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ABSTRACT

Flexible Integration as an Efficient Decision-Making Rule*

In this Paper we combine a non-cooperative decision-making game in a federal structure with two levels of interest and an incomplete contract which sets the rules of the game. The question we pose is how to combine *ex ante* efficiency of the design with *ex post* efficiency of the outcomes in the decision-making game. The Paper shows that in common policies there are no designs that lead to both types of efficiency but flexible integration is a way to achieve both.

JEL Classification: C72, D71, D72
Keywords: incomplete contracts, integration, legislative bargaining, non-cooperative games

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NON-TECHNICAL SUMMARY

The legislative process in the European Union, as defined in the Union Treaty, is an incomplete contract between 15 national governments. The design of the contract covers the set of policy issues where it applies and the decision-making rules, i.e. the division of powers among actors involved in the process and the rules, how decisions can be made and the possible degree of flexibility. Moreover, the Treaty gives competence to a supranational actor, which represents the upper (integration) level, to make policy proposals. Member states form a legislature that represents the local (national) level and either accepts or rejects the proposals made by the supranational player. In this Paper we build a stylised model of EU type of integration. Our attempt is to draw some general conclusions on how the decision-making rules should be designed in this context.

Since the Union Treaty is an incomplete contract and as it gives full agenda-setting power on integration to the supranational actor it leaves room for abuse of power and potentially leads to an inefficient level of integration from member countries' points of view. Basically, inefficiencies are due to the fact that the Treaty is designed behind a veil of ignorance while proposals are made after the state of nature is observed. The design of the Treaty tries to take into account the consequences of all relevant states of nature.

In this Paper we develop a non-cooperative game model for EU the type of decision-making where national and supranational interests are involved and combine it with the design of an incomplete contract, which sets the rules for a decision-making game. In the legislation sub-game the agenda-setter can be interpreted like a seller and the legislature like a buyer who, however, accepts offers if a required majority is reached. We assume that in the first period those who design the Treaty (median voters in participating countries) are able to set a majority rule, or a degree of flexibility (i.e. how much member states can deviate from an outcome). Member states are supposed to be *ex ante* similar: their ideal outcomes have uniform distribution on one-dimensional policy space. We may interpret the policy space in terms of deepness of integration. We also assume that there is a positive probability of no gains from integration, hence member states prefer disintegration instead.

At the design stage, information concerning the future states of nature is incomplete. Participating countries do not sign the Treaty if there are no expected gains from it. The state of nature under which the legislation game is played is observed by the agenda-setter and member states after the treaty has been signed. We thus assume that at legislation level there is perfect information.

We then analyse the design of an efficient incomplete contract under above-mentioned mechanisms. We make a distinction between two types of efficiency: *ex ante* efficiency (when the Treaty is signed) and *ex post* efficiency after the acceptance or rejection of a proposal is realised.

If information is perfect at the legislation level there is a clear trade-off between *ex ante* and *ex post* efficiency when only common policies are used. There is an upper limit for majority rules that can lead to *ex ante* optimality whereas only unanimity rule leads to *ex post* efficiency. To minimise *ex post* inefficiency the upper limit of *ex ante* optimal decision-making rules should be chosen. If *ex ante* efficiency is not required but only *ex post* efficiency then unanimity rule is efficient but yields only a very small change compared to *status quo*.

When decision-makers are able to choose between zero integration and a proposal both *ex ante* optimality and *ex post* efficiency can be reached. Then the majority rule should be chosen from the interval (1/2, 3/4]. Under this flexible arrangement it is also possible that the agenda-setter starts using super-majorities when choosing its proposals. This, in fact, redistributes power from the agenda-setter and majority members for those who would be in minority. Yet, flexible integration is both *ex ante* and *ex post* efficient.

In summary, the Paper shows that if similar member states of a federal structure want to design the decision-making rules that yield *ex ante* and short-term *ex post* efficient outcomes they have to use flexibility in the design. In practise this means that there must be a minority insurance which guarantees at least the same outcome that would have occurred in *status quo* for those who do not gain from a common policy. In common policies *ex post* efficiency can be achieved only in the long run unless unanimity rule is used. Unanimity requirement is, however, *ex ante* inefficient, hence also dominated *ex post* by lower majority requirements in the long run.

1. Introduction

The legislative process in the European Union is defined in the Union Treaty which is an incomplete contract signed by 15 national governments. The design of the contract covers the set of policy issues where it applies and the decision-making rules, i.e. the division of powers among actors involved in the process and the rules, how decisions can be made. Moreover, the Treaty establishes a federal structure with an executive, who represents the upper (integration) level and a legislature which represents the local (national) level. Since the Union Treaty is an incomplete contract and as it gives full agenda-setting power on integration to the executive it leaves room for abuse of power and potentially leads to inefficient outcomes from member countries' point of view. In this paper, we deal with optimal design of such contract.

One fundamental element of European integration is that unanimity of national governments is required for giving the competence to the executive. Ideally, one may then think that the agenda-setter could be seen as a benevolent intermediator between participating member states. The Treaty makes, however, possible to the agenda-setter to represent supra-national views as an independent self-interested player with her own views not necessarily equal to any member state's view or an average of them. This may strengthen the distinction between local and central level even when the agenda-setter is benevolent because by trying to take into account all member states at the same time any particular local interests cannot be fully respected. This, in fact, may limit integration in issues where preferences are supposed to vary. On the other hand, as an incomplete contract the Treaty consists of unforeseen states of nature in the issues that are included. Therefore countries may gain from integration under one state of nature while the reverse may hold for another state of nature. To participate to a contract like this a single country must expect to gain from integration on average. This is likely to increase integration since potential losses in one issue may be covered by gains from other issues or in one issue losses under certain circumstances are covered by gains under other circumstances.

