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National Interests, EU Enlargement and Coalition Formation

Four Essays on National Influence in the EU

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ABSTRACT: The study examines member states national influence in the decision making of EU Council. The analysis is based on power and control measures of cooperative games. The study consists of two parts, the first one of which concentrating on the EU enlargement's impacts on the distribution of power and, the second one of which enlightening how the distribution of power is affected by coalition formation. The first contribution essay in chapter 2 introduces a quantitative measure for analysing the influence deficit of the EEA agreement compared to opportunities for wielding influence as EU member. It is shown that the measure could get both positive and negative values and that it increases as the efficiency inside the Union improves. Chapter 3 concentrates on the EFTA entrants' influence in the Union and their impact on decision making abilities. It is shown that the EFTA countries, althrough having a significant opportunities to wield influence, cannot cause a major policy change in the Union. This is due to Union's tendency to secure the best opportunities to exert power via blocking decisions. The EFTA countries do not create an inefficiency problem - it already exists. Chapter 4 extends the analysis to coalitions. The well-known sub-systems inside the Union are studied. It is shown that small coalitions do not notably change the distribution of voting power, but they strengthen possibilities to represent national views via blocking the passage of proposals. In chapter 5, the assumtion of identical preferences inside coalitions is abandoned. It is thus allowed that coalition members collaborate with members of other coalitions. Two voting issues, trade policy and social regulation, of the EU are studied with the model. It is explicitly shown how members of predetermined unions gain in exerting blocking power even in the case they do not form a blocking minority. For this reason, in the voting issues studied in chapter 5, a major policy change is unlikely, althrough pressures to take the EFTA entrants' views into account, create an additional dimension to common policies of the EU. The motivation of the study, as well as a more extensive summary of results are presented in the introductory essay. Some open questions are left for future work.

Key-words: cooperative games, decision making, EU, voting power

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TIIVISTELMÄ: Tutkimus tarkastele jäsenmaiden vaikutusmahdollisuuksia EU:n päätöksenteossa. Analyysi perustuu kooperatiivisen peliteorian valta- ja tyytyväisyysindekseihin. Tutkimus sisältää kaksi osaa, joista ensimmäinen käsittelee EU:n laajenemista EFTA-mailla ja toinen koalitioiden merkitystä vallan jakaumalle. Luvussa 2 esitetty ensimmäinen kontribuutioessee esittelee kvantitatiivisen tavan mitata ETA-ratkaisun ja EU-jäsenyyden välistä eroa vaikutusmahdollisuuksissa. Tutkimus osoittaa, että niin sanottu vaikutusvaje voi olla joko positiivinen tai negatiivinen ja että se kasvaa, kun EU:n tehokkuus paranee. Luvussa 3 keskitytään EFTA-maiden vaikutusvaltaan unionissa ja niiden aiheuttamiin muutoksiin vallan jakautumisessa. osoitetaan, että EFTA-mailla on merkittävät mahdollisuudet vaikuttaa, mutta suuria politiikkamuutoksia ne eivät voi saada aikaan. Tämä johtuu EU:n päätöksentekojärjestelmästä, jossa mailla on insentiivit edustaa kansallisia näkemyksiään uhkaamalla päätösten estämisellä. EFTA-maat eivät luo tehottomuusongelmaa unioniin, vaan se on jo olemassa. Luvussa 4 tarkastelu laajennetaan koalitioihin. Luvussa tutkitaan EU:n tunnettuja alisysteemejä. Koalitiot eivät muuta merkittävästi vallan jakaumaa, mutta parantavat mahdollisuuksia tuoda kansallisia näkemyksiä esille, koska uhkaus päätösten estämisestä tulee vakuuttavammaksi. Luvussa 5 luovutaan oletuksesta, että koalitiot ovat pysyviä. Näiden niin sanottujen semikoalitioiden jäsenet voivat tehdä yhteistyötä myös koalition ulkopuolisten jäsenten kanssa. Luvussa näytetään eksplisiittisesti, kuinka insentiivit edustaa näkemyksiään päätösten estämisen kautta muodostuvat. Luvussa tarkastellaan kahta esimerkkitapausta: kauppapolitiikkaa ja sosiaalinormistoa. EFTA-maat eivät saa aikaan politiikan suunnanmuutosta, mutta saavat omat etunsa mukaan edustetuiksi osana EU:n yhteistä politiikkaa. Tutkimusaiheen perustelut ja tulosten laajempi esittely ovat löydettävissä johdantoluvusta, jossa nostetaan esille myös joitain avoimia kysymyksiä tulevalle tutkimukselle.

Asiasanat: EU, kooperatiiviset pelit, päätöksenteko, valtaindeksit

Preface

This collection of essays consists of three journal articles, an article in a CEPR conference volume and an introductory essay. The articles are as follows:

1. Kari Alho and Mika Widgrén: "Economics and Politics of EU Enlargement", World Economy, Vol. 17, September 1994;

2. Mika Widgrén: Voting Power and Control in the EU Council: The Impact of the EFTA Entrants, in Baldwin, Haaparanta and Kiander, eds., Expanding Membership of the European Union, CEPR, Cambridge University Press;

3. Mika Widgrén: Voting Power in the EC and the Consequences of Two Different Enlargements, European Economic Review Vol 38, No. 5, 1153-1170;

4. Mika Widgrén: Probabilistic Voting Power in the EU Council: The Cases of Trade Policy and Social Regulation, The Scandinavian Journal of Economics 97(2), 345-356.

I was introduced to the subject matter of the theoretical part of this thesis by Matti Pohjola already during an undergraduate course in microeconomics which he gave at the University of Helsinki in fall 1986. I wrote my master's thesis on the Shapley value, which is the most important theoretical backbone of this study. During that time I benefitted for valuable comments from Yrjö Vartia and Matti Pohjola, who has been my supervisor ever since.

The major part of this study was carried out at the Research Institute of the Finnish Economy (ETLA) in 1991-1994. There Kari Alho gave me the impetus to apply the methods of this study to EU decision making a long time before Finland's application for membership was seriously debated. During my stay at ETLA I also benefitted from several discussions with Pentti Vartia and the comments from the participants of the seminars at the Institute. Also the opportunities to contribute to studies carried out by ETLA's research program for European integration and my affiliation with CEPR's international trade program in 1994 provided a sound background for this thesis.

The thesis has been completed at the Yrjö Jahnsson Foundation, my current employer, which has supported the study from the very beginning. The Foundation's chairman Chancellor Jaakko Honko and Managing Director Arto Alho have given me their full support to take the final steps with the thesis during the last year. During the final phase also Seppo Honkapohja gave me valuable advice concerning the dissertation. Both ETLA and the Foundation has provided exellent research facilities and an encouraging atmosphere to carry out this study. I am grateful for the Foundation for research grants in 1990, 1991, 1992 and 1993 as well as for a grant from the Finnish Cultural

Foundation in 1991. An award for my licentiate thesis from the OKO-Bank Group's Research Foundation is gratefully acknowledged.

I have presented parts of my work in several seminars, in which I have got valuable comments from Pekka Ahtiala, Kari Alho, Richard Baldwin, Robert Baldwin, Carl Hamilton, Reino Hjerppe, Seppo Honkapohja, Vesa Kanniainen, Klaus Kultti, Lars Lundberg, Arne Melchior, Hannu Nurmi, Matti Pohjola, Gérard Roland, Hannu Salonen, André Sapir, Enrico Spolaore, Antti Tanskanen, Pentti Vartia, Alan Winters, Andreas Wörgötter and Stephen Yeo. Thanks are also due to John Rogers, who has polished my English.

Finally, I want to express my love to my wife Tea and my twin sons Joona and Miska, who have given their full support and love for me in these years. For reaching this point, I owe them my deep gratitude.

Espoo, March 1995

Mika Widgrén

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Chapter 1

Measuring National Influence in the European Union: An Introductory Essay

1 Background

The four essays collected herein deal with national influence on the European Union. There are two main themes behind the analyses: first, the accession of the three EFTA countries into the EU and, second, coalition formation and its impacts on the distribution of power and on possibilities to represent national views in the Union. The accession of the three EFTA countries into the Union plays an important role also in the second part of this study.[1].

The analysis of this study is concentrated on the EU Council of Ministers. The motivation behind this restriction is the inter-governmental decision making system of the EU. National interests are represented in the Council which is also the decision making body of the European Union.

In the Council, Germany, Italy, France and the UK have 10 votes each; Spain 8 votes; the Netherlands, Greece, Portugal and Belgium 5 votes each; Denmark and Ireland 3 votes each and Luxembourg 2 votes. Most decisions are made by a qualified majority which was made up of 54 votes before the EFTA countries' entry. Among the new entrants Austria and Sweden have 4 votes and Finland has 3 votes. After the enlargement 62 votes out of 87 are required for a qualified majority. Let us denote the EU before the enlargement by EU(12) and after the enlargement by EU(15). The study also investigates the EU(16) which is the EU(15) plus Norway, and EU(19), which contains the EU(12) and the seven EFTA countries before Austria, Finland and Sweden gave up their EFTA membership in 1994 (see chapter 4).[2]

The influence of the national governments is analysed using the power and control measures of cooperative game theory. The most well-known representative of these measures is the Shapley-Shubik index of power (Shapley and Shubik 1954), which is based on the Shapley value introduced by Lloyd Shapley (1953) [3]. Following the general approach of cooperative games these measures do not contain any explicit non-cooperative bargaining model for coalition formation. [4] The main purpose of all power measures is to

[1]One aspect of the EFTA countries accession is the formation of a Nordic sub-system inside the Union. This has been analysed briefly in chapter 4. A more detailed discussion can be found in Widgrén (1993a). Another additional theme is the need for a voting rule reform after the accession of the three EFTA countries. Its consequences are analysed in chapter 3 but a more detailed discussion can be found in Widgrén (1994a).

[2]Chapter 4 was first published before the referenda in Austria, Sweden, Finland and Norway. The difference between the results regarding the EU(15) and EU(16) is small. As regards the Nordic cooperation without Norway, see, however, Widgrén (1993a).

[3]There is an extensive literature concerning the Shapley value and its reformulations and generalisations. One noteworthy collection of essays is Roth (1988a), which was composed in honour of Lloyd Shapley's 65th anniversary. A survey of the Shapley value and its generalizations is Widgrén (1990).

[4]About the bargaining foundations of the Shapley value, see Gul (1989). For a more general discussion on the bargaining foundations of cooperative solution concepts, see Nash (1950) and Binmore and Dasgupta (1987).

evaluate voters' a priori prospects of playing a game.

In Shapley's original work the approach was axiomatic [5]. Thus players' voting behaviour was modelled by using a set of general assumptions [6]. In this study, however, we apply a probabilistic approach which is introduced by Straffin (1977, 1988). [7] [8] The main difference between the axiomatic approach and the probabilistic approach is that the latter makes assumptions directly concerning the voting behaviour while the former restricts rather the properties of the measures - or the solution concepts - themselves. [9]

Here we have chosen the probabilistic approach for three reasons. First, although the axiomatic approach is very elegant, [10] the probabilistic approach serves a wider scope to analyse different voting situations. Also, since our goal is to measure national influence, it is natural to utilize the probability measure interpretation of voting power rather than the axiomatic solution interpretation.[11] Second, the probabilistic interpretation allows us to introduce a concept of control which is another way to evaluate players' influence in voting games [12]. Power and control are the two main themes of this study. A third reason for applying the probabilistic approach is that the probabilistic assumptions regarding the voting behaviour are, at least in principle, statistically testable [13]. The probabilistic approach also allows us to test the stability of the results in a more sensible way since the development of the different variants of a power measure is straightforward. This can

[5]For a more detailed discussion about the axiomatization of the power measures and their refinements, see Shapley (1953), Bolger (1979), Chun (1989), Dubey (1975), Dubey, Neyman and Weber (1981), Lehrer (1988), Owen (1982a), Packel and Deegan (1980) and Young (1985).

[6]The original axioms were symmetry, efficiency and linearity. Symmetry states that similar players should have similar prospects. In voting games two voters with the same number of votes should be equally powerful. Efficiency means that the gains of playing a game should be divided consistently and linearity means that when two independent games are combined the value of the combined game should be equal to the sum of the values in the two games.

[7]Regarding the probabilistic power measures, see also Owen (1972, 1977, 1982, 1988), Rothblum (1988), Starffin, Davis and Brams (1982), Weber (1989, 1988) and Widgrén (1993, 1994).

[8]One interpretation of the Shapley value is that it is an expected utility of playing a game. For a more detailed discussion, see Roth (1977a, 1988a, 1988b).

[9]In his original work Shapley (1953) actually suggested that the Shapley value is a unique solution concept for the n-person cooperative games.

[10]For simple voting games, see Dubey (1975), Dubey and Shapley (1979).

[11]In empirical studies the probabilistic approach is common. It is a much more pragmatic way to model voting situations than the axiomatic approach since it focuses on individuals' voting behaviour. Examples can be found in Owen (1982), Leech (1988), Pohjola (1987) and Widgrén (1993a, 1993b, 1994a, 1994b, 1994c, 1995a). For a more detailed discussion, see Straffin (1988) and Widgrén (1995b).

[12]There are two important questions for an individual member concerned when evaluating his or her position in the body. They are 1) the question of effect on outcome (i.e. what is the probability that an individual's vote will make a difference in the group decision) and 2) the question of group-individual agreement (i.e. what is the probability that the group decision will agree with an individual's vote) (see Straffin, Davis and Brams 1982, Straffin 1988). In this study we evaluate the first question by the measures of voting power and the second one by the measures of control

[13]It is worth noting, however, that the secrecy of the decision making in the EU Council prevents us from testing the assumptions.

be illustrated roughly as follows. In the axiomatic approach the two most well known measures of voting power, namely the Shapley-Shubik index and the Banzhaf-index, are different solution concepts since they have different axiomatizations behind them. In the probabilistic approach these two indices belong to the family of probabilistic power indices and basically they are based on a rather similar joint probability distributions regarding the voting behaviour.

Power and control indices do not concentrate on any particular question of voting but rather measure national influence in an abstract sense. They capture some general features behind the players' voting behaviour. It can be argued that the power measures of cooperative games analyse the voting body rather than the voters (see Straffin 1988). In this sense they serve an efficient method to describe a voting body much more appropriately than by using the voting weights [14].

2 On Voting Power and Control

While the intuitive meaning of influence is easy to understand, its formal quantitative definition is more difficult. Perhaps the most important question to be posed is "What kind of elements regarding influence we can take into account?" In each voting body - like the EC Council of Ministers - there are formal and informal ways to influence an outcome. The former is based on voting weights that each member state has in voting and the latter is based on personal contacts, ministers' support groups, officials, lobbyists, etc. In this sense the measurable part of power is restricted only to the formal part. This kind of approach can be critisized since the measures do not take into account that voter A has, for example, a wider range of important personal contacts of better information channels than voter B. However, the formal analysis of influence can also be easily defended since we may always ask, "Can we really say anything about the informal contacts in a measurable sense?" To elaborate on this question more it is worth stressing that for a formal measure of influence we need something that is observable and longlasting enough. For the informal ways of wielding influence it is typical that they are neither observable nor longlasting since, for example, the governments change. The formal analysis of influence assumes that each voter has unlimited possibilities to make personal contacts, to get information, etc. This sounds quite reasonable because the ways to get informal power are not restricted - as long as voters remain within legal limits.

In this study we distinguish between two different aspects of influence in EU decision making. First, we analyse the question of power. We define power as the probability that a member state affects the voting outcome, (i.e. the probability of making a difference in

[14] It is common knowledge that in general the voting weights are poor proxies for measuring how powerful a voter is.

the group decision). Our second question concerns control of decisions. We investigate control by estimating probabilities for so-called group-individual agreement (i.e. the probability that the group decision will agree with one's decision and it will block a decision if an individual votes 'against' and ensure acceptance of a proposal if it votes 'for'). We call the former negative and the latter positive control. With these control measures we can analyse the risk of being outvoted, which is an essential question for every member state when unanimity is not needed for decisions.

Cooperative game theory is based on comparisons of voting outcomes. Let N denote the set of n players (voters). It is worth stressing that we make no distiction between the outcomes of a vote and coalitions. In simple voting games with n voters we can divide the 2^n possible yes-vote coalitions into either winners (majorities) or losers (minorities) [15]. Formally, a weighted voting game can be defined as a function $w = w[q; w_1, \ldots, w_n; p_1, \ldots, p_n]$, where $q \in [0, 1]$ is the share of votes required for a majority, w_i:s are the voting weights and p_i:s are probabilities that i votes for a random bill. These probabilities describe voters' preferences. The p_i-values close to one reveal that i is likely to support a proposal and hence it is important for this voter to obtain the proposal's aims.

The comparison of voting outcomes can be formalized by the following function

$$v(S) = \begin{cases} 1, & \text{if } \sum_{i \in S} w_i \geq q \\ 0, & \text{otherwise} \end{cases} \tag{1}$$

where $v : 2^N \mapsto \{0, 1\}$ denotes an indicator which simply distinguishes between winning and losing coalitions by taking into account the majority rule $q \in [0, 1]$. Equation (1) is usually referred to as a *coalitional form* of the game. [16]

To answer the question of how powerful a certain voter i is we have to define the coalitions (or outcomes) in which the voter is crucial. It should be intuitively clear that voters are crucial to the outcome exactly when they can swing a majority to a minority. We call the group of these coalitions minimum winning coalitions with respect to i. To answer the question of *positive control* we simply pick out the majorities where a certain voter is a member and to analyse *negative control* we need the minorities where i is not a member (i.e. the voter votes 'no' and the yes-vote coalition cannot form a majority). It is easy to see that the aspects of influence can be easily measured with the help of probabilities for the above-mentioned events. The basic idea behind the probabilistic

[15] Note that we assume that voters can either vote 'yes' or 'no'. The decision whether to vote or not is not modelled. In the EU Council this simplification is not very serious since an absention has the same impact as a no-vote.

[16] Note that the original term used by von Neumann and Morgenstern (1944) was a *characteristic function*. The term coalitional form describes the idea more properly. For a more detailed discussion, see Aumann (1987).

approach is to calculate mathematical expectations for these probabilities (see chapter 4).[17]

In general terms, let $\mathcal{W}$ denote the class of winning coalitions (majorities) formally defined as follows: $\{S \in \mathcal{W}\} \Leftrightarrow \{S \in 2^N,\ \mu(S) \geq q\}$ where $\mu(S)$ denotes the number of votes in coalition S and q denotes the required majority rule. Let us denote the complement class of $\mathcal{W}$ by $\mathcal{L}$ and refer to its sets as losing coalitions. In addition, it is easy to see that the coalitions with a losing complement coalition form a class of blocking coalitions $\mathcal{B}$.

Let us now write the probability that a coalition S is formed as follows: $P\{\mathcal{S} = S\} = \Pi_{i \in S} p_i \Pi_{j \notin S}(1 - p_j)$. If we take the sum of these probabilities multiplied by the values of coalitional form over all possible coalitions, we will have the mathematical expectation for the value of function v. This expectation is often called the *multilinear extension* (MLE) of v defined by Owen (1972, see footnote 17). Let us denote the MLE by $f(p_1, \ldots, p_n)$. Let us now define a dual for (1) as follows: $v^*(S) = v(N - S)$. It is easy to see that while v is an indicator for the winning coalitions v^* is an indicator for the blocking coalitions. Let us denote the MLE for $v^*(\cdot)$ by $f^*(\cdot)$ respectively.

Particularly, for the voting games defined above $f(p_1, \ldots, p_n)$ and $f^*(p_1, \ldots, p_n)$ can be interpreted as probabilities, because $v(\cdot)$ and $v^*(\cdot)$ are indicator variables. As regards control we may write the following conditional probability for i's positive control

$$P\{S \in \mathcal{W} | p_i = 1\} = \sum_{i \in S, S \in \mathcal{W}} \prod_{j \in S - \{i\}, j \neq i} p_j \prod_{k \notin S, k \neq i} (1 - p_k) = f(p_1, ..., p_n | p_i = 1) \qquad (2)$$

and for negative control

$$P\{S \in \mathcal{B} | p_i = 0\} = \sum_{i \notin S, S \notin \mathcal{W}} \prod_{j \in N - S, j \neq i} (1 - p_j) \prod_{k \in S} p_k = f^*(p_1, ..., p_n | p_i = 1). \qquad (3)$$

Let us refer to equation (2) as a *polynomial for positive control* and to equation (3) as a *polynomial for negative control* respectively.

The traditional power indices, namely the Shapley-Shubik and Banzhaf indices, presume that voters exert power whenever their vote makes a difference to a decision. In voting

[17] A slightly different interpretation is presented in Owen (1982). He refers to linear algebra where each coalition is can be illustrated as a corner of the unit hyper-cubic, i.e. a point where the coordinates are either one or zero. The former stands for voting 'yes' while the latter stands for voting 'against'. Let n denote the dimension. The hyper-cubic has 2^n corners in an n-dimensional space. Now, by extending (1) to the whole cubic the analogy to the probabilistic approach is reached.

games this happens when the voter is able to swing a losing coalition into a winner. The power index is the probability that a voter is able to make the difference. We refer to the majorities which can be turned into a loser by the removal of one player as *minimum winning coalitions*. Let us define a class of such coalitions $\mathcal{M}$ as follows: $\{S \in \mathcal{M}\} \Leftrightarrow \{S \in \mathcal{W},\ \exists i \in S:\ S - \{i\} \in \mathcal{L}\}$. In particular, we are interested in the sub-class $\mathcal{M}_i$ of $\mathcal{M}$ defined for any fixed i. Hence $\{S \in \mathcal{M}_i\} \Leftrightarrow \{S \in \mathcal{W},\ S - \{i\} \in \mathcal{L}\}$. The class $\mathcal{M}_i$ defines the coalitions where i is critical in the above-mentioned sense. It is referred to as *minimum winning coalitions* w.r.t. i. Hence power can be now written as follows

$$P\{S \in \mathcal{M}_i\} = \sum_{S \in \mathcal{M}_i} \prod_{j \in S - \{i\}} p_j \prod_{k \in N - S} (1 - p_k) = f_i(p_1, ..., p_n), \tag{4}$$

which is referred to as *power polynomial* and where $f_i(\cdot)$ denotes the i^{th} partial derivative of f. Note that equation (4) does not involve p_i.

To calculate the explicit probabilities that 'a voter has power or control' we need a probability distribution for outcomes. To define a probability distribution for the occurence of outcomes we need a probability model for each voter's behaviour (i.e. a probability distribution for the probability that i votes 'yes' or 'no'). There are two possible ways to define such a distribution, namely to estimate statistically the joint probability distribution for the voting behaviour of each voter by using historical data [18] or to work with reasonable a priori assumptions.

In the EU Council of Ministers the choice is simple because voting is secret and there is no historical data available. Yet, it is worth stressing that even if we had voting data for a certain period, it is not necessarily reasonable to use it because of the fact that governments change and thus national interests could change over time. Historical data does not necessarily contain enough information to make conclusions about the future or it might lead to biased conclusions about future voting. That is why general a priori types of assumptions are usually used in formal analysis of power (see, however, Lane and Stenlund 1989).

Perhaps, the simplest a priori assumption is to suppose that each outcome occurs with equal likelihood. Actually, this very simple assumption is a consequence of the so-called *independence assumption*, whereby it is supposed that each voter i independently chooses the probability p_i to vote 'yes' from a uniform distribution. On average they are indifferent on whether to vote 'yes' or 'no'. Each voter's behaviour can be interpreted as a Bernoulli experiment with a probability of 1/2 and the number of voters giving a yes-vote is binomially distributed, as we know from the basics of probability calculus.

[18] See, however, the discussion in Straffin (1988).

Thus independence indicates that each voter tosses a coin to choose whether to vote 'yes' or 'no'.

The independence assumption can also be characterised with the concepts of information and communication. Choosing a probability from a uniform distribution illustrates that we do not know anything about the voting proposal. The independent behaviour of voters illustrates that they do not try to communicate to make compromises. The former property seems to be reasonable for any formal measure of influence unless there is information about the issues. The latter suits, at least intuitively, well in characterizing the early phases of decision making where the voters have not sought compromises and the draft proposal is not amended. Straffin (1988) argues that due to this interpretation independence is an appropriate assumption for voting bodies where there is no appreciable communication between voters.

Supposing the occurence of each outcome to be equally likely is not the only possibility to model the voting behaviour in a general and reasonable way. Moreover, investigating only the possible outcomes does not give us enough information about the voting process to reveal the voter who actually makes the difference. In yes-vote majorities there are several crucial voters. [19] Let us call a voter who actually makes the difference a pivot.

If we think about the coalition formation - or merely voting behaviour - it should be, at least in principle, possible to order voters according to their propensity to vote 'for' a proposal. Intuitively it sounds quite reasonable that voters differ from each other according to their willingness to give their support to a proposal. By assuming that the occurence of each of these orderings of voters is equally likely we also assume that there are $n!$ different voting questions and they occur with equal probability. In the literature this assumption is usually referred to as *homogeneity*. [20]

At first sight, homogeneity, interpreted as above, may sound odd. The usual critisism of the homogeneity assumption concerns the intepretation of voters' permutations and it has been argued that their connection to power is weak. However, as the equal probability of each outcome was an implication of a certain probability model for each individual's voting behaviour, the same holds true for the permutation illustration of the homogeneity assumption. Thus the interpretation that is based on permutations is illusory, a consequence rather than the reason.

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[19]Note that this also leads to a private good interpretation of national influence. The gains of a winning coalition are divided among the crucial voters. As far as common policies are concerned this is not necessarily reasonable. To be exact, voting power evaluates the national influence on voting, not directly the national impact on policy decisions. For a more detailed discussion, see Barry (1980) and Holler and Packel (1983), Widgrén (1994c).

[20]Note that this does not remove the private good interpretation. It is implicitly assumed that a pivot will get all and the rest of the players will not get anything. It is worth stressing, however, that this holds only in permutational sense. There are several permutations and pivots leading to a single outcome in combinational sense. Thus the group of crucial voters divides the gains. The main difference between homogeneity and independence is that they give different probability weights to outcomes.

The probability model behind the homogeneity can be characterized as follows. Let us assume that the probabilities p_i that a voter i supports a proposal are somehow equalized to t for each i and let us also assume that this t is chosen from a uniform distribution. Heuristically, homogeneous voters have agreed about the general acceptance (the probability t) of a proposal and it is then allowed to vary randomly on the interval from zero to one. Thus we take into account also the proposals that are rejected or never voted on. When assuming homogeneity the outcomes with any number of yes-votes occur equally likely.

Homogeneity gives us more information about the voters than the assumption of independence. The basic idea is that the probabilities that voters support a proposal are correlated. Hence there has been considerable communication between the voters and they have possibly amended a proposal somewhat. While independence characterizes the early phases of decision making, homogeneity tries to model the whole decision making process as it takes into account all questions of voting between heaven and earth. In particular, it stresses the late phases of decision making because reaching aggreement on the value of a "common standard" t usually requires negotiations.

It is interesting that the homogeneity assumption is the only possible assumption that indicates consistent distribution of power without standardizing the indices. Thus the measures of power sum up to unity. This is due to the property of homogeneity that it defines a unique pivot for each vote. It is a necessary condition to define a consistent distribution of power (Dubey, Neyman and Weber 1981). Assuming independence implies that we have several pivotial voters in each vote. Assuming independence, the probability that a voter is crucial is referred to as the $Banzhaf\ index$ (BI) and assuming homogeneity it is referred to as the $Shapley-Shubik\ index$ (SSI). Formally the indices can be written as follows

$$P_{ind}\{\mathcal{S}=S, S\in\mathcal{M}_i\}=\int_0^1\int_0^1\dots\int_0^1 f_i(p_1,\dots,p_n)dp_1\dots dp_n=\sum_{S\in\mathcal{M}_i}(\frac{1}{2})^{n-1}=\beta_i', \quad (5)$$

which is referred to as the Banzhaf power index (BI) and

$$P_{hom}\{\mathcal{S}=S, S\in\mathcal{M}_i\}=\int_0^1 f_i(t,\dots,t)dt=\sum_{S\in\mathcal{M}_i}\frac{(s-1)!(n-s)!}{n!}=\Phi_i \quad (6)$$

which is referred to as the Shapley-Shubik power index (SSI).

Similarly the measures of control are often referred to as Rae and $Straffin\ index$, respectively. Assuming homogeneity the probability that the proposal is accepted on

condition that one votes 'yes' - the positive part of the Straffin index - can be written as follows

$$P\{a\ proposal\ is\ accepted \mid i\ votes\ 'yes'\} = \int_0^1 f(\underbrace{t,...,t}_{i-1},1,\overbrace{t,...,t}^{n-i})dt \qquad (7)$$

where i is a positive integer smaller than n. The positive part of the Rae index can be written by letting $t = 1/2$ respectively. To analyse one's possibilities to pursue negative control - the negative part of the Straffin index, i.e. the probability that a group decision rejects a bill one votes against, we use the dual probability of (7) on condition that $p_i = 1$ as follows: [21]

$$P\{a\ proposal\ is\ rejected \mid i\ votes\ 'no'\} = \int_0^1 f^*(\underbrace{t,...,t}_{i-1},1,\overbrace{t,...,t}^{n-i})dt \qquad (8)$$

where i is a positive integer smaller than n. The negative part of the Rae index can be written respectively by letting $t = 1/2$. The arithmetic average of equations (7) and (8) is referred to as control.[22]

In this study we apply the measures of control in two ways (see chapters 2 and 3). First, we follow the analysis of Cubbin and Leech (1983) [23] and analyse the question of concentration of power in the sense of how well the decisions of the EU can be controlled by a group of countries. For this we define a leading coalition as a group of $m = 0,...,n$ largest countries and calculate the measures in equations (7) and (8) for these coalitions.[24] Second, we combine the analysis of Barry (1980) and Straffin, Davis and Brams (1982) by decomposing the measure of success (control) into two parts, the first one of which stands for luck and the second one for decisiveness (see chapter 2). In this study, we apply this decomposition to compare formally national influence in two

[21] Another way to calculate negative control is simply to utilize the complement $1-f$ of f on condition that $p_i = 0$.

[22] In the literature there is a wide range of terms for equations (7) and (8) and their averages. Straffin, Davis and Brams (1982) and Nevison (1982) use the term satisfaction, Widgrén (1993a, 1994a) uses the term control and Barry (1980) the term success. Cubbin and Leech (1983) use positive control to measure the concentration of power.

[23] For other studies using similar methodology, see Leech (1987a, 1987b, 1987c), Leech and Leahy (1991), Pohjola (1988) and Widgrén (1993a).

[24] Note that the question of power concentration can be analysed directly by utilizing the information of power indices. For a more detailed discussion see Laakso and Taagepera (1982). As regards the EU, see Widgrén (1994a) where the main conclusions are very similar to those made in chapter 3.

cases, namely in the EU and in the EEA agreement ouside the EU. The basis for this evaluation is the following

$$success = luck + decisiveness = 1/2 + (1/2) \cdot \beta \tag{9}$$

where the first equality holds simply as a definition by Barry (1980) and the second equality holds if we assume that voters are independent (Straffin, Davis and Brams 1982). By slightly reformulating equation (9) we can make conclusions of how much voting power a country needs inside the Union in order to cover the costs of giving up the "opting out" alternative in the EEA and the risks of unpleasant decisions inside the EU.

3 On Reformulations of Power Indices for Games with Coalitions

Coalition formation, the second theme of this study, is analysed by using two alternative methods. On the one hand, we may think that certain countries form coalitions since they collaborate on a more continuing basis than the others. The question to pose is what are the impacts of coalitions on the power distribution (see chapter 4). On the other hand, we may argue that certain countries cooperate since their preferences are more or less alike in other voting issues while they are different in others. Coalitions are then formed in order to achieve certain policy goals (see chapter 5). The question to pose is, whether it is profitable, in terms of power, to form coalitions or can the collaborating countries achieve the goals.

The impacts of coalition formation are studied here by applying Owen's (1977) version for the SSI in games with coalition structures. [25] The basic idea behind Owen's reformulation is that voters in a coalition have similar preferences. Coalition's members divide the gains of cooperation according to their possibilities to threaten the others. Thus each player and each sub-coalition in a coalition gain proportionate to their influence outside the coalition, respectively.

Let N be the player set and $\mathcal{I} = \{M_1, \ldots, M_p\}$ a partition of N to a priori coalition structure, i.e. a collection of alliances which have made a prior commitment to pool their endowments in the game. For the union M_j the total power Φ_j can be easily calculated from the *quotient game* (u, P), where $P = \{1, 2, \ldots, p\}$ denotes the set of unions and $u(S) = v\left(\bigcup_{j \in S} M_j\right) \; \forall \; S \subset P$. There is no reason to assume that the union would lose the power it could obtain. Because of this efficiency requirement of sub-systems it seems natural to set the sum of individual power indices in each union to the total power of

[25] For a more detailed discussion about the method, see Owen (1977), Aumann and Dreze (1974), Shenoy (1979), Hart and Kurz (1983) and Kurz (1988).

that union. Hence we have $\sum_{i \in M_j} \Phi_i = \Phi_j$. For determining the distribution of power in coalition M_j we have to define a subgame w_j among the players in M_j which reflects the possibilities of different sub-unions when defecting from the sub-system M_j. Let K be a sub-union of M_j and K' its complement relative to M_j. The coalitional form's values of the game w_j played in the coalition M_j can be now defined as power indices of M_j's sub-unions in the game $v_{M_j|K}$, where the coalition M_j is replaced by sub-union K in the quotient game, i.e. $u(S) = v\left(\bigcup_{j \in S} M_j - K'\right)$ and $w_j(K) = \Phi_K[v_{M_j|K}]$. Owen (1977) suggests that the value for the individual players in the game with a priori unions should be calculated as a value in the game w_j. Hence we have

$$\Phi_i[u; \mathcal{I}] = \Phi_i[w_j]. \tag{10}$$

As it is shown in Owen (1977) the SSI for the games with coalition structures can be calculated as a weighted average of the terms $\Delta_i u(Q \cup K) = u(Q \cup K \cup \{i\}) - v(Q \cup K)$, where Q is an arbitary union of quotients M_j $(j \neq k)$, $K \subset M_k$, $i \in M_k$ and $i \notin K$. Reformulation of the Shapley-Shubik index for the game u with a coalition structure $\mathcal{I}$ (CSSI) can be now written as follows

$$\Phi_i^{CS}[u; \mathcal{I}] = \sum_{S \subset P, j \notin S} \sum_{K \subset M_j, i \notin K} \frac{s!(p-s-1)!k!(m_j-k-1)!}{m_j!p!} \Delta_i u(Q \cup K), \tag{11}$$

where p, s, k and m_j are the cardinalities of the sets P, S, K and M_j respectively. The marginal contribution term is more complicated than in the games without coalition structures, since although u is a simple game, w_j is not.

Another way to analyse the relation between predetermined collaboration and power is to apply the standard voting assumptions. Keeping the above-mentioned interpretations of communication in mind, we may think that BI is a measure of voters' abilities to exert influence before the decision making has actually started and the SSI gives one possible consistent distribution of power in this process. A richer way to use the two standard assumptions is to combine them and to assume that there are both homogeneous and independent voters. This combination of the standard assumptions is referred to as *partial homogeneity* (see Straffin, Davis and Brams 1982, Straffin 1977, 1988 and chapter 5 of this study). One interesting way to extend the partial homogeneity is to assume that there are two opposite groups of homogeneous voters. Thus it is presumed that there is one homogeneous group with a voting standard t and another with a voting standard $1 - t$. Let us denote these semicoalitions by S and R. Also let us assume that there is a group U of independent voters between the opposite homogeneous groups. Partial homogeneity yields that the partition of voters is not fixed - cooperation across the union borders is possible as it is not the case with the usual coalition structures. That is why we use the term semicoalition-structure for the structure of partially homogeneous

voters' groups. It yields the following formula for the probabilistic power index

$$\begin{aligned}\pi_i &= P\{i \text{ is crucial for the decision}\} = P\{\mathcal{S} = S, S \in \mathcal{M}_i\} \qquad (12)\\ &= \underbrace{\int_0^1 \int_0^1 \cdots \int_0^1}_{u+1} f_i(\overbrace{t,\ldots,t}^{s}; p_{s+1},\ldots,p_{s+u};\\ &\quad \overbrace{(1-t),\ldots,(1-t)}^{r})dp_{s+1}\ldots dp_{s+u}dt\\ &= \int_0^1 f_i(\overbrace{t,\ldots,t}^{s}; \underbrace{1/2,\ldots,1/2}_{u}; \overbrace{(1-t),\ldots,(1-t)}^{r})dt\end{aligned}$$

where n, s, u and r denote the cardinalities of sets N, S, U and R respectively and $f_i(\cdot)$ is the i^{th} partial derivative of function f defined earlier. Equation (11) is very similar to equations (5) and (6) and it can be easily derived from (4) by stating $p_i = t$ for voters in semicoalition S, $p_i = 1 - t$ for voters in semicoalition R and $p_i = p_i$ for members of U. Then (11) is no more than an expectation of (4) given that $p_j \sim U(0,1)\ \forall\ j \in U$ and $t \sim U(0,1)$.

4 On Empirical Studies of Voting Power

In addition to the wide theoretical literature on the Shapley value and its reformulations there is also an extensive empirical literature. Power and control measures have been usually applied to institutions where voting takes place but there are also other types of empirical studies as well. [26]

In the 1980s shareholders' meetings were one of the most popular research areas as regards voting power or control. In the UK Cubbin and Leech (1983), Leech (1987a, 1987b, 1987c) and Leech and Leahy (1991) applied these measures in order to analyse the concentration of power in the largest companies in the UK. Cubbin and Leech (1983) suggested a concentration measure which was actually very similar to the Rae index of satisfaction. The only difference between the Rae index and the Cubbin-Leech measure is that the former is an average of positive and negative control while the latter measures only positive control.[27] This measure was also applied by Pohjola (1988) using data on the largest Finnish companies.

[26] For a suggestion to determine internal telephone billing rates, see Bilera - Heath and Raanan (1978) and for aircraft landing fees, see Littlechild and Owen (1973) and Littlechild and Thompson (1977). Applying the Shapley value to cost allocation in a broader sense is analysed in Roth and Verrechia (1979).

[27] For a discussion, see also Nevison (1982).

The distribution of power in the shareholders' meeting is usually more difficult to analyse than the distribution of power in legislative institutions. There are two reasons for this. First, the absentions are more common in the former and they can also have very different consequences regarding to the body. In the EU Council the absentions are identical to no-votes, which is not the case in shareholders' meetings and hence they do not have any effects on the analysis of the EU but, certainly, have effects on the analysis of shareholders' meetings. Second in the shareholders' meetings the distribution of votes is usually very uneven and the data concerning the smallest shareholders' shares are not always available. Also the number of shareholders is typically so high that the exact calculation methods are impossible to apply.

As regards the increasing number of voters the power measures can be easily approximated by using a probabilistic voting model and applying the central limit theorem. A textbook presentation of the approximation can be found in Owen (1982). In this study we apply approximation methods for the calculations concerning the EU(16) or bigger. This is due to the observation that the approximation errors decline rapidly when measuring power in the EU Council. It was noted in Widgrén (1994b, chapter 2 in this study) that in the EU(16) there were no approximation errors larger than 0.001. The approximation methods have been earlier applied by Leech (1988) and Pohjola (1987) for voting power calculations and by Leech (1983, 1987a, 1987b, 1987c) and Pohjola (1988) for concentration calculations in shareholders' meetings and Owen (1975, 1982) for the U.S. presidential elections.

Another way to analyse voting games with an extensive number of players is to apply the theory of oceanic games. The main limitation of this approach is, however, that it is game-specific. The oceanic games are by definition such that there are a few large players with voting weights w_i and a group of minor players each having a very small fraction of votes. As the number of small voters goes to infinity the game can be modelled as a game of large voters and the "ocean". As the latter converges to a non-atomic fraction of votes its voting behaviour can be modelled by a probability distribution. Thus the ocean is like a fuzzy player.[28] As is typically the case, the large companies have a few large shareholders and an extensive group of small shareholders and that is why the oceanic game approach is an appropriate way to model shareholders' meetings. This is done in Rydqvist (1987) concerning the largest Swedish companies.

Political institutions like parliaments or the EU Council of Ministers have been a popular research area in which to apply the power measures. The Shapley-Shubik power index was originally proposed as a specialization of the wider Shapley value concept in Shapley and Shubik (1954), where they offered "a method for the a priori evaluation of the division of power among the various bodies and members of a legislature or committee system." The authors used the U.S. Congress as an example. An alternative

[28] A more detailed describtion of the method is presented in Shapiro and Shapley (1978) and in Milnor and Shapley (1978).

approach to analyse the U.S. Congress is proposed in Straffin (1988) where he applies the partial homogeneity assumption by supposing that members of the Republican party and the Democratic party vote homogeneously among themselves but independently of members of the other party. National parliaments have been analysed e.g. by Laakso (1979), Laakso and Taagepera (1979), Holler (1982) and Wiberg (1992) and the European Parliament by Johnston (1977, 1982). The usual assumption in these studies is that all representatives in one party vote similarly. This is, of course, restrictive. There are, however, interesting features that have been taken into account in these studies. One of them is the ideological distance between the parties (Wiberg 1992) and another is government formation (Holler 1982) or the effective number of parties in a parliament (Laakso and Taagepera 1982).[29] When interpreted in probabilistic terms the concept of ideological distance is rather similar to the idea of partial homogeneity (see chapter 5). One interesting possibility could be to model the parliamentary decision making as a two-level coalition formation game where parties form homogeneous groups and the ideological distance between the parties determines how likely it is that a representative votes with another party. As regards the European Parliament there are two dimensions to determining representatives' voting behaviour: national interests and ideological interests. This has been taken into account in Johnston (1982).

Recently, the enlargement of the EU by three EFTA countries and the debate on the needs to reform the decision making in the EU have created a new vawe of literature applying measures of influence. Not surprisingly, the majority of this literature comes from the new entrant countries, especially, since the EEA Agreement's influence deficit was one of the most important reasons for EFTA countries to join the Union (for a comparison of an EFTA country's influence under the EEA and EU membership, see Alho and Widgren 1994, chapter 2 of this study). Enlargements of the European Union have encouraged for voting power reserch already before the EFTA countries' entry. In the mid-1980s there was a vawe of voting power analysis in regard to the accession of three Mediterranean countries (e.g. see Brams and Affuso 1985a, 1985b). Towards the 1990s the role of majority voting in the EU was substantiallly strengthened, which has also made national influence significantly more important topic. The increasing importance of how national views can be represented in the Union has created an expanding literature of both quantitative and qualitative assesments of EU's institutions' abilities to operate and member states' role in the Union. Quantitative evaluations of the former see Widgrén (1994a) and as regards the latter voting power analysis can be found in Widgrén (1993), Widgrén (1994b, 1995a), Herne and Nurmi (1993), Hosli (1993). Other closely related studies in this field are Johnston (1977, 1982), Johnston and Hunt (1977), Brams, Doherty and Weidner (1991), Nurmi (1992) Winkler (1991, 1993), who analyses also the impacts of the CEEC entrants and Widgrén (1993a, 1993b, 1994c, 1995b).

Most studies concerning the EU Council are rather straightforward. Thus they present only basic calculations and do not apply any reformulated versions of power measures.

[29]For the effective number of countries in the EU, see Widgrén (1994a, 1994c).

In this study, one of the main contributions is to analyse what kind of impacts the predetermined groups of member countries have on distribution of power and decision making abilities in the EU Council. Also our goal is to analyse how national views can be represented by forming coalitions. Another theme, which is mostly disregarded in previous studies, is control. Here the aim of the control analysis is to complete the analysis and give support for the conclusions of voting power analysis, particularly, as regards the decision making abilities of the EU Council. Of course, the enlargement of the Union by three EFTA countries and the discussion on the future enlargements of the EU have made the subject of national influence very topical. That is why all four contributions presented in chapters 2-5 somehow concern the consequences of the EU enlargement in 1995.

Voting power approach is not, of course, the only way to analyse national influence in the EU decision making and the Union's abilities to operate. Political analysis of the EU decision making is, however, typically descriptive (see Wallace 1990, de Schoutheete 1990, Stålvant 1990, Lodge 1986, Fitzmaurice 1988 and Corbett 1989).[30] Qualitative analysis concerning the national impact has been presented by Hamilton (1991). An interesting study of the speed of EU decision making has been carried out by Sloot and Verschuren (1990) and the relation between power and budgetary flows has been described by Baldwin (1994).

5 The Outline of this Study and Summary of Results

In the late 1980s the decision making in the EU Council became more interesting research subject because the role of majority voting was strengthened and thus unanimity requirement was very much dismantled. In this study we concentrate on the EU(12) and the EU(15). Thus our analysis concerns national influence mainly before and after the entry of Sweden, Austria and Finland (see, however, chapter 3).[31]

This study has two parts. The first concerns the impacts of the Union's enlargement by three EFTA countries. In chapter 3 we present how the three former EFTA countries change the distribution of power and possibilities to control decisions in the Council. The enlargement of 1995 is also compared to the enlargement of the Union by the Mediterranean countries in the 1980s. The impact of the EFTA countries accession has been analysed quantitatively earlier by Nurmi (1992), Herne and Nurmi (1993) and Widgrén (1993a, 1993b). Winkler (1991, 1993) investigates also the impacts of possible

[30] For a textbook presentation of the institions of the EU, see Nicoll and Salmon (1990), Lodge (1989) or Nugent (1989).

[31] Voting power in the EU before 1986 has been analysed by Brams and Affuso (1985a, 1985b), Johnston (1977), Johnston and Hunt (1977), Nurmi (1992) and Widgrén (1993b).

future enlargemments of the EU. In earlier literature the question to pose has been what is the member states' role in the EU decision making, i.e. how much power do they exert. In chapter 3 our main focus is to analyse the EFTA entrants' impact on the Union's abilities to operate. That is why we extend the standard analysis to cover control as well.

In the public debate one of the main arguments behind the EFTA countries' accession to the EU was the so-called influence deficit. The usual motivation behind this argument goes as follows. In the EU, the EFTA countries take part in the decision making while in the EEA they do not have such a right. However, in the EEA the EFTA countries have no similar obligations as full members either. In chapter 2 we introduce a quantitative method to compare the EEA and full membership. It is based on the concept of success introduced by Barry (1980). In chapter 2 we decompose the success measure into two parts following Straffin, Davis and Brams (1982). This allows us to make more careful arguments regarding the influence deficit. The influence deficit can be either positive or negative. Basically it depends on three factors, namely the overlap between the Union competences and the contents of the EEA Agreement, the Union's abilities to take decisions and the EFTA countries evaluation of agenda control in the EU. In chapter 2 our aim is to quantify the influence deficit by applying and combining the methods described above.

Chapter 3 shows that decision making process in the EU favours strongly small countries. It is shown that the new entrants would get 12 per cent of the total power in the EU Council of Ministers. Relative to their share of the population in the EU of 15 members the new entrants' share of power is over two times higher. The new entrants would have a strong position in the EU decision making. However, the loss of power for the current members is smaller than in the enlargements of the Community in 1973 or in the 1980s. Also it can be argued that the Mediterranean enlargement in the 1980s changed the EU decision making more than the EFTA entrants. In the 1980s the need for compromises increased remarkably. Strengthening the role of qualified majority voting was a necessary reform to reach the balance between compromises and competition. This balance does not change due to the EFTA entrants.

The conclusion concerning control in chapter 3 is twofold: first, it seems to be very difficult to promote a passage of proposals, while for preventing decisions the reverse seems to hold and second, accomplishing seems to be the more difficult in an expanded EU the more independently the voters act. However, old members do not lose their control in the expansion of the Union but there will be three new members with significant control positions regarding preventing decisions. It can be also argued that high national control over decisions implies more power to the officials in preparatory bodies. Remarkable decisions will need a deep homogeneity between the member states. It can be reached by negotiating and by preparing proposals properly. This implies that there is a danger that decision making is ineffective. The national control and need for homogeneity are together an effective way to secure subsidiarity principle.

As far as decision making efficiency is concerned, the current qualified majority rule gives too much negative control to member states. One cannot, however, argue that the new entrants create the inefficiency problem. It already exists. In terms of negative control the increased inefficiency due to the new entrants could be eliminated by reducing the majority requirement by 3 votes. In general terms, avoiding the problem of easy blocking and inefficiency requires lower majority rules. This would decrease member states' negative control over decisions significantly. However, it is surprising that the balance of voting power remains almost unchanged if the decision making rule is lowered from a qualified to simple or double majority. The latter even improves small countries' positions.

Chapter 3 shows that negative control is the main element for new entrants' to have an effect on policies pursued. Thus it is unlikely that there will be a significant policy change. That is why the new entrants and also the other members should concentrate on their most important interests. The Mediterranean countries maintain their key role and it is profitable for them to deepen their cooperation. However, the Northern members' incentives to try to push through proposals that they prefer will also increase.

If common policies create positive externalities for member states, lower majority rules should be used to improve efficiency and the Union's capabilities. As regards national influence, improving efficiency is not a matter of power distribution. The double majority is an exception as it increases small countries' and Germany's power, although the reason for such a proposal is, without any doubt, based on entirely different arguments. Since in the current context lower majority rules give more weight and power to the supranational Union and its Commission and less weight to national interests, the improvement of the EU decision making efficiency is a matter of centralization and not a matter of the distribution of national influence.

Chapters 4 and 5 deal with coalition formation and they also form the second part of the thesis. In earlier literature there are very few empirical studies applying the methods of CS games. In chapter 4 we analyse so-called sub-systems in the EU. Sub-systems are groups of countries that collaborate on a permanent and official basis (see de Schoutheete 1990, Stålvant 1990). In chapter 4 we apply the theory of coalition structure games (CS games). Voting power was first extended to CS games by Aumann and Dreze (1974) and reformulated in a more satisfactory fashion by Owen (1977) and Hart and Kurz (1983). As in all chapters of this study, also in chapter 4, we utilize the probabilistic interpretation of power measures. For CS games this is introduced by Owen (1977) and that is why we follow his analysis in chapter 4.

In the earlier literature there are no satisfactory analyses of the coalition formation consequences in the EU. In Brams, Doherty and Weidner (1991) it is assumed that by forming a coalition France and Germany both have a veto [32]. By applying the standard

[32]Note that this feature is explicitly analysed in Widgrén (1993b, 1994c) and in chapter 3 of this study.

Banzhaf index they show that such countries gain considerably. Another theme regarding coalitions in earlier studies is how much different parts of a member state wield influence (Johnston 1977, Winkler 1993). It is common of the earlier studies that they investigate the coalitions, not the members of coalitions.

In chapter 4 there are two main results concerning the gains of coalition formation. First, the additional power an alliance could obtain clearly increases with respect to the voting weight of the block when it is assumed that no counter-blocks are formed. In terms of voting power the gains are obvious only for the coalitions of the size close enough for a blocking minority. Second, given that there is a possibility to form counter-coalitions, it seems that the gains and losses change remarkably. One important observation is that members of some coalitions lose while it is possible for members outside coalitions to gain. Thus, in some cases, belonging to a coalition could be a burden. [33]

Power measures for CS games address the consequences of the formation of certain coalitions. Hence they analyse the distribution of power given that a certain coalition structure exists. In order to maintain the coalition structure, voters in one group should have identical preferences. In chapter 5 we abandon this assumption by assuming that voters in one group have identically distributed preferences, i.e. they have similar standards to evaluate a random bill.

In chapter 5, we analyse voting power regarding two voting issues in the EU, namely trade policy and social regulation.[34] The basis for the semicoalitions is made as in Hamilton (1991) by using qualitative data. This kind of division is naturally subjective. Grounds can be found, however, to support the realism of these kinds of groupings in the EU. They can be interpreted as examples giving light to patterns of voting power in the presented policy cases. The probabilistic interpretation of power and the probability model for voters' preferences allow us to investigate the patterns of power in different types of voting issues where, for example, one group is strongly against a proposal and thus the opposition is strongly for, or neutral questions where all voters are nearly indifferent (see chapter 5).

The main conclusion of chapter 5 is that, in terms of probabilistic voting power, coalition formation in the EU Council is profitable when the aim of cooperation is blocking proposals. When trying to push proposals through, coalitions of a reasonable size do not seem to ensure probabilistic power gains for those who collaborate.

In the EU(12) the results reveal that in trade policy all members with the exception of Luxembourg lose power in a probabilistic sense when compared to SSI without predetermined voting coalitions. Moreover, the analysis of different proposal categories suggests that in trade policy the assumed a priori partition of members produces a neutral rather than a protectionist or a liberal policy. In social regulation there is pressure towards

[33] See also Widgrén (1994c) for a more detailed discussion.

[34] For a more extensive discussion concerning trade policy of the EU, see Winters (1994).

looser norms although by forming a semi-coalition the countries in favour of tighter norms gain in terms of probabilistic voting power. The accession of the three EFTA countries strengthens the coalition supporting a liberal external trade policy or tighter social regulation norms when measured in terms of votes. However, it is shown that this change is not enough to spur general policy changes. In social regulation the countries against tighter norms are able to defend loose norms successfully. In trade policy the new members increase the pressures towards a liberal policy. The fear of a protectionist policy seems to vanish but the course of EU's external trade policy to a liberal direction is, however, in the hands of the protectionist group.

6 Concluding Remarks

As it was mentioned earlier the formal analysis of power is a difficult task with many dimensions. It is self-evident that this study cannot capture them all. There are at least three extensions of power analysis beyond the scope of this study. First, since the main emphasis of cooperative voting model is a priori voting behaviour with otherwise being very implicit, it disregards the costs of forming coalitions. Of course, we may argue that the costs are similar for each player, but on the other hand it would be interesting to combine the impacts of ideological distance and coalition formation costs. As noted in chapter 5 of this study, member states of the EU often need the opposition in order to push through proposals they prefer.

The second weakness of standard analysis is that it disregards the formal relation between voting power and national influence on common policies (see Widgrén 1994c). First, it can be argued that the traditional power measures analyse influence on voting rather than the direct impact on the contents of policies. Also, these measures presume that the value of each outcome can be assigned to the pivotal or critical voters in a majority. As regards the European Union they thus analyse national influence in the private good context although most decisions of the EU Council can be considered to be collective goods. As far as member states' policy impact is concerned these violations may lead to biased estimates.

Widgrén (1994c) has derived a decomposion which shows that voting influence can be presented as a weighted sum of policy power and luck. This decomposotion gives us more information concerning the nature of the ways to wield influence in EU decision making. Widgrén (1994c) investigates the policy impact with the help of Holler's public good index of power (HPI) (Holler and Packel 1983) and the voting impact by the standardised Banzhaf-index (SBI) (Banzhaf 1965). Actually the definitions of the HPI and SBI are very close to each other and the main difference between the two is what outcomes they take into account. The results give, however, additional information concerning the distribution of power in the EU (see Widgrén 1994c).

It has been argued earlier that a voter exerts voting power when he belongs to a minimum winning coalition defined as follows: $\{S \in \mathcal{M}_i\} \Leftrightarrow \{S \in \mathcal{W},\ S - \{i\} \in \mathcal{L}\}$. Holler's power index presumes that a voter exerts power when he belongs to a winning decisive set where, by definition, all voters are crucial. Hence formally the class of winning decisive sets $\mathcal{M}_\mu$ is defined as follows $\{S \in \mathcal{M}_\mu\} \Leftrightarrow \{S \in \mathcal{W},\ S - \{i\} \in \mathcal{L} \forall i\}$. It is easy to see that when based on minimum winning coalitions the power analysis concentrates on voting outcomes where unnecessary voters can make others crucial. As regards the policy outcomes this is not possible since the policy decision of a majority with and without dummy-voters should, of course, be the same. This feature of minimum winning coalitions is eliminated by using winning decisive sets as a base.

The third possible extension is to give richer structures for the determination of voting behaviour, i.e. preferences. In this study we have made two kinds of restrictions for standard voting assumptions. We have assumed, first, that certain countries have identical preferences and thus we have analysed the impacts of coalition formation (see chapter 4). Second we have assumed that according to qualitative data we may argue that in some voting issues there are predetermined collaborating groups and they do not have identical but identically distributed preferences (see chapter 5). The third possibility is to endogenize member countries' preferences with the help of quantitative data.

The simplest way to make such an extension is to assume that basically the EU member countries are homogeneous. This is reasonable since they have set up the Union and thus they have agreed to pursue common policies. The second step of the analysis would, however, take into account that there are certain country characteristics which affect voting behaviour. Formally each country i would have in each question j of voting its own voting standard $u_{ij}(t)$. It is easy to see that the power and control polynomials presented above easily become very complicated with this assumption. However, by assuming that t is a more general voting standard, i.e. the acceptance of Union's competences, we could make reasonable voting models by applying the tranformation u_{ij} for each voter in each voting issue. Thus the idea is to build voting models where voters' preferences distance is based on quantitative data. A more detailed analysis on this is, however, left here for future research.[35]

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[35]See, however, Widgrén (1995c) where he uses the following tarnsformation of the homogeneity assumption

$$F_i(t) = t^{exp(\frac{x_i - x^*}{x^*})^n} \tag{13}$$

where x^* denotes the standard of the Commission's proposals in terms of preferences' determinant variable, x_i-values denote the respective national standards and n denotes how intensively member states defend their views. This transformation thus takes into account the pairwise distances between member states and the Commission (Union average) in their evaluations regarding proposals.

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Chapter 2

Economics and Politics of EU Accession
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PART I

1 Introduction

The traditional goal of the integration policies of the EFTA countries has been to avoid the threat of trade diversion, especially with respect to their exports to the EC. Accordingly, the EFTA countries have wanted to achieve an 'economic membership' of the EC with respect to their exchange of industrialised goods. In the early 1970s, this goal led to the free trade agreements with the Community and now, from the beginning of 1994, to a participation in the EU internal markets through the European Economic Area (EEA). At the same time, however, the EFTA countries carefully avoided political supranational ties with the EC. The EEA, through a commitment to the EU internal market legislation, has weakened the basis for national sovereign policy-making, and opened what can be described as an influence deficit of the EFTA countries in decisions which also shape their own affairs. Internally, the Nordic model of social and economic management is based on concensus decision-making with strong corporatist structures between the government and the central interest organisations of employers, labour, farmers and forest owners - a structure of balanced interests with an 'economy wide rent sharing equilibrium' (Alho 1993). Accordingly, it is difficult to accept adverse inter-industry type of changes related to the opening of agriculture to the EU without compensation, even through the established positions are only created by artificially high import barriers.

All the studies carried out in the various EFTA countries show that EU membership is superior to staying outside under the EEA agreement when the long-run real income is used as an indicator of social welfare. [1] The major areas where changes can be felt are agriculture, i.e. participation in the CAP, participation in EMU, restructuring of the rest of the sheltered sector like the public and private service sector through intensified capital mobility and tax competition, and budgetary flows between the new member states and the Union. There are number of other sectors which are important in the membership but which do not make a big difference to the totality. Foreign trade is one of these, but as the barriers have already been effectively dismantled between the EFTA coutries and the EU, the effect of the changes in trade barriers with the EU, and with third countries, are not going to be of major importance in relation to the total effects.

Outside the EU, there is a threat of marginalisation for the EFTA countries. They would perhaps not attract investment by foreign or domestic firms. In the internal management of the society and economy, two basic types are coceivable. The EFTA countries could return to the old model of centralised rent sharing arrangements. But they could in principle also adopt more competitive structures than those in the EU and abolish all barriers in foreign trade including agriculture. The former would likely

[1] For Finland, see Alho, Kotilainen and Widgrén (1992) and VATT (1992); for Sweden, see Utrikesdepartemented (1993); for Norway, see SSUE (1992), for Austria, see Breuss (1991). For all the EFTA countries, see CEPR (1992).

take place in reality, the latter strategy being mostly of theoretical interest only. So, outside the Union, the Nordic countries would lose some of the gains related to the more competitive structures of membership.

The aim in the following sections is to discuss two issues in more detail. First, the most difficult economic accession area for the most protectionist EFTA countries, namely agriculture, is analysed in more depth. Secondly, the most difficult politival accession area, national sovereignty, independence and influence under different integration alternatives, is analysed in detail.

2 Agricultural adjustment and welfare gains

Agriculture is observed by many observers to be a failure in the EU operations. It is heavily subsidised, protected and bureaucratic. However, of the Nordic countries, Finland and Norway have an even higher level of protection and clearly lower productivity than that in the EU. So, a welfare gain can be reaped from the opening of agriculture to the EU level as well. This is likely to be reflected in the EFTA countries in different ways. In Finland, producers are likely to lose initially, while in Sweden they will gain (see Rabinowicz 1993).

We should take both a partial and a general equilibrium view of agriculture from the angle of the whole economy. In addition to the partial effects, changes can be take place which are a result of the current inefficient relation between agriculture and the rest of the economy, at least in Finland. This is simply reflected in the fact that productivity in agriculture is much lower than on average elsewhere in the economy and that it is only a fraction of that in the EU agriculture. This is due both to the inferior climatic conditions and the inefficient production structure with a small average farm size by international comparison. If Finland joins the Union, there will be change in producer prices, which will be lowered on average by one-third or forty per cent. In addition to a general reduction, this means a change in the internal structure of relative prices, as EU prices are higher for livestock in relation to grain than those prevailing now in Finland. In the former subsector the adjustment pressure is lower than in the latter. The problem of divergent internal changes and adjustment will, however, be omitted in the following.

The farmers' before-tax income is determined by the value of the gross production, less the cost of intermediate inputs plus direct income support. Outside the EU, in the present Finnish tax structure, agriculture is tax exempt in value added taxation, and therefore the tax included in the purchased inputs is not deductible by farmers. Also, currently, a part of the cost of exporting the surplus production in excess of domestic consumption is at the farmers' own reponsibility. Inside the CAP of the EU, the indirect taxes of the intermediate inputs will be deductible, and there is no domestic reponsibility

to finance surplus export as it is shifted to the EU. A part of the income support also comes now from the EU budget.

Let $Q = F(K, L, I)$ be the production function for aggregate output, using present capital input K, labour L, distributed as they are presently over the set of existing farms, and intermediate inputs I. The relation between production optima inside and outside the EU (superscript 1 and 0 respectively) is determined by the differential relation

$$\frac{Q_I^1}{Q_I^0} = \frac{P_A^0}{P_A^1}\frac{P_I^1}{P_I^0}\frac{1}{1+t^0}, \tag{1}$$

where the first term on the right-hand side is the relation of the average producer prices in agriculture outside to that inside the Union, the second is the reaction of the costs and the last represents the change in idirect taxation. The first factor includes two opposite effects, the drop in producer prices and as there is no domestic cost of surplus production in the EU situation, an improvement in the effective terms of trade.

Altogether, it is more than unity and in the order of 1.3 as the producer prices will decline by forty per cent. The second factor is less than unity because the costs of purchased intermediate inputs of agriculture are also going decline by an amount which is not easy to assess quantitatively, but which will likely rise over time, and the third factor is clearly below unity. So, a priori, we cannot definitively tell whether production will be markedly cut or not. It is normally assumed in Finnish studies that going over to the CAP would cut Finnish agricultural production by a third. However, the above discussion implies that this estimate seems to be an exaggregation. The reduction in output may be clearly less than this, in order of 10 per cent only. Anyway national subsidies are planned to be channelled so that income per farmer will be roughly maintained at the pre-EU level.

The operating surplus has to cover the capital cost and the wage costs on the farm. Assume that the labour input is fixed for each farm. With constant or increasing returns to scale on capital and the intermediate input in agriculture, the minimum efficient farm size will rise as a result of lower agricultural proces. As shown in Alho (1993), if under unutilised increasing returns to scale in agriculture there is a simultaneous drift towards a larger farm size, agricultural output may in fact increase.

In the food industry (subscript F), outside the EU the net indirect taxes of the industry are currently manipulated in Finland with a national system, which allows more than full deductibility (with a coefficient $d > 1$) of inputs purchased from agriculture. If we simply assume a linear technology between agricultural inputs and foodstuffs, we can derive the following relation between the foodstuff prices faced by a consumer inside and outside the EU,

$$\frac{P_F^1}{P_F^0} = \frac{1+t^1}{1+t^0}\frac{P_A^1}{P_A^0}\frac{1-t^0}{1-d}. \tag{2}$$

Here the first factor on the right-hand side is the relation between indirect taxation inside and outside, with t being the indirect tax rate, the second the relation of agricultural

prices, and the third the propensity of the old tax system to reduce foodstuff prices. It has been agreed that initially, t^1 will be 17 per cent, and in 1998 will be reduced to 12 percent, t^0 being 22 per cent. The last factor and the first factor roughly net each other out in the immediate stage after accession to the Union. It is true that equation (2) gives an excessive view on the possibilities to cut consumer prices, as it only takes into account the raw material prices, and that it should be weighted with their cost share in foodstuffs. However, as pointed out by Rabinowitcz (1993) and the experts in this field, the other cost of element in the foodstuff industry may also be pressed down under EU membership. Normally, it is assumed that consumer prices of foodstuffs will drop initially by some 10-15 per cent. However, the reaction may also be more vigorous if the other cost elements in the foodstuff industry and retail trade are also rationalized.

Let us, then, turn to analyse the welfare effects of the adjustment of agriculture to the EU. Current production is some 12 billion FIM, 2.5 per cent of the GDP, the value of gross production being some 22 billion FIM. Production is some 20 per cent more than domestically consumed. The partial effects consist of the reduction in the producer surplus, increase in consumer surplus, change in budgetary balance of the Finnish treasury and of the budgetary flows between Finland and the EU. As it seems to be a national goal to fully compensate farmers their income losses, most of the partial gains are due to the reduction in food prices and the change in budgetary balance. After an initial period of a rise in government support to agriculture, the government will gain through reduced budgetary flows as the costs of agricultural inputs are also going to decline.

Consumers would gain through reduced prices. This estimate could be in the order of 6-7 billion FIM, as the budget for these items is some 43 billion FIM and the price elasticity for foodstuffs is normally estimated to be quite small. The government will benefit, as it has also financed a part of the export surplus, and this burden will be shifted to the Union. This terms-of-trade gain would turn into a loss if domestic production dropped so low that the net exports turned into net imports, as the imports from the EU would clearly cost more than imports from the world markets. Should this happen, it would anyway be of quite small magnitude, in the order of a few hundred million FIM annually. The overall gain to the taxpayers is the slight reduction in the necessary direct income flows to farmers and the shift of the export surplus to the EU. The overall welfare gain of 6-7 billion FIM annually can also, to a large extent, be seen as contributed by the direct income support by the CAP reform and by the LFA support and the reduced cost of exporting the surplus production. If the volume of domestic production is going to decline more than predicted, these estimates will change so that roughly one billion FIM of produces incomes is lost for each ten per cent reduction in the volume of output. This has to be contrasted with the potential to improve the resource allocation in the whole economy which is not likely to be efficient in the current situation.

The resource reallocation potential is reflected in the fact that the productivity of Finnish agriculture is only one-third of that in the most efficient EU producer countries, Denmark

and the Netherlands, irrespective of the large capital investments in Finnish farming in the 1980s. Also internally, the productivity of agriculture is clearly less than elsewhere in the economy. We can therefore expect sizeable long-term general equilibrium welfare gains if the resources could be diverted and employed efficiently elsewhere in the economy. If agricultural production is cut more than outlined above, there is a stronger pressure for the present resources in agriculture to find employment elsewhere in the economy. Because of the productivity gap, the gain to the economy becomes bigger the stronger the pressure to rationalize the production pattern of agriculture. If agriculture can be supported by income transfers, the losses in producer incomes will not lead to a scrapping of the unprofitable farms or to mergers producing farms. Permanent subsidies should therefore be applied with caution.

3 Political dimension

The EEA is an economic area which contains two distinct pillars, namely the EFTA and the EU. Problems arise because the pillars are asymmetric in many respects. For the EFTA countries, the EEA is something more than a free trade agreement, but for the Union it is an international agreement and, as such, something less than the achievements of the EU. This is why it is difficult to integrate the two pillars in a way which could work satisfactory. The EEA Agreement gives EFTA countries a right to benefit from the economic gains of the single market. The price for this is political since, first, the EEA Agreement itself harmonised national laws and, second, decision making in the EEA is built on the EU base.

The EEA Agreement does not give EFTA countries a right to initiate, and they do not have a representation in the Commission as they would if they were members. Given a proposal, the EU pillar takes the decision in the Council of Ministers by a qualified majority vote and the EFTA pillar takes its position by unanimous decision. Thus, each EFTA country has a right to veto an EEA decision. This does not, however, mean that the Council of the Union cannot take the decision. Its status merely changes from an EEA decision to a normal EU decision. The EEA Agreement cannot form contradictions with the EU legislation and thus, by opting out, the EFTA countries do not choose between the new EEA legislation and the status quo, but rather between the new EEA norms and the modified agreement, taking into account the progress of the EU legislation. As regards the decision making of the Union, it has often been argued that small countries, like Finland, Sweden and Norway, cannot influence the decisions of the EU. Here we show, however, that the EEA Agreement could be more problematic in this sense.

The EEA Agreement does not cover all the areas of the EU's competence. In this respect, the main difference between the EEA and the Union is that the former contains

neither the common external trade policy nor the CAP. In these areas, the Union has a strong competence and the decisions of the EU do not tie the EFTA countries' hands. Particularly, the Union's external trade policy could have indirect consequences for the EFTA countries as members of the EEA.

In the Finnish public debate, the fear of losing national sovereignty is one of the main themes. A closer look at the concept of sovereignty shows, however, that as a member state of the EU Finland will lose only one type of sovereignty, while in other respects the Union membership strengthens her position. Let us distinguish the three following meanings of sovereignty, as in Lord (1992):

- formal legal right to final decision
- privacy and separation of national decision-making from external influences
- power, leverage, ability to produce results and all the other factors that contribute to the practical control of a state or a society over its own destiny.

Wallace (1990) distinguishes between the concepts of sovereignty and autonomy. In his terminology, the former concerns the ability of a nation to act on its own rather than under an instruction of another nation, and the latter concerns the ability of a nation to attain its objectives through unilateral action. Autonomy is closely related to interdependence and thay can be interpreted as two alternative means to achieve national goals. In this respect the third meaning of sovereignty in the list above deals with the trade-off between autonomy and interdependence.

When comparing the EEA Agreement and the Union membership, it can be argued that the entrants lose sovereignty in the sense of formal right to a final decision and also in the sense of privacy in certain fields of EU cooperation. While the EEA Agreement ties the EFTA countries in many respects to the EU decisions the losses of privacy are not significant. The possibilities to maintain the formal right to a final decision depends on the role of opting out strategy and on the Union's competences which are not covered by the EEA Agreement, namely the CAP and the common external trade policy. The usage of opting out is very problematic since it either leads to country-specific arrangements or causes the overall functioning of the agreement to deteriorate.

As regards the third aspect of sovereignty, we have to take a closer look at Finland's role in EU decision-making. In the Council of Ministers, which is the decisive body of the Union, decision-making is based on weighted voting. Member states' votes are weighted such that Germany, Italy, France and the UK have 10 votes each; Spain 8 votes; the Netherlands, Greece, Portugal and Belgium 5 votes each; Denmark and Ireland 3 votes each; and Luxembourg has 2 votes. Most questions are solved by the qualified majority which is made up of 54 votes out of 76. Among the entrants, Austria and Sweden get

4 votes, and Finland and Norway 3 votes in the Council of Ministers. Hence the total number of votes increases to 90 and the qualified majority is made up of 64 votes given that the Union enlarges by the four EFTA countries.

To answer the question of national influence in the EU, we have to distinguish between two concepts, namely success and decisiveness. Regarding joint decisions, a country is said to be successful whenever the decision corresponds with her views. A part of the success is, however, based on luck. Sometimes the joint decisions agree with the views of a single actor, although she does not take part in the decision-making at all. Whenever a country has success, but not luck, she exerts power in this abstract sense. Thus luck and decisiveness are two alternative ways to get the outcomes that a voter wants (see Barry, 1980) and, formally, $success = luck + decisiveness$. As far as the questions of the EEA overlap with those of the Union, this reduces for each EFTA country to $success_{EEA} = luck_{EU}(1-d)$, where $(1-d)$ is a 'discount' factor illustrating that in the EEA the EFTA countries do not have an agenda control. In the questions not related to EU, $success_{EEA}$ reduces to 1.

In the EU, the way to see where a country exerts power is to look at those votes where she is critical in the sense that she can swing a losing coalition into a winner. This voting power is closely related to decisiveness, since it requires that a country take part in the decision-making. Let us now elaborate more on the above-mentioned definition of success in the case of EU membership by assuming that each voting outcome occurs with an equal likelihood. It can then be shown that the following holds (see Straffin, Davis and Brams, 1982):

$$success_{EU} = 1/2 + 1/2b \tag{3}$$

where b is the probability that a country is critical for an outcome, i.e. voting power measured by the *Banzhaf index* (for a more detailed analysis, see Widgrén, 1994a). Since the equiprobability assumption yields that the probability of being lucky is 0.5, equation (3) is an explicit way to express success in the EU. Using equation (3), the difference between the success in the EU and in the EEA is as follows:

$$success_{EU} - success_{EEA} = (1/2+1/2b) - (a+(1-a)(1-d)/2) = 1/2b - 1/2(a-d-ad) \tag{4}$$

where a is an overlap factor of the EEA Agreement and the competences of the Union describing a total overlap by the value zero. It can be easily seen that the difference in deciveness, the first term in (4), is positive since the EEA Agreement does not give the EFTA countries a right to vote. The luck effect, the second term in (4), could make the difference negative since the Union is also competent in the areas which are not covered by the EEA Agreement. In that case a country has more discounted luck outside the EU than it exerts power inside the EU. Since it is likely that both a and d are small, the term ad converges to zero and the crucial factor is the relationship between EFTA countries' preference concerning agenda control and the share of EU competence which is not covered by the EEA.

It is interesting that moving towards lower majority requirements in the EU increases the difference between the EEA and the Union membership in terms of success. For this there are two channels. First, a lower majority rule increases directly the *b*-indices (see Widgrén, 1994a) and, second, it can be argued that a lower majority could also make agenda control more preferable. Intuitively, it is clear that efficient decision-making in the Union makes progress faster and, thus, makes things more difficult in the areas not in the EU but closely related to it.

4 Concluding remarks

EU membership is not going to mean a major change to the EFTA countries with respect to the present situation with economic membership in the EU. In their policies and preferences, the Union countries share the same values as the EFTA countries. The magnitude of this change should therefore be limited, as internally, through the EEA, the Nordic countries are well prepared for membership, with the exception of agriculture. The biggest political hesitation towards membership in the EU arises from the fact that national sovereignty is imagined to be put under threat. This fear may be greater in the Nordic countries than elsewhere because of their extensive reliance on social consensus and nationwide packages in decision-making. However, on the contrary, under EU membership we have shown that the Nordic countries gain some of the influence lost under the EEA and are thereby able to fill the 'influence deficit' gap prevailing under the EEA.

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Chapter 3

Voting Power and Control in the EU:
The Impact of the EFTA Entrants
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Expanding Membership of the European Union,
CEPR/Cambridge University Press

1 Introduction

National aspects and the balance of national voting power in the EU play an important role as long as the governments have direct influence in the decision making process. The decisive body of the Union is the Council of Ministers where Germany, Italy, France and the UK have 10 votes each; Spain 8 votes; the Netherlands, Greece, Portugal and Belgium 5 votes each; Denmark and Ireland 3 votes each and Luxembourg 2 votes. Decisions are made mainly by the qualified majority for which 54 votes out of 76 were required before the EFTA countries' entry. Among the new entrant countries Austria and Sweden have 4 votes and Finland has 3 votes. The qualified majority in an expanded EU is made up of 62 votes out of 87[1].

The Council of Ministers offers a nice example for cooperative game theory since it is a weighted majority game with an asymmetric decision making rule. Since 1986, when the Single European Act went into force, the role of qualified majority voting has became more important. Recently there have been pressures towards simple majority or so-called double majority voting in the Council due to the fear of the Union's weakening abilities to operate after the enlargement.

The purpose of this paper is to analyse national influence in the EU. The concept of influence is divided into direct effect on outcomes of votings and into control (see section 2). Particular attention is paid to the impact of the new entrants. The analysis can be divided into three parts. First, we analyse the national influence on the current members' point of view. We thus intend to investigate the loss of current members' power both in absolute and relative terms. Second, we analyse the control of the new entrants over decisions and their opportunities to change the direction of pursued policies. Third, our purpose is to give measures concerning the rules of the decision making game. We thus investigate the effects of changes in the voting rule[2].

The analysis in this paper is based on power and satisfaction indices of cooperative games (see section 2). Power indices have been mostly applied to institutions where voting takes place. Voting power in the EU Council of Ministers has been analysed earlier in Brams and Affuso (1985a, 1985b), Brams, Doherty and Weidner (1991), Widgrén (1993a, 1993b, 1994a, 1994b, 1994c, 1995) Nurmi (1992) and Herne and Nurmi (1993).

The rest of the paper is organized as follows. In section 2 we present the measures of voting power and control. The results obtained for the current Community and for an expanded EU with four new EFTA countries as members are summarised in sections 3, 4 and 5 and, finally, conclusions are presented in section 6.

2 Measuring the National Influence in the EU

While the basic notion of influence is understood by everyone, it turns out to be quite tricky to define formally. For instance, in the EU Council of Ministers, while most would agree that Germany has more influence than Luxembourg, it is not obvious how one would quantify such a statement. We know that Germany has more votes than Luxembourg and it is intuitively acceptable that it should have more - or at least as much - influence as Luxembourg. However, as the following example illustrates, voting weights alone are poor proxies for influence and hence what we need is a more appropriate measure of influence.

As it turns out three separate measures have been explored in the literature. The first measure of influence, which we call *power*, answers the question "How likely is it that a particular country's weighted vote will be essential to the to the passage of a proposal?" A second natural measure, which we call *negative control* answers a related but different question: "How likely is it that a proposal will be rejected when a particular country votes 'no'?" Finally a third measure, *positive control*, answers the question, "How likely is a proposal to be adopted when a country votes 'yes'?

Having defined measures of influence, we are still a long way from quantifying them for current and potential EU members. The outcome of a weighted vote on a specific issue depends upon three things: the majority rule adopted (e.g. simple majority or qualified majority), the weights assigned to the various countries and the voting behaviour of the countries. Of these three, modelling the voting behaviour poses the greatest conceptual problems[3]. For instance on a certain issue before the Council of Ministers a very small country like Luxembourg might be absolutely crucial to obtaining a qualified majority. In such situation one could say Luxembourg had a lot of power. However, on many other issues, Luxembourg's votes might be quite irrelevant, so one might say that Luxembourg had no influence. This issue by issue approach, while appealing at first sight, is impractical. To make a general statement about how much influence Luxembourg has under certain voting rules would require us to predict each country's position on every conceivable issue. This sort of judgement would be far too subjective.

The approach adopted in the literature (and in this paper) is to describe countries' voting behaviour in a more abstract way. We say that country i will vote 'yes' on a randomly selected issue by probability of p_i. The voting behaviour of n countries can be described by the so-called *acceptability vector*, which is an n-dimensional vector of the p_i's. These p_i's help us to quantify specific measures of power. To see how, we consider a simple example. Using this simple example can define power and control indices in order to fix ideas and introduce terminology.

Suppose that there are three countries - A, B and C - whose voting weights are 49%, 49% and 2% respectively. Moreover suppose that we were absolutely certain, for some

reason, that each country was equally likely to vote for or against a randomly chosen issue, implying that the correct acceptability vector is $(1/2, 1/2, 1/2)$. Finally suppose that the voting is conducted according to the simple majority rule. Obviously there are 8 possible outcomes in the voting: $YYY, YYN, YNY, YNN, NYY, NYN, NNY, NNN$ using the notation that the first, second and third letters reflect the votes of A, B, and C respectively and that Y indicates a 'yes' vote and N a 'no' vote. Given the acceptability vector each outcome occurs with an equal probability of $1/8$.

Careful inspection of the outcomes (keeping the weights in mind) shows that C's yes-vote is crucial to passage of a proposal whenever A and B disagree. This occurs in 4 of the 8 possible outcomes: YNY, YNN, NYY and NNY. The total probability that C's vote is crucial is the sum of the probabilities of YNY, YNN, NYY and NNY. Given the acceptability vector assumed, each of these occur with $1/8$ probability, so the total probability is 0.5. Clearly 0.5 could be taken as a formal measure of country C's power. Country C's negative control is measured by the probability that the outcome of voting agrees with its no vote. This occurs in 3 out of 4 outcomes[4], so C's negative control could be measured as 0.75. Likewise, its positive control is $3/4$. One would measure power and control for A and B in similar fashion. It turns out that they have exactly the same power and control figures as C. Thus the distribution of votes can indeed be a poor measure for influence.

Furthermore, maintaining the assumed acceptability vector we could see how the power and control measures of the three countries change when we altered the majority rule to say a two-thirds majority rule, or changed the weights of the three countries, or added a fourth country. For each of these changes the voting system would give different power and control indices for each of the three countries.

The trouble with the primitive power and control indices introduced in this example is that they are sensitive to the exact acceptability vector we assumed[5]. To get around this problem we would want indices that describe power and control for a wide range of acceptability vectors. The literature addresses this problem by calculating the indices, assuming a joint probability for the p_i's[6]. In particular the literature has focused on two standard joint probability distributions (jpds) for the p_i's. The first assumption is called *independence*. This assumes that the p_i's are independently and uniformly distributed on the closed interval between zero and one. The second is called *homogeneity*. It assumes that all of the p_i's in a given acceptability vector equal a fraction, which we call t, but that the value of t is uniformly distributed over $[0, 1]$.

To define the power and control indices that will be used to investigate the impact EU enlargement has on various countries' influence in the Council of Ministers, it is useful to adopt a more structured approach than was taken in the simple example. First, following the terminology of cooperative game theory we consider the outcomes in the simple example above as equal to coalitions. The list of outcomes in the simple example above can be written as a list of 'yes' vote (or 'no'-vote)[7] coalitions as follows:

$\{A,B,C\};\{A,B\};\{A,C\};\{A\};\{B,C\};\{B\};\{C\};\emptyset$. It can be easily seen that there are different coalitions. For our analysis three different types of coalitions are essential. First, a country is crucial for the outcome and has power when it belongs to a minimum majority with respect to itself (i.e. it can swing the majority yes-vote coalition to minority by voting 'no'). In our example C is crucial in coalitions $\{A,C\}$ and $\{B,C\}$ (or outcomes YNY and NYY). Second, a country has negative control when it does not belong to a 'yes' vote coalition and only a minority yes-vote coalition is formed. In our example coalitions $\emptyset$, $\{A\}$ and $\{B\}$ (or outcomes NNN,YNN and NYN) are such. Finally, a country has positive control when it belongs to a majority 'yes' vote coalition.

Let N be the set of n ministers in the Council of Ministers. Supposing that they vote 'yes' or 'no' independently of each other, we can write for any coalition $S \subset N$ (or any particular array of 'yes' and 'no' votes), the probability that it will be formed as follows,

$$P\{'coalition\ \ S\ \ is\ \ formed'\} = \prod_{i \in S} p_i \prod_{i \notin S} (1 - p_i) \qquad (1)$$

which is no more than a binomial probability with varying p probabilities. In our example above they were constant and that is why the number of 'yes' votes in outcomes were binomially distributed as we can see by having a closer look at the outcomes and their probabilities of occurrence in the example. The sum of the probabilities in (1) over all possible 2^n coalitions (or outcomes) is always 1[8]. Thus (1) formally defines a probability distribution over all possible outcomes. If we take the sum of these probabilities over the chosen classes[9] of coalitions (minimum majorities with respect to each voter, majorities where a particular voter is a member and blocking coalitions where a particular voter is a member), we will have the probabilities that we need for our measures of influence.

The assumptions that we made about the p_i probabilities and a large number of coalitions in the EU make the calculation more difficult than in our simple example above. In an enlarged EU of 16 members there are $2^{15} = 32768$ coalitions (i.e. there are that many possible outcomes) while there were 8 of them in the example. In addition, independence and homogeneity share the property that we are working with the mathematical expectations of an infinite number of acceptability vectors. It is not difficult to imagine what kind of process it would be to calculate the measures of influence of all 15 countries by classifying the 32768 outcomes, even with a single acceptability vector. The latter problem is easy to handle by using the standard methods of probability calculus, but for the former we need cooperative game theory.

In the 'yes'or 'no' type of voting, the basic classification of coalitions is to divide them into majorities and minorities. If we take a sum of probabilities in equation (1) over the class of the required majority, we have a probability that a winning coalition is formed. This sum is usually referred to as a *multilinear extension* of v (MLE). All the three measures of influence can be calculated by using it. Let us denote the MLE with a given acceptability vector by $f(p_1,\ldots,p_n)$.

Intuitively the easiest measure to understand is positive control, which can be calculated for country i simply by setting $p_i = 1$ (i votes 'yes' for sure) in the MLE. Country i's negative control can be calculated by setting $p_i = 0$ (i votes 'no' for sure) and taking the complement probability of the MLE (i.e. $1 - f(\cdot)$, the probability that a coalition does not win). The most difficult measure to calculate is power. Again it is possible go through all majorities and count the ones where i is crucial. A much simpler method is to take partial derivates of the MLE $f(p_1, \ldots, pn)$. It turns out that the partial derivates are measures of power as defined at the beginning of this section. To clarify these ideas we may write the power polynomial for our example (keeping the voting weights in mind) as follows: $f(p_A, p_B, p_C) = p_A p_B p_C + p_A p_B(1 - p_C) + p_A p_C(1 - p_B) + p_B p_C(1 - p_A) = p_A p_B + p_A p_C + p_B p_C - 2p_A p_B p_C$. Using the primitive acceptability vector we can now check the calculations in the example. Positive control ($p_A = 1$) for C is simply $1/4 + 1/2 + 1/2 - 2(1/4) = 3/4$ and negative control ($p_A = 0$) $1 - (0 + 0 + 1/4) = 3/4$. Derivating the MLE with respect to p_C yields $f_C(p_A, p_B, p_C) = p_A + p_B - 2p_A p_B$ and assuming the acceptability vector $(1/2, 1/2, 1/2)$ we have 0.5 power for C.

Generally, if we calculate the probability that one is crucial in the sense that she/he swings the coalition from losing to winning we have the two following well-known formulas. Let f_i be the i^{th} partial derivate of the power polynomial f and $\mathcal{M}_i$ the class of minimum winning coalitions with respect to i (i.e. coalitions where i is crucial with respect to the outcome) and let S be a randomly chosen coalition. Independence yields

$$\begin{aligned} P_{ind}\{'i \text{ is crucial to the passage of a proposal}'\} &= \int_0^1 \ldots \int_0^1 f_i(p_1, \ldots, p_n) dp_1 \ldots dp_n \\ &= f_i(p_1, \ldots, p_n) \\ &= \sum_{S \in \mathcal{M}_i} (\frac{1}{2})^{n-1} \\ &= \beta_i', \end{aligned} \tag{2}$$

where the subscript "ind" stands for independence. The second equivalence is interesting. It shows that after all the independence assumption implies our primitive acceptability vector in the example above. That is why independence is often referrred to as indifference. This property can be easily checked by taking a double integral of the formula $p_A + p_B - 2p_A p_B$ in the example above. The third equivalence can be easily understood intuitively by thinking how one becomes crucial. We need an outcome where a minimum majority coalition is formed and i belongs to that coalition. The sum formula in (2) is a probability that such an event will occur. What is important in the term $(1/2)^{n-1}$, describing the probability that a randomly chosen outcome will materialise is that it is independent of the number of 'yes' votes (or 'no' votes) in the outcome. Thus each outcome has an equal probability of occuring. In the literature the equation (2) is referred to as the Banzhaf power index (BI). Let n and s denote the cardinal numbers

(cardinalities) