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Working Paper

A Dynamic Theory of Secession

CESifo Working Paper, No. 7257

Provided in Cooperation with:
Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Esteban, Joan; Flamand, Sabine; Morelli, Massimo; Rohner, Dominic (2018) : A Dynamic Theory of Secession, CESifo Working Paper, No. 7257, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:
https://hdl.handle.net/10419/185455

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CESifo WORKING PAPERS

7257
2018

September 2018

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
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www.cesifo-group.org/wp

An electronic version of the paper may be downloaded
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CESifo *Working Paper No. 7257*
Category 2: Public Choice

A Dynamic Theory of Secession

Abstract

This paper builds a dynamic theory of secessions, conflictual or peaceful, analyzing the forward looking interaction between groups in a country. The proposed framework allows us to jointly address several key stylized facts on secession, and generates several novel predictions. We find that if a group out of power is small enough, then the group in power can always maintain peace with an acceptable offer of surplus sharing for every period, while when there is a mismatch between the relative size and the relative surplus contribution of the minority group, conflict followed by secession can occur. Accepted peaceful secession is predicted for large groups of similar prosperity, and higher patience is associated to a higher chance of secession. We formulate as a result a number of policy recommendations on various dimensions of federalism and other institutions.

JEL-Codes: C700, D740.

Keywords: secessions, conflict, surplus sharing, mismatch.

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August 16, 2018
This paper developed from an initial draft written as a contribution to the conference in honor of Shlomo Weber at SMU in 2016. Very helpful comments from Michael Gibilisco and Jessica Sun and conference and seminar audiences in Bocconi, ASSET, Michigan, Reus, NYUAD, the 2018 NYU-LSE conference in political economy, the ThRED 2018 conference and the 2018 Cornell political economy workshop are gratefully acknowledged. Joan Esteban gratefully acknowledges financial support from the Ministry of Economy and Competitiveness, through the Severo Ochoa Programme for Centres of Excellence in R&D (SEV-2015-0563) and grant number ECO2015 – 66883-P, from the Generalitat de Catalunya grant 2017SGR1359, and from National Science Foundation grant SES-1629370. Sabine Flamand is grateful for financial support from the Ministry of Economy and Competitiveness Grant number ECO2016-75410-P. Massimo Morelli wishes to thank the European Research Council, advanced grant 694583. Dominic Rohner is grateful for financial support from the ERC Starting Grant 677595

1 Introduction

Historically, secessions from empires or states have taken place in a variety of contexts, and their features have varied. Some secessions have taken place in peace. For instance, the Roman Empire voluntarily and peacefully split into two similarly large and similarly rich halves marked by some salient differences in social and religious norms. Or to take a contemporary case, after the Fall of the Berlin Wall Czechoslovakia split peacefully into two similarly large and rich halves, marked by ethnic differences. In contrast, other secessions have been considerably less harmonious: The collapses of the Soviet empire and Yugoslavia were accompanied by a series of bloody conflicts, with disagreements over whether to split or stay together. In both cases the sizes of the composing regions varied greatly, and while the richest and most productive regions were eager to secede (i.e., Russia, the Baltic states, resp. Slovenia and Croatia) other regions opposed secession. Finally, in many countries no group wants to split, and peaceful union is sustainable over a long time period.

The understanding of the underlying drivers of this rich range of potential outcomes is very incomplete at best, and many features of secessionism remain unexplained puzzles. As discussed in greater detail below, one can highlight the following four empirical stylized facts: 1) Conflict followed by secession often occurs when there is a mismatch between the relative economic potential of a group and its relative size (with very rich or productive groups being particularly eager to split); 2) Countries with large, similarly productive groups are most likely to experience peaceful secession; 3) Very small group do only rarely attempt to secede and unions with small minority groups are likely to be stable; 4) A higher level of patience increases the probability of secession – may it be peaceful or conflicted. There is substantial empirical evidence for these patterns, yet the existing (static) models of secession can only partially address some of them.

To address this gap in the literature, we build what to the best of our knowledge is the first full-blown dynamic model of stability and break-down of states, which allows us to explain jointly all four aforementioned stylized facts. We consider a country with two groups that can differ in size, economic productivity, and in preferences for the type of public good to be supplied. The types of public goods we have in mind are culture, language, legislation, and other identity related collective decisions.

Setting up or maintaining a State carries a cost. As long as a non-homogeneous

State remains united (which we call the "union" case), the group in power selects the public goods and determines how the surplus is shared. With secession we have two separate States, each producing its own public good and paying the fixed cost for running the State. The overall trade-off is between the economies of scale of larger states (as the fixed administrative costs are shouldered by a larger population) and the cost of preference heterogeneity (the opposition group cannot select its favored public good). We include these features in the model for comparability with the literature.

We assume that the group in power can make a proposal (union or secession), which the group in opposition can either accept or reject, inducing costly conflict. The game continues with the winning group acquiring full control of power, choosing between seceding or taking the surplus and becoming the new ruling group in the union. In the latter case, the threat of conflict may induce the group in power in the next period to compensate the opposition with larger transfers. The proposal depends on the value attached to the continuation of the game. It is an infinite horizon game, with secession being an absorbing state (after secession no more strategic decisions are made).

This is a complete information sequential game, and we show that it has a unique Subgame Perfect Equilibrium outcome. Depending on the parameters the equilibrium will consist of union, peaceful secession, conflict followed by secession, or endless conflict. A sketch of the findings can be described using as key variables the relative size and the relative productivity of the opposition group.

When no importance is ascribed to the future (equivalent to a static game) and the value of producing the preferred public good is small, union is the equilibrium for almost all pairs of population and relative productivity, the exception being when the population share of the opposition and its productivity are sufficiently large. In this case the equilibrium is peaceful secession. When the benefit from producing the preferred public good increases, the set of parameter values yielding an equilibrium of peaceful secession becomes larger. Moreover, a zone emerges where a numerous yet relatively unproductive opposition triggers conflict. Importantly, in this static setting conflict is never followed by secession.

Things change as the value attached to the future increases. First, the zone of parameters where union is a SPE shrinks. The parameter values for which peaceful secession is a SPE continue to have similar qualitative properties: sufficiently large share of opposition population and similar productivity. In contrast, the set of

parameter values for which the SPE is conflict followed by secession arises and becomes larger and larger as the time discount factor approaches unity. This type of equilibrium is found when there is a severe mismatch between the opposition group's population and productivity (that is, when the opposition group is large but unproductive or small and disproportionately productive). Therefore, the more the future counts, the narrower the range of parameter values for which union is the SPE and the broader the range for secession, either peaceful or after conflict. The main reason for the greater scope for secession as the time discount factor increases is that secession is an end state. With a high time discount factor the short-run costs of secession weigh less by comparison with the stream of future payoffs from independence.

The literature's classic trade-off between the preference heterogeneity of citizens and increasing returns to country size are nested in our stage game, but the dynamic analysis highlights many other interesting and relevant tensions. The focal point of many papers is whether there are inter-group [inter-regional] transfers that would deter a group from secession and independence. The various contributions differ in the specification of the preference heterogeneity within and across groups and in the nature of the benefits of country size. Our paper has a different point of departure: remaining united implies that the public decisions will have to be negotiated every period by groups with different preferences and priorities, while secession entails a cost today but no need to bargain with the other group ever again. This inter-temporal argument, in our view, is an essential factor in the reasoning for or against secession and it generates a radically different equilibrium characterization from the static game.[3]

A second major difference between our setting and most of the previous literature is that we explicitly model conflict as an integral component of the secession trade-off. Conflict can occur on the equilibrium path because the different public good preferences create a sort of indivisibility problem.[4] As we discuss below, the conflict literature envisages only a few dynamic frameworks, where conflict onset

[3] One can appreciate its critical importance also by considering the complementary problem of union formation: we should expect such a decision to be guided by the expected future payoffs from the interaction within the union, not by any immediate gains.

[4] If the group in power imposes a language or religion or type of rules that are disliked by the opposition group, and that would indeed be changed in case of victory of the opposition, bargaining cannot fully eliminate the risk of conflict, even if there is complete information. See e.g. Fearon (1995).

and secession after conflict are never equilibrium phenomena that are both possible in the same model. The innovations of making a secession framework dynamic and explicitly modelling conflict allow us to generate a series of novel predictions. They also enable our setting to be the first model that can jointly account for the four empirical stylized facts on secession mentioned above, which we shall present in greater detail below.

The remainder of the paper is organized as follows: Section 2 reviews the literature and discusses the main stylized facts. Section 3 sets up the model. Section 4 characterizes the equilibrium outcomes, and Section 5 explains in detail the equilibrium relevance of productivity, population sizes and impatience. Section 6 discusses policy implications and Section 7 concludes.

2 Related literature and stylized facts

Starting with an account of the existing theoretical literature, this paper belongs first of all to the literature on border formation and secessionism.[5] One key point made by this strand of economic literature is that the size of countries results from the trade-off between economies of scale and the costs of differences in the preferences over public goods and government policies.[6] The literature distinguishes various potential determinants of the incentive for secession: region size (Goyal and Staal, 2004), international openness (Alesina, Spolaore and Wacziarg, 2000, 2005; Gancia, Ponzetto and Ventura, 2017); democratization (Alesina and Spolaore, 1997; Arzaghi and Henderson, 2005; Panizza, 1999); the optimal level of public spending (Le Breton and Weber, 2003; Le Breton et al., 2011); the presence of mobile ethnic groups (Olofsgård, 2003); the presence of natural resources in potentially secessionist regions (Gehring and Schneider, 2017; Hunziker and Cederman, 2017); or external threats (Alesina and Spolaore, 2005, 2006; Wittman, 2000). Bolton and Roland (1996, 1997) focus on differing preferences for income tax policies owing to inter-regional differences in income distribution.

The literature on secessionism has also studied whether there exist mechanisms of interregional compensation such that potentially seceding regions are better off staying in the union. Haimanko et al. (2005) show that in an efficient union whose

[5] Excellent reviews of the literature on secessionism are provided in Bolton et al. (1996), Alesina and Spolaore (2003), and Spolaore (2014).

[6] See e.g. Friedman (1977), Buchanan and Faith (1987), Barro (1991) and Desmet et al. (2011).

citizens' preferences are strongly polarized, the threat of secession cannot be eliminated without interregional transfers. Le Breton and Weber (2003) establish the principle of partial equalization: the gap between advantaged and disadvantaged regions must be narrowed, but should not be completely eliminated.[7] Alesina and Spolaore (2003) point out the problems for compensation transfers, such as feasibility issues and administrative costs, political credibility, or incompatibility with other social goals.[8] The recent paper by Gibilisco (2017) analyzes the potential effects of decentralization in a repeated game in which the periphery, when it is not repressed by the center, may initiate a secessionist mobilization whose probability of success depends on the amount of accumulated resentment. Repression feeds resentment, while a hands-off policy attenuates it. He finds that the relationship between decentralization and the likelihood of secessionist unrest is non-monotonic.

Few authors explicitly introduce a conflict technology in the context of separatism. We have already noted that in Gibilisco (2017) the periphery may plot for a costly mobilization that with some probability may end up in secession. Spolaore (2008) analyzes the choice of regional conflict when a peripheral (minority) region wishes to secede, focusing on the trade-off between economies of scale and heterogeneity of preferences where transfers are barred.[9] Anesi and De Donder (2013) construct a static model of secessionist conflict with an exogenous winning probability; they find the existence of a majority voting equilibrium with government type biased in favor of the minority. Our contribution is complementary to theirs: our dynamic setting features general transfers and links the probability of victory to group size.

In the conflict literature only a handful of papers have explicitly modelled the incentives for secession. Morelli and Rohner (2015) have built a model allowing for both nationwide and secessionist conflict, showing that the most conflict-prone

[7] See also Flamand (2015).

[8] Related to this, Bordignon and Brusco (2001) analyze whether constitutions should include provisions for agreed potential secessions, arguing that if peaceful secession is not foreseen, the society may incur ex-post important efficiency losses due to conflict. Yet, making splitting up less costly makes it more likely to happen.