Through there are examples of different levels of integration in different EU countries still the bulk of the Union Treaty is common for all member states without exceptions.. An alternative way to organize integration would be a less restrictive institutional design like functional federalism.[1] At the extreme this

[1] For a discussion on overlapping political jurisdictions, see Casella and Frey (1992) or Eichenberger & Frey (1998). European integration as a mixture of a common base and open partner-

would lead to issue-by-issue bargaining among member states and to exclusion of countries that do not have gains from integration in respective issues.[2]

In this paper, we develop a simple non-cooperative agenda-setting model for decision-making where two levels of interests are represented and combine this with the design of an incomplete contract which sets rules for the bargaining. We assume that in the first period, the incomplete contract of legislative bargaining is signed. We suppose that this is decided unanimously by the local governments that are holding office at period one. Local governments are assumed to be tied to local voters in their integration decision. This is taken into account by assuming that at the local level the participation constraint of the median voters must be satisfied. If it is not the country will not sign the Treaty.[3]

The first period of the game relates this paper to design of institutions literature since the median voters at the local level act like principals who design the decision-making institutions and establish a new sub-principal, namely the supranational executive. Then, with the competence given by the incomplete contract the agenda-setter is able to propose complete contracts, depending on to the state of the nature, to local governments. They are the agents of the game and form the legislature making decisions whether to accept the agenda-setter's proposals. Then the main question we pose is how to design the rules for the legislation game in a way the outcomes are ex ante and ex post efficient. We also discuss how a more flexible system where players that fall into a minority are insured against the losses from integration and how this affects to outcomes' efficiency.

Recently the political economy literature on policy-making in (federal) constitutions has expanded rapidly. With this respect this paper has some similarities with Persson, Roland & Tabellini (1997) where separation of powers and accountability in purely presidential and parliamentary constitutions and the role of agenda-setting and information as sources of power are analysed. The decision-making structure of the model in this paper is, in fact, is similar to parliamentary system in their paper in the sense that the agenda-setter is only indirectly account-

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ships - flexible integration - is analysed in Dewatripont et al. (1995).

[2]With respect to European integration a term Europe a la carte is often used.

[3]Note that in Austria, Finland and Sweden there was an advisory referendum before they joined the European Union in 1995. In the UK referendum was held after her membership. In Denmark referendum was held before she joined the EU in 1973 but also in 1992 because of the Maastricht Treaty and in 1998 due to Amterdam Treaty. The original version of the Maastricht Treaty was rejected in Denmark but accepted later in the second referendum. In France and Ireland the Maastricht Treaty got majority's support in referendums in 1992. In Norway EU membership has been rejected twice by referendum in 1972 and 1994 respectively.

able for median voters at the local level but the legislature is directly accountable via the participation constraints of local median voters.[4] Accountability is, however, only of ex ante nature. An outcome may be ex post inefficient but we do not analyse the consequences of that. The legislation game in our model thus has democracy deficit and the basic question of the paper is to investigate whether the designers of the Treaty are able to get rid of its potentially negative consequences and still maintain ex ante efficient rules.

The existing literature on the similar institutions, like the EU decision-making, can be divided into two categories. First, there is a literature on voting power within European institutions and the distribution of power among the three main legislative bodies in the EU, namely the Commission, the Council of Ministers and the European Parliament. Basically, this literature draws on Shapley value and its variations applied in simple cooperative voting games. One of the key questions in this literature is to analyse how the current design of EU institutions distributes power among member states of the EU and among the main legislative bodies within the EU (see Laruelle & Widgren 1998a and references therein). Standard power indices do not, however, take into account preferences, strategic agenda-setting nor inter-institutional relations.[5] The usual finding of this literature is that the local level (Council of Ministers) is more powerful in the EU than the agenda-setter (Commission). In the context of standard power indices agenda-setting power can be taken into account only as an expectation leaving strategic aspects of agenda-setting aside. Expected agenda-setting has been incorporated into a voting power model in Laruelle & Widgren (1998b) where EU decision making procedures are modelled as probabilistic voting models and where agenda-setting is added to the model by assuming that the Commission can alone form a winning coalition when it does not make a proposal. This makes the Commission the most powerful body in the EU. Steunenberg (1997) adds strategic aspects of agenda-setting into power analysis by defining power as the difference that a player makes to an equilibrium outcome compared to the outcome in the case where the player would be a dummy-player. Also he finds that the agenda-setter is the most

[4]Note that by assuming that unanimity of median voters directly designs the Treaty we disregard the potential collusion between national legislature and executive. In practise national governments agree and sign the integration treaty. We implicitly assume that voters observe the draft treaty before it is signed and that they are able to prevent the signature for example in referendum.

[5]To some extent these questions are tackled in Laruelle & Widgren (1998b), Widgren (1995) and Kirman & Widgren (1995). For a critical view and discussion, see Garrtett & Tsebelis (1999a, 1999b), Holler & Widgrén (1999) and Berg & Lane (1999).

powerful player unless unanimity rule is applied. This paper has similarities with power index literature since the Treaty is modelled as an incomplete contract, which is implicitly a part of every voting power model.

