Società italiana di economia pubblica

WORKING PAPERS

OPTIMAL SECESSION RULES

Massimo Bordignon Sandro Brusco

September 1999
Revised March 2000

JEL Classification: H1, H7
Keywords: Secession, Federalism

Pavia, May 2000

Optimal Secession Rules*

Massimo Bordignon§ Sandro Brusco¶

September 1999

Revised March 2000

Abstract

Should the constitution of a federation allow for peaceful secession? Constitutionally defined secession rules are optimal *ex post* if the federation breaks down. However, they may be suboptimal *ex ante* if the member countries receive a benefit from the perceived long-term stability of the federation and constitutionally defined secession rules increase the probability of a break-up. The optimal social contract trades off *ex ante* benefits and *ex post* losses, and it may avoid explicit secession rules. If transfers are costly, the trade-off is present even if *ex post* renegotiation is allowed. Finally, we show that under asymmetric information it is more difficult to keep the federation together and that a secession war may occur.

*Previous versions of this paper have been presented at seminars held at the University of Venice, Catholic University of Milan, Bocconi University, the ZEW institute in Mannheim. We thank all participants for useful comments and in particular Agar Brugiavini, Richard Cornes, Gianluca Feminis, Bernd Genser, Kai Konrad, Paolo Manasse, Jack Mintz, Panu Poutvaara, Konrad Stahl, Guido Tabellini, and David Wildasin. In private correspondence, Michael Le Breton also offered useful comments. At last, the comments of two referees and the associate editor greatly helped in making clearer both the content and the exposition of the paper. The final responsability for all remaining errors rests on the authors only.

§IUAV, Venice and Catholic University of Milan; mbordig@mi.unicatt.it

¶Universidad Carlos III de Madrid, Departamento de Economía de la Empresa and Università di Cagliari. brusco@emp.uc3m.es

JEL Classification numbers: H1, H7

Keywords: Secession, Federalism.

1 Introduction

Should the member countries of a federation be allowed to leave peacefully that federation? And if explicit secession rules are to be introduced, how should they be structured?

Even if the federal constitution does not allow for peaceful exit rules, member states may always attempt to secede *not* peacefully. Indeed, if a state perceives that remaining in a federation is against its interest, then it is only the threat of military action that may induce it to give up its claims to independence. Recent history is full of examples in which a secession was attempted, and either blocked (i.e. Kosovo, Kurdistan) or eventually obtained (i.e. Bosnia, Eritrea), by the use of military force and resulting economic destruction. In all these cases, *ex ante* (constitutional) rules for leaving the federation could in principle play a positive economic role, by reducing the *ex post* cost of breaking up the federation. Yet, most existing federations do not allow for a 'right to secede', and in the few cases in which they do, this right is usually expressed so vaguely or is so severely constrained to seem hardly effective in practice [1]. Even in the case of the European Monetary Union (EMU), the possibility that some of the members might in the future decide to regain their monetary sovereignty is not considered. Yet, many observers fear that a unique monetary policy may turn out to be unbearable for some of

[1] For example, the 1971 Constitution of the former Socialist Federal Republic of Yugoslavia (as the 1972 URSS constitution) explicitly acknowledged the right to secession of the member republics, without however being specific on the way in which this right could be implemented. As history has shown, this lack of clarity may have been dearly paid for by the country itself. On the contrary, the recent 1995 Ethiopian constitution recognizes the right to secede for the member nations and it spells out in detail the rules for secession. However, the rules are so strict (involving a positive vote to secession by the two-third majority of the Parliament, a national referendum and an agreed-upon division of assets) to make it difficult to believe they could be applied in practice. See Bookman (1993), Raina (1995) and Blaustein and Flanz (1998) for further institutional details.

the member countries. Should this lead eventually to a breakup of the EMU, it will certainly result in a serious disruption of economic and political relations in Europe. Again, explicit secession rules could ease the process, reducing the costs for both the remaining and the leaving countries.

So why are secession rules so rarely part of a constitutional agreement? Since these rules are likely to be optimal *ex post*, in the event that the federation breaks down, the rationale for their absence must lie in *ex ante* considerations. The absence of explicit secession rules can be seen as a commitment device to increase the stability of the federation. By *not* introducing these rules, the federation raises the exit cost for its members, thus reducing the probability of a break-up in the future. In turn, committing to a federation may be economically advantageous if the benefits a country receives from joining the federation depend on its (expected) duration.

It seems hard to dispute that this factor was at work in the case of the EMU. Forming a monetary union, rather than, say, agreeing to irrevocable fixed exchange rates, may be more advantageous exactly because it is more costly to break a monetary union than simply unilaterally change an exchange rate. Thus, the expected benefits of fixed exchange rates, in terms of reduced uncertainty and increased price stability, may be more easily obtained with a single currency. More generally, the benefits that a country may enjoy by joining a federation today (e.g. fiscal co-insurance, common defence policy, increased trade etc.) may be harder to obtain if it is commonly perceived that the federation will not be there tomorrow.

This suggests to look at optimal secession rules as a way to trade off *ex ante* and *ex post* benefits. By making secession more difficult a federation provides an *ex ante* economic advantage to its members, as to a large extent the success of the federation depends on the perception of its future duration. On the other hand, rules making secession more difficult increase the cost of a break-up should this occur, and may force the countries to stick together even when it is no longer efficient to do so. In this paper, we make a first attempt to address this trade-off formally. We do so by assuming that at the time of joining the federation, the member countries can write a *complete social contract* (federal

constitution) specifying transfers and secession rules in every possible future contingency. This seems to be a natural benchmark for the analysis, one on which to build for future research. Furthermore, the complete contracts framework may not be too much out of the mark for those federal constitutions (such as, for example, the Maastricht Treaty) which do in fact consider very specific contingent rules for the member countries.

In this setting, we derive the optimal secession rules under scenarios of increasing complexity and realism. We start with the benchmark case of full information and no renegotiation. We first show that in this case there is indeed the trade-off we discussed above: to gain *ex-ante* benefits the optimal constitution may actually impose *ex post* losses on the member countries. However, we also show that under complete information, secession rules are usually a part of the optimal federal constitution. Next, we study how secession rules are affected by *ex post* renegotiation. Renegotiation is crucial to our argument here, because if countries by renegotiating *ex post* could undo all that is written in the constitution *ex ante*, the trade-off we focus on in this paper would simply disappear. We show that this does not in general happen if transfers are costly.

Finally, we abandon the complete information setting by assuming that each country has private information on some of its characteristics. Issues of asymmetric information in federations have raised considerable interest in the recent literature (i.e. Laffont, 1995, Lockwood, 1999, Cornes and Da Silva, 2000, Bordignon et al., 2000, Tabellini and Persson, 1996), especially with reference to the European Union. We show that, under asymmetric information, in order to keep incentives aligned the constitution will in general make it more difficult for the countries to leave the federation, not allowing them to secede peacefully even in those states of the world where maintaining the federation is suboptimal *ex ante* and not only *ex post.* Indeed, if conditions of asymmetric information are pervasive, no secession rules at all may well be the optimal second best solution. As a result, huge welfare losses, including a possible secession war, may characterize the federation *ex post* in some states of the world.

Our work can be seen as complementing two different lines of research in economics: the recent literature inquiring on the reasons for the break-up and the integration of countries (Bookman, 1993, Casella, 1992; Alesina and Spoalore, 1997; Alesina, Perotti and Spoalore, 1995; Bolton and Roland, 1997; Alesina, Spoalore, and Wacziag, 1998, Bolton, Roland and Spoalore, 1996; Wei, 1992), and the older literature inquiring on the normative reasons for introducing secession clauses in federal constitutions (Buchanan and Faith, 1987; Chen and Ordershook, 1994, Wood, 1981). The former literature highlights a number of economic and political reasons why countries should dissolve or integrate; however, it does not take into account that some of the costs of doing so are endogenously determined, and should therefore be explained and not simply assumed. The latter finds a number of reasons for introducing secession rules in federal constitutions; however, it does not ask why so few existing federal constitutions do in fact allow for secession clauses. Finally, although the issue of a "secession clause" has already been raised in connection with the EMU formation (e.g. Buchanan, 1990, Bernholz, 1992, Apolte, 1997), we are aware of no previous study which has attempted to study systematically the trade-off involved in such a clause.

