffected. Then, an increase in the size of the Periphery increases both the incentives to secede for the Periphery and the ones to resist secession for the Center. Conversely, the effect of an increase of the cost of the public good is ambiguous. Indeed, an increase in $k$ decreases the incentives of the Periphery to secede, while increasing the attractiveness of unification for the Center.

## 6.2 Sequential Conflict: The Center is the Leader

Suppose that the Center moves first, that is, it chooses the amount to be invested in the conflict before the Periphery. As before, but now in the second stage of the game, the Periphery chooses $F_P$ so as to maximize

$$EU_P^F = \pi U_P^S + (1-\pi)U_P^U - \frac{F_P}{1-s} \tag{4}$$

which yields the best response function $F_P(F_C)$ in (3). In the first stage, the Center chooses $F_C$ in order to maximize

$$EU_C^L = \frac{F_P(F_C)}{\left[F_P(F_C) + F_C\right]} U_C^S + \frac{F_C}{\left[F_P(F_C) + F_C\right]} U_C^U - \frac{F_C}{s} \tag{5}$$

Equilibrium conflict efforts are now given by

$$F_C^* = \frac{\left[k(1-s)\right]^2}{4\left[ag(1-s) - sk\right]}$$

$$F_P^* = \frac{k(1-s)}{2} - \frac{\left[k(1-s)\right]^2}{4\left[ag(1-s) - sk\right]} = \frac{k(1-s)}{2} - F_C^*$$

As for the simultaneous case, the Center invests more in the conflict than the Periphery if and only if the union is efficient ($a < a^*$). More importantly, observe that $F_P^*$ may be negative. In particular, the Periphery is active in the conflict if and only if

$$a > \frac{k(1+s)}{2g(1-s)} = a_P$$

If heterogeneity costs are "too" low ($a < a_P$), we are at a corner solution in which the Periphery is inactive. In such case, the leader (the Center) invests the minimum resources required in the first stage in order to discourage the Periphery from investing in the subsequent stage. In particular, the Center invests

$$F_C^* = ag(1-s) - sk$$

Observe that the pre-emptive investment of the Center coincides with the stakes of the Periphery, from which it follows that the higher the incentives for secession (as long as $a < a_P$), the more the Center needs to invest resources as a deterrence strategy, thereby making sure that the union is preserved.

In an interior equilibrium ($a > a_P$), the probability of secession is given by

$$\pi^* = 1 - \frac{k(1-s)}{2\left[ag(1-s) - sk\right]}$$

and total conflict intensity is given by

$$F_C^* + F_P^* = \frac{k(1-s)}{2} = (1-\pi^*)\left[ag(1-s) - sk\right]$$

It turns out that when both regions are active, total conflict intensity is independent of the intensity of heterogeneity costs, which can be seen directly from the analytical expression of the conflicts efforts in the interior solution. An increase in $a$ decreases the investment of the Center in the first stage, while increasing the one of the Periphery in the second stage by exactly the same amount. Furthermore, an increase in the cost of the public good now unambiguously yields more conflict intensity.

Observe that while total conflict intensity reflects the stakes of the Center at the interior solution, it reflects the ones of the Periphery at the corner one. Indeed, in order to keep the Periphery inactive, the Center has to invest as much as the Periphery has to win from the conflict. In that case, therefore, conflict intensity reflects the incentives for secession.

Suppose we are at the interior equilibrium ($a > a_P$). If the union is efficient ($a < a^*$), the Center invests more in the conflict than in the simultaneous case, while the Periphery invests less. Total conflict intensity increases, while the probability of secession is lower. Conversely, if the union is inefficient ($a > a^*$), the Center chooses to lower competition by investing less in the conflict than in the simultaneous case. In turn, the Periphery also lowers its contribution to the conflict. As a result, conflict intensity decreases, while the probability of secession is higher.

If $a < a_P$ (and thus the union is efficient), heterogeneity costs are too low for the Periphery to find it worthwhile to invest in the conflict. In turn, the Center invests the minimum amount required so as to keep the separatists inactive. This aggressive pre-emptive behaviour of the Center increases total conflict intensity with respect to the simultaneous case, while the union between the two regions is preserved.

### 6.3 Sequential Conflict: The Periphery is the Leader

If the Periphery moves first, the Center chooses $F_C$ so as to maximize

$$EU_C^F = \pi U_C^S + (1-\pi)U_C^U - \frac{F_C}{s} \tag{6}$$

which yields the best response function $F_C(F_P)$ in (2). In the first stage, the Periphery chooses $F_P$ in order to maximize

$$EU_C^L = \frac{F_P}{[F_P + F_C(F_P)]}U_P^S + \frac{F_C(F_P)}{[F_P + F_C(F_P)]}U_P^U - \frac{F_P}{1-s} \tag{7}$$

Equilibrium conflict efforts are now given by

$$F_C^* = \frac{ag(1-s) - sk}{2} - \frac{[ag(1-s) - sk]^2}{4k(1-s)} = \frac{ag(1-s) - sk}{2} - F_P^*$$

$$F_P^* = \frac{[ag(1-s) - sk]^2}{4k(1-s)}$$

As before, in an interior equilibrium, the Center invests more than the Periphery if and only if the union is efficient ($a < a^*$). Furthermore, the Center is active in the conflict if and only if heterogeneity costs are low enough, that is, if and only if

$$a < \frac{k(2-s)}{g(1-s)} = a_C$$

If heterogeneity costs are "too" high ($a > a_C$), we are at a corner solution in which the Center is inactive. In such case, the leader (the Periphery) invests the minimum resources required in the first stage in order to deter the Center from investing in the subsequent stage. In particular, the Periphery invests

$$F_P^* = k(1-s)$$

Observe that the pre-emptive investment of the Periphery coincides with the stakes of the Center, from which it follows that the lower the incentives to prevent secession, the more the Periphery needs to invest resources in the conflict as a deterrence strategy, thereby making sure that secession takes place.

In an interior equilibrium ($a < a_C$), the probability of secession is given by

$$\pi^* = \frac{ag(1-s) - sk}{2k(1-s)}$$

and total conflict intensity is given by

$$F_C^* + F_P^* = \frac{ag(1-s) - sk}{2} = k(1-s)\pi^*$$

Contrary to the case where the Center is the leader, conflict intensity now closely follows the stakes of the Periphery, and is thus increasing in heterogeneity costs, and decreasing in the cost of the public good. As for the case where the Center moves first, conflict intensity reflects the stakes of the leader at the interior solution, while it reflects the ones of the (inactive) follower at the corner solution. When the Center is inactive, therefore, conflict intensity reflects its incentives to resist secession from the Periphery.

At the interior equilibrium ($a < a_C$), if the union is efficient ($a < a^*$), the Periphery invests less in the conflict than in the simultaneous case, and so does the Center. Total conflict intensity decreases, while the probability of secession is lower. Conversely, if the union is inefficient ($a > a^*$), the Periphery chooses to increase competition between the two regions in the first stage, hence it invests more in the conflict than the in simultaneous solution. In turn, the Center decreases its contribution to the conflict, total conflict intensity increases, and so does the probability of secession.

At the corner equilibrium ($a > a_C$), heterogeneity costs are so high that the Periphery adopts a preemptive behaviour, that is, it invests just the amount of resources required to keep the Center inactive in the conflict. Total conflict intensity is higher than in the simultaneous case, and the Periphery secedes from the Center.

### 6.4 Simultaneous versus Sequential Conflict

In the following lemmas, we compare the properties of the equilibrium depending on whether the conflict takes place simultaneously or sequentially, and dependent on which of the Center or the Periphery moves first.

**Lemma 1** (Regional Conflict Efforts)**.**

1. *At a corner solution, the region acting as the leader invests more in the conflict than in the simultaneous solution.*
2. *The Periphery invests more when it acts as the leader (interior solution) than in the simultaneous case if and only if the union is inefficient;*
3. *The Center invests more when it acts as the leader (interior solution) than in the simultaneous case if and only if the union is efficient.*
4. *A region invests more in the simultaneous case than when it acts as the follower.*

When the region moving first follows a deterrence strategy, it always has the effect of increasing its contribution to the conflict as compared to the simultaneous case. At an interior solution, and consistent with Dixit (1987), the region acting as the leader invests more in the conflict than in the simultaneous case if and only if it has the highest probability of winning in the latter. As we saw, which region invests the most in the conflict (and thus has the highest win probability) depends on whether the union is efficient. If it is, the Center has the highest stakes, so that $\pi^* < 1/2$ in the simultaneous version of the game. In turn, this implies that the Center is more aggressive when it moves first than in the simultaneous conflict. Likewise, the Periphery acting as the leader invests more in the conflict than in the simultaneous case whenever the union is inefficient. Finally, the region acting as the follower always decreases its contribution to the conflict relative to the simultaneous case.

**Lemma 2** (Probability of Secession)**.** $\pi^*$ *is higher in the simultaneous conflict than in the sequential one if and only if the union is efficient.*

Lemma 2 basically states that the sequential version of the conflict always has the effect of making the efficient outcome more likely, irrespective if whether the Center or the Periphery moves first. Clearly, this is also true at the corner solutions of the sequential conflict.

**Lemma 3** (Expected Utility)**.**

1. *A region is better off as the leader than at the simultaneous solution;*
2. *The Center is better off as the follower than at the simultaneous solution if and only if the union is efficient;*
3. *The Periphery is better off as the follower than at the simultaneous solution if and only if the union is inefficient.*

A region is always better off acting as the leader than when the conflict takes place simultaneously. Furthermore, this is true regardless of whether the union is efficient or not. The leading region may invest more or less in the conflict than in the simultaneous case depending on whether the union is efficient, while in either case, it yields strictly higher expected utility. Interestingly, being the follower in the conflict does not necessarily yields lower expected utility than in the simultaneous case. In particular, if the region with the highest stakes acts as the follower in the conflict, it invests less than in the simultaneous case, while its chances of success are higher. Therefore, in an efficient union, the Center is better off as the follower than in the simultaneous case, while if the union is inefficient, the same applies to the Periphery.

**Lemma 4** (Total Conflict Intensity)**.**

1. *Total conflict intensity is higher at the corner solutions than at the simultaneous solution;*
2. *When the Center is the leader, total conflict intensity is higher than in the simultaneous solution if and only if the union is efficient;*
3. *When the Periphery is the leader, total conflict intensity is higher than in the simultaneous solution if and only if the union is inefficient.*

When heterogeneity costs are either low ($a < a_P$) or high ($a > a_C$), preemptive behaviour by the high-stakes region maximizes the amount of resources wasted in the conflict. Furthermore, this is also true when both regions are active in the sequential conflict ($a_P < a < a_R$). In an efficient union, total conflict intensity is maximized when the Center moves first, while in an efficient union, it is maximized when the Periphery is the leader.

## 6.5 Proofs of the Lemmas

*Proof of Lemma 1.* Equilibrium efforts when the conflict is simultaneous are given by

$$F_C^* = \frac{[k(1-s)]^2 [ag(1-s)-sk]}{[k(2s-1)-ag(1-s)]^2}$$

$$F_P^* = \frac{k(1-s)[ag(1-s)-sk]^2}{[k(2s-1)-ag(1-s)]^2}$$

If $a < a_P$ and the Center is the leader, the Periphery is inactive while the Center invests

$$F_C^* = ag(1-s) - sk$$

Therefore, the Center invests more when it is the leader than in the simultaneous case if and only if

$$\frac{[ag(1-s)-sk]^2 [k(3s-2)-ag(1-s)]}{[ag(1-s)-k(2s-1)]^2} < 0$$

which is always satisfied. If $a > a_C$ and the Periphery is the leader, the Center is inactive while the Periphery invests

$$F_P^* = k(1-s)$$

Therefore, the Periphery invests more when it is the leader than in the simultaneous case if and only if

$$\frac{[k(1-s)]^2 [k(3s-1)-2ag(1-s)]}{[ag(1-s)-k(2s-1)]^2} < 0$$

which is always satisfied. Hence, at a corner solution, the active region always invests more than in the simultaneous conflict.

At an interior solution, if the Center moves first, equilibrium efforts are given by

$$F_C^* = \frac{[k(1-s)]^2}{4[ag(1-s)-sk]}$$

$$F_P^* = \frac{k(1-s)}{2} - \frac{[k(1-s)]^2}{4[ag(1-s)-sk]}$$

If the Periphery moves first, equilibrium efforts are given by

$$F_C^* = \frac{ag(1-s)-sk}{2} - \frac{[ag(1-s)-sk]^2}{4k(1-s)}$$

$$F_P^* = \frac{[ag(1-s)-sk]^2}{4k(1-s)}$$

The Center invests more when it is the leader than in the simultaneous case if and only if

$$\frac{[k(1-s)]^2}{4\,[sk-ag(1-s)]}\left[1-\frac{4\,[ag(1-s)-sk]^2}{[ag(1-s)-k(2s-1)]^2}\right]<0$$

which holds if and only if $a<a^*$. Likewise, the Periphery invests more when it is the leader than in the simultaneous case if and only if

$$\frac{[ag(1-s)-sk]^2}{4k(s-1)}\left[1-\frac{4\,[k(1-s)]^2}{[ag(1-s)-k(2s-1)]^2}\right]<0$$

which holds if and only if $a>a^*$. Finally, the Center invests more in the simultaneous case than when it is the follower if and only if

$$\frac{[k-ag(1-s)]^2\,[ag(1-s)-sk]\,[ag(1-s)-k(3s-2)]}{4k(1-s)\,[ag(1-s)-k(2s-1)]^2}>0$$

which is always satisfied. Likewise, the Periphery invests more in the simultaneous case than when it is the follower if and only if

$$\frac{k(1-s)\,[k-ag(1-s)]^2\,[2ag(1-s)-k(3s-1)]}{4\,[ag(1-s)-sk]\,[ag(1-s)-k(2s-1)]^2}>0$$

which is always satisfied.

□

*Proof of Lemma 2.* We know that $a_P<a^*<a_C$, from which it follows directly that the result holds at the corner solutions ($a<a_P$ or $a>a_C$). Suppose that we are at the interior solutions of the sequential conflicts. When the conflict is simultaneous, the probability of secession is given by

$$\pi^*=\frac{ag(1-s)-sk}{ag(1-s)-k(2s-1)}$$

When the Center moves first, it is given by

$$\pi^*=1-\frac{k(1-s)}{2\,[ag(1-s)-sk]}$$

while if the Periphery moves first, it is given by

$$\pi^*=\frac{ag(1-s)-sk}{2k(1-s)}$$

A secession is more likely when the conflict is simultaneous than when the Center moves first if and only if

$$\frac{k(1-s)\,[k-ag(1-s)]}{2\,[ag(1-s)-sk]\,[ag(1-s)-k(2s-1)]}>0$$

which holds if and only if $k > ag(1-s)$, or equivalently, $a < a^*$ (i.e., the union is efficient). Likewise, a secession is more likely when the conflict is simultaneous than when the Periphery moves first if and only if

$$\frac{[ag(1-s)-ks]\,[k-ag(1-s)]}{2k(1-s)\,[ag(1-s)-k(2s-1)]} > 0$$

which holds if and only if $k > ag(1-s)$, or equivalently, $a < a^*$ (i.e., the union is efficient). Therefore, regardless of which region moves first, a secession is more likely when the conflict is simultaneous than when it is sequential if and only if the union is efficient.

□

*Proof of Lemma 3.* Suppose the Center is the leader and $a < a_P$, so that the Periphery is inactive. The Center is better off as the leader than in the simultaneous case if and only if

$$\frac{[sk-ag(1-s)]\left[(ag)^2(1-s)^2-agk(1-s)(3s-1)+k^2(s^2+s-1)\right]}{s\,[k(1-2s)+ag(1-s)]^2} > 0$$

which is always satisfied. If $a > a_P$, both regions are active in the conflict, and the Center is better off as the leader than in the simultaneous case if and only if

$$\frac{[k(1-s)]^2\,[k-ag(1-s)]^2}{4s\,[ag(1-s)-sk]\,[k(2s-1)-ag(1-s)]^2} > 0$$

which is always satisfied. Suppose now that the Periphery is the leader and $a > a_C$, so that the Center is inactive. The Periphery is better off as the leader than in the simultaneous case if and only if

$$\frac{k\left[(ag)^2(1-s)^2-k^2(s^2-3s+1)-agk(1-s^2)\right]}{[k(2s-1)-ag(1-s)]^2} > 0$$

which is always satisfied. If $a < a_C$, both regions are active in the conflict, and the Periphery is better off as the leader than in the simultaneous case if and only if

$$\frac{[k-ag(1-s)]^2\,[ag(1-s)-sk]^2}{4k(1-s)^2\,[k(1-2s)+ag(1-s)]^2} > 0$$

which is always satisfied. Hence, a region is always better off as the leader than in the simultaneous conflict.

Suppose the Periphery is the follower and $a < a_P < a^*$, hence the Periphery is inactive. From the participation constraint of the simultaneous conflict, it follows directly that the Periphery is better off at the simultaneous solution than when it is the (inactive) follower. If $a > a_P$, both regions are active in the conflict, and the Periphery is better off as the follower than in the simultaneous case if and only if

$$\frac{k\,[ag(1-s)-k]\left[4(ag)^2(1-s)^2-agk(1-s)(9s-1)+k^2(4s^2+s-1)\right]}{4\,[ag(1-s)-sk]\,[k(1-2s)+ag(1-s)]^2} > 0$$

which is satisfied if and only if $k < ag(1-s)$, or, equivalently, $a > a^*$ (i.e., the union is inefficient). Therefore, the Periphery is better off as the follower than in the simultaneous case if and only if the union is inefficient. Suppose now that the Center is the follower and $a > a_C > a^*$, hence the Center is inactive. From the participation constraint of the simultaneous conflict, it follows directly that the Center is better off at the simultaneous solution than when it is the (inactive) follower. If $a < a_C$, both regions are active in the conflict, and the Center is better off as the follower than in the simultaneous case if and only if

$$\frac{[ag(1-s)-k]\,[ag(1-s)-sk]\left[(ag)^2(1-s)^2+k^2(9s-4s^2-4)-agk(1-s^2)\right]}{4k(1-s)s\,[k(1-2s)+ag(1-s)]^2} > 0$$

which is satisfied if and only if $k > ag(1-s)$, or, equivalently, $a < a^*$ (i.e., the union is efficient). Therefore, the Center is better off as the follower than in the simultaneous case if and only if the union is efficient.

□

*Proof of Lemma 4.* If $a < a_P$ and the Center is the leader, we are at a corner solution where total conflict intensity coincides with the investment of the Center, and is given by

$$F_C^* = ag(1-s) - sk$$

Likewise, if $a > a_C$ and the Periphery is the leader, we are at a corner solution where total conflict intensity coincides with the investment of the Periphery, and is given by

$$F_P^* = k(1-s)$$

If the conflict is simultaneous, both the Center and the Periphery are active in the conflict for all values of $a$, and total conflict intensity is given by

$$F_C^* + F_P^* = \frac{k(1-s)\,[ag(1-s)-sk]}{ag(1-s)-k(2s-1)}$$

Therefore, if $a < a_P$, total conflict intensity is higher when the Center is the leader than in the simultaneous case if and only if

$$\frac{[ag(1-s)-sk]^2}{k(2s-1)-ag(1-s)} < 0$$

which is always satisfied. Likewise, if $a > a_C$, total conflict intensity is higher when the Periphery is the leader than in the simultaneous case if and only if

$$\frac{[k(1-s)]^2}{k(2s-1)-ag(1-s)} < 0$$

which is always satisfied. Thus, total conflict intensity is higher at the corner solutions than when the conflict is simultaneous.

Suppose we are at the interior solutions of the sequential conflict. If the Center moves first, total conflict intensity is given by

$$F_C^* + F_P^* = \frac{k(1-s)}{2}$$

If the Periphery moves first, total conflict intensity is given by

$$F_C^* + F_P^* = \frac{ag(1-s) - sk}{2}$$

Total conflict intensity is higher when the Center moves first than when the conflict is simultaneous if and only if

$$\frac{k\left[ag(1-s) - k\right]}{2(k + ag)} < 0$$

which is satisfied if and only if $ag(1-s) < k$, or, equivalently, $a < a^*$ (i.e., the union is efficient). Likewise, total conflict intensity is higher when the Periphery moves first than when the conflict is simultaneous if and only if

$$\frac{\left[ag(1-s) - sk\right]\left[k - ag(1-s)\right]}{2(1-s)(k + ag)} < 0$$

which is satisfied if and only if $ag(1-s) > k$, or, equivalently, $a > a^*$ (i.e., the union is inefficient).

□

## 6.6 Proofs of the Propositions

*Proof of Proposition 1.* Proposition 1 is a direct consequence of Lemma 3. Suppose that the union is efficient ($a < a^*$) and the Center has to decide whether to move first or to wait. If the Periphery commits to move early, this means that the Center has the choice between playing the simultaneous game or being the follower. Given that the union is efficient, the Center prefers the second alternative. If the Periphery commits to wait, the Center has the choice between being the leader or palying the simultaneous game, hence it chooses to move early. Consider now the choice of the Periphery. If the Center commits to move early, and provided the union is efficient, the Periphery also moves early (the Periphery prefers the simultaneous game to being the follower whenever the union is efficient). If the Center commits to wait, the Periphery chooses to move early, as being the leader always yields higher expected utility than playing the simultaneous conflict. Therefore, the only equilibrium timing of the conflict when the union is efficient is such that the Periphery moves first, while the Center is the follower. Furthermore, as $a < a^* < a_C$, both regions are active in the conflict. By a similar reasoning, the only equilibrium timing of the conflict when the union is inefficient ($a > a^*$) is such that the Center moves first, while the Periphery is the follower. Furthermore, as $a > a^* > a_P$, both regions are active in the conflict. □

*Proof of Proposition 2.* See Section 7.2. □

*Proof of Proposition 3.* See Section 7.3. □

*Proof of Proposition 4.* See Section 7.2. □

*Proof of Proposition 5.* See Section 7.3. □

*Proof of Proposition 6.* We know that when $a < a_P$ (and thus the union is efficient) or $a > a_C$ (and thus the union is inefficient), the socially efficient outcome is the most likely when the region with the highest stakes moves first, yielding the corresponding corner solution. Furthermore, if $a < a_P$, conflict intensity is higher when the Center is the leader than when the Periphery is the leader if and only if

$$\frac{1}{2}\left[ag(1-s) - sk\right] > 0$$

which is always satisfied. As we know that conflict intensity is higher when the Center is the leader than when the conflict is simultaneous (Lemma 4), conflict intensity is the highest at the corner solution (the high-stakes region moves first). Likewise, if $a > a_C$, conflict intensity is higher when the Periphery is the leader than when the Center is the leader if and only if

$$\frac{k(1-s)}{2} > 0$$

which is always satisfied. As we know that conflict intensity is higher when the Periphery is the leader than when the conflict is simultaneous (Lemma 4), conflict intensity is the highest at the corner solution (the high-stakes region moves first).

If $a_P < a < a_C$, we are at the interior solutions of the sequential conflict. We know that conflict intensity is higher when the conflict is sequential than when the conflict is simultaneous if and only if the high-stakes region moves first (Lemma 4). Therefore, this is also the timing that maximizes conflict intensity among all the possible timings. We know that the equilibrium probability of secession is higher when the conflict is simultaneous than when it is sequential if and only if the union is efficient (Lemma 2). Furthermore, the equilibrium probability of secession is higher when the Periphery moves first than when the Center moves first if and only if

$$\frac{\left[k - ag(1-s)\right]^2}{2k(1-s)\left[ag(1-s) - sk\right]} > 0$$

which is always satisfied. That is, secession is the most likely when the Periphery moves first, and unification is the most likely when the Center moves first. Therefore, if the union is efficient, the probability of secession is minimized when the Center moves first, while if the union is inefficient, the probability of secession is maximized when the Periphery moves first.

□

*Proof of Proposition 7.* We know that when the low-stakes region moves first, total conflict intensity is lower than in the simultaneous conflict (Lemma 4), while the socially efficient outcome is more likely (Lemma 2). Thus, it follows directly that total welfare is higher when the low-stakes region is the leader than in the simultaneous case. Suppose that $a < a_P < a^*$. If the Center moves first, the Periphery is inactive, while if the Periphery moves first, we are at the interior solution. In such case, total welfare is higher when the Periphery is the leader than when the Center is the leader if and only if

$$\frac{[ag(1-s)-sk]^2}{2k(1-s)} > 0$$

which is always satisfied. Suppose that $a > a_C > a^*$. If the Periphery moves first, the Center is inactive, while if the Center moves first, we are at the interior solution. In such case, total welfare is higher when the Center is the leader than when the Periphery is the leader if and only if

$$\frac{[k(1-s)]^2}{2\left[ag(1-s)-sk\right]} > 0$$

which is always satisfied. Suppose that $a_P < a < a_C$. In that case, regardless of whether the Center or the Periphery moves first, we are a an interior solution of the sequential conflict. Total welfare is then higher when the Center is the leader than when the Periphery is the leader if and only if

$$\frac{[k-ag(1-s)]\left[(ag)^2(1-s)^2+k^2(1+s-s^2)-agk(1-s)(3-s)\right]}{2k(1-s)\left[ag(1-s)-sk\right]} > 0$$

which is satisfied if and only if $k < ag(1-s)$, or, equivalently, $a > a^*$ (i.e., the union is inefficient). Therefore, for all values of $a$, total welfare is maximized when the low-stakes region moves first. In other words, in an efficient union, total welfare is maximized when the Periphery moves first, while in an inefficient union, total welfare is maximized when the Center moves first.

□

*Proof of Proposition 8.* Direct from the corresponding analytical expression of $\pi^*$. □

*Proof of Proposition 9.* Direct. □

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