Second, there is a literature spatial voting games which relies on players preferences and analyses the sets of feasible policies under different assumptions on players preferences. In terms of agenda-setting spatial models analyse the constraints for making proposals under various preference structures.[6] Power in spatial models is defined as the distance between the equilibrium and an actors's preferred point. The smaller the distance the more an actor exerts power.[7]The two main differences between spatial voting games and voting power models is that preferences are fixed in the former whereas they are not in the latter and that agenda-setting is strategic in the former whereas it is not in the latter.[8]In this paper, the multi-agent version of the model is related to spatial voting games in a sense that only connected coalitions are formed within the legislature in each issue. The main difference between spatial voting games and this paper is that the former investigates decision-making more as a complete contract whereas in this paper the Treaty on integration is seen as an incomplete contract. The same phenomenon characterizes the differences between spatial voting games and voting power literature in the sense that the latter is like an ex post analysis of an issue or set of issues and the former is an a priori evaluation of large set of issues that are not known exactly. In this paper our aim is to integrate the two into one model, which sheds light to the relationship of these two very separate literatures so far.

The main purpose of this paper is to analyse the relationship between central and local players when the former has the right to propose and the latter has the right to decide. In addition, a more fundamental question we pose is how the division of powers among the two levels contributes to the expected level of integration and its relation to optimal level of expected integration.[9] In this paper we do not analyse the cases where groups of countries for over-lapping institutions of integration although it is certainly an important theme.

[6]For applications to the EU, see Garrett (1992), Grombez (1995, 1997), Tsebelis (1996).

[7]Note that this definition of power does not distinguish between power and luck (Barry 1980). An equilibrium may correspond with one's preferences due to her power or luck.

[8]For a discussion of applicability of power index models and spatial models to EU decision making see Garrett & Tsebelis (1997, 1999a) and Holler & Widgren (1999).

[9]Note that the purpose of this paper is not to analyse EU procedures per se. Therefore, we limit the analysis to the core point that is repeated in all EU procedures, namely the fact that the acceptance of a qualified majority among member states is required.

The preferred points (ideal policies) of the central and local level are measured in one-dimensional metric space and the status quo point is normalized to zero. From the agenda-setter's point of view the goal is to make a proposal is to choose the closest point to its ideal point within the set of feasible policies and status quo. With this respect the paper is related to spatial voting games literature where, for example, EU member states' preferences play a significant role in restricting the set of feasible outcomes of the game.

The rest of the paper is organized as follows. Section 2 gives the notation, basic definitions of the game and describes the model. Section 3 derives the results and section 4 concludes and discusses ideas for future research.

2. The Model

2.1. The Game

Let us define the set of possible proposals (and also decisions) as a one-dimensional metric space $I = (\alpha, \beta)$ where α is sufficiently small and β is sufficiently large. The player set consists of the agenda-setter, the governments and the median voters at the local level. Suppose that the local level consists of n agents (governments) denoted by the set $\Gamma = \{1, 2, ...n\}$ with the set of preferred points $\Lambda_{\Gamma,r} = \{\lambda_{1r}, \lambda_{2r}, ...\lambda_{nr}\}$ in issue r with a given state of nature respectively. Treaty designers do not observe the state of nature. Therefore we distinguish between governments that make legislative decisions and governments that design the Treaty. Let us denote the latter set by $\Psi = \{1', 2', ...n'\}$ with expected preferred policy positions $E\Lambda_{\Gamma,r} = \{E\lambda_{1r}, E\lambda_{2r}, ...E\lambda_{nr}\} := \{\psi_{1r}, ..., \psi_{nr}\}$ respectively. Then we have a $2n + 1$ player game $\mathcal{G}$ with a player set $N = \{\Psi, \Sigma, \Gamma\}$, where Σ, the agenda-setter, can be described as a seller of integration, Λ, the legislature, as a buyer and Ψ,the median voters, as a set of designers of the incomplete contract (rules of the game). In each issue and after observing the state of nature the agenda setter makes a proposal $\chi_{r,\theta}$.

The set of players' ideal points is defined as $\Delta = \{\psi_{1r}, ..., \psi_{nr}, \sigma_r, \lambda_{1r}, \lambda_{2r}, ...\lambda_{nr}\}$. Write $\Omega_{r,\theta} \in I$ for a decision made in issue $r \in R$ under state of nature $\theta \in \Theta$. The outcome $\Omega \subset I$ for the set of decisions in all issues in R under any state of nature in Θ. Pay-offs for the players are defined on the basis of distances between ideal points and the outcome. Hence

$$\Pi_r = (-E\left|\psi_{1r} - \Omega_r\right|, ..., -E\left|\psi_{nr} - \Omega_r\right|; -|\frac{m}{n}\left(\sigma_r - \Omega_r\right)|;$$

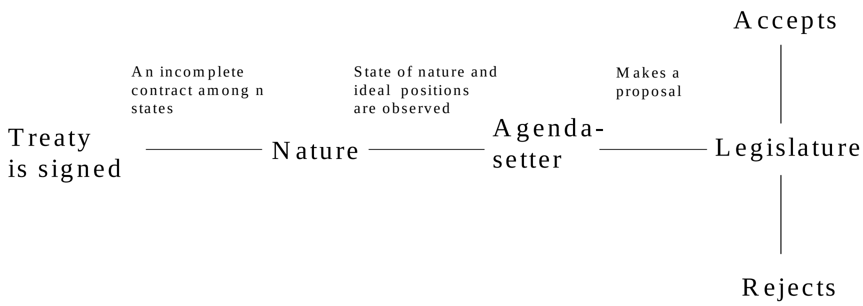

Figure 2.1: *The Game Tree*

$$-|\lambda_{1r} - \Omega_r|, -|\lambda_{2r} - \Omega_r|, ..., -|\lambda_{nr} - \Omega_r|),$$

where m is the number of countries that adopt the outcome and $\sigma \in I_+, \lambda \in I, \psi \in I$.[10] In terms of bargaining, we can interpret $|\lambda_{r,\theta} - \Omega_{r,\theta}|$ as a transfer from local player to a principal who faces a cost $|\sigma_{r,\theta} - \Omega_{r,\theta}|$ of providing integration in issue r under θ. Let $E\Omega_r = P(\theta)\,\Omega_r$ where $P(\theta)$ is a priori probability distribution for states of nature. We assume that countries are a priori similar and their ideal positions are uniformly distributed, hence $\lambda_i \sim U(\alpha, \beta) \quad \forall i \in \Gamma$ and $\psi_i = \frac{\alpha+\beta}{2}$. From the median voters' point of view their expected cost of integration is then $E|\psi_{ir} - \Omega_r|$. In the case where a proposal lapses, we simply have $\Omega_r = 0$, which is also the status quo point. In sum, we assume that median voters do not evaluate integration on issue-by-issue basis and their participation is based on expected outcomes. Figure 1 shows the game tree of the above described process.

[10] For example in the EU, the local agent consists of 15 governments. That is why λ should be interpreted here as a preferred point of a simple majority among the local representatives. In the next section, we extend the model to multi-agent case. The rules of the game are designed unanimously. Therefore, ψ is like an expectation. If $\psi < 0$ the median voter does not have expected gains from integration and hence does not participate (see section 2.3 below).

2.2. Constraints at Legislation Stage

The legislature forms its opinion in each issue after observing the state of nature and the participation means merely that a proposal on that issue is accepted. The agenda setter is supposed to participate by making proposals but she does not participate if the rules may lead to disintegration, hence $\Omega < 0$. Her participation constraint is

$$|\sigma_r - \Omega_r| \leq \sigma_r.$$

The costs of no-integration are $|\lambda_i|$, $|\sigma|$ and $E|\psi_{ir}|$. Moreover, suppose $\chi_r = 0 \Rightarrow \Omega_r = 0$.[11] Each player is assumed to be risk neutral and having linear loss function and trying to minimize the distance between Ω_r and her ideal point. Let q be the majority rule. Then $\mathcal{G}_{n,r} = (\{\Sigma, \Lambda, \Psi\}, (\chi_r; \Omega_r\,|(\chi_r, q)\,; q), (-E\,|\psi_{1r} - \Omega_r|, ..., -E\,|\psi_{nr} - \Omega_r|\,; -|n(\sigma_r - \Omega_r)|; -|\lambda_{1r} - \Omega_r|, -|\lambda_{2r} - \Omega_r|, ..., -|\lambda_{nr} - \Omega_r|))$ is game $\mathcal{G}$ with n local players in issue r.

Definition 1. *Let χ_r be a proposal. The self-selecting set of players S w.r.t. χ_r consists of players i for whom $|\lambda_{ir} - \chi_r| < |\lambda_{ir}|$. Let us denote such set by $S(\chi_r)$. More generally a self-selecting set of positions $\gamma \in [\alpha, \beta]$ consists of positions $\gamma \in \Upsilon$ for which $|\gamma_{ir} - \chi_r| < |\gamma_{ir}|$. A self-selecting set of players is $\chi-$accepting if $\sum_{i \in A} \mu(i) \geq q$ where $\mu : \Gamma \rightarrow [0,1]$ is the weight of player i, $\sum_{i \in \Gamma} \mu(i) = 1$, and $q \in (0.5, 1]$ is the treshold required for acceptance of χ and a self-selecting set of positions is $\chi-$accepting if $\int_{|\gamma_{ir} - \chi_r| < |\gamma_{ir}|} d\mu \geq q(\beta - \alpha)$. Let us denote such sets by $A(\chi)$.*

The definition gives the conditions that lead to acceptance of a proposal: the number of local players whose self-selection constraints are satisfied must be large enough to reach the required majority or in the case of positions it is required that a large enough sub-interval of positions on $[\alpha, \beta]$ accepts a proposal. Let us denote the classes of self-selecting and $\chi-$accepting sets by $\mathcal{S}(\chi)$ and $\mathcal{A}(\chi)$. Note that local players' individual rationality constraints yield that any accepting set of players (coalition) w.r.t. a given proposal is connected, i.e. if $i \in A \wedge i + 2 \in A \Rightarrow i + 1 \in A$.[12] and a set of positions

[11] This is because we assume that if the seller does not try to sell anything, the buyer cannot buy anything either. See, however, section 3 for more discussion.

[12] This is the usual critique that is expressed in spatial voting games literature towards power indices approach as in the latter coalitions that are considered are not necessarily connected (see Garrtet & Tsebelis 1998, Tsebelis & Garrett 1997).

The following definition conceptualises minimal winning coalitions with a given proposal χ when players' policy preferences lie on uni-dimensional space.

Definition 2. *A* $\chi-$*accepting set* $\overrightarrow{A}(\chi)$ *with the property* $\sum_{i\in \overrightarrow{S}} \mu(i) \geq q > \sum_{i\in \overrightarrow{S}} \mu(i) - \mu\left(\min_{j\in \overrightarrow{S}} \{\lambda_j\}\right)$ *is lower bound minimal accepting and a* $\chi-$*accepting set* $\overleftarrow{A}(\chi)$ *with the property* $\sum_{i\in \overleftarrow{S}} \mu(i) \geq q > \sum_{i\in \overleftarrow{S}} \mu(i) - \mu\left(\max_{j'\in \overleftarrow{S}} \{\lambda_{j'}\}\right)$ *is upper bound minimal accepting. The positions* $\overrightarrow{\lambda}(\chi) = \min_{j\in \overrightarrow{S}} \{\lambda_j\}$ *and* $\overleftarrow{\lambda}(\chi) = \max_{j\in \overleftarrow{S}} \{\lambda_j\}$ *are lower and upper bound pivotal if* $\overrightarrow{S\left(\overrightarrow{\lambda}(\chi)\right)} \in \overrightarrow{A\left(\overrightarrow{\lambda}(\chi)\right)}$ *and* $\overleftarrow{S\left(\overrightarrow{\lambda}(\chi)\right)} \in \overleftarrow{A\left(\overrightarrow{\lambda}(\chi)\right)}$ *respectively.*

The definition puts together minimal winning coalitions and spatial preferences since potentially pivotal players are pivotal only if their own ideal point would be accepted by the other players of a coalition. Otherwise they would not have bargaining power within the coalition. Note that there exist proposals that make χ-accepting sets and hence sets of upper and lower bound pivotal players empty but the classes $\overrightarrow{\mathcal{A}}$ and $\overleftarrow{\mathcal{A}}$ are non-empty, hence there exists a proposal, that is accepted by a minimal winning coalition. Since the proposal is assumed to be of take-it-or-leave type the agenda setter maximises her pay-off by picking a minimal winning coalition where either upper or lower bound pivotal player can be made indifferent between status quo and the proposal which is located as close as agenda setter's ideal point as possible.

2.3. Constraints of Treaty Design

From the local level's point of view there are three elements that affect the efficiency of the incomplete contract of integration. They are information, right to amend a proposal and the decision-making rule.

First, we assume that there must be expected gains from integration. Let $\lambda_i \sim U(\alpha, \beta)$. Let $E\pi_{i|in}$ and $E\pi_{i|out}$ denote local player i's expected pay-offs if she signs and does not sign the Treaty. Then we can write the participation constraint for the median voter in one country as follows

$$
\begin{aligned}
-E\pi_{i|in} &= \frac{|\alpha|}{\beta-\alpha}\left(\frac{-\alpha}{2}+E\Omega^*\right)+\frac{\beta}{\beta-\alpha}\left(\frac{\beta}{2}-E\Omega^*\right) && (IR_\Psi)\\
&\leq E\left|\lambda_i\right| = -E\pi_{i|out} && (2.1)
\end{aligned}
$$

this means that we must have $\beta > |\alpha|$ since from (IR_Ψ) we have $\frac{\beta^2-\alpha^2}{2(\beta-\alpha)} + \frac{|\alpha|-\beta}{\beta-\alpha}E\Omega^* < \frac{\beta+\alpha}{2} = E\lambda_i \Rightarrow \frac{2(|\alpha|-\beta)}{\beta^2-\alpha^2} < 0$ as $E\Omega^* > 0$. This only tells that the probability of expected gains from integration must exceed the probability of expected losses from integration.

Definition 3. *If (IR_Ψ) holds for all $i \in \Gamma$ then the outcome ex ante dominates status quo.*[13]

If this is the case we also have the following efficiency criteria.

Definition 4. *Let $\lambda_i \sim U(\alpha,\beta)$ and $\beta > |\alpha|$. The Treaty is ex ante efficient if $E\Omega^* = \frac{\beta}{2} = E(\lambda_i|\lambda_i > 0)$.*[14]

In other words, ex ante efficiency requires that the expected outcome (proposal) equals local players' expected preferred point.[15]

Then for ex post considerations we have

Definition 5. *Let $\lambda_i \sim U(\alpha,\beta)$ and $\beta > |\alpha|$ and let $\Omega^* \in [0,\beta]$ denote the equilibrium outcome. The outcome ex post dominates status quo if $\Pi_r(\lambda_i|\Omega^*) = |\lambda_i - \Omega^*| \geq |\lambda_i|$ for all $i \in \Gamma$ and $r \in R$ and $\Pi_r(\lambda_i|\Omega^*) = |\lambda_i - \Omega^*| > |\lambda_i|$ at least for one $i \in \Gamma$.The Treaty is ex post efficient if there are no alternative outcomes $\Omega' \in I$ that dominate Ω^*.*

Let us also define the following additional ex post dominance and efficiency requirements

[13] Note that $E\Omega^*$ depends on the majority rule. Later we derive how ex ante efficiency and the choice of the majority rule are related.

[14] Actually this is an implication of the property $\beta > |\alpha|$. This can be easily checked by minimizing IR_Ψ.

[15] Note that all local players have the same expectation of their preferred points. In this paper we do not consider the case where expectations may vary and its consequences. This is left for future work.