The rest of the paper is organized as follows. In section 2 we spell out the model. In section 3 we derive the optimal federal constitution in the benchmark case of full information and no renegotiation. In section 4 we allow countries to renegotiate the Constitution *ex post* and study the optimal contract in this case. Section 5 characterize the optimal constitution under asymmetric information. Concluding remarks are offered in section 6. The appendix collects the proofs.

2 The Model

We consider a simple economy with two countries and two periods, and for simplicity we assume no discounting between periods. In period 0, the two countries have to decide whether or not to form a federal union enabling them to produce a public good, G, without knowing precisely what their preferences about G will be in period 1. More precisely, while it is common knowledge that each

country's preferences in period 1 will have the form

$$U_1^i\left(m^i, G\right) = \theta^i G + m^i$$

θ^i is assumed to be a random variable, taking value $\overline{\theta}$ with probability p and $\underline{\theta}$ with probability $1-p$, where $\overline{\theta} > 0 > \underline{\theta}$. Thus, the federal public good may turn out to be a 'bad' for some countries in period 1[2]. The random variables θ^1 and θ^2 are independently distributed. We also assume that G can only be produced within the federation, that its production occurs at no cost and in fixed quantity, and we set this quantity equal to 1. Thus, in a sense, in this model the federal public good is the federation itself. The variable m^i denotes country i's private consumption. The pair $\theta = \left(\theta^1, \theta^2\right)$ is the state of the world at period 1, and the set of all possible states of the world is denoted by Θ.

For simplicity, we also assume that at period 0 no production of the federal public good occurs. Nevertheless, if the countries decide to form the federation, they enjoy in period 0 a utility which is an increasing function of the probability that the federation will be maintained in period 1. This captures the idea, discussed in the introduction, that a federation provides greater utility to its members when it is expected to last. Let ϕ denote the state of the federation at time 1, with $\phi = 0$ denoting a break-up of the federation and $\phi = 1$ indicating that the federation is maintained. In period 0 countries are identical, and their utility is given by:

$$U_0^i = \gamma \Pr\left(\phi = 1\right)$$

where $\gamma \geq 0$ is a parameter. Notice that since secession is possible, ϕ is a random variable. Its realization will depend on the particular rules chosen for secession at the constitutional stage and on the realization of the state of the world $\theta = \left(\theta^1, \theta^2\right)$.

At the constitutional stage, the countries have to decide what rules to choose for secession, and what rules to choose for redistributing income among them. Throughout the paper, we will assume

[2] As an illustration, one may think that for some EMU countries the public good 'price stability' offered by the monetary union may turn out in the future to be a 'bad', as they may prefer a more lax monetary policy to increase economic activities.

that at period 1 a country has always the option to secede violating the constitutional rules (the 'independence war' option). At the same time, after formally joining a federation, a country deciding to leave it unilaterally must pay a cost. Furthermore, we assume that if one country decides to secede against the constitutional rules, it imposes a cost on the other countries as well, due to the resulting economic weakening or dissolving of the same federation[3]. For simplicity, we will consider here only the case in which the costs of secession are symmetric among seceding and not seceding countries. Thus, we assume that if a country decides to secede unilaterally in period 1, the federation is dissolved and each country suffers a cost c, intended as the amount of resources destroyed in the 'independence war'.

The constitution may grant a right to secede to the member countries. In that case, if a country decides to leave the federation unilaterally in period 1, the costs of the independence war are avoided, and the federation may be dissolved at lower costs for all countries. In what follows, we normalize these dissolving costs at 0. For the sake of generality, however, we also allow the constitution to grant a 'conditional' right to secede to the member countries, by asking a leaving country to pay (or receive) a monetary compensation to (from) the remaining countries.

The constitution can in principle specify different secession and transfer rules for different states of the world. We will denote by $d(\theta)$ the decision to maintain or dissolve the federation at period 1 when the state of the world is θ, with $d(\theta) = 1$ denoting the decision to maintain the federation and $d(\theta) = 0$ denoting the decision to dissolve.

Private consumption can be transferred among countries. However, we assume that, because of

[3] The interpretation to be given to these costs depends on the type of federation one has in mind. In the case of EMU, for instance, the costs of a unilateral secession for the seceding country would largely be in terms of the cost of building up again a credible national monetary institution. For the countries remaining in the EMU, on the other hand, the cost of a secession would largely be in terms of a loss of reputation by the European monetary institutions. In the case of a political federation, the costs of a secession for both seceding and not seceding countries could be in terms of a souring of international relationships, which may lead to a military conflict.

administrative and incentive costs, one unit of consumption can be transferred from one country to another only if a deadweight cost $\lambda \geq 0$ is paid. This means that in order to give $\tau \geq 0$ units of consumption to country i, the other country has to pay a tax equal to $\tau(1+\lambda)$. The consumption of country i in period 1 at state of the world θ is then equal to its initial wealth plus the difference between the transfer received and the tax paid: $m^i(\theta) = w^i + \tau^i(\theta) - T^i(\theta)$, where $\tau^i(\theta) \geq 0$ and $T^i(\theta) \geq 0$ indicate respectively the lump-sum subsidy obtained and the lump-sum tax paid to the federation when the state of the world is θ. It will become clear that no country receives subsidies and pay taxes at the same time, so only one of these variables can be strictly positive for a given country. Finally, to simplify the notation further, we normalize the level of wealth by setting $w^i = 0$ for each i.[4]

Thus, a constitution specifies, for each state of the world θ, the decision $d(\theta)$ to be taken and the transfers and taxes for each country to be paid[5]. The sequence of events we consider is the following:

1. At period 0 the federation is either formed or not formed. In the first case, a constitution is drafted and approved unanimously by all countries involved; in the second case, the game ends.

2. At the beginning of period 1, the state of world θ is realized. The realization of θ^i may be observed by both countries (full information), or by country i only (asymmetric information);

   If renegotiation is allowed, the two countries may decide to rewrite the constitutional rules.

3. Following the constitutional rules, a federal decision is taken about whether the federation should be maintained or dissolved and what transfers should be implemented.

[4] This implies that we are allowing for negative consumption of the private good. Readers who do not feel at ease with this possibility may alternatively interpret the assumption as stating that the initial level of wealth is large enough so that it is never binding when deciding the optimal level of transfers and subsidies. Nothing changes with respect to the formulation chosen into the text.

[5] In what follows transfers and taxes can be paid and received even if $d(\theta) = 0$. This captures the idea of a conditional right to secede referred to above.

4. Each country decides whether to accept the federal decision or to undertake an independence war.

5. According to the decisions taken above, the payoffs of the countries are realized and the game ends.

In our framework, a constitution is a social contract, and the exact content of this contract depends on the kind of variables we allow the contract to be written on. The benchmark case, which we discuss in the next section, is that of complete contracts under complete information and no renegotiation. After characterising the benchmark case, we study how the results change when renegotiation is allowed and asymmetric information is introduced.

3 Complete Information and No Renegotiation

When dealing with the complete information problem, we can restrict our attention to constitutions such that the *ex post* individual rationality constraint is never violated, so that the 'independence war' is never declared. In this case the expected utility of country i is given by:

$$E\left(U^i\right) = \gamma \Pr\left(d\left(\theta\right) = 1\right) + \sum_{\theta \in \Theta} p\left(\theta\right)\left(d\left(\theta\right)\theta^i + \tau^i\left(\theta\right) - T^i\left(\theta\right)\right)$$

The expected social welfare is the sum of the expected utilities:

$$S = 2\gamma \Pr\left(d\left(\theta\right) = 1\right) + \sum_{\theta \in \Theta} p\left(\theta\right)\left(d\left(\theta\right)\left(\theta^1 + \theta^2\right) + \sum_{i=1}^{2}\left(\tau^i\left(\theta\right) - T^i\left(\theta\right)\right)\right) \tag{1}$$

and the budget constraint $\sum_{i=1}^{2}\left(\left(1+\lambda\right)\tau^i\left(\theta\right) - T^i\left(\theta\right)\right) = 0$ has to be satisfied for each θ. This can be written as:

$$\sum\left(\tau^i\left(\theta\right) - T^i\left(\theta\right)\right) = -\lambda\sum\tau^i\left(\theta\right). \tag{2}$$

Substituting for the above equation, we can then rewrite the social welfare function S as:

$$S = 2\gamma \Pr\left(d\left(\theta\right) = 1\right) + \sum_{\theta \in \Theta} p\left(\theta\right)\left(d\left(\theta\right)\left(\theta^1 + \theta^2\right) - \lambda\left(\sum_{i=1}^{2}\tau^i\left(\theta\right)\right)\right)$$

Since countries are *ex-ante* identical, it is natural to focus on *symmetric* constitutions. By this we mean that the decision to dissolve or maintain the federation is based only on the number of $\overline{\theta}$'s and $\underline{\theta}$'s, and that countries having the same level of θ^i receive (pay) the same transfer (tax). As θ is fully observable and verifiable, there are no incentive compatibility constraints to be considered. Furthermore, if it turns out to be optimal to form the federation, the *ex ante* participation constraints are trivially satisfied in the symmetric case. The only serious constraints are therefore the *ex post* participation constraints. This means that each country must receive at least $-c$ in each state of the world θ. We say that a constitution provides a *secession clause* if, for some state of the world θ, the federation is constitutionally dissolved, so that $d(\theta) = 0$.

Absent asymmetric information (and incentive compatibility constraints), we can study the optimal design of the constitution looking separately at each state of the world. As constitutions are symmetric, there are three states of the world to be considered, namely $\left(\overline{\theta}, \overline{\theta}\right)$, $\left(\overline{\theta}, \underline{\theta}\right)$ and $(\underline{\theta}, \underline{\theta})$. To derive the optimal constitution, note first that if the benefits generated by the federation were independent of its expected duration (i.e. $\gamma = 0$ in (1)), then the optimal social contract would take a very simple form:

- If $\underline{\theta} \geq -c$ then dissolve the federation when $\theta^1 + \theta^2 < 0$ and maintain it if $\theta^1 + \theta^2 \geq 0$. Since transfers imply a deadweight loss it is optimal to set their level at zero for every state of the world. The condition $\underline{\theta} \geq -c$ ensures that the *ex post* individual rationality constraint is satisfied for every agent when transfers are zero.

- If $\underline{\theta} < -c$ then the federation is viable only if a transfer of at least $\tau^* = -(\underline{\theta} + c)$ is paid to countries of type $\underline{\theta}$. Therefore the deadweight loss of transfers has to be taken into account. Let θ be a state of the world, and let $j \in \{0, 1, 2\}$ be the number of countries having $\theta^i = \underline{\theta}$. Then the federation is maintained if $(2 - j)\overline{\theta} + j\underline{\theta} - \lambda j\tau^* \geq 0$ and it is dissolved otherwise[6].

When positive benefits from duration (i.e. $\gamma > 0$) are introduced, it may become *ex ante* optimal to

[6] Notice that this condition implies that the *ex post* individual rationality constraint for type $\overline{\theta}$ is satisfied.

prescribe that the federation be maintained in some states of the world in which this is not *ex post* optimal. In this case it is necessary to arrange transfers in such a way that the *ex post* participation constraints are satisfied. To see how these two effects interact in determining the optimal constitutional rules, consider first the case $\underline{\theta} \geq -c$. Since positive transfers involve a deadweight loss, the optimal choice is to set all transfers equal to zero. The choice between maintaining or dissolving the federation in period 1 thus involves a comparison between the *ex ante* benefits and the *ex post* potential losses (at zero transfers). Take for example the case $(\overline{\theta}, \underline{\theta})$. From an *ex ante* perspective, the decision to maintain the federation in this state of the world implies an expected benefit equal to $2\gamma \Pr\left(\overline{\theta}, \underline{\theta}\right) + \Pr\left(\overline{\theta}, \underline{\theta}\right)\left(\overline{\theta} + \underline{\theta}\right)$, so that the federation should be maintained if $2\gamma + \left(\overline{\theta} + \underline{\theta}\right) \geq 0$, even if this is not *ex post* efficient (i.e. if $\left(\overline{\theta} + \underline{\theta}\right) < 0$).

Next, suppose $\underline{\theta} < -c$; in this case a transfer $\tau^* = -\left(\underline{\theta} + c\right)$ must be paid to type $\underline{\theta}$ in order to keep it in the federation and the deadweight loss from the transfer must also enter in the optimal choice. In the case $(\overline{\theta}, \underline{\theta})$ the *ex ante* social utility equals $2\gamma + \overline{\theta} + \underline{\theta} - \lambda\tau^*$, *provided* that at this allocation the individual rationality constraint of type $\overline{\theta}$ is also satisfied ; that is, provided that $\overline{\theta} - (1+\lambda)\tau^* \geq -c$. Thus, the constitution prescribes that the federation should be maintained in case $(\overline{\theta}, \underline{\theta})$ if *both* the conditions $2\gamma + \overline{\theta} + \underline{\theta} - \lambda\tau^* \geq 0$ and $\overline{\theta} - (1+\lambda)\tau^* + c \geq 0$ are satisfied, and it should be dissolved otherwise. Notice that the individual rationality constraint of type $\overline{\theta}$ in case $(\overline{\theta}, \underline{\theta})$ can also be written as $\overline{\theta} + \underline{\theta} - \lambda\tau^* + 2c \geq 0$. This implies that the two conditions can be written as:

$$\overline{\theta} + \underline{\theta} - \lambda\tau^* \geq -2c \qquad\qquad \overline{\theta} + \underline{\theta} - \lambda\tau^* \geq -2\gamma$$

so that we can summarize the two inequalities by the condition:

$$\overline{\theta} + \underline{\theta} - \lambda\tau^* \geq -2\min\{c, \gamma\} \tag{3}$$

In the case $\underline{\theta} < -c$, when the inequality in (3) is satisfied then it is both feasible and convenient to maintain the federation in period 1. We can then summarize the results of this section in the following proposition:

Proposition 1 *Assume that complete contracts are possible, there is full information, and that the member countries are able to commit not to renegotiate the constitution. Then the optimal social contract prescribes* $d(\theta) = 1$ *if:*

$$\sum_{i=1}^{2} \left(\theta^i - \lambda \max \left\{ 0, - \left(\theta^i + c \right) \right\} \right) \geq -2 \min \{c, \gamma\} \tag{4}$$

Whenever the condition is satisfied, a country with $\theta^i = \underline{\theta}$ *receives a subsidy* $\tau^* = \max \{0, -(\underline{\theta} + c)\}$. *If condition (4) is not satisfied then* $d(\theta) = 0$ *and transfer and taxes are zero.*

The proposition has a number of interesting implications. First, the optimal constitution may involve a secession clause. For example, in the case $(\underline{\theta}, \underline{\theta})$ and $\underline{\theta} < -c$, the optimal constitution certainly prescribes $d(\underline{\theta}, \underline{\theta}) = 0$. Second, the right to secede, when granted, is always unconditional. Transfers are socially costly and they are only used (at the lowest possible level) to convince disadvantaged countries to remain in the federation. The threat of using the secession war is credible in this case, since $\underline{\theta} < -c$ implies that the country is better off fighting rather than accepting the federation without compensating subsidies. On the other hand, when the federation is constitutionally dissolved there is no need to compensate countries with a high type, since in this case war is not a credible threat.

Third, there may be a conflict between *ex ante* and *ex post* optimality. When there are benefits from the expected duration of the federation, the social contract may compel the federation to go on even if it would be *ex post* optimal not to do so since $\theta^1 + \theta^2 < 0$. We therefore face a classical time inconsistency problem: member countries may be tempted to renegotiate the constitution and dissolve the federation *ex post*. We now investigate when this is possible and what effects the possibility of renegotiation may have on the optimal constitution.

4 Renegotiation

If the countries were able to renegotiate successfully whenever the constitution prescribes a course of action yielding an *ex post* aggregate loss, then the only feasible constitutions would be the ones

prescribing *ex post* efficiency. In a sense, the constitution would be irrelevant. No *ex ante* agreement would be needed, since *ex post* efficient agreements would be reached anyway. If the constitution matters, it must be the case that there are situations in which renegotiation cannot modify what is defined in the constitution, although it would be *ex post* optimal to do so. In this section, we show that when $\lambda > 0$ (costly transfers) this is indeed the case in our model and then derive the optimal renegotiation proof constitution.