[9] Our model differs in several important dimensions from Spolaore (2008)'s: Our setup is dynamic, it includes the option of compensating transfers and allows for the groups having different productivities per capita. See also Flamand (2016), who complements Spolaore's model by analyzing the effect of inequality on the conflict equilibrium, and considers the possibility of using partial decentralization as a way to prevent conflict.

situations are those in which mineral resources are concentrated in the minority region, leading to secessionist pressures. Their empirical analysis finds that the situations where most oil revenues accrue in minority regions are in fact a major driver of civil war. One major difference between that paper and the present one is that now we have a dynamic model that allows for both conflicted and peaceful secession.[10]

In sum, our's is the first dynamic model of secession and takes into account the incentives for conflict and potential compensating transfers. This framework generates a novel equilibrium comprising zones of peaceful union, peaceful secession, centrist conflict (i.e., endless conflict path where no one secedes) and secessionist conflict. This is later shown to differ very substantially from the one that would be obtained in a static framework. Importantly, our model is also the first one to jointly explain all four empirical stylized facts discussed below.

2.1 Empirical stylized facts

Mismatch and conflicted secession: A first important stylized fact is what we call *mismatch* between relative productivity and relative size of groups in regions where separatism manifests itself. In the literature to date several studies have presented systematic evidence that natural resource-rich ethnic minorities have a relatively high propensity to engage in separatist conflict (see e.g., Sorens, 2012; Morelli and Rohner, 2015; Paine, 2017). In fact, there are many examples of conflicts in which (resource-)rich ethnic minority groups aim at secession.[11] Examples include the armed separatist movement in now independent Timor-Leste, the civil war in Nigeria's Biafra region and the recent fighting in the Niger Delta regions of Nigeria, Katanga's attempt to secede from the Congo in 1960-1963, the Basque country's armed struggle for independence from Spain, the rebellion of the Aceh Freedom Movement in Indonesia starting in 1976, and the Sudan People's Liberation Army struggle beginning in 1983. Other ethnically divided countries with separatism linked to a wealth of local natural resources include Angola, Myanmar, Democratic Republic of Congo, Morocco and Papua New Guinea.

[10] Another article studying endogenous country borders and war is Caselli, Morelli and Rohner (2015). Unlike our current paper, their static model focuses on interstate wars.

[11] This draws on the more detailed accounts of Ross (2004), Collier and Hoeffler (2006) and Morelli and Rohner (2015).

These cases just mentioned have often involved actual political violence, but the impact of resource spoils is also perceptible in less violent calls for secession. Gehring and Schneider (2017) find that the Scottish bid for independence has been systematically fuelled by the value of prospective oil fields, while Suesse (2017) shows that at the moment of the collapse of the Soviet Union popular support for the creation of new sovereign states was stronger in the oil rich republics.[12]

The mismatch stylized fact seems also to matter in the opposite case in which the opposition group's relative size is much larger than its relative productivity. There are anecdotal accounts and case studies indicating that both the poorest and the richest regions tend to develop grievances against the central state and build nationalist movements (see Gourevitch, 1979; Horowitz, 1985; Bookman, 1992). Further, for a sample of 31 federal states, Deiwiks, Cederman and Gleditsch (2012) show that secessionist conflict takes place in regions whose income is either substantially below or substantially above the national average, and that roughly average regions are the most peaceful.

The dynamic theory we propose in this paper will offer, among other things, a clear prediction that is fully in line with such a stylized fact, namely with the general observation that there needs to be a *mismatch* between the relative strength and the relative productivity of the two groups in order to possibly rationalize the existence of conflict followed by secession.

We do not report here any evidence or stylized facts about war initiation data because it is not very reliable, for the following reason: where it is the group in power that wants to split, this could equally well take the form of an unfair distribution of the collective surplus, provoking rebellion by the opposition group. Therefore, the theoretical distinction –which party is the one to trigger conflict and secede– seems unlikely to be fully discernable empirically.

Peaceful secession with large, similarly rich groups: A second, related,

[12] Although in these examples the prosperity of separatist regions is linked to natural resources, this is not indispensable. In fact, there are many more cases of prosperous regions aiming for secession even where the source of wealth is not natural resource spoils. Conflictual secessions by regions that were substantially richer than the country as a whole include Slovenia and Croatia's separation from Yugoslavia, and Eritrea's war of independence from Ethiopia. In 1993, when Eritrea won its independence, its GDP per capita (at constant 2005 US dollars) was 70 percent larger than Ethiopia's (World Bank, 2017) and in the next year the difference jumped to more than 100 percent. Further examples of separatist movements in relatively rich regions include the Basque country and Catalonia in Spain as well as Flanders in Belgium.

broad observation or stylized fact that is worth pointing out is that separatism tends to be less violent when the groups involved are of intermediate or large size and of similar prosperity.

The separation between Czech Republic and Slovakia –two lands of comparable size and prosperity– was peaceful, like the division of the ancient Roman Empire into two similar halves –West and East. Britain is of similar per capita GDP to the EU average and large in size, and its split from the EU has been –so far– within the boundaries of the law. Other examples of peaceful secessions with similar features include Singapore-Malaysia, Austria-Hungary and Norway-Sweden (see Young, 1994).

Peaceful union when opposition groups are small: A third stylized fact that we need to mention is that peaceful union tends to prevail when minority groups are small. Many enduring states are characterised either by ethnic homogeneity or by extreme ethnic fractionalisation, while ethnically polarized countries are less likely to experience persistent peaceful union (Montalvo and Reynal-Querol, 2005; Esteban, Mayoral and Ray, 2012). As our model predicts, when potential separatist groups are absent (in the case of ethnic homogeneity) or very small in size (in the case of high ethnic fractionalization), forming a separate state would be very costly, so peaceful union is more easily sustained. Think for example of such cases as German-speaking Südtirol in Italy, Martinique and Guadeloupe in France, Galicia in Spain or the Sami people in Northern Scandinavia. Suesse (2017) also shows that during the collapse of the Soviet Union smaller regions were on average less likely to seek independence and more likely to favor maintaining the union.

Higher patience favors secessionism: A fourth stylized fact is that strikingly, many secessionist movements occur in places with relatively high patience, such as for example in Quebec (Canada), Scotland (UK), Catalunya / Basque Country (Spain), Tibet / Taiwan (China), or Corsica (France), and also the formerly united Czech Republic and Slovakia are characterized by high patience levels (see the recently collected data by Dohmen et al., 2015). In contrast, in Latin America patience levels are remarkably low, and the continent is known to have been surprisingly spared from separatism, prompting The Economist to ask "Why Latin America has no serious separatist movement?" (23 November 2017). There is one exception, though, as acknowledged by The Economist, namely the secessionist movement in the Santa Cruz region in Bolivia. Conspicuously, Bolivia is the only Latin American country with above average patience scores, according to the data of

Dohmen et al. (2015), highlighting again the positive correlation between patience and secessionism.

A further empirical prediction of the model is that in the case of low patience and low economic destruction costs of conflict (which typically goes together with low GDP per capita – the smaller the size of the economy the less can be destroyed) conflict not followed by secession is predicted. According to the Dohmen et al. (2015) patience data indeed the two countries with lowest patience (and that also happen to have a low GDP per capita) are Nicaragua and Rwanda, both of which have experienced decades-long fighting without a secessionist component.

As we will see, the general theory provided below yields predictions that are broadly consistent with all these stylized facts.

3 The model

Consider a country with two ethnic groups, i and j, with population size N_i and N_j, $N_i + N_j = N$.

There is a total divisible surplus denoted by $S > 0$, and each group considers its contribution to the total surplus S_h, $h = i, j$, as an important indicator of what it would have in case of secession, i.e., $S_i + S_j = S$.[13] The total surplus S may be obtained from production as well as from non-produced rents. We denote by $A > 0$ the cost of running the State, so that the divisible surplus in a given period is $S - A$.

Assume WLOG that group j is in power at the beginning of the game. Taking equal per capita division of the surplus as a benchmark, we say that j makes the strategic choice of treating i with λ_i fairness if the share of surplus received by group i is $\lambda_i n$, where $n \equiv N_i/N$ denotes the population share of the opposition group. In addition to the divisible surplus, citizens' utility also depends on the type of public goods provided, on which the two groups have different preferences. The group in

[13] In reality, in a country in which the two groups are geographically segregated in separate regions the assumption is realistic, but if they are much more integrated and production has various kinds of complementarities, a group's expected total output after secession could be lower, in the aftermath, say, of a collapse of domestic trade (see Suesse, 2017b). For simplicity we ignore this complication (but we capture costs of secession through the parameter A, described below). Note also that adding the role of segregation or intermingled groups would be possible, by adding to the model a scalar $\alpha \in [0, 1]$ such that when group i splits it obtains αS_i, with α going to 1 in the case of perfect segregation. Hence, the effect of segregation is quite straightforward and can be taken out of the analysis for conciseness.

power chooses the public good it likes most, which gives all its members a payoff differential, so that if group h is in power they obtain $P_h > 0$ extra utility per member over the opposition group, which gets zero public good utility by normalization. The prime examples of public goods here are language, culture, legislation, government-favored religion, but the idea could extend more generally to policies and their different utility implications for people with differing ideologies.

In the case of an ethnic secession, with groups i and j forming new states, each group would have to incur the cost of setting up or maintaining the state institutions and re-organizing production. For simplicity, we assume that the cost of running each new State is A, without differentiating between the cost of the original State and that of each new State. Therefore there are returns to scale because the fixed cost A is divided up among a larger population. After secession each group can produce its preferred public good. We take the differential public good utility levels P_j and P_i (with j and i in power, respectively) as given, representing the reduced form expected differential effects.[14]

The player in power j has two possible moves: (i) propose a distribution of surplus in the union, with fairness λ_i; and (ii) propose peaceful secession.

If a surplus sharing proposal or a peaceful secession proposal by the group in power is rejected by the opposition group, then a costly conflict begins. Each group has a probability of victory equal to its population share.[15] With the victory, the effective resistance of the other group gets temporarily nullified until next period in which, established as the opposition to power, they can again challenge proposals. At the moment of victory, the winner can aim either to conquer power in the union and capture the entire surplus leaving nothing for the loser in that period, or to secede and take away its own surplus forever, making the loser bear the cost of conflict D. We assume that $D < \min\{S_i, S_j\}$ and $A < \min\{S_i, S_j\}$.[16]

[14] An expected differential public good utility P_j for the case in which j is in power could for example depend on the expected willingness of j to allow cultural pluralism or decentralized production of different public goods. We close the paper with a discussion of decentralized, federal policies, allowing for reducing the differential benefit from being in power.

[15] For simplicity, we do not assume an advantage for the incumbent. Of course if staying in power strengthens the group in power (see Fearon, 1995), then the equilibrium probability of war and secession should be expected to change slightly, but qualitatively allowing for this difficult extension does not seem to add anything interesting to our analysis of the structural secession incentives.

[16] The assumption $A < \min\{S_i, S_j\}$ is made for making the problem interesting (if it did not

We use the following normalized notation: $n = \frac{N_i}{N}, s = \frac{S_i}{S}, a = \frac{A}{S}, d = \frac{D}{S}, \sigma = \frac{S}{N}$.

Notice that $\min\{S_i, S_j\} > A$ implies that $S > A + \min\{S_i, S_j\} > A + D$. The latter inequality, or its equivalent $1 - a - d > 0$, will appear at different stages of our analysis. It is immediate that in a one-shot game, in case of conflict, the winner always opts to maintain the union: since $\min\{S_i, S_j\} - D > 0$, there is more surplus to be obtained. Hence a violent conflict leading to secession can be an equilibrium solution only if the game has more than one period.

The per-period payoffs to the two players in the three possible scenarios are as follows:

- Equilibrium union

$$U_i^U(\lambda_i) \equiv \lambda_i n \frac{S - A}{N_i} \text{ and} \tag{1}$$

$$U_j^U(\lambda_i) \equiv (1 - \lambda_i n) \frac{S - A}{N_j} + P_j; \tag{2}$$

- Secession

$$U_i^S \equiv \frac{S_i - A}{N_i} + P_i \text{ and}$$

$$U_j^S \equiv \frac{S_j - A}{N_j} + P_j; \tag{3}$$

- Conflict

$$U_i^C \equiv n \left[\frac{S - A - D}{N_i} + P_i \right] \text{ and}$$

$$U_j^C \equiv (1 - n) \left[\frac{S - A - D}{N_j} + P_j \right], \tag{4}$$

  taking into account that the winner takes the entire surplus of that period.

The timeline is as follows:

1. *Production:* Each period starts with a group in power, say j; output is produced, and surplus S is obtained.

2. *Proposal:* The group in power chooses whether to start a conflict right away or make one of two possible proposals: [i] union, proposing a distribution of the surplus with λ_i fairness; [ii] peaceful secession proposal.

hold, secession would never be a viable option for at least one of the groups).

3. *Peace or conflict:* The opposition can either accept or challenge the proposal. If it is accepted, it is carried out; if it is challenged, conflict follows.

4. *Exercise of power.* If there is peace, and hence j remains in power, the policies announced are carried out, these being either (i) the announced distribution of the surplus or (ii) secession. In case of conflict the winner has temporarily eliminated all resistance and can unrestrictedly choose between secession and union. In the first case, it splits the country and takes its own produced surplus (while placing the full cost of conflict, D, on the loser); in the second case it appropriates the entire remaining surplus leaving nothing for the losers and begins the next period in power. The loser begins next period as the organized opposition that can challenge unacceptable proposals.

5. *Consumption:* At the end of every period the entire remaining surplus is consumed.

The expected payoff of future periods is discounted by the usual discount factor $\delta \in [0, 1]$. The only state variable is the identity of the group in power. Note that decisions are sequential, and hence this is a complete information infinite horizon sequential game.

4 Equilibrium characterization

Given stationarity, any SPE path ending with a peaceful agreement on distribution consists of an initial proposal by group j that is immediately accepted by group i. Accordingly, any path that starts with a rejection ends either with permanent conflict or conflict with eventual secession.

The opposition can influence the initial offer by threatening conflict. But this threat is credible only if such a one-step deviation has a continuation that is itself subgame perfect, SP. We now analyze the conditions under which such SP continuations after a rejection do exist. When there are multiple SP continuations, the one preferred by the group in power making the proposal is the one that matters. Identifying the continuation paths after a conflict for different parameter values will give us the minimum payoff that any SPE has to grant to this player. We shall start by characterizing the conditions under which the threat of endless conflict is credible.

4.1 Indefinite conflict

The only way for conflict to last indefinitely is for each player to reject the other's proposal in every period. Such an infinite sequence of conflicts could be an SP path, because neither player would have a profitable deviation (it takes only one player to provoke conflict). This path involves the destruction of D surplus in every period and consists of a sequence of strategies each rejecting the other's proposal when in opposition and making an unacceptably unfair proposal when in power (say, allocating zero surplus to the opposition).

After any conflict, the winner decides whether to secede or to maintain union, appropriating the entire remaining surplus for that period. When the winner decides to secede, the strategic interaction is terminated.

Therefore, in order to determine whether or not permanent conflict is an SP path we need to check whether the winner will prefer to deviate from continued conflict and opt for secession. We now compute the value for i of being a winner and continuing with conflict, $\overline{V}_i^{cc}$, and compare it with the value of being a winner in the conflict and deviating by choosing secession, $\overline{V}_i^{cs}$. The value of being the loser is denoted by $\underline{V}_i^{cc}$.

$$\overline{V}_i^{cc} = \frac{S - D - A}{N_i} + P_i + \delta \left\{ \frac{N_i}{N} \overline{V}_i^{cc} + \frac{N_j}{N} \underline{V}_i^{cc} \right\}, \text{ and}$$

$$\underline{V}_i^{cc} = 0 + \delta \left\{ \frac{N_i}{N} \overline{V}_i^{cc} + \frac{N_j}{N} \underline{V}_i^{cc} \right\}.$$

Solving, we obtain

$$\underline{V}_i^{cc} = \frac{\delta \frac{Ni}{N}}{1 - \delta \frac{Nj}{N}} \overline{V}_i^{cc},$$

and hence

$$\overline{V}_i^{cc} = \frac{1 - \delta \frac{N_j}{N}}{1 - \delta} \left[\frac{S - D + N_i P_i - A}{N_i} \right]. \tag{5}$$

Now compute the value of being the winner and seceding $\overline{V}_i^{cs}$:

$$\overline{V}_i^{cs} = \frac{1}{1 - \delta} \left(\frac{S_i + N_i P_i - A}{N_i} \right). \tag{6}$$

Therefore, i will prefer to continue the conflict rather than deviate and secede if

$$S_j - D \geq \frac{\delta N_j}{N} (S - D + N_i P_i - A). \tag{7}$$

Mutatis mutandis, the condition for j to continue conflict rather than deviate and secede is:

$$S_i - D \geq \frac{\delta N_i}{N}(S - D + N_j P_j - A). \tag{8}$$

Clearly, permanent conflict is an SP path following i's rejection of a proposal by j whenever (7) and (8) are both satisfied. We denote the set of parameters satisfying these conditions by $\mathbf{A}$, and we will call a continuation path with endless conflict a path of type A.

The two conditions can be rewritten as

$$s \leq (1-d)[1-\delta(1-n)] - \frac{\delta}{\sigma}(1-n)(nP_i - a\sigma)$$

and

$$s \geq d - \frac{\delta}{\sigma} n \left[(1-n)P_j + (1-a-d)\sigma\right].$$

These expressions are constraints on the share of surplus produced by the opposition i, s, relative to its population, n. Group i in opposition prefers conflict to secession if its share is sufficiently small; that is, if the surplus they will expropriate from the defeated group, $1-s$, is sufficiently large. Similarly for group j: the surplus produced by the opposition has to be large enough to make conflict preferable to secession.

The following lemma summarizes the characterization of the set $\mathbf{A}$ of parameter values for which a continuation path of endless conflict (type A path) is a SPE.

Lemma 1. *Let the opposition player start by triggering conflict. Then the necessary and sufficient condition for the sequence of endless conflicts to be a SPE is that*

$$s \leq (1-d)\left[1-\delta(1-n)\right] - \frac{\delta}{\sigma}(1-n)(nP_i - a\sigma), \textit{and} \tag{9}$$

$$s \geq d + \frac{\delta}{\sigma} n \left[(1-n)P_j + (1-a-d)\sigma\right]. \tag{10}$$

Therefore, the necessary and sufficient condition for the set $\mathbf{A}$ *to be non-empty is*[17]

$$\delta < \delta_A \equiv \frac{(1-2d)\sigma}{(1-n)n(P_i + P_j) + (1-a-d)\sigma} > 0. \tag{11}$$

[17] Note that our assumption that $D < \min\{S_i, S_j\}$ and $A < \min\{S_i, S_j\}$ implies that $1-a-d > 0$ and $1-2d > 0$.

The set $\mathbf{A}$ is non-empty when the discount factor is small enough. But notice that if $a > d + n(1-n)\frac{P_i+P_j}{\sigma}$ we have $\delta_A > 1$ and hence $\mathbf{A}$ is non-empty even for the highest discount factor. Therefore, whenever the expected aggregate cost of conflict is small relative to the cost of running the State we shall have that $\mathbf{A}$ is non-empty even when $\delta \to 1$.[18] When this inequality is reversed we have that for a sufficiently large discount factor permanent conflict will cease to be a SPE. A sufficient condition is that $a < d$. In this case, the closer n is to $1/2$ the larger is the set of discount factors for which the path type A is not SP. Finally, observe that for arbitrarily large P_i and P_j, the set $\mathbf{A}$ may still be empty even for low values of the discount factor δ. Indeed, given that the groups highly value their preferred public good, they must be very short-sighted in order to prefer playing permanent conflict rather than seceding.

4.2 The threat of secession

If either of the conditions characterizing $\mathbf{A}$ is violated, we can seek to determine the conditions under which continuation involves secession. Consider first the case in which player i, victorious in conflict, opts for secession while j would continue to play indefinite conflict. For player i the payoff from secession is exactly what we computed in (6), and should be larger than continuing conflict as in (5). Therefore, player i triggers conflict and secedes after the first victory, knowing that j will always play conflict iff

$$S_j - D \leq \frac{\delta N_j}{N}(S - D + N_i P_i - A). \tag{12}$$

Using the same notation as before, this condition can be rewritten as

$$s > (1-d)(1+\delta n) - \delta\left[1 - d + \frac{1-n}{\sigma}(nP_i - a\sigma)\right].$$

We must now check the conditions under which player j will continue to play conflict even knowing that i will eventually secede. After a victory, the value of

[18] This inequality can be rewritten as $A > D + nP_jN_j + (1-n)P_iN_i$. This means that the cost of running a state A is larger than the expected loss from conflict. This expected loss consists of the destruction of surplus D, and the loss experienced by each group in the aggregate value of the public good $P_hN_h, h = i, j$ in case of victory of the opponent with probabilities n and $1-n$, respectively.

continuing conflict is

$$\overline{V}_j^{cc} = \frac{S - D + N_j P_j - A}{N_j} + \delta \left[\frac{N_j}{N} \overline{V}_j^{cc} + \frac{N_i}{N} \left(\frac{1}{1-\delta} \frac{S_j + N_j P_j - A}{N_j} - \frac{D}{N_j} \right) \right].$$

Therefore

$$\overline{V}_j^{cc} = \frac{1}{1 - \delta \frac{N_j}{N}} \left[\frac{S - D + N_j P_j - A}{N_j} + \frac{\delta}{1-\delta} \frac{N_i}{N} \frac{S_j + N_j P_j - A - (1-\delta) D}{N_j} \right].$$

The value $\overline{V}_j^{cc}$ has to be greater than that of opting for secession after the first victory. That is

$$\overline{V}_j^{cc} \geq \frac{1}{1-\delta} \frac{S_j + N_j P_j - A}{N_j}.$$

This inequality simplifies to

$$S_i \geq D \left(1 + \delta \frac{N_i}{N} \right). \tag{13}$$

That is

$$s > d(1 + \delta n).$$

Combining inequalities (12) and (13) we fully characterize the set of parameter values for which the path that consists of i triggering conflict and seceding after the first victory while j would play permanent conflict is a SPE. We denote this set by $\mathbf{B_i}$, with the following characterization:

Lemma 2. *Let the opposition player start by triggering conflict. Then the continuation path with j playing conflict at every iteration and i seceding after the first victory is a SPE iff:*

$$s > (1-d)(1+\delta n) - \delta \left[1 - d + \frac{1-n}{\sigma} (n P_i - a\sigma) \right] \quad \textit{and} \tag{14}$$

$$s > d(1 + \delta n). \tag{15}$$

Furthermore, the set $\mathbf{B_i}$ is always non-empty.

It can readily be verified that inequality (14) is exactly the reverse of inequality (9) characterizing the set $\mathbf{A}$ in Lemma 1.

We now turn to the case in which group j opts for secession at the first victory while the opposition group i chooses indefinite conflict. Group j opts for secession

in response to the opposition playing conflict when inequality (8) is reversed, that is, when

$$S_i - D < \frac{\delta N_i}{N}(S - D + N_j P_j - A).$$

In our simplified notation this inequality can be written as

$$s < d + \frac{\delta}{\sigma} n \left[(1-n)P_j + (1-a-d)\sigma\right]. \tag{16}$$

Notice that this inequality is the reverse of inequality (10) characterizing the parameter values in set **A** in Lemma 1. Therefore, the parameter values satisfying inequality (16) above cannot belong to the set **A**.

By the same steps as before we obtain that the condition for i to prefer continued conflict knowing that j seeks secession is

$$S_j \geq D\left(1 + \delta \frac{N_j}{N}\right),$$

that is

$$s < [1 - (1+\delta)d] + \delta d n. \tag{17}$$

Inequalities (16) and (17) fully characterize the set $\mathbf{B_j}$ of all the parameter values for which, after i has rejected the initial proposal, the continuation with i playing indefinite conflict and j seceding at the first victory is a SPE. Formally:

Lemma 3. *Let the opposition player start by triggering conflict. Then the continuation path with i playing conflict at every iteration and j seceding after the first victory is a SPE iff the following two inequalities are satisfied:*

$$s < d + \frac{\delta}{\sigma} n \left[(1-n)P_j + (1-a-d)\sigma\right] \tag{18}$$

and

$$s < 1 - d - \delta(1-n)d. \tag{19}$$

The set $\mathbf{B_j}$ is always non-empty.

The last case in which an initial rejection by i can be sustained by a credible threat of secession is one in which both groups opt for secession after the first victory. We can obtain the parameter values for which such continuation is SP. Let us consider the opposition player i. When victorious, the payoff from secession for i is

$$\overline{V}_i^{cs} = \frac{S_i + P_i N_i - A}{(1-\delta)N_i}.$$

The payoff from triggering a new conflict $\overline{V}_i^{cc}$ is

$$\overline{V}_i^{cc} = \frac{S - D + P_i N_i - A}{N_i} + \delta \left[\frac{N_i}{N} \overline{V}_i^{cc} + \frac{N_j}{N} \left(\frac{S_i + P_i N_i - A}{(1-\delta) N_i} - \frac{D}{N_i} \right) \right].$$

Simplifying, we easily obtain that $\overline{V}_i^{cs} \geq \overline{V}_i^{cc}$ iff

$$S_j \leq \left(1 + \delta \frac{N_j}{N} \right) D. \tag{20}$$

Using our simplified notation, this can be rewritten as

$$s \geq [1 - (1+\delta)d] + \delta dn.$$

Performing the same calculations for player j, one obtains $\overline{V}_j^{cs} \geq \overline{V}_j^{cc}$ iff

$$S_i \leq \left(1 + \delta \frac{N_i}{N} \right) D. \tag{21}$$

In our simplified notation, can be rewritten as

$$s \leq d + \delta dn.$$

Inequalities (20) and (21) fully characterize the set $\mathbf{C}$ of all the parameter values for which after i rejects the initial proposal the SPE continuation is that the winner of this first conflict, whoever it is, chooses secession. Formally:

Lemma 4. *Let the opposition player start by triggering conflict. Then the continuation path where whoever wins decides to secede is a SPE iff the following two inequalities are satisfied:*

$$s \geq [1 - (1+\delta)d] + \delta dn, \tag{22}$$

and

$$s \leq d + \delta dn. \tag{23}$$

The set $\mathbf{C}$ *is empty whenever* $\delta < \frac{1-2d}{d}$.

Note that if $d < 1/3$, that is, the cost of conflict D be less than $1/3$ of the aggregate surplus S, the set $\mathbf{C}$ is empty for all $\delta \in [0, 1]$. Consistently with the various estimates of the cost of conflict mentioned in the empirical literature, which evaluate conflict costs to be below such a threshold, we shall make the realistic assumption that $d < 1/3$ and hence obtain that $\mathbf{C}$ is an empty set.[19]

Corollary 1. *Let* $d < 1/3$. *Then the set* $\mathbf{C}$ *is empty.*

[19] Empirically, the costs of conflict have been found to correspond to a relatively small part of economic output (Collier, 2007).

4.3 Intersections

We let $\mathbf{B}$ denote $\mathbf{B_i} \cup \mathbf{B_j}$. We have established that $\mathbf{A} \cap \mathbf{B} = \emptyset$, but we have also established that $\mathbf{B_i} \cap \mathbf{B_j}$ can be non-empty. Thus, for parameter values in such an intersection we need an argument to select which continuation path would follow a rejection by the opposition group.

Consider any set of parameters in $\mathbf{B_i} \cap \mathbf{B_j}$. In such a set of situations the group in power, acting as a Stackelberg leader, can implicitly select its preferred continuation path. It is easy to show that if j wins the conflict and we are in $\mathbf{B_i} \cap \mathbf{B_j}$, j strictly prefers to play conflict (knowing that i will secede at the first victory) rather than seceding, hence j selects the path B_i.

Consider group j in power at time zero. Suppose that the payoff of peaceful secession for j is lower than the payoff for j from peaceful union where i is offered a value of λ_i such that i is indifferent between accepting and rejecting to then enter a continuation path B_i. This scenario is basically one in which the Stackelberg leader chooses both the offer λ_i of the day and chooses effectively the continuation path in case of rejection. The standard theorems in game theory tell us that this is indeed a SPE if there is no one-stage profitable deviation for group i. We know by construction that rejecting the proposal taking as given the continuation game is not strictly profitable, and we know that conditional on j playing conflict continuation after victory i's best response is indeed to secede after an eventual victory, hence there is no one stage deviation that i could possibly enact that would lead to strict payoff increase, neither on the equilibrium path nor off the equilibrium path. Hence there is no reason for j to ever consider the outside option $V_i^{B_j}$.

In sum, the continuation path B_j is relevant only if the set of parameters is in $\mathbf{B} \setminus \mathbf{B_i}$.

4.4 Full Characterization of SPE

We can now characterize the SPE for the whole game. Let us compute first the value for i of the rejection of the first proposal followed by a type B_i SP path, which we denote $V_i^{B_i}$. If in any iteration player i wins, it secedes and the game ends; and if it loses it gets a period pay of zero and enters the new period with j in power playing conflict. Hence we have

$$V_i^{B_i} = \frac{N_i}{N} \frac{S_i + N_i P_i - A}{(1-\delta) N_i} + \frac{N_j}{N} \delta V_i^{B_i}.$$

Solving for $V_i^{B_i}$ and using our compact notation we obtain

$$V_i^{B_i} = \frac{nP_i + \sigma(s-a)}{(1-\delta)\left[1-\delta(1-n)\right]}. \tag{24}$$

Let us now compute the value for i of rejection followed by a type B_j path. In this case, whenever i wins, it captures the entire surplus (minus destruction D) and triggers a new conflict in the next iteration. When j wins it secedes. The value $V_i^{B_j}$ is

$$V_i^{B_j} = \frac{N_i}{N}\left[\frac{S + N_iP_i - A - D}{N_i} + \delta V_i^{B_j}\right] + \frac{N_j}{N}\left[\frac{S_i + N_iP_i - A}{(1-\delta)N_i} - \frac{D}{N_i}\right].$$

Solving now for $V_i^{B_j}$ we obtain

$$V_i^{B_j} = \frac{nP_i - a\sigma}{n(1-\delta)} + \frac{\sigma(n-d)}{n(1-\delta n)} + \frac{s\sigma(1-n)}{(1-\delta)n(1-\delta n)}. \tag{25}$$

We now compute the equivalent payoffs for j, $V_j^{B_i}$ and $V_j^{B_j}$. Following the same steps as above we obtain

$$V_j^{B_i} = \frac{1}{1-(1-n)\delta}\left\{(1-n)\left[\frac{(1-a-d)}{(1-n)}\sigma + P_j\right] + n\left[\frac{1}{1-\delta}\left[\frac{(1-s-a)}{(1-n)}\sigma + P_j\right] - \frac{d}{(1-n)}\sigma\right]\right\}, \tag{26}$$

$$V_j^{B_j} = \frac{P_j(1-n) + (1-a-s)\sigma}{(1-\delta)(1-\delta n)}. \tag{27}$$

Finally, we compute the payoffs for i and j under the type A path:

$$V_i^A = \frac{1}{1-\delta}\left[(1-a-d)\sigma + nP_i\right], \tag{28}$$

$$V_j^A = \frac{1}{1-\delta}\left[(1-a-d)\sigma + (1-n)P_j\right]. \tag{29}$$

The potential SPE for the full game can be of the following types: agreement on the distribution of the surplus within the union, agreement on secession, conflict followed by secession, or endless conflict. We start by computing the value of maintaining union. For individuals of group i, V_i^U is:

$$V_i^U = \lambda_i \frac{N_i}{N}\frac{S-A}{(1-\delta)N_i} = \lambda_i \frac{S-A}{(1-\delta)N} = \lambda_i \frac{\sigma}{1-\delta}(1-a), \tag{30}$$

$\lambda_i = 1$ would correspond to full equality in the distribution. For individuals of the group in power j the value of union V_j^U is

$$V_j^U = \left(1 - \lambda_i \frac{N_i}{N}\right) \frac{S - A}{(1-\delta)N_j} + \frac{P_j}{1-\delta} = \frac{(1-\lambda_i n)(1-a)\sigma + (1-n)P_j}{(1-\delta)(1-n)}. \tag{31}$$

The value of a peaceful secession V_i^S and V_j^S is

$$V_i^S = \frac{S_i + N_i P_i - A}{(1-\delta)N_i} = \frac{nP_i + \sigma(s-a)}{n(1-\delta)} \text{ and} \tag{32}$$

$$V_j^S = \frac{S_j + N_j P_j - A}{(1-\delta)N_j} = \frac{P_j(1-n) + (1-a-s)\sigma}{(1-\delta)(1-n)}. \tag{33}$$

Let us start by comparing the value of the proposal of peaceful secession V_i^S with either $V_i^{B_i}$, $V_i^{B_j}$ or V_i^A. Using (24) and (32), we immediately obtain that $V_i^S > V_i^{B_i}$ for all the parameter values. Hence a necessary condition for the rejection of the secession proposal is that the parameters belong to the set $\mathbf{R} \equiv \mathbf{A} \cup \{\mathbf{B} \setminus \mathbf{B_i}\}$.

Lemma 5. *Let j start by proposing secession. Then i rejects peaceful secession if and only if the parameter values belong to the set $\mathbf{R}$; otherwise it will be accepted. The set $\mathbf{R}$ is a subset of $\mathbf{A} \cup \mathbf{B_j}$, and is given by*

- $(n, s) \in \mathbf{A}$ *and* $s < \frac{(1-n)(a\sigma - nP_i) + n(1-d)\sigma}{\sigma}$;
- $(n, s) \in \mathbf{B_j}$ *and* $s < 1 - \frac{d}{n}$.

Denoting by $\mathbf{K}$ the complement of $\mathbf{R}$, player j knows that for all the parameter values in $\mathbf{K}$ it can obtain at least the payoff of secession, which therefore constitutes a lower bound outside option when considering the offer to make to group i. If the parameter values belong to $\mathbf{R}$, so that i would reject secession, distribution within the union is a SPE if the two players get payoffs at least as great as what they get by following the corresponding conflict path.

If the parameter values belong to $\mathbf{K}$, we need to check whether the group in power will indeed make a secession proposal knowing that it would be accepted. We first check whether j prefers a peaceful secession to conflict under the paths A and B_i (under the conflict path B_j, we know that j always prefers peaceful secession to conflict, since they would secede at the first victory). We have that $V_j^S > V_j^A$ if and only if

$$s \leq d + \frac{n}{\sigma}\left[(1-n)P_j + (1-a-d)\sigma\right] \equiv s_A^S \tag{34}$$

and $V_j^S > V_j^{B_i}$ if and only if $s \leq \frac{d}{1-n}$. If the group in power prefers peaceful secession to the corresponding conflict type, we still need to check whether there exists a fairness level such that group j is better off under the union than under peaceful secession. Conversely, if the group in power prefers conflict to peaceful secession, we need to check whether there exists a fairness level such that group j is better off under union than under the corresponding conflict path. Finally, for the fairness offer λ_i to be feasible, it has to be smaller than $1/n$.

Denote by λ_j^S the fairness offer by j that would make j indifferent between the outcomes U and S. Similarly, denote by λ_k^A, $\lambda_k^{B_i}$ and $\lambda_k^{B_j}$ the λ's of indifference with respect to the corresponding conflict payoff for $k = i, j$. Using this notation and the simple partition of the space described above with $\mathbf{R}$ and $\mathbf{K}$, we can prove the following characterization result:

Proposition 1. *For every array of feasible parameter values there is a unique SPE outcome. The SPE outcomes are:*

- Peaceful Union*: j proposes a distribution with λ_i fairness and i accepts it when:*
  - $(n,s) \in \mathbf{R} \cap \mathbf{A}$ *and* $\lambda_i^A \leq \min\{\lambda_j^A, \frac{1}{n}\}$
  - $(n,s) \in \mathbf{R} \cap \mathbf{B_j}$ *and* $\lambda_i^{B_j} \leq \min\{\lambda_j^{B_j}, \frac{1}{n}\}$
  - $(n,s) \in \mathbf{K} \cap \mathbf{A}$, $s \leq s_A^S$ *and* $\lambda_i^A \leq \min\{\lambda_j^S, \frac{1}{n}\}$
  - $(n,s) \in \mathbf{K} \cap \mathbf{A}$, $s > s_A^S$ *and* $\lambda_i^A \leq \min\{\lambda_j^A, \frac{1}{n}\}$
  - $(n,s) \in \mathbf{K} \cap \mathbf{B_i}$, $s \leq \frac{d}{1-n}$ *and* $\lambda_i^{B_i} \leq \min\{\lambda_j^S, \frac{1}{n}\}$
  - $(n,s) \in \mathbf{K} \cap \mathbf{B_i}$, $s > \frac{d}{1-n}$ *and* $\lambda_i^{B_i} \leq \min\{\lambda_j^{B_i}, \frac{1}{n}\}$
  - $(n,s) \in \mathbf{K} \cap \mathbf{B_j}$ *and* $\lambda_i^{B_j} \leq \min\{\lambda_j^S, \frac{1}{n}\}$
- Peaceful Secession*: j proposes secession and i accepts it when:*
  - $(n,s) \in \mathbf{K} \cap \mathbf{A}$, $s \leq s_A^S$ *and* $\lambda_j^S < \lambda_i^A$
  - $(n,s) \in \mathbf{K} \cap \mathbf{B_i}$, $s \leq \frac{d}{1-n}$ *and* $\lambda_j^S < \lambda_i^{B_i}$
  - $(n,s) \in \mathbf{K} \cap \mathbf{B_j}$ *and* $\lambda_j^S < \lambda_i^{B_j}$

- CONFLICT SECESSION: *j's proposal is rejected and either i or j secedes after the first victory when:*
  - $(n, s) \in \mathbf{R} \cap \mathbf{B_j}$ *and* $\lambda_i^{B_j} > \max\{\lambda_j^{B_j}, \frac{1}{n}\}$
  - $(n, s) \in \mathbf{K} \cap \mathbf{B_i}$, $s > \frac{d}{1-n}$, *and* $\lambda_i^{B_i} > \max\{\lambda_j^{B_i}, \frac{1}{n}\}$
- ENDLESS CONFLICT: *j's proposal is rejected and there is endless conflict when:*
  - $(n, s) \in \mathbf{R} \cap \mathbf{A}$ *and* $\lambda_i^A > \max\{\lambda_j^A, \frac{1}{n}\}$
  - $(n, s) \in \mathbf{K} \cap \mathbf{A}$, $s > s_A^S$, *and* $\lambda_i^A > \max\{\lambda_j^A, \frac{1}{n}\}$

The proof is in the appendix. The following section offers an intuitive comparison of the equilibria using a graphical representation for different levels of the time discount factor δ.

5 Equilibrium analysis: Population, surplus and impatience

We now examine how the SPE varies as the key parameters change. Our paper places emphasis on the role of the future in determining the kind of equilibria. In order to develop a sense of how the time discount factor δ influences equilibria we shall study the two extreme cases –$\lim \delta \to 1$ and $\delta = 0$– as well as intermediate values of δ. We shall also study the role of relative population size and of productivity.

5.1 Equilibria with $\delta \to 1$

The key λ thresholds that permit identification of the different equilibria become simpler when $\delta \to 1$:

$$\lambda_j^B \equiv \lambda_j^{B_j} = \lambda_j^{B_i} = \lambda_j^S = \frac{s}{(1-a)n} \tag{35}$$

$$\lambda_j^A = 1 + \frac{(1-n)(nP_j + d\sigma)}{(1-a)n\sigma} \tag{36}$$

$$\lambda_i^B \equiv \lambda_i^{B_j} = \lambda_i^{B_i} = \frac{nP_i + \sigma(s-a)}{(1-a)n\sigma}. \tag{37}$$

$$\lambda_i^A = 1 - \frac{\sigma d - nP_i}{(1-a)\sigma} \tag{38}$$

Here it is irrelevant which group provokes secession following the first victory. After all, in both cases the two players will have their respective secession payoffs forever. It also becomes undistinguishable from the case in which secession starts in the first period. In other words, the great simplification of the limiting case is that we have just one critical fairness threshold for each group under the conflict paths ending up in secession by either of the groups.

Let us define two thresholds related to the conflict path of type A:

- n_A^U solving $\lambda_i^A = \lambda_j^A$, which simplifies to $P_i = \frac{1}{n}\left[\frac{d\sigma}{n} + (1-n)P_j\right]$;
- n_A^λ solving $\lambda_i^A = \frac{1}{n}$, which simplifies to $P_i = \frac{\sigma}{n^2}\left[1 - a - n(1-a-d)\right]$.

We can easily obtain the following:

Lemma 6. *The degrees of fairness* (λ_i, λ_j) *satisfy*

$$\lambda_i^B \leqslant \lambda_j^B \text{ iff } n \leqslant \frac{a\sigma}{P_i}, \tag{39}$$

$$\lambda_i^A \leqslant \lambda_j^A \text{ iff } n \leqslant n_A^U. \tag{40}$$

Further, the feasibility of transfers implies that

$$\lambda_i^B \leqslant \frac{1}{n} \text{ iff } n \leqslant (1-s)\frac{\sigma}{P_i}, \tag{41}$$

$$\lambda_i^A \leqslant \frac{1}{n} \text{ iff } n \leqslant n_A^\lambda. \tag{42}$$

Inequalities (39) and (40) tell us whether or not the degree of fairness that j has to offer for the opposition to accept union rather than conflict is lower than the maximum j would tolerate before preferring any other option. Observe that in fact, this is equivalent to asking whether total welfare under a peaceful union with fairness level λ_i^K is higher than total welfare under the conflict path K. As the payoffs are linear, total welfare under any of the conflict paths or under union are independent of how the surplus is distributed between the two groups. Thus, the thresholds in inequalities (39) and (40) do not depend on s.

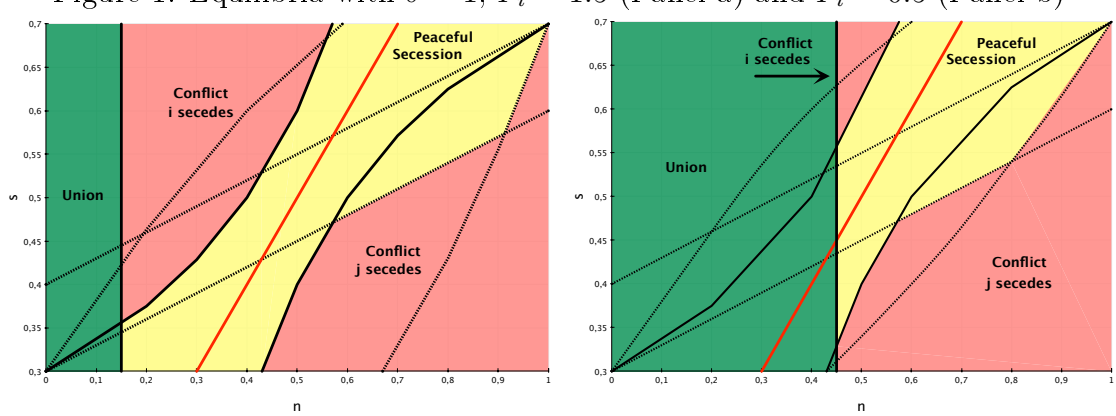
Using this information we can characterize the SPE in terms of the parameter values. We know that unless the group in power prefers secession, $\lambda_j \geq \lambda_i$ is a necessary and sufficient condition for a peaceful union to be a SPE in which the group in power will offer λ_i to the opposition, provided that λ_i is feasible. Here we give a complete characterization of the SPE.

Proposition 2. *For $\delta \to 1$ the SPE is:*

- Peaceful Union *iff*
  - $(n, s) \in \mathbf{B}$ *and* $n \leq \frac{\sigma}{P_i} \min\{a, 1-s\}$;
  - $(n, s) \in \mathbf{A}$ *and* $n \leq \min\{n_A^U, n_A^\lambda\}$.
- Peaceful Secession *iff*
  - $(n, s) \in \mathbf{B_i}$ *and* $n > \max\{\frac{a\sigma}{P_i}, 1 - \frac{d}{s}\}$;
  - $(n, s) \in \mathbf{B_j}$ *and* $\frac{a\sigma}{P_i} < n < \frac{d}{1-s}$.
- Conflict Secession *iff*
  - $(n, s) \in \mathbf{B_i}$ *and* $\frac{a\sigma}{P_i} < n < 1 - \frac{d}{s}$ *or* $\frac{(1-s)\sigma}{P_i} < n < \frac{a\sigma}{P_i}$;
  - $(n, s) \in \mathbf{B_j}$ *and* $n > \max\{\frac{a\sigma}{P_i}, \frac{d}{1-s}\}$ *or* $\frac{(1-s)\sigma}{P_i} < n < \frac{a\sigma}{P_i}$.
- Endless Conflict *iff* $(n, s) \in \mathbf{A}$, *and* $n > \max\{n_A^U, n_A^\lambda\}$

Figure 1 depicts the different equilibria on the (n, s) space ($[0, 1] \times [s_{min}, s_{max}]$) varying the value of P_i for $\delta = 1$, $\sigma = 1.5$, $d = 0.3$, $a = 0.15$ and $P_j = 0.5$.[20] Notice that since $a < d$ and $\delta = 1$, the set $\mathbf{A}$ is empty. For the first panel, we set $P_i = 1.5$, while for the second panel we set $P_i = 0.5$.

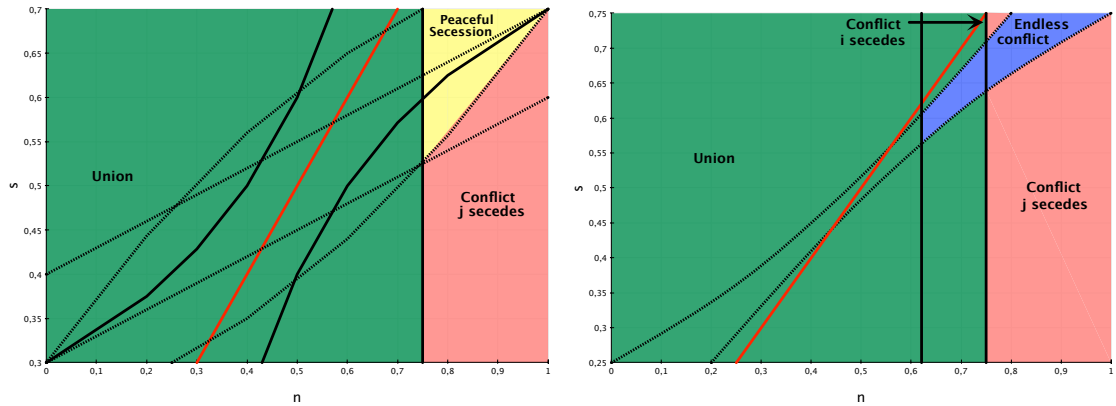
Figure 1: Equilibria with $\delta = 1$, $P_i = 1.5$ (Panel a) and $P_i = 0.5$ (Panel b)



[20] The interval $[s_{min}, s_{max}]$ is given by $[\max\{a, d\}, 1 - \max\{a, d\}]$.

Figure 2 depicts the different equilibria varying the value of d for $\delta = 1$, $\sigma = 1.5$, $a = 0.25$ and $P_i = P_j = 0.5$. Notice that when $a > d$ the set $\mathbf{A}$ may be non-empty for low values of d. For the first panel, we set $d = 0.3$, while for the second panel we set $d = 0.05$.

Figure 2: Equilibria with $\delta = 1$, $d = 0.3$ (Panel a) and $d = 0.05$ (Panel b)



In view of Proposition 2, when will we see a union threatened by secessionism? Which are the destabilizing factors?

- Whether the union is the SPE critically depends on the opposition being small in population size (small n). Union cannot be a SPE when the opposition is sufficiently populous. The critical level depends on the other parameters. Above the threshold level we have peaceful secession whenever the two groups have similar productivity, $s \approx n$. If the productivities are sufficiently dissimilar and n is above the threshold we shall have conflict followed by secession.

- Comparing Panel a and b in Figure 1 we verify that an increase in the appreciation of the own preferred public good by the opposition P_i (i.e. moving from Panel b to a) drastically shrinks the set of parameter values for which union is the SPE. Secession is now the SPE even for small population size of the opposition n. Furthermore, when the share of the surplus produced by the opposition s is sufficiently large (small) we shall have conflict followed by secession by the opposition (incumbent) when victorious.

- Comparing Panel b in Figure 1 and Panel a in Figure 2 we can observe the effect of an increase in the cost of running a state, relative to the surplus, a. As was to be expected, the increase in a substantially enlarges the set of parameter values

for which union is the SPE because it is too expensive to run an independent state. This is at the expense of secession either peaceful or preceded by conflict. This point is relevant to the case of international political unions that have the effect of lowering the domestic running costs of the members while increasing the surplus. Such reduction of a might destabilize a domestic union thus leading to agreed secession or to conflict followed by secession.

- Comparing Panels a and b in Figure 2, one can see that with lower destruction costs of conflict (small d), peaceful secession may give way to endless conflict.

- When the two players have similar productivity [along the 45 degree line] the SPE is always peaceful either as union or as secession. Conflict can occur only when there is a mismatch between the relative size of the opposition group and the relative productivity of the opposition group. Contrary to the literature on secession that assumes that the two players have equal productivity, as in Spolaore (2008), our model predicts that there is no possibility of reaching secession via conflict when the two groups have similar productivity.

Our characterization of peaceful union as a SPE also includes the degree of fairness $\lambda_i^K, K = A, B_i, B_j$ conceded by the group in power j in order to make the opposition prefer this proposal over the outcome of either of the alternative options. How is equilibrium fairness affected by the key parameters? The result critically depends on the type of threat supporting the equilibrium union.

- An increase in n has opposite effects depending on whether the threat is permanent conflict or conflict and secession. In both cases the increase in n reduces the equilibrium per capita payoff. But, when the threat is permanent conflict an increase in n increases λ_i^A because their win probability in the repeated conflict is higher. Hence the compensation needed to keep the union is larger than when the threat is conflict followed by secession.

- An increase in the economic surplus, hence of σ, reduces the fairness of the union equilibrium under the two types of threat. The increase in the distributable surplus increases the payoff under all scenarios, union, conflict and secession and permanent conflict. But this has the effect of reducing the relative valuation of the public good after secession or after victory in the indefinite

conflict. In contrast, this component of the expected payoff in the union continues to be zero for the opposition. Hence, in relative terms the opposition requires less compensation in order to preserve union.

- Obviously, the opposition group i will be treated with more fairness if P_i goes up.[21]

There are two areas of parameter values in which the SPE entails conflict followed by secession, and both display a *mismatch* between the relative strength and the relative productivity of the opposition group. One area corresponds to the case in which the opposition has high productivity s/n but it is not very populous. Secession is profitable to the opposition group because they will control a large surplus. For this reason, the group in power finds the size of the transfer necessary to ensure union too large, unacceptable. Since the group in power is the largest, it has a high probability of winning the conflict and securing a large surplus. Hence, group j prefers to postpone secession as long as possible by triggering a sequence of conflicts until eventually the opposition wins and secedes.

The second area consists of the SP path in which the opposition triggers conflict in every period until group j wins and secedes. In this area the opposition is characterized by relatively low productivity but very large population (high relative strength), giving it an advantage in conflict. To see this, imagine the group in power as a tiny minority that produces almost the entire economic surplus. It is immediate that it pays the super-majoritarian opposition to trigger conflict indefinitely with the near certainty of victory. Accordingly, it is optimal for the group in power to separate from the large and poor group.

Peaceful secession is a SPE when the opposition group is large and productivity differences are small. In this case, the opposition has a significant chance of winning a conflict. Since productivity does not differ greatly between the two groups, the main advantage of taking power or of seceding is the possibility of producing the preferred public good. In order to preserve union, the group in power would have to compensate the opposition economically for giving up their preferred public good. Given comparable productivity, and given that from the perspective of the group in

[21] In a potential future extension of the model where preferences for public or cultural goods are unknown, the impact of P_i on surplus sharing through bargaining will create incentives to pretend that P_i is even higher than real.

power the opposition is "too large" to be compensated, both groups prefer to bear the cost of a separate State and enjoy their preferred public good.

Our core message is that union will be preserved when the group out of power is not too large, whereas if the opposition group is sufficiently large, eventually secession should take place, either peacefully (in more balanced productivity/size scenarios) or through conflict (in cases with greater mismatch). While we share with Alesina and Spolaore (1997) and Spolaore (2008) the prediction that the larger the minority opposition group the more likely a secession will take place, our setting generates in addition the prediction that a mismatch between relative size and relative production implies that the passage to secession will be through costly conflict.[22]

5.2 Equilibria with $\delta = 0$

In order to show the importance of a dynamic theory to explain secessions, in this section we contrast our previous results with the ones obtained when $\delta = 0$, i.e., the static benchmark.

When only present costs and benefits count, the fundamental features of the model change. Challenging a proposal leads to conflict with a value that depends solely on the one period cost and the potential benefits of grabbing the surplus. Clearly, as long as $D < \min\{S_j, S_i\}$, we cannot have conflictual secession because the winner of the conflict would strictly prefer to take over power in the union and expropriate the entire surplus. We have seen that permanent conflict (type A path) is not a credible threat unless the discount factor is sufficiently low. In fact, when $\delta = 0$, the (static version of the) conflict path A is the only SP deviation for all values of the parameters. That is, the entire (n, s) space collapses to the set $\mathbf{A}$. As the equilibrium conditions under the conflict path of type A do not depend on δ (see Appendix), they are readily applicable to the static case. Therefore, the static Stackelberg game has a simple equilibrium, in which the group in power chooses the best proposal, taking into account the only threat available.

Let us start by characterizing the opposition group's best reply to any proposal. Knowing this, we can derive the equilibrium proposals that the group in power will make. The degree of fairness λ_i^A for which the opposition i weakly prefers union over conflict is the one corresponding to the conflict path of type A, which does not

[22] In Anesi and De Donder (2013) such an increase in population has an ambiguous effect on the likelihood of secession.

depend on δ:

$$\lambda_i^A = 1 - \frac{\sigma d - nP_i}{(1-a)\sigma}.$$

We have shown in the previous section that this fairness level is feasible (i.e., $\lambda_i^A \leq 1/n$) if and only if $n \leq n_A^\lambda$. Further, we know from Lemma (5) that under conflict path A, i would reject a secession proposal if and only if

$$s < \frac{(1-n)(a\sigma - nP_i) + n(1-d)\sigma}{\sigma}. \tag{43}$$

If (43) is satisfied, we are in $\mathbf{R}$ where i rejects a secession proposal. Then, we have that the group in power prefers a peaceful distribution within the union to conflict if and only if $\lambda_i^A < \lambda_j^A$. As we saw in the previous section, this is true whenever $n < n_A^U$. If (43) is not satisfied (i.e., we are in $\mathbf{K}$), we need to check whether the group in power would indeed make a secession proposal knowing that it would be accepted. We know that under path A, the group in power j prefers peaceful secession to conflict if and only if $s < s_A^S$ (equation (34)). In such case, we still need to check whether there exists a fairness level such that the group in power prefers a peaceful distribution within the union to peaceful secession, which will be the case if and only if $\lambda_i^A < \lambda_j^S$, which simplifies to

$$s > n\left(1 - a - d + \frac{nP_i}{\sigma}\right).$$

Conversely, if $s > s_A^S$, we need to check whether the group in power prefers peaceful distribution to conflict, which depends on whether $\lambda_i^A < \lambda_j^A$, hence on whether $n < n_A^U$. Therefore, we have:

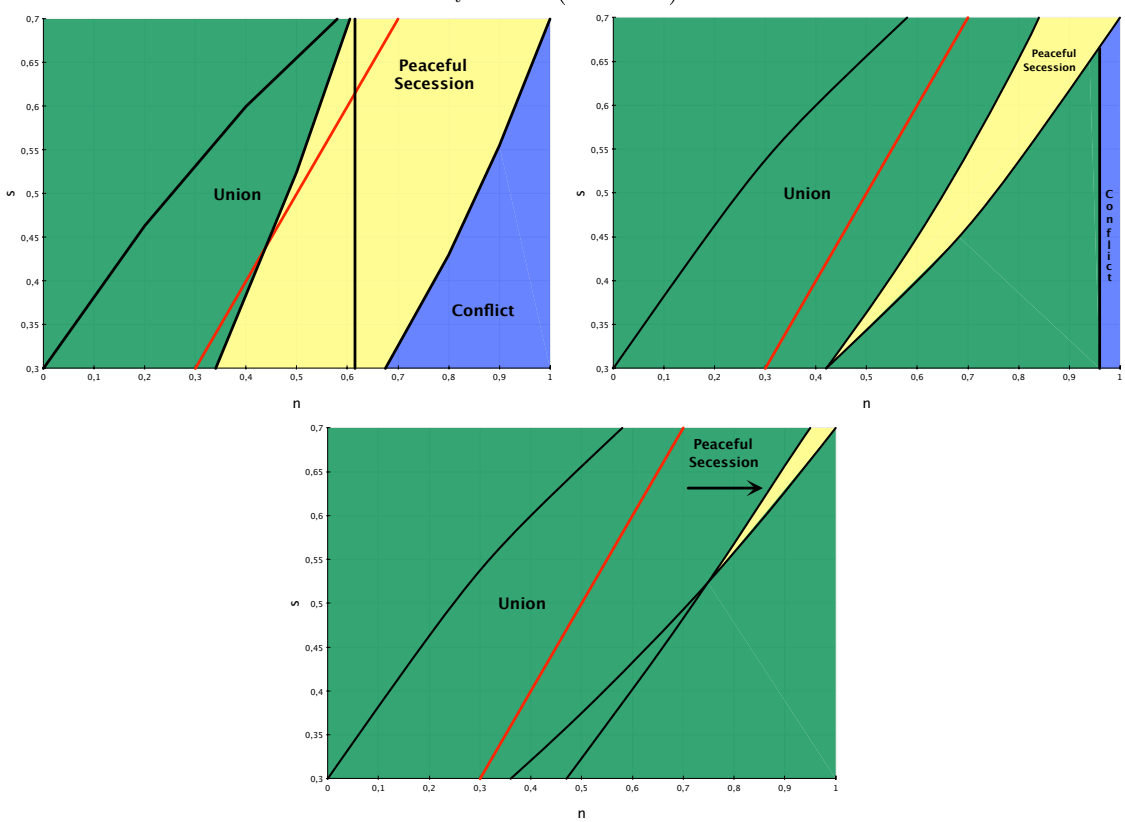
Proposition 3. *When $\delta = 0$, the unique equilibrium is as follows:*

- Peaceful Union *iff*
  - $(n, s) \in \mathbf{R}$ *and* $n \leq \min\{n_A^U, n_A^\lambda\}$;
  - $(n, s) \in \mathbf{K}$ *and* $n\left(1 - a - d + \frac{nP_i}{\sigma}\right) < s \leq s_A^S$;
  - $(n, s) \in \mathbf{K}$ *and* $s > s_A^S$ *and* $n \leq \min\{n_A^U, n_A^\lambda\}$.
- Peaceful Secession *iff* $(n, s) \in \mathbf{K}$ *and* $s \leq \min\left\{s_A^S, n\left(1 - a - d + \frac{nP_i}{\sigma}\right)\right\}$.
- Conflict *iff*

- $(n, s) \in \mathbf{R}$ *and* $n > \max\{n_A^U, n_A^\lambda\}$;
- $(n, s) \in \mathbf{K}$ *and* $s > s_A^S$ *and* $n > \max\{n_A^U, n_A^\lambda\}$.

Figure 3 depicts in Panels a and b the different equilibria on the (n, s) space for $\delta = 0$ and the rest of parameter values as in Figure 1: $\sigma = 1.5, P_j = 0.5, d = 0.3$ and $a = 0.15$. We depict in three separate Panels the SPE for three descending values of P_i.

Figure 3: Equilibria with $\delta = 0$, $P_i = 1.5$ (Panel a), $P_i = 0.5$ (Panel b) and $P_i = 0.3$ (Panel c)



In a static environment we can have three possible equilibria: union, agreed secession or conflict. How large the set is of parameter values with union as the equilibrium critically depends on P_i. We start with discussing Panel c in Figure 3, where the chosen parameter values are such that $d > \frac{P_i}{\sigma}$. In this case the cost of conflict is high relative to the benefit of obtaining the preferred public good, hence conflict is never an equilibrium. It is always feasible for the group in power

to buy the opposition off, so that the only possible equilibria are union with a fair distribution and agreed secession. Where the opposition is sufficiently large and productive, the equilibrium is peaceful secession. On the one hand, the opposition prefers peaceful secession to conflict, since the gain from triggering a conflict and possibly expropriating the whole surplus is not so large (the cost of conflict is high and the opposition is similarly wealthy as the group in power). On the other hand, it is costly to buy this opposition off, and so the group in power prefers peaceful secession to union.

We now compare the previous Panel with Panel b where P_i has been increased and the previous inequality has been reversed. When the opposition group is sufficiently large, group j is no longer willing to concede a very high λ_i^A due to the greater compensation needed for i to giving up on a highly valued public good P_i. Consequently, the conflict area appears in the right Panel b of Figure 3. Observe, however, that there is no conflict when s is sufficiently large, since in that case the opposition prefers peaceful secession to conflict, and so does the group in power. Finally, moving from panel b to panel a, we see that a higher valuation of the public good (larger P_i) further shrinks the zone of union.

Decreasing the returns to scale –lowering A– or increasing the preference diversity –increasing P_i– has the effect of broadening the set of parameter values for which secession is the equilibrium outcome. These predictions are broadly in line with those of Alesina and Spolaore (1997).

We now compare the SPE in the two extreme cases of $\delta = 0$ and $\delta \to 1$. Compare the two Panel a and b of Figures 1 and 3. Panels a are for $P_i = 1.5$ and b for $P_i = 0.5$. Here are some observations:

- The static game predicts union for a much larger set of parameter values than in the infinite horizon case. Besides union, when $\delta = 0$ there can only be agreed secession and conflict. In contrast, for $\delta \to 1$ we can also have conflict followed by secession triggered by either side.

- The two extreme cases share the feature that as n increases the SPE eventually becomes a peaceful secession and with further increases becomes conflict. However, in view of Panels b in Figures 1 and 3, in the static case there can be union even for very large n. In fact, when P_i is quite small, as in Panel c

of Figure 3, there is no conflict and union is an equilibrium for n arbitrarily close to unity.

- Another shared feature of the two extreme cases is that there cannot be conflict unless the two groups differ in productivities. However, the type of equilibria for parameters sufficiently away from the 45° line are very different in the two extreme cases. Under farsightedness we can have conflict with secession when there are significant differences in productivity between the two groups – when the opposition group is much richer or poorer per capita. In contrast, in the shortsighted scenario, conflict happens only when the relative population size of the opposition is sufficiently large and their productivity is below average.

- Comparing Panel b in Figure 1 and in Figure 3, both with $P_i = 0.5$, we observe that patient players would trigger conflict and secede for a large subset of parameter values. In the impatient scenario, we shall have conflict only if the opposition's population is arbitrarily large relative to the group in power.

Summing up, comparing Figures 1 and 3 –i.e., with and without valuing the future– the predictions generated by our dynamic model differ radically from the foregoing. When the future is not taken into account, peaceful union is the equilibrium, except for a sharply restricted set of parameter values, as described above. In a dynamic setup, however, the future benefits from secession can outweigh the one-shot cost of conflict. Thus the demand for agreeing to remain in the union may become unaffordable and peaceful union less likely.[23] This leads to either peaceful secession or one party triggering conflict in order to enjoy the infinite future stream of utility from secession.

We now examine the different SPEs for intermediate values of the time discount factor.

5.3 Intermediate δ

For a more nuanced understanding of the role of the time discount factor δ beyond the sharp comparison of Figures 1 and 3, consider first the parameter space in which the continuation equilibrium after proposal rejection involves j seeking secession at

[23] A similar logic can be found in McBride and Skaperdas (2014). In a model of repeated conflict they find that the larger the discount factor the more likely conflict is a SPE.

first victory while i would continue struggling for power within continued union. The value of eventual secession for j increases with the discount factor. Hence j wants to retain a larger share of the surplus in case of peace with respect to low values of δ where the outside option is continuous conflict. Consequently, the set of equilibria with peaceful union must be smaller in the dynamic than in the static game. And the higher the discount factor, the greater the difference between the predictions.

The same argument holds where the opposition plans to secede after the first victory (i.e., in B_i). The time-discounted payoff from this strategy is greater than that from continued conflict, and again the difference increases with the discount factor. Therefore, the peaceful distribution demanded to stay in the union will be higher, hence harder to satisfy.

To further clarify the role of the future, let us now consider a few intermediate examples for $\delta = 0, 0.6, 0.8$, and 1. The rest of the parameter values are $\sigma = 1.5$, $d = 0.3$, $a = 0.15$, $P_i = 1.5$ and $P_j = 0.5$.

Figure 4: Equilibria with $\delta = 0$ [Panel a], $\delta = 0.6$ [Panel b]

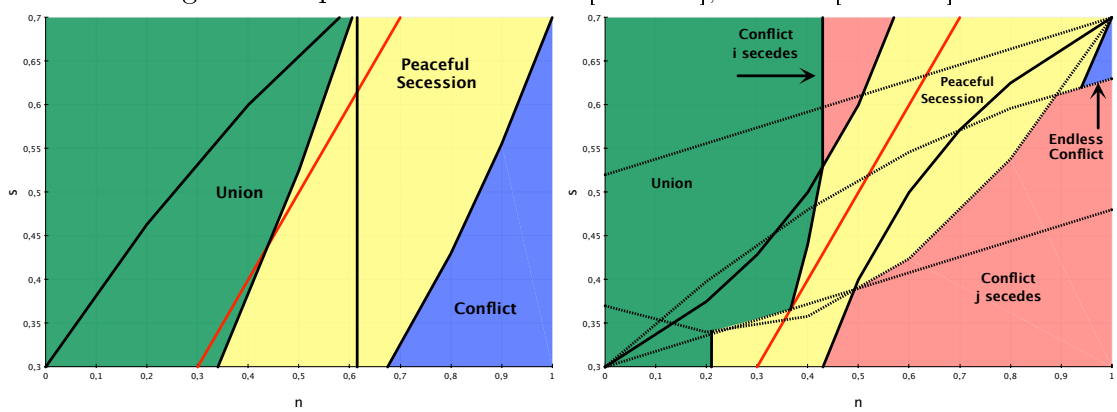
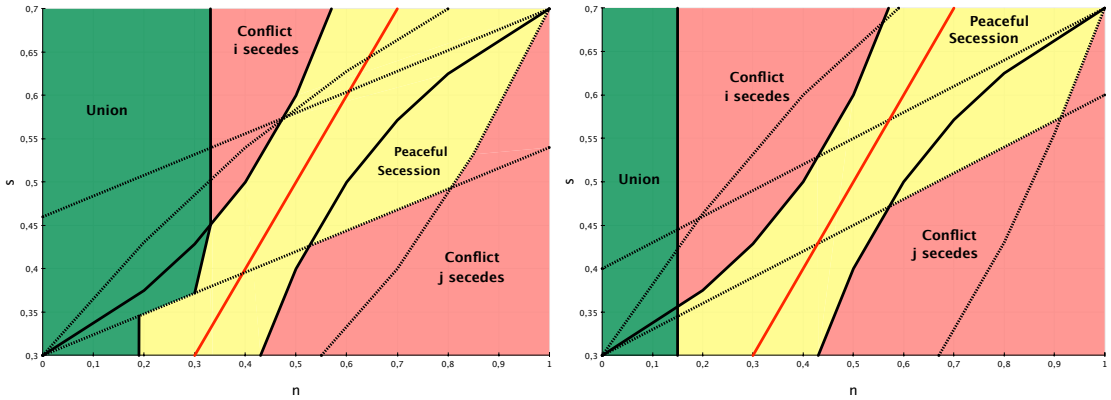


Figure 4: Equilibria with $\delta = 0.8$ [Panel c], $\delta = 1$ [Panel d].



The four Panels in Figure 4 display some common features. There is always an area in which the SPE is peaceful secession. This is the case when the opposition group is sufficiently large. At the same time, the productivity of this group is roughly at a par with the group in power. Union is more likely to be a SPE when n is small. In spite of these common features, however, in line with our argument above, as the future counts more and more the infinite stream of benefits from seceding (producing own public good and consuming own surplus) dominates the one-shot cost of conflict. Hence, we see that the parameter space for which union is a SPE contracts, and at the same time the area of conflict leading to secession expands. Overall, we shift from a situation where union is the SPE for most of the parameter values to a one where secession –peaceful or conflictual– is the dominant SPE. Unlike the static models of secession, our dynamic setting yields the novel prediction that as the time discount factor increases, the incentives for secession expand.

6 Policy implications

Welfare statements are generally hard to make and involve various measurement problems (e.g., P_i may be hard to measure). This being said, given that conflict is costly, a robust welfare statement to make is that in terms of aggregate welfare peaceful union dominates permanent conflict, and agreed peaceful secession dominates secession after conflict. Hence, in the discussion of potential policy implications below we shall focus on institutions or measures that reduce the likelihood of the two outcomes that imply costly conflict (secession achieved through conflict, as well as permanent conflict). This way we do not make any judgment on whether

union or peaceful secession is more desirable – which may very much depend on the particular context.

One obvious policy dimension that is natural to consider is federalism versus centralisation. What makes it difficult to assess the relative virtues of federalism is the fact that it bundles together a variety of characteristics – some of which may favor peaceful outcomes while others may favor conflict.[24] Hence, we shall below attempt to "unbundle" what is commonly understood under the term of federalism, and distinguish particular components.

6.1 Pluralism of local culture (lowering P_i and P_j)

One policy typically associated with federalism is the permission for the local state to select its own language of instruction in school, religious ceremonies and cultural events. In terms of our model, this corresponds to a decrease in P_i and P_j, which increases the scope for union and decreases the zone of secessionist conflict, as shown above. Intuitively, if within the same country local regions can select their own preferred policies over a wide range of matters they can up to some extent "have their cake and it eat" – they can benefit from the scale economies for the things that are centralized and where preference heterogeneity does not play a big role (e.g., national defense) while they can still select their own policies for a wide range of matters where preference heterogeneity is large (e.g., education, health, culture, social state).

There are three caveats to mention: First, a limit to the maximum level of pluralism sustainable are of course economies of scale. While in many cases there are relatively few economies of scale for choices that arguably matter most in terms of identity and heterogeneous tastes (i.e., language, religion, traditions, culture), other policies like national defense, diplomatic representation, industrial policies, transportation may have less of a symbolic value but entail larger economies of scale.

The second caveat is that a lower P_i makes it also "cheaper" to keep the (now less unhappy) opposition group in the union, which leads to a lower level of monetary "fairness", i.e., a lower λ_i. Catalonia may illustrate this: While it has obtained

[24] See Cederman et al. (2015) on the potentially ambivalent effect of devolution. Gibilisco (2017) analyses how the repression of regional values may delay conflict but increases resentment and hence the probability of conflict in future.

the right to have Catalan as official language, it has been found that the level of net fiscal transfers to the central government is so high that in terms of public service provision Catalonia obtains less than several regions that were poorer before taxation.[25]

Third and finally, depending on the policy at stake, P_i and P_j may be more or less related or independent. There may be dimensions for which the government can reduce P_i at no cost (e.g. allowing the opposition group to perform their traditional folk songs may not affect P_j). We would typically expect that in most cases such uncontroversial policies would be enacted (the opposition would typically not oppose more autonomy, and the government could buy off the now less unhappy opposition more cheaply – with a lower λ_i). In contrast, in other policy dimensions there may be a trade-off, where increasing autonomy for the opposition could impose a cost on the incumbent group. E.g. allowing certain religious practices could lower P_i but may also reduce P_j. Endogenizing this trade-off could be an interesting extension to our setting which we plan to study in future work.

6.2 Melting pot leading to converging tastes (lowering P_i and P_j)

Another policy that may reduce P_i and P_j is to encourage fostered interaction between groups. Members of different groups meeting more often may naturally lead to having more in common and tastes converging. Think of the United States with new arrivers starting to believe in the "American Dream" and traditional American culture starting to integrate elements of the new arrivers (e.g., food habits, like French Fries or Tex-Mex). While the centrally imposed banning of some cultural traits (say, some language) may lead to resentments and large P_i, the bottom-up convergence of tastes through free interaction may well reduce over time P_i and P_j, which implies greater scope for union. While to a large extent interaction may happen naturally and may be dictated by economic gains, the state of course can still put in place particular policies that encourage inter-group interaction such as subsidised student exchanges, language courses, TV formats celebrating the benefits

[25] López-Casasnovas and Rosselló-Villalonga (2014) conclude that in terms of tax collection per capita Catalonia was ranked 3d among the Spanish regions, but only 10th in terms of total resources spent.

of inter-group interaction.[26]

6.3 Guaranteeing more fair sharing of surplus (setting a minimum λ_i)

Besides the local pluralism discussed above, there are other dimensions of federalist institutions to evaluate. Given the aforementioned risk of low λ_i for the opposition in federalist states (which in our setting is simply due to the Stackelberg leader exploiting its first-mover-advantage), one may think that formulating guaranteed fair distributions (i.e., minimum λ_i, which we can label $\overline{\lambda}_i$) may help maintaining a peaceful and stable union – this idea may underlie several mechanisms in place in certain federal states trying to fix a given resource distribution.

Our model predicts that this policy may backfire. In fact, while guaranteeing a fair distribution, e.g., $\overline{\lambda}_i = 1$, may be desirable in terms of fairness, it may if anything reduce the bargaining range for which union can be maintained. Formally, and using the notation introduced above, for union to be acceptable for both j and i, it needs to hold that $\lambda_j > \lambda_i$. If the minimum fairness lies in between, $\lambda_j > \overline{\lambda}_i > \lambda_i$ it may indeed booster equality without harming union, but when the constitutionally protected minimum fairness level is so generous that $\overline{\lambda}_i > \lambda_j > \lambda_i$, rigid minimum fairness may jeopardize bargaining and the survival of the union. The logic of this result –well-intended rigid ramparts to exploitation may hinder bargaining– is similar to the finding in Esteban, Morelli and Rohner (2015) that democratic exploitation limits may lead a government to substitute exploitation with elimination, hence triggering mass killings.

6.4 Fiscal federalism: subsidiarity and fiscal decentralizing (letting each group keep its production S_j, S_i)

Federalist constitutions also sometimes include provisions linked to fiscal federalism such as the principle of subsidiarity and strong fiscal decentralization (think of

[26] See Paluck (2009), Paluck and Green (2009), and Rohner, Thoenig and Zilibotti (2013) on how belief targeting can foster peaceful interaction and cooperation. In particular, Paluck (2009) finds that exposure to the treatment of the "social reconciliation" radio soap opera in Rwanda has raised inter-ethnic empathy, compared to the control group exposed to the "health" radio soap opera.

Switzerland where roughly two thirds of state resources remain at the local level). Such provisions could be promising as suggested by the empirical analysis of Cederman et al. (2015) which finds overall a conflict-reducing effect of territorial autonomy.

In terms of our model, the purest form of this boils down to keeping seperate S_j and S_i, with even in union each group retaining its production, but paying some share (for simplicity, say, half) of the resources A required to running the central state. Intuitively, such extreme fiscal autonomy would rule out any mismatch of one group profiting much more from union and the incentive structure would become very similar to constellations on the 45 degree line in our figures.

Clearly, a group $k = i, j$ faced with the option of keeping under union S_k and benefiting from lower administrative costs (say, $A/2$ instead of A) than under independence would never want to split unless it was in opposition with P_k being very large. Given that holding completely separate accounts would make it harder for j to impose the public good provision to i, we can at present consider the extreme case with each group k maintaining under union its full budgetary autonomy – keeping its S_k, and selecting its preferred public good, resulting in $P_k = 0$. The scope for accepted secession would in such a situation be completely eliminated (staying together does not entail any costs relative to splitting, but permits to save administrative costs).

6.5 The value of union: Impact of corruption (change in a)

A key aspect of administrative costs is whether they are constant across different states. Consider a potential extension to our setting where we would allow for different levels of administration costs A for union and independence, i.e., A^S being different from A^U. Think of a situation where the current nation state is very corrupt, resulting in high excess costs of administration (large A^U), and under independence waste could be reduced for the new state ($A^S << A^U$). This would again increase the attractiveness of splitting, reducing the zone of peaceful union (in terms of the model, the effect would be similar to a reduction in a). Hence, in a nutshell, also corruption reducing policies can curb the scope for conflicted secession.

6.6 Power-sharing (λ and P_i, P_j set in simultaneous bargaining)

Recent empirical evidence has shown power-sharing to reduce conflict in multi-ethnic countries (see Cederman et al., 2013; Mueller and Rohner, 2018). In our context, power-sharing could have two effects: First, turning our sequential Stackelberg game into a simultaneous game where at the beginning the two groups bargain over λ. The absence of first-mover advantage would mean that the opposition group may receive more than λ_i and the peace dividend may be shared among both groups. While this may indeed increase fairness, it does not alter whether there exists such a peace dividend (i.e., it does not increase the likelihood of $\lambda_j > \lambda_i$). Second, power-sharing may entail a joint selection of the public good, hence also lowering P_i and P_j, which we have shown above to increase the scope for peaceful union.

6.7 Economic ties that bind can curtain conflict (higher d)

As seen above, when the relative destruction cost of conflict, d, raises, this lowers the scope for permanent conflict and for conflict followed by secession. A factor that can raise destruction costs is the integration of production of different ethnic groups in the country.[27] Groups that depend on each other for business relations may not only have more similar tastes, but will also typically find conflict more disruptive. There is substantial empirical evidence showing that more business links between ethnic groups in society lead to higher destruction costs of conflict and hence less conflict in equilibrium.[28]

[27] Incidentally, also general economic prosperity matters, as it may make conflict less attractive by raising the opportunity cost of destruction and lost production. E.g. Collier (1999) has found that the destruction potential is larger in higher value added, more complex sectors that are intense in capital and transactions, while the destruction potential is lower in less complex activities such as subsistence farming. Hence, when a country becomes richer, the relative destruction cost of conflict d raises, hence reducing conflict.

[28] See the discussion in Rohner, Thoenig, Zilibotti (2013), as well as Horowitz (1985) on protected middleman minorities in Indonesia, Myanmar, Malaysia and India, Bardhan (1997), Varshney (2001, 2002) and Jha (2013) on inter-ethnic business as rampart against riots in India, and Olsson (2010) and Porter *et al.* (2010) on inter-ethnic trade lowering tensions in Africa.

7 Conclusion

Previous work on secession has focused largely on the trade-off between economies of scale and heterogeneity of preferences, and none has considered simultaneously the scope of conflict and long-run incentives. We link the literature on secession with that on conflict and build a dynamic model that highlights the effect of intertemporal incentives. The model generates a novel picture that features some interesting predictions: When an opposition group is of comparatively small size, peaceful union is a stable outcome. At the other extreme, when the potential secessionist group is large and about as productive as the group in power, conflict can also be avoided – albeit at the cost of dismantling the original union, via peaceful secession.

When the potential separatist group is large enough to be viable but not to have military power that commands restraint on the part of the governing group, and especially where there is a mismatch between population size and economic potential, the risk of political violence is severe, as the more prosperous group wants separation, while the other fights to maintain union. A zone of eternal conflict without secession may also exist, when destruction costs of conflict are low. Our model also generates the novel finding that higher patience in fact increases secessionist pressures.

The policy implications of our analysis are manifold. First of all, we find that while some dimensions of federalism (pluralism of local culture, fiscal decentralization) are expected to ease tensions, others (financial equalization) tend to make peaceful union harder to sustain. We also predict promising effects of policies encouraging melting pot societies, economic integration, as well as power-sharing and curbing corruption.

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Appendix

Proof of Proposition 1

Let us start with the parameters in $\mathbf{R} \cup \mathbf{B_j}$, in which i rejects peaceful secession. We check whether j can find a distribution within the union such that preserving union is weakly preferable for both players to conflict of type B_j. If such a distribution exists, this will be the unique SPE. If it does not exist, the only SPE is permanent conflict by player i and secession by j with its first victory. We now obtain the degree of fairness that would make each player indifferent to conflict and then verify whether they are mutually compatible. A distribution within the union can be an SPE iff $\lambda_j^{B_j} \geq \lambda_i^{B_j}$, that is, the fairness required to make i accept the distribution is less than would be needed to make j prefer that distribution over conflict along the path B_j. By the same argument, if the parameters belong to $\mathbf{R} \cup \mathbf{B_j}$ and $\lambda_j^{B_j} < \lambda_i^{B_j}$, the unique SPE consists in conflict after the initial proposal and j seceding.

Using (31) and (27), the $\lambda_j^{B_j}$ that equates the two payoffs is

$$\lambda_j^{B_j} = \frac{(1-\delta)(1-n)nP_j + \sigma\left[(1-a)(1-\delta)n + s(1-n)\right]}{(1-a)(1-\delta n)n\sigma}. \tag{44}$$

Repeating this exercise with player i we obtain $\lambda_i^{B_j}$ to be

$$\lambda_i^{B_j} = \frac{1}{(1-a)}\left[\frac{P_i}{\sigma} + \frac{s(1-n)+(1-\delta)(n-d)}{n(1-\delta n)} - \frac{a}{n}\right]. \tag{45}$$

Then we get that $\lambda_j^{B_j} > \lambda_i^{B_j}$ if and only if $n < n_{B_j}^U$, where $n_{B_j}^U$ solves

$$(1-\delta n)P_i = P_j(1-n)(1-\delta) + \sigma\left[a(1-n) + d(1-\delta)\right].$$

For the distribution to be feasible, it must hold that $\lambda_i^{B_j} < \frac{1}{n}$, which simplifies to

$$s < \frac{\sigma\left[1+(1-\delta)d-n\right] - n(1-\delta n)P_i}{(1-n)\sigma}.$$

We can apply the same reasoning to find the SPE with the parameters in $\mathbf{R} \cup \mathbf{A}$, where the fairness levels and thresholds are now given by

$$\lambda_j^A = 1 + \frac{(1-n)(nP_j + d\sigma)}{(1-a)n\sigma}, \tag{46}$$

$$\lambda_i^A = 1 - \frac{\sigma d - nP_i}{(1-a)\sigma}. \tag{47}$$

Then we get that $\lambda_j^A > \lambda_i^A$ if and only if $n < n_A^U$, where n_A^U solves

$$P_i = \frac{1}{n}\left[\frac{d\sigma}{n} + (1-n)P_j\right].$$

For the distribution to be feasible, it must hold that $\lambda_i^A < \frac{1}{n}$, which simplifies to $n < n_A^\lambda$, where n_A^λ solves

$$P_i = \frac{\sigma}{n^2}\left[1-a-n(1-a-d)\right].$$

Let us now analyze the case in which player i would accept a secession if proposed. Specifically, we first restrict the parameters to the set $\mathbf{K} \cap \mathbf{B_i}$. We are interested in checking whether j would indeed propose a peaceful secession knowing that i would accept it.

We start by verifying whether j would prefer conflict along the path B_i to a consensual secession acceptable to i. From (33) and (26), with some manipulation, we can obtain that

$$V_j^S - V_j^{B_i} = \frac{\sigma}{(1-n)\big[1-\delta(1-n)\big]}\left[d-(1-n)s\right],$$

which is positive if and only if $s < \frac{d}{(1-n)}$. Suppose this is true and thus j prefers peaceful secession to conflict. We still need to verify that there is no distribution that is acceptable to i and that j would prefer to peaceful secession. We have that a distribution within the union is an SPE if and only if $\lambda_j^S \geq \lambda_i^{B_i}$ and $\lambda_i^{B_i} \leq \frac{1}{n}$. Otherwise, the SPE consists in j proposing a secession and i accepting it. Using (30), (31), (24), and (26) we readily obtain:

$$\lambda_i^{B_i} = \frac{\sigma(s-a)+nP_i}{\sigma(1-a)\left[1-\delta(1-n)\right]}, \tag{48}$$

and

$$\lambda_j^S = \frac{s}{n(1-a)}. \tag{49}$$

Then we have that $\lambda_j^S \geq \lambda_i^{B_i}$ if and only if

$$s \leq \frac{n(nP_i - a\sigma)}{\sigma(1-\delta)(1-n)},$$

while $\lambda_i^{B_i} \leq \frac{1}{n}$ if and only if

$$s \leq a + \delta(1-a) + \frac{(1-a)(1-\delta)}{n} - \frac{nP_i}{\sigma}.$$

Suppose now that $s > \frac{d}{(1-n)}$, so that j prefers conflict to peaceful secession. We easily obtain that

$$\lambda_j^{B_i} = \frac{(1-\delta)d+ns}{(1-a)\left[1-\delta(1-n)\right]n}. \tag{50}$$

In this case, the SPE will be a peaceful distribution within the union if and only if $\lambda_j^{B_i} \geq \lambda_i^{B_i}$ and $\lambda_i^{B_i} \leq \frac{1}{n}$. After some computations, we get that $\lambda_j^{B_i} \geq \lambda_i^{B_i}$ if and only if $n \geq n_{B_i}^U$, where $n_{B_i}^U$ solves

$$n(nP_i - a\sigma) = (1-\delta)\sigma d.$$

Suppose now that we are in $\mathbf{K} \cap \mathbf{B_j}$ where i would accept a secession proposed by j. Notice that in this set, j always prefers peaceful secession to conflict, since they would secede at the first victory (and j knows that i would accept a secession proposal). Therefore, we only need to check whether j would propose a peaceful

secession or a distribution within the union. Following the same steps as above, we have that a peaceful distribution within the union is SPE if and only if $\lambda_j^S > \lambda_i^{B_j}$ and $\lambda_i^{B_j} < \frac{1}{n}$. Otherwise, j proposes secession and i accepts.

Finally, suppose that we are in $\mathbf{K} \cap \mathbf{A}$ where i would accept a secession proposed by j. We first check whether j prefers a peaceful secession to a peaceful distribution within the union, which is true if and only if

$$s \leq d + \frac{n}{\sigma}\left[(1-n)P_j + (1-a-d)\sigma\right] \equiv s_A^S.$$

We follow the exact same steps as for the set $\mathbf{K} \cap \mathbf{B_i}$, using the fairness values in equations (46), (47) and (49). This completes our characterization of SPE.

QED.