Definition 6. *The outcome ex post majority dominates status quo if* $\Pi_r(\lambda_i|\Omega^*) = |\lambda_i - \Omega^*| \geq |\lambda_i|$ *for all* $i \in M$ *and* $r \in R$ *and* $\Pi_r(\lambda_i|\Omega^*) = |\lambda_i - \Omega^*| > |\lambda_i|$ *at least for one* $i \in M$. *The Treaty is ex post majority efficient if there are no alternative outcomes* $\Omega' \in I$ *and majorities* M' *that majority dominate* Ω^*.

Majority dominance requires that there exists a majority and players in the majority are at least as well-off as in status quo. Let us also define the following form of flexible integration

Definition 7. *Let us refer to an outcome that is adopted by all local players as a common policy. Let us refer to a treaty that requires (a) that only a pre-defined majority of local players adopt a common policy and (b) defines alternative common outcome for those who don't adopt the common policy to flexible integration treaty.*

Note that we have written agenda-setter's utility $\Pi_\Sigma = -|n(\sigma - \Omega)|$. More generally, for flexible integration we have $\Pi_\Sigma^F = -|(n\sigma - m\Omega_i)|$ $s.t.$ $\Omega_i \geq 0$ where m is the number of players required for majority.

3. Results

Since information is perfect when the state of nature is observed the agenda-setter is able to observe the preferred points of decision-makers. As the proposal is of take it or leave it type the problem reduces to agenda-setter's maximization problem. Let us first make the following lemma

Lemma 1. *Let* $\overrightarrow{\lambda}(\chi)$ *and* $\overleftarrow{\lambda}(\chi)$ *be the positions of lower and upper bound pivotal players and let* $\chi \geq 0$. *Then* $2\overrightarrow{\lambda}(\chi) \geq \overleftarrow{\lambda}(\chi)$.

Proof. If $\chi \geq 0$ then $\overrightarrow{\lambda}(\chi) \geq 0$ and $\overleftarrow{\lambda}(\chi) \geq 0$ if they exist. A player with a position $\overrightarrow{\lambda}(\chi)$ accepts all proposals $\chi \in \left[0, 2\overrightarrow{\lambda}(\chi)\right]$. If $2\overrightarrow{\lambda}(\chi) < \overleftarrow{\lambda}(\chi)$ then the player with an ideal point $\overrightarrow{\lambda}(\chi)$ would not accept a proposal $\chi = \overleftarrow{\lambda}(\chi)$ and as being pivotal $\chi = \overleftarrow{\lambda}(\chi)$ would be rejected. But this is in contradiction with the fact that $\overleftarrow{\lambda}(\chi)$ is upper bound pivotal position, which would be accepted by a majority of players with $\lambda_i \leq \overleftarrow{\lambda}(\chi)$.

It is worth noting that lower and upper bound pivotal players must both accept a proposal. It is also possible that the latter does not exist. This holds when there are no minimal winning coalitions with the property given by lemma 1 above. A more significant implication of lemma 1 is, however, that the position of the lower bound pivotal player determines the equilibrium outcome. Then we have the following proposition, which characterizes the equilibrium in the decision-making game.

Proposition 1. *Suppose* $\mathcal{G}_n$ *with a player set* $N = \{\Sigma, \Gamma, \Psi\}$ *and the set of ideal points* $\Delta = \{\psi_1, ..., \psi_n, \sigma, \lambda_1, \lambda_2, ...\lambda_n\}$ *and with pay-off function* $\Pi = (-E\,|\psi_1 - \Omega|\,, ... - E\,|\psi_n - \Omega| - |n\,(\sigma - \Omega)\,|, -|\lambda_1 - \Omega|, -|\lambda_2 - \Omega|, ..., -|\lambda_n - \Omega|)$. *Then under complete information at legislation level we have the following sub-game perfect Nash equilibrium*

$$\chi^*(\lambda) = \begin{cases} \sigma & if \quad \left(\overrightarrow{\lambda} > \frac{1}{2}\sigma\right) \\ 2\overrightarrow{\lambda} & if \quad \overrightarrow{\lambda} \in \left(0, \frac{1}{2}\sigma\right] \\ 0 & if \quad \overrightarrow{\lambda} \leq 0 \end{cases}$$

Proof. *If* $\overrightarrow{\lambda} > \frac{1}{2}\sigma$ *there exists a majority that accepts* σ. *If* $\overrightarrow{\lambda} \in \left(0, \frac{1}{2}\sigma\right]$ *a proposal* $2\overrightarrow{\lambda}$ *is accepted by a majority and it is also the closest accepted proposal to* σ *since* $\overleftarrow{\lambda} \leq 2\overrightarrow{\lambda}$ *because otherwise* $\overleftarrow{\lambda}$ *would be rejected or* $\overrightarrow{\lambda}$ *would not be the uppest lower bound of pivotal points. If* $\overrightarrow{\lambda} \leq 0$ *there exists no* $\chi > 0$ *s.t.* $A(\chi) \neq \emptyset$.

Note that the optimal proposal depends on the $\overrightarrow{\lambda}(\chi) = \inf\left\{\overrightarrow{\lambda_k}\right\}$, i.e. the uppest lower bound of $\chi-$pivotal positions. From the Treaty design perspective the median voters are only able to use the probability distribution of $\overrightarrow{\lambda}$ when making ex ante optimality or efficiency considerations. The Treaty is assumed to be ex ante efficient due to individual rationality constraints of median voters. Since information is complete it is easy to see that *majority rule efficiency* is reached regardless of the chosen majority rule. The agenda-setter simply picks the majority where the uppest lower bound pivotal player is closest to her preferences or in the case where the status quo point lies further from $\overrightarrow{\lambda}$ than σ the agenda-setter puts $\chi = \sigma$.

From statistics we know

$$\lambda_{(n-m)} \sim beta\,(n-m, m+1)$$

where n is the number of local players and m is the number of players required for majority, hence $\lambda_{(n-m)}$ is the uppest lower bound pivotal player. Now $E\lambda_{(n-m)} = \frac{n-m}{n+1}$. The expected location $E\eta\left(\lambda_{(n-m)}\right)$ of $\lambda_{(n-m)}$ on $[\alpha, \beta]$ can be written

$$\begin{aligned} E\eta\left(\lambda_{(n-m)}\right) &= \alpha + E\lambda_{(n-m)}(\beta-\alpha) \\ &= \alpha + \frac{n-m}{n+1}(\beta-\alpha) \\ &= E\overrightarrow{\lambda} \end{aligned}$$

Write $q' = 1 - \frac{n-m}{n+1} = \frac{m+1}{n+1}$. Then we have $E\eta\left(\lambda_{(n-m)}\right) = q'\alpha + \left(1-q'\right)\beta \rightarrow q\alpha + (1-q)\beta$ when $n \rightarrow \infty$. For simplicity let us assume that n is sufficiently large. Then we have

Proposition 2. *If $\alpha = 0$ then any $q \in \left(\frac{1}{2}, \frac{3}{4}\right]$ is ex ante efficient.*

Proof. If $\alpha = 0$ we have $E\Omega^* = \sigma$ if $(1-q)\beta \geq \frac{1}{2}\sigma \Rightarrow q \in \left(\frac{1}{2}, \frac{3}{4}\right]$ as $q > \frac{1}{2}$ by definition and $E\sigma = \frac{1}{2}\beta$.

In other words if there are expected gains of integration for all local players both ex ante efficiency can be reached on quite wide range of majority rules. Note, however that in ex post terms the outcome is neither necessarily efficient for players that belong to a minority nor it does dominate status quo. Moreover if $\alpha < 0$ this becomes more likely. Only majority rule efficiency can be reached. We may write the following.

Remark 1. *In common policies, unanimity rule is the only voting rule that yields ex post efficiency in $\mathcal{G}_n$ under perfect information. If $\alpha = 0$ the expected outcome is $2E(\min\{\lambda_i\} \mid \min\{\lambda_i\} \geq 0) > 0$. If $\alpha < 0$ the expected outcome is $0 < \varepsilon < 2E(\min\{\lambda_i\} \mid \min\{\lambda_i\} \geq 0)$ where $\varepsilon \underset{n\rightarrow\infty}{\rightarrow} 0$.*

It is worth stressing that under unanimity rule agenda-setting does not make sense any more and the game could be organised as an issue-by-issue bargaining.

We can calculate the probability of being outvoted for each local player or probability of an outcome which is individually ex post dominated by status quo, $P_i(IE)$. If $\alpha = 0$ it is $P_i(IE) = \frac{(1-q)\beta}{\beta-\alpha}$. With this respect $q = \frac{3}{4}$ is the ex post best decision-making rule among ex ante efficient rules if $\alpha = 0$.

More generally ex ante efficiency can be reached if $\frac{-1}{c} q\beta + (1-q)\beta \geq \frac{1}{4}\beta$ where $c = -\frac{\alpha}{\beta}$. This yields

Proposition 3. *if* $|\alpha| > 0$ *ex ante efficiency requires* $\frac{1}{2} < q \leq \left(\frac{3}{4}\right)\frac{1}{1+c}$. *If* $c > \frac{1}{2}$ *there exists no ex ante efficient majority rules.*

Proof. *Note that* $E\sigma = \frac{1}{2}\beta$.*If* $\alpha < 0$ *we have* $E\Omega^* = \frac{1}{2}\beta$ *if* $q\alpha + (1-q)\beta \geq \frac{1}{4}\beta$. *Write* $-\alpha = c\beta$. *Then* $-cq\beta + (1-q)\beta \geq \frac{1}{4}\beta \Rightarrow \frac{3}{4} \geq q(1+c)$ *which yields* $\frac{1}{2} < q \leq \left(\frac{3}{4}\right)\frac{1}{1+c}$. *If* $c > \frac{1}{2}$ *the left-hand falls below* $\frac{1}{2}$.

The proposition shows the trade-off between ex ante and ex post efficiency. If the probability of no gains from integration increases ex ante efficiency can only be reached with a lower majority rule. This, on the other hand implies ex post inefficiency. There also exists a treshold $-\alpha = \frac{1}{2}\beta$ beyond which ex ante efficiency cannot be reached.

Note that to reach ex ante efficiency the local players give all power to the agenda-setter. Since ex ante efficiency can be reached if $\frac{-1}{c} q\beta + (1-q)\beta \geq \frac{1}{4}\beta = \frac{1}{2}E\sigma$ this is actually equivalent with $E\chi^* = \sigma$. In other words ex ante efficiency is achieved as far as the expected equilibrium proposal is equal with the preferred point of the agenda-setter.

On the other hand, the ex post pay-off vector may be written

$$\begin{aligned}\Pi_P &= (-n\left|\sigma - \min\left\{\sigma, 2\overrightarrow{\lambda}\right\}\right|, \\ &\quad -|\lambda_{(1)} - \min\left\{\sigma, 2\overrightarrow{\lambda}\right\}|, -|\lambda_{(2)} - \min\left\{\sigma, 2\overrightarrow{\lambda}\right\}|, ..., -|\lambda_{(n)} - \min\left\{\sigma, 2\overrightarrow{\lambda}\right\}|)\end{aligned}$$

which implies that all local players with $\lambda_i < \min\left\{\frac{1}{2}\sigma, \overrightarrow{\lambda}\right\}$ will be worse off ex post. Consider next the following very simple way of decentralize the outcome. Let us assume that each local player has the right to either accept a proposal χ or to choose status quo point. This does not affect ex ante efficiency nor as far as $\beta > |\alpha|$. This would not change agenda-setters equilibrium strategy either since it is based on the location of pivotal player's preferred point or her own preferred point. Ex post pay-off vector is then

$$\begin{aligned}\Pi_P &= (-m\left|\sigma-\min\left\{\sigma,2\overrightarrow{\lambda}\right\}\right|-(n-m)\,\sigma,-|\lambda_{(1)}-\min\left\{\sigma,2\overrightarrow{\lambda}\right\}|,...,\\ &\quad -|\lambda_{(m)}-\min\left\{\sigma,2\overrightarrow{\lambda}\right\}|,-\left|\lambda_{(m+1)}\right|,...,-|\lambda_{(n)}|)\end{aligned}$$

which is ex post efficient. This, in fact, means that both ex ante and ex post efficiency can be reached by using flexible integration rules as defined in previous section. It is also worth stressing that under this rule the agenda setter may have incentives to use effectively a higher majority rule than it is written in the Treaty. This implies that the agenda-setter does not pick the uppest lower bound pivotal point but makes her proposal on the basis of "lower" integration level. Let Ω' denote an alternative proposal as follows

$$\Omega' = 2\lambda_{(n-m-j)},\quad j \leq n-m+1.$$

Then the agenda-setter chooses Ω' instead of Ω^* if

$$\sigma-\left(\frac{m}{n}\right)\Omega^* > \sigma-\left(\frac{m'}{n}\right)\Omega'$$

which yields

$$\frac{\Omega'}{\Omega^*} > \frac{m}{m'}.$$

In other words if the uppest lower bound pivotal player of a super majority $\left(\frac{m'}{n}\right)$has her position closer to $\overrightarrow{\lambda}$ than the required majority share is to super majority share then it is optimal for the agenda-setter to choose a super majority. Note that this logic may even result a unanimity support.

4. Conclusions

This paper has dealt with efficient design of an integration treaty. The main emphasis of the paper is on decision-making rules. The paper has made a distinction between on the one hand the treaty design and on the other hand decision-making procedure with the rules designed in the treaty.

If information is perfect in the decision-making procedure there is a clear trade-off between ex ante and ex post efficiency when only common policies are used. There is an upper limit for majority rules that can lead to ex ante efficiency whereas only unanimity rule leads to ex post efficiency. To minimize ex post inefficiency the upper limit of ex ante optimal decision-making rules should be chosen.

The definition of ex post efficiency that is used in the paper is very strict as it requires that local players must be better-off in all issues under any state of nature. This does not allow log-rolling. It is quite easy to see that the probability of being worse-off declines very quickly if two or more issues are decided as a package. If the number of issues is substantially large the probability of being ex-post worse-off goes to zero. This, in fact, corresponds with the requirement of expected gains from integration, which forms the basis for local players' participation constraint. In ex post terms this means that in the long run a majority rule should be ex post efficient if it is ex ante efficient.

When decision-makers are able to choose between zero integration and a proposal both ex ante optimality and ex post efficiency in a strict sense can be reached. Then the majority rule should be chosen from the interval $\left(\frac{1}{2}, \frac{3}{4}\right]$. Under this flexible arrangement it is possible that the agenda-setter starts using super-majorities when choosing its proposals. This, in fact, redistributes power from the agenda-setter and majority members for those who would be in minority.

Table 1. Summary of efficiency results

	Majority, q	*Ex ante efficient*	*Ex post efficient (strict)*
Common policy	$\frac{1}{2} < q \leq \left(\frac{3}{4}\right)\frac{1}{1+c}$	YES	NO
Common policy	$\left(\frac{3}{4}\right)\frac{1}{1+c} < q < 1$	NO	NO
Common policy	$q = 1$	NO	YES
Flexible policy	$\frac{1}{2} < q \leq \left(\frac{3}{4}\right)\frac{1}{1+c}$	YES	YES

A comparison of different voting rules and requirements is shown in table 1. Among the alternative rules that are analysed in this paper flexible integration seems to be the best since it yields ex ante efficiency and both short and long run ex post efficiency. Ex ante efficient rules yield long rung gains ex post and the more likely it is the closer the chosen majority rule is to the upper limit of ex ante efficient rules. If the likelihood of no gains from integration is high enough - one third or higher - ex ante efficiency cannot be reached although there are expected gains from integration. If only strict ex post efficiency is required the expected outcome converges to status quo solution and there is no sense to set the rules as issue-by-issue unanimity bargaining would indicate the same result.

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