In our context, renegotiation means that the countries *unanimously* agree to a change of the constitution, modifying the transfers and the decision to dissolve or maintain the federation. We begin our analysis by checking whether the contract derived in the case of no renegotiation can survive. The first observation is that the decision to dissolve the federation is always renegotiation proof. From proposition 1, $d(\theta) = 0$ whenever $2\min\{c,\gamma\} + \sum_{i=1}^{2}(\theta_i - \lambda\tau^i(\theta)) < 0$. This implies $\sum_{i=1}^{2}\left(\theta^i - \lambda\tau^i(\theta)\right) < 0$, so that separation is *ex post* optimal.

The renegotiation constraint may become binding only when the no-renegotiation contract prescribes that the federation should be maintained. When the state of the world is $\left(\overline{\theta},\overline{\theta}\right)$ then the optimal contract prescribes no transfers and maintaining the federation. This is obviously renegotiation proof. On the other hand, if the state of the world is $(\underline{\theta},\underline{\theta})$ then the optimal contract prescribes no transfers and maintaining the federation if and only if $\gamma + \underline{\theta} \geq 0$ and $\underline{\theta} \geq -c$ (or, more compactly, $\underline{\theta} \geq -\min\{c,\gamma\}$). This is clearly not renegotiation-proof, as the member countries can agree to modify the constitution and allow for peaceful separation. In fact, it is clear that there is no way in which the countries can credibly commit to maintain the federation in the state of the world $(\underline{\theta},\underline{\theta})$ when renegotiation is possible. Notice that in 'symmetric' states of the world, the deadweight cost of transfer λ plays no role, since no transfer is possible. When the state is $\left(\overline{\theta},\underline{\theta}\right)$ this is no longer true. We start establishing the following result.

Lemma 1 *The optimal social contract is renegotiation-proof at state θ when the federation is dissolved.*

If the federation is maintained at $\left(\overline{\theta},\underline{\theta}\right)$ *then the optimal contract is renegotiation proof if:*

$$\overline{\theta}+\underline{\theta}-\tau^{*}\lambda\geq-\lambda\left(\overline{\theta}-\tau^{*}\left(1+\lambda\right)\right) \tag{5}$$

where $\tau^{*}=\max\left\{0,-\left(\underline{\theta}+c\right)\right\}$.

In order to interpret the lemma, observe that the expression on the left hand side of the inequality is simply the *ex post* social utility of maintaining the federation, given by the sum of the direct utilities minus the deadweight loss of the transfers necessary to keep the federation together. On the right hand side, we have the deadweight loss of the transfers which have to be paid in order to dissolve the federation. The transfer has to compensate the type $\overline{\theta}$ country, receiving a utility $\overline{\theta}-\tau^{*}\left(1+\lambda\right)$ if the federation is maintained. This is the *ex post* social utility of dissolving the federation. Thus, the lemma establishes that the original social contract is renegotiation proof if the net social utility of maintaining the federation is larger than the net social utility of dissolving it.

Notice that, in presence of a conflict between *ex ante* and *ex post* optimality, the original social contract can be renegotiation proof only if $\lambda>0$; if λ were equal to zero then (5) would certainly be violated whenever $\sum\theta^{i}<0$. This provides the intuition for the lemma; by not allowing the federation to dissolve in some cases, the social contract creates a vested interest in countries of type $\overline{\theta}$ to maintain the federation. If transfers involve a deadweight loss, countries of type $\underline{\theta}$ may not have enough resources to compensate countries of type $\overline{\theta}$ for dissolving the federation.

Suppose now that condition (5) is *not* satisfied and it is *ex ante* desirable to maintain the federation at $\left(\overline{\theta},\underline{\theta}\right)$. Is there anything that can be done *ex ante* in order to avoid renegotiation *ex post*? In particular, is it possible to re-design the contract and specify transfers so as to make renegotiation impossible and maintain the federation?

To understand the question, remember that in order to agree to dissolve peacefully a federation, the countries enjoying a positive utility from the federation have to be compensated with transfers giving them at least equivalent utility. By setting different transfers *ex ante*, the social contract can

modify the *status quo* utility levels. In turn, by modifying the *status quo*, the social contract can also modify the deadweight costs incurred to compensate the countries benefiting from the federation. In principle, it might therefore be possible that by setting transfers different from the optimal ones the constitution would make it impossible to renegotiate the social contract. This, however, turns out not to be the case.

Proposition 2 *No social contract can prevent renegotiation and dissolution of the federation at state* $\left(\overline{\theta},\underline{\theta}\right)$ *if condition (5) is not satisfied. The optimal social contract with renegotiation allows for dissolution of the federation in all the states in which either the optimal social contract without renegotiation prescribes dissolution or condition (5) is not satisfied.*

The proposition implies that it is impossible to modify the structure of the transfers so as to increase the stability of the federation when condition (5) is violated. The intuition is simple. The optimal social contract under no renegotiation minimizes the amount of transfers given the *ex post* participation constraints. Any (feasible) modification of the transfers therefore increases their aggregate level. Since transfers are socially costly, this implies reducing the social utility of maintaining the federation. However, it also implies increasing the cost of dissolving the federation, as different and higher transfers change the status quo. The first effect makes it more difficult to keep the federation going on; the second makes it more difficult to dissolve it. But the first effect always dominates the second, so that it is never possible to make the federation more stable by moving away from the optimal transfers.

In fact, suppose that the transfer to country $\underline{\theta}$ is increased by one unit when the federation is maintained. This means that country $\underline{\theta}$ is less willing to bribe country $\overline{\theta}$ and convince it to renegotiate the agreement. In particular, the maximum amount country $\underline{\theta}$ is willing to pay is decreased by one unit. However, country $\overline{\theta}$ is now easier to bribe, since its utility when the federation is maintained is now lower by an amount $1+\lambda$ (the extra tax needed to finance the extra subsidy). Thus the reduction in the willingness to pay by country $\underline{\theta}$ is more than compensated by a reduction in the amount needed

to convince $\overline{\theta}$ to renegotiate. Therefore, if country $\overline{\theta}$ is willing to renegotiate when the transfers are τ^*, it must also be willing to renegotiate when the transfers are $\tau > \tau^*$.

The implication is that the optimal social contract when renegotiation is possible closely resembles the optimal social contract when renegotiation is not allowed. Renegotiation reduces the set of states in which the federation can be maintained. Whenever maintaining the federation is impossible or not desirable, the optimal social contract prescribes dissolution[7]. While renegotiation does reduce the set of feasible outcomes, implying a reduction in expected social welfare, the presence of renegotiation does not induce a distortion in the transfers whenever the federation is maintained.

5 Asymmetric Information

Suppose now there is asymmetric information about the realization of the state of the world θ. As usual, the stochastic structure of the model is common knowledge but only country i observes the actual realization of θ^i at the beginning of period 1. How does the optimal social contract change?

This section is motivated by the recent focus in the fiscal federalism literature on problems of asymmetric information in federations, between the federal and the local governments. For instance, asymmetric information problems are probably at the root of the serious budget problems in federal countries such as China and the former republics of USSR, where most tax revenue is collected and administered locally (Laffont, 1995). Should the European Commission budget increase in size, asymmetric information problems might become a serious problem in the European Union as well, as the member countries are still in charge of collecting their own revenue and they are also the main source

[7] From the point of view of the implementation of the contract, dissolution has to be explicitly prescribed when $\underline{\theta} \geq -c$. In this case, if the social contract were not to prescribe explicitly the dissolution of the federation in the asymmetric case, the country of type $\underline{\theta}$ would have to bribe the country of type $\overline{\theta}$. Dissolution would occur anyway, but (socially costly) positive transfers would have to be paid. In the case $\underline{\theta} < -c$ it is not necessary to include explicitly a secession clause, since a country of type $\overline{\theta}$ will accept to renegotiate and dissolve the federation.

of national statistics (Bordignon et al., 2000; Cornes and Silva, 2000).

In our context, asymmetric information may become an issue only if the countries, by lying about their true θ^i, may affect the implementation of the constitutional rules to their advantage. To study this issue, we set up the problem as a direct revelation game. That is, we assume that the social contract at time 0 establishes tax and transfer schemes, as well as secession rules, as a function of the *declared state of the world* by all countries. We also impose specific constraints guaranteeing that each country has an incentive to declare the truth about its type, given that it expects the other to do the same (Bayesian revelation game). Note that each country i has still the option to refuse the social decision, making everybody pay the cost c. As in the complete information case, the *ex post* participation constraints of all countries must therefore again be satisfied for the social decision to be implemented in period 1.

There is however an important difference. Under complete information it is never optimal to prescribe a decision such that the *ex post* individual rationality constraints are violated. This would only lead to each country paying a cost c, and it is obviously better to set $d(\theta) = \tau^i(\theta) = T^i(\theta) = 0$ and avoid paying that cost. Under incomplete information things may be different. In principle, it may now become convenient to trigger an 'independence war' under some circumstances if this helps to keep incentives aligned. By the same token, it might also become convenient to let the federation peacefully dissolve at a cost, by imposing a monetary compensation for the leaving countries.

To analyze the problem under asymmetric information we need introduce some new notation. Let $\chi^i(\theta)$ be the decision by country i to trigger the independence war at state of the world θ, with $\chi^i(\theta) = 1$ denoting acceptance of the social decision and $\chi^i(\theta) = 0$ denoting the decision to fight. Let $\chi(\theta) = \chi^1(\theta)\chi^2(\theta)$, so that $\chi(\theta) = 1$ if the war is not triggered and $\chi(\theta) = 0$ otherwise. Feasible social rules have to take into account the incentive compatibility constraints for the two types of countries. Define:

$$U^i\left(\theta^i, \theta^{-i}\right) = \max\left\{\left(d\left(\theta^i, \theta^{-i}\right)\theta^i + \tau^i\left(\theta^i, \theta^{-i}\right) - T^i\left(\theta^i, \theta^{-i}\right)\right)\chi^{-i}\left(\theta^i, \theta^{-i}\right) - \left(1 - \chi^{-i}\left(\theta^i, \theta^{-i}\right)\right)c;\ -c\right\}$$

as the utility of a country of type θ^i announcing the truth, when the other country announces θ^{-i}. When the other country decides to secede unilaterally (that is, $\chi^{-i}\left(\theta^i,\theta^{-i}\right)=0$) the utility is $-c$. If the other country accepts the decision, then the utility for country i is whatever is best between accepting the decision and fighting the independence war. Furthermore, define:

$$U_{\underline{\theta}}\left(\overline{\theta},\theta^{-i}\right)=\max\left\{\left(d\left(\underline{\theta},\theta^{-i}\right)\overline{\theta}+\tau^i\left(\underline{\theta},\theta^{-i}\right)-T^i\left(\underline{\theta},\theta^{-i}\right)\right)\chi^{-i}\left(\underline{\theta},\theta^{-i}\right)-\left(1-\chi^{-i}\left(\underline{\theta},\theta^{-i}\right)\right)c;\ -c\right\}$$

as the utility of a country i of type $\overline{\theta}$ announcing $\underline{\theta}$. Again, this utility is given by the highest of two terms. The first term is country i's utility if i accepts the social decision, given that $\chi^{-i}\left(\underline{\theta},\theta^{-i}\right)$ is the decision to stay or not in the federation by the other country when i declares $\underline{\theta}$. The second term is i's utility if i rejects the social decision (i.e. $-c$) . Clearly, a $\overline{\theta}$ country lying about its type, will decide to refuse or accept the social decision according to which of these two terms is larger. The term $U_{\overline{\theta}}\left(\underline{\theta},\theta^{-i}\right)$, denoting the utility of a country i of type $\underline{\theta}$ announcing $\overline{\theta}$, can be defined similarly.

Using this notation, the *ex ante* maximization problem under asymmetric information can be written as:

$$\max_{d(\theta),\tau^i(\theta),T^i(\theta)} 2\gamma\sum_{\theta\in\Theta}\Pr(\theta)\,d(\theta)\,\chi(\theta)+$$
$$\sum_{\theta\in\Theta}\Pr(\theta)\left(\left(d(\theta)\left(\sum_{i=1}^{2}\theta^i\right)+\tau^i(\theta)-T^i(\theta)\right)\chi(\theta)-(1-\chi(\theta))\,2c\right)$$

s.t.

$$\sum_{i=1}^{2}\left((1+\lambda)\,\tau^i(\theta)-T^i(\theta)\right)\leq 0 \qquad \text{each } \theta \qquad \text{(BC)}$$

$$\begin{array}{lll}\chi^i(\theta)=0 & \text{if} & d(\theta)\,\theta^i+\tau^i(\theta)-T^i(\theta)<-c\\ \chi^i(\theta)\in[0,1] & \text{if} & d(\theta)\,\theta^i+\tau^i(\theta)-T^i(\theta)=-c\\ \chi^i(\theta)=1 & & \text{otherwise}\end{array} \qquad \text{each } i,\ \theta\in\Theta \quad \text{(EPIR)}$$

$$\sum_{\theta^{-i}\in\{\underline{\theta},\overline{\theta}\}} p\left(\theta^{-i}\right) U^i\left(\overline{\theta},\theta^{-i}\right) \geq \sum_{\theta^{-i}\in\{\underline{\theta},\overline{\theta}\}} p\left(\theta^{-i}\right) U_{\underline{\theta}}\left(\overline{\theta},\theta^{-i}\right) \qquad (\overline{\text{IC}})$$

$$\sum_{\theta^{-i}\in\{\underline{\theta},\overline{\theta}\}} p\left(\theta^{-i}\right) U^i\left(\underline{\theta},\theta^{-i}\right) \geq \sum_{\theta^{-i}\in\{\underline{\theta},\overline{\theta}\}} p\left(\theta^{-i}\right) U_{\overline{\theta}}\left(\underline{\theta},\theta^{-i}\right) \qquad (\underline{\text{IC}})$$

where $p\left(\theta^{-i}\right)$ is the probability that the other country is of type $\theta^{-i} \in \left\{\underline{\theta},\overline{\theta}\right\}$. Constraint BC is the budget constraint which has to be satisfied for every θ. EPIR is the *ex post* individual rationality constraint. It requires that a country should start a war whenever the utility enjoyed by accepting the social decision is less than $-c$. $\overline{\text{IC}}$ and $\underline{\text{IC}}$ are the incentive compatibility constraints for the high and low type, respectively[8].

Clearly, the only difference with the optimization problem considered in the previous sections is given by the two IC constraints. How does their presence affect the solution? One obvious observation is that whenever the solution described in proposition 1 satisfies the IC constraints then this will be the solution for the case of asymmetric information too. Hence, to verify if asymmetric information matters, we have first to check if at the complete information solution the IC constraints are binding; if they are not, then the solution is unaffected by asymmetric information. This leads us immediately to the following proposition.

Proposition 3 *If $\underline{\theta} \geq -c$ then the optimal social contract under asymmetric information is the same as under complete information. The same occurs when $\underline{\theta} \leq -c$ and the optimal social contract under complete information prescribes that the federation is maintained only if $\theta = \left(\overline{\theta},\overline{\theta}\right)$.*

The proof is immediate and it is omitted. Intuitively, if either $\underline{\theta} \geq -c$ or the original contract requires $d(\theta) = 1$ only if $\theta = \left(\overline{\theta},\overline{\theta}\right)$, no transfer needs to be paid at the complete information contract. But if no transfer is paid, then the announcement has the only effect of determining whether the federation

[8] Given the assumption of symmetric constitutions and *ex ante* identical countries with independent shocks, the incentive compatibility constraints are given by just two inequalities, one for type $\underline{\theta}$ and one for type $\overline{\theta}$.

should be maintained or not. And since an announcement of $\underline{\theta}$ increases the probability that the federation is dissolved, it is clear that type $\overline{\theta}$ will tell the truth. A similar reasoning holds for type $\underline{\theta}$. Proposition (3) thus implies that asymmetric information can be problematic only if positive transfers are involved, that is, in the two country case, if $\underline{\theta} < -c$ and $d(\overline{\theta}, \underline{\theta}) = 1$ is deemed desirable from an *ex-ante* point of view. In what follows we only focus on the case in which this optimal 'complete information' social contract is not incentive compatible under incomplete information. Otherwise, it is obvious that the 'complete information' social contract is still optimal under incomplete information.

We begin by establishing the following proposition.

Proposition 4 *Suppose $\underline{\theta} < -c$ and the incentive compatibility constraint for type $\overline{\theta}$ is not satisfied at the optimal complete information social contract. Then whenever the federation is maintained, the optimal contract under asymmetric information has the same transfers and taxes as in the complete information case.*

The proposition states that, if it is desirable to maintain the federation in case $(\overline{\theta}, \underline{\theta})$ under asymmetric information, incentive problems cannot be dealt with by distorting the transfer in that case. The intuition is fairly straightforward. Under asymmetric information, the only incentive compatible constraint which matters is the one relative to type $\overline{\theta}$. Type $\underline{\theta}$ would never have an incentive to lie, pretending to be of type $\overline{\theta}$ instead, because this would lead it to paying taxes rather than receiving subsidies in some states of the world, or to maintain the federation more frequently. So suppose that at the state of the world $(\overline{\theta}, \underline{\theta})$ it is *ex ante* optimal to maintain the federation but that the incentive compatibility constraint for type $\overline{\theta}$ is not satisfied. Is there any distortion of the transfers which would make the social contract incentive compatible in this case? The answer is clearly no. Reducing the transfers to type $\underline{\theta}$ below τ^* is unfeasible, because they are already at the lowest possible level. Raising them is not incentive incompatible, as it increases the benefit of lying for type $\overline{\theta}$. Introducing positive transfers for type $\overline{\theta}$ is unfeasible, because there is no one who could pay for them.

Hence, given that is either unfeasible or sub-optimal to modify the transfers when the federation is maintained, the only possibility which is left at the constitutional level is to change either the transfers or the secession rules in those states of the world where *the federation is dissolved.* In principle, there are three basic different strategies which could be used to make the social contract incentive compatible. The first is simply to set the transfers equal to zero in any (declared) state of the world. In this case the federation is maintained only when the state of world $\left(\overline{\theta},\overline{\theta}\right)$ is realized, and optimality would require $d\left(\overline{\theta},\overline{\theta}\right)=1$ and $d(\theta)=0$ for all the other $\theta's$, so avoiding the "independence war" costs. This solution is not very satisfactory if γ is large, and indeed with this solution it may be impossible to support the federation even in those cases in which it would be *ex post,* and not only *ex ante,* efficient to do so.

Second, the social contract could attempt to *reward* type $\overline{\theta}$ for telling the truth, by imposing to the country of type $\underline{\theta}$ to pay a transfer to the country of type $\overline{\theta}$ whenever the federation is dissolved. That is, the constitution could grant a 'conditional' right to secede to the countries, allowing them to secede only if a compensation is paid to the other country when this declares to be of the high type. However, this solution cannot be optimal in the two countries case, for it would still imply that the federation is dissolved in the mixed case $(\overline{\theta},\underline{\theta})$, thus providing no *ex ante* advantage to the countries. This can be obtained more cheaply from a social point of view (as no distorting transfer is paid) by setting all the transfers equal to zero and imposing $d(\overline{\theta},\underline{\theta})=0$ [9].

Finally, the constitution might attempt to *punish* type $\overline{\theta}$ for lying. It could do so by imposing $d(\underline{\theta},\underline{\theta})=1$ even for that state of the world at which it is clearly *ex ante* inefficient to maintain the federation. In fact, as the federation is more likely to dissolve when type $\overline{\theta}$ lies, this action would increase the cost of lying for this type, by making it pay a cost $-c$ rather than 0 should these states

[9] Notice that this result is specific of the two countries case. With more than two countries and therefore with more mixed cases to consider, a 'conditional' right to secede may indeed turn out to be optimal under asymmetric information. See the working paper version of this work (1999) for a formal proof.

occur. This solution may eliminate the incentive compatibility problem, at the cost of having the countries paying the independence war costs in one state of the world.

Which strategy is worth pursuing depends on the parameters of the problem. In particular, suppose $\underline{\theta} < -c$ and $2\gamma + \underline{\theta} + \overline{\theta} - \lambda\tau^* > 0$. In this case, the optimal policy under complete information is to maintain the federation in all cases except $(\underline{\theta}, \underline{\theta})$. That is, under complete information, the optimal secession rules are $d\left(\overline{\theta}, \overline{\theta}\right) = d\left(\overline{\theta}, \underline{\theta}\right) = 1$ and $d(\underline{\theta}, \underline{\theta}) = 0$. Suppose that the relevant incentive compatibility condition for type $\overline{\theta}$ is violated at this contract, that is:

$$p\overline{\theta} + (1-p)\left(\overline{\theta} - (1+\lambda)\tau^*\right) < p\left(\overline{\theta} + \tau^*\right)$$

where p is the probability of type $\overline{\theta}$. No transfer can be paid when the state of the world is $(\underline{\theta}, \underline{\theta})$, and when the state of the world is $\left(\overline{\theta}, \underline{\theta}\right)$ ex post individual rationality requires that the low type is the one receiving the transfer. Therefore, the only way to make sure that the incentive compatibility constraint for the high type is satisfied and maintain the federation in the same cases as under complete information is to impose $d(\underline{\theta}, \underline{\theta}) = 1$, letting a secession war burst if this case occurs. This is enough to make the incentive compatibility constraint of the high type satisfied if the inequality:

$$p\overline{\theta} + (1-p)\left(\overline{\theta} - (1+\lambda)\tau^*\right) > p\left(\overline{\theta} + \tau^*\right) - (1-p)c$$

is satisfied. The trade-off here is as follows. Letting $d(\underline{\theta}, \underline{\theta}) = d\left(\underline{\theta}, \overline{\theta}\right) = 0$, we make sure that no independence war is ever triggered, but we have to give up any hope to maintain the federation in the state $\left(\overline{\theta}, \underline{\theta}\right)$, since this would violate incentive compatibility for type $\overline{\theta}$. Selecting $d(\underline{\theta}, \underline{\theta}) = d\left(\underline{\theta}, \overline{\theta}\right) = 1$ implies that the two countries will have to pay the 'independence war' cost whenever the state of the world is $(\underline{\theta}, \underline{\theta})$; it is exactly this cost that aligns the incentives to tell the truth for type $\overline{\theta}$, thus making it possible to maintain the federation in state of the world $\left(\overline{\theta}, \underline{\theta}\right)$. It is clear that if γ is large enough it is optimal to set $d(\underline{\theta}, \underline{\theta}) = 1$.

Summing up, there are two basic conclusions to be drawn from this section. First, asymmetric information reduces expected welfare and makes it more difficult to keep together the federation.

Second, in order to cope with asymmetric information, the social contract may limit the introduction of secession rules, not allowing the countries to leave the federation at zero cost even when it would optimal to do so *ex ante* and not only *ex post*. This policy may be needed to satisfy the incentive compatibility constraints. The implication is that under asymmetric information there may be states of the world where the countries suffer heavy welfare losses *ex post*; indeed, as we have shown above, under asymmetric information countries may end up with the payoffs of the 'secession war', whereas this was never possible under full information.

Of course, we obtain these results under asymmetric information because we have not allowed the countries to renegotiate the contract *ex post*. Paying the cost of a secession to break the federation, when the same could be dissolved at zero cost for everybody may not appear a very credible outcome. On the other hand, the possibility of renegotiation would modify the incentive compatibility constraints. Renegotiation *ex post* should be correctly modeled as a bargaining problem under asymmetric information, but unfortunately in this case the results are sensitive to the assumptions made on the structure of the negotiation process. We prefer to leave the matter here and simply note that whatever the framework chosen to model this kind of problem, bargaining under asymmetric information in general does not lead to Pareto efficient outcomes. We therefore believe that the possibility of a secession war under asymmetric information is robust to the introduction of renegotiation.

6 Concluding Remarks.

We began this work by asking a few simple questions: should secession rules be introduced in a federal constitution? And if so, how should they be structured? The paper addresses these questions in a very simple two-country model, and it offers the following answers. The basic trade-off in choosing optimal secession rules is between the *ex post* benefits of reducing the cost of dissolving the federation and the *ex ante* benefits of credibly committing to the federation. The specific features of the rules depend on the economic and institutional framework in which the federation operates. Assuming

that the member countries can write a complete contract at the time of joining in a federation, we get a very neat characterization of the optimal secession rules. Under conditions of full information, secession rules may or may not be introduced, depending on the relevance of the benefits *ex ante* to commit to the federation, which in turn depend on the exact features of the public good which is offered by the federation. However, if they are introduced, secession rules should usually take the form of an unconditional right to secede; because of the deadweight loss of taxation, no monetary compensation should be paid by the leaving countries. Furthermore, although the optimal secession rules – or rather the lack of them – may induce some welfare loss *ex post*, a secession war is never possible. The constitution would always prefer to let the countries leave peacefully if the alternative is a costly war.

Results change with asymmetric information. In that case, it might be optimal not to introduce secession rules at all at the constitutional level, although this may lead to a costly secession war under some realization of the states of the world. The reason for this reversal of results is that under asymmetric information the countries which benefit from the federation *ex post* may have an incentive to lie in order to avoid paying compensating transfers. As the federation breaks up more easily when the benefiting countries lie, it may be optimal to make it more costly to break the federation, so as to induce truthful revelation of types. As a result, however, severe welfare losses may occur under asymmetric information if the federation ends up breaking up.

Our results are roughly consistent with the empirical evidence on existing federations. Few constitutions allow for peaceful secessions, and when they do, they usually provide an unconditional right to secede. Our results may also be used to question the optimality of the current constitutional arrangements in the European Monetary Union, which do not consider any secession rule. We think however that the issue deserves more research. As the analysis was meant to cast some light on a so far neglected issue, the model has been deliberately kept at a very simple level.

Several extensions (such as for instance to allow for multiple, asymmetric and risk averse countries)

would be worth pursuing in order to cast further light on the characteristics of existing federations. For example, by simply introducing extra countries a number of new issues could be discussed. The federation might survive when some of the countries leave, thus changing the incentive structure. A group of countries may form a coalition to expel others, and so on. In the working paper version of this paper (1999) for example, it was shown that with three countries optimal secession rules under asymmetric information may take the form of a 'conditional' right to secede, with the leaving countries being forced to pay monetary compensations to the remaining countries.

It should also be pointed out that our results crucially depend on the possibility of using complete contracts at the constitutional level. The 'complete contracts' paradigm is a useful benchmark and it might not be too bad an assumption for some existing federations. However, in many other cases, constitutions are probably better seen as incomplete contracts. That is, because of the impossibility of predicting and describing *ex ante* all future contingencies, constitutions can only specify *procedures* to make decisions which are independent of contingencies (see Dixit, 1996, Tabellini and Persson, 1999; Aghion and Bolton, 1998). In our context, one should therefore ask which optimal procedures should be chosen at the constitutional level to allow for peaceful secession, taking into account the trade-off between *ex ante* and *ex post* optimality which is implicit in the secession rules. We think that extending our analysis to these issues would be a very interesting avenue for further research.

Appendix

Proof of Proposition 1. If we ignore the *ex post* individual rationality conditions, optimality requires that the federation be maintained in all states of the world such that:

$$2\gamma + \theta^1 + \theta^2 \geq 0 \tag{6}$$

If $\underline{\theta} \geq -c$, the *ex post* participation constraints are satisfied when no transfer occurs. Therefore in that case it is both feasible and desirable to maintain the federation. Notice that if $\underline{\theta} \geq -c$ then

condition (4) implies condition (6). If $\underline{\theta} < -c$ then compensating transfers are needed. Since transfer are socially costly, optimality requires that they be equal to the lowest possible amount. Therefore, an agent of type $\underline{\theta}$ receives a transfer $\tau^* = -(\underline{\theta} + c)$. The associated cost is $\lambda\tau^*$ for each agent of type $\underline{\theta}$ so that, once the individual rationality constraint of type $\underline{\theta}$ has been taken into account, the condition for social optimality becomes:

$$\sum_{i=1}^{2} \left(\theta^i - \lambda \max\left\{0, -\left(\theta^i + c\right)\right\}\right) \geq -2\gamma \tag{7}$$

We have to make sure that the *ex post* individual rationality constraint for type $\overline{\theta}$ is satisfied, that is:

$$\overline{\theta} - \tau^* (1 + \lambda) \geq -c \tag{8}$$

since a total subsidy τ^*has to be paid to type $\underline{\theta}$. Using $\tau^* = -(\underline{\theta} + c)$, inequality (8) can be written as:

$$\overline{\theta} + (\underline{\theta} - \lambda\tau^*) \geq -2c$$

which can also be written as:

$$\sum_{i=1}^{2} \left(\theta^i - \lambda \max\left\{0, -\left(\theta^i + c\right)\right\}\right) \geq -2c \tag{9}$$

Therefore, maintaining the federation is both desirable and feasible when inequalities (7) and (9) are both satisfied. This is equivalent to condition (4).

Proof of Lemma 1. We have already shown that the decision to dissolve is renegotiation proof. Suppose that the constitution prescribes that the federation should be maintained. In this case, the country with $\theta^i = \underline{\theta}$ is paid a transfer $\tau^* = \max\{0, -(\underline{\theta} + c)\}$ and the country of type $\overline{\theta}$ pays $\tau^*(1 + \lambda)$. A country of type $\underline{\theta}$ always receives a negative utility (i.e. $-c$) when the federation is maintained. If it also turns out that $\overline{\theta} - \tau^*(1 + \lambda) \leq 0$ then the countries will renegotiate and agree to dissolve the federation at zero cost. It is immediate to see that in this case condition (5) is violated.

Suppose then that $\overline{\theta} - \tau^* (1+\lambda) > 0$. In this case the federation is dissolved only if the type $\underline{\theta}$ country is able to compensate the type $\overline{\theta}$ country. For this to be the case, it must be possible to find a transfer R such that:

$$R \geq \overline{\theta} - \tau^* (1+\lambda) \qquad -R(1+\lambda) \geq \underline{\theta} + \tau^*$$

The first inequality states that the transfer received by a country with type $\overline{\theta}$ must be enough to make it accept the dissolution of the federation. Transferring R to the type $\overline{\theta}$ country requires a tax $R(1+\lambda)$ on the type $\underline{\theta}$ country. The second inequality implies that countries with type $\underline{\theta}$ are willing to pay the tax in order to get the federation dissolved. The transfer R exists, so that renegotiation is possible, if:

$$0 \geq (1+\lambda)\left(\overline{\theta} - \tau^* (1+\lambda)\right) + (\underline{\theta} + \tau^*)$$

This implies that renegotiation can be prevented only if (5) holds.

Proof of proposition 2. Assume that condition (5) is not satisfied. We first observe that any social contract that maintains the federation at state $\left(\overline{\theta}, \underline{\theta}\right)$ and gives a positive transfer to countries of type $\overline{\theta}$ is not renegotiation proof.

A subsidy to a country of type $\overline{\theta}$ can only be paid if $\underline{\theta} > -\overline{c}$, otherwise the participation constraint for types $\underline{\theta}$ would be violated. In that case we have $\tau^* = 0$ and since (5) is violated we have:

$$\overline{\theta} + \underline{\theta} < -\lambda\overline{\theta}. \tag{10}$$

Suppose that the social contract prescribes a positive transfer τ to countries with type $\overline{\theta}$. In order to renegotiate the contract and dissolve the federation it has to be possible to compensate the country of type $\overline{\theta}$. Therefore, renegotiation occurs if we can find R such that:

$$R > \overline{\theta} + \tau \qquad -R(1+\lambda) > \underline{\theta} - \tau(1+\lambda)$$

Combining the two inequalities, we see that renegotiation is possible if $-\lambda\overline{\theta} > \overline{\theta} + \underline{\theta}$, which is exactly condition (10).

Therefore, we only need to worry about transfers to countries of type $\underline{\theta}$. Since (5) is violated we have:

$$\overline{\theta} + \underline{\theta} < -\lambda\overline{\theta} + \tau^*\lambda(2+\lambda) \tag{11}$$

Assume that a transfer $\tau > \tau^*$ is paid to countries of type $\underline{\theta}$. Renegotiation occurs if the utility of each country is negative. Furthermore, utility cannot be positive for both types, since this would imply that condition (5) is satisfied. We have therefore to consider only cases in which either the utility of type $\underline{\theta}$ or the utility of type $\overline{\theta}$ is strictly positive. Let us look at the two cases.

Case 1: $\underline{\theta} + \tau > 0$, $\overline{\theta} - \tau(1+\lambda) < 0$. In this case types $\overline{\theta}$ have to compensate types $\underline{\theta}$ in order to dissolve the federation. Renegotiation is possible if there exists R satisfying:

$$R > \underline{\theta} + \tau \qquad\qquad -R(1+\lambda) > \overline{\theta} - \tau(1+\lambda)$$

which yields the condition:

$$\overline{\theta} + \underline{\theta} < -\lambda\underline{\theta} \tag{12}$$

>From (12) and (11), we conclude that renegotiation is always possible if:

$$-\lambda\underline{\theta} \geq \tau^*\lambda - \lambda\overline{\theta} + \tau^*\lambda(1+\lambda)$$

which can also be written as:

$$\overline{\theta} - \tau^*(1+\lambda) \geq \underline{\theta} + \tau^* = -c$$

which is always satisfied.

Case 2: $\underline{\theta} + \tau < 0$, $\overline{\theta} - \tau(1+\lambda) > 0$. In this case renegotiation is possible if:

$$\tau\lambda(2+\lambda) - \lambda\overline{\theta} \geq \overline{\theta} + \underline{\theta} \tag{13}$$

Since (11) is satisfied, inequality (13) is satisfied if $\tau > \tau^*$. This must be the case, since τ^* is the lowest¡t transfer satisfying *ex post* individual rationality.

Proof of proposition 4. We first establish the following lemmas.

Lemma 2 *Suppose $\underline{\theta} < -c$. Then for every feasible social contract it must be the case that for each state of the world θ such that $d(\theta)\chi(\theta) > 0$ we have $\tau^i(\theta) = 0$ if $\theta^i = \overline{\theta}$.*

Proof. If $d(\theta)\chi(\theta) > 0$ then *ex post* rationality has to be satisfied. Since we are analyzing the case $\underline{\theta} < -c$, type $\underline{\theta}$ must receive a strictly positive transfer. Therefore, in every symmetric constitution type $\overline{\theta}$ must pay a tax whenever the federation is maintained and type $\underline{\theta}$ is present. If no type $\underline{\theta}$ is present then zero transfers are implied by symmetry.

Lemma 3 *The probability of dissolving the federation is higher when a type $\underline{\theta}$ is announced, that is:*

$$\sum_{\theta^{-i}\in\{\underline{\theta},\overline{\theta}\}} p\left(\theta^{-i}\right)\chi^{-i}\left(\overline{\theta},\theta^{-i}\right)d\left(\overline{\theta},\theta^{-i}\right) \geq \sum_{\theta^{-i}\in\{\underline{\theta},\overline{\theta}\}} p\left(\theta^{-i}\right)\chi^{-i}\left(\underline{\theta},\theta^{-i}\right)d\left(\underline{\theta},\theta^{-i}\right)$$

Proof. Since $\underline{\theta} < -c$, the federation is always dissolved when the state of the world is $(\underline{\theta},\underline{\theta})$. If it is also dissolved when the state of the world is $\left(\overline{\theta},\underline{\theta}\right)$ then the lemma is proved. If not, then any optimal contract must have $d\left(\overline{\theta},\overline{\theta}\right)\chi\left(\overline{\theta},\overline{\theta}\right) = 1$, since this does not violate the IC constraint for the low type and helps in making the IC constraint for the high type satisfied.

Lemma 3 is used to prove the following.

Lemma 4 *It is never the case that a country of type $\underline{\theta}$ receives a subsidy $\tau^i\left(\underline{\theta},\theta^{-i}\right) > -(\underline{\theta}+c)$ when the federation is maintained.*

Proof. Because of the deadweight cost λ, transfers enter negatively into the objective function. It cannot therefore be the case that, at an optimal point, no constraint is binding. In particular, either $\overline{\text{IC}}$ or $\underline{\text{IC}}$ must be binding. Clearly, a reduction in $\tau^i\left(\underline{\theta},\theta^{-i}\right)$ does not violate $\overline{\text{IC}}$. Therefore, $\underline{\text{IC}}$ must hold with equality. Since the subsidy is paid, the federation is maintained in the state of the world $\left(\underline{\theta},\overline{\theta}\right)$ and optimality requires that it be maintained at state $\left(\overline{\theta},\overline{\theta}\right)$ as well. This implies that by falsely announcing $\overline{\theta}$, a type $\underline{\theta}$ will trigger the independence war for sure, since whatever the announcement of

the other country the social decision will be to maintain the federation paying no subsidy to the country announcing $\overline{\theta}$. Thus, the RHS of the IC constraint is just $-c$. But then, if $\tau^i\left(\underline{\theta},\theta^{-i}\right) > -\left(\underline{\theta}+c\right)$ the IC constraint cannot hold with equality, since by announcing $\underline{\theta}$ the country receives strictly more than $-c$ if the other country announce $\overline{\theta}$ and at least $-c$ otherwise. This ends the proof of the lemma.

The two lemmas imply that we can restrict our attention to social contracts such that $\tau^i(\theta) = \tau^*$ whenever $d(\theta)\chi(\theta) > 0$. It is clear that at each state of the world taxes are set at the level that balance the budget, that is whenever the federation is maintained taxes and subsidies are exactly as in the complete information situation. The reason is that taxes enter negatively into the objective function and can only create problems for the IC constraint of type $\overline{\theta}$.

References

[1] Aghion P. and Bolton, P., 1998 *Incomplete Social Contracts,* mimeo, Princeton University.

[2] Alesina A., Perotti R. and Spolaore E., 1995 "Together or separately? Issues on the costs and benefits of political and fiscal union" *European Economic Review,* **39**: 751-58

[3] Alesina A. and Spolaore E., 1997, "On the number and size of nations", *Quarterly Journal of Economics,* **112**: 1027-1056

[4] Alesina A., Spolaore E. and Wacziag R., 1997, *Economic integration and political disintegration,* NBER w.p. n^o 6163.

[5] Apolte T., 1997, "Secession clauses: a tool for the taming of an arising Leviathan in Brussels?" *Constitutional Political Economy*, **8**: 57-70.

[6] Blaustein A.P. and Flanz, G.H, 1998, *Constitutions of the countries of the world: a series of updated texts, constitutional chronologies and annotated bibliographies,* Oceana, London.

[7] Bernholz, P., 1991, "Institutional aspects of the European Integration" in Borner, S. and Grubel, H. (eds) *The EC after Maastricht. Perspectives from the outside.* MacMillan, London.

[8] Bolton, P. and Roland G., 1997, "The break-up of nations: a political economy analysis" *Quarterly Journal of Economics, **112**: 1057-1089.*

[9] Bolton, P., Roland G. and Spolaore E., 1996 "Economic theories of the break-up and integration of nations" *European Economic Review,* **40**: 697-705.

[10] Bookman, M.Z. , 1993, *The Economics of Secession* St. Martin Press, New York.

[11] Bordignon M., Manasse, P. and Tabellini, G. 2000 "Optimal regional redistribution under asymmetric information" forthcoming, *American Economic Review.*

[12] Bordignon M., S. Brusco 1999 "Optimal secession rules" ZEW Discussion Paper No. 99-51.

[13] Buchanan J.M., 1990, "Europe's Constitutional Opportunity" in Vibert, F. (ed.) *Europe's Constitutional Future,* IEA, London.

[14] Buchanan J.M. and Faith, R.L. 1987 "Secession and the limits of taxation: toward a theory of internal exit" *The American Economic Review* **77**: 1023-1031.

[15] Casella, A., 1992 "On markets and clubs: economic and political integration of regions with unequal productivity " *European Economic Review, **82**:* 115-21.

[16] Chen, Y., and Ordeshook, P.C., 1994, "Constitutional secession clauses" *Constitutional Political Economy,* **5**: 45-60.

[17] Cornes R. and Silva, E., 2000 "Local public goods, inter-regional transfers and private information", *Journal of Urban Economics **47**: 39-60.*

[18] Dixit A., 1996, *The Making of Economic Policy*, MIT Press.

[19] Laffont J.J. 1995 *Incentives in China's federal system*, mimeo, University of Toulose.

[20] Lockwood B., 1999 "Inter-regional insurance" *Journal of Public Economics*, **72**: 1-37.

[21] Raina, P, 1995 *The Constitutions of new democracies in Europe* Merlin Books, New York

[22] Tabellini G. and Persson, T., 1996 "Federal fiscal constitutions: risk sharing and redistribution", *Journal of Political Economy ,* **104**: 979-1009.

[23] Tabellini G. and Persson, T., 1999, "Political Economics and Public Finance", forthcoming *Handbook of Public Economics,* North Holland.

[24] Wei, S., 1992 *To divide or to unite: a theory of secessions* mimeo, University of California at Berkeley.

[25] Wood, J.R., 1981, "Secession : a comparative analytical framework", *Canadian Journal of Political Sciences,* **5**: 221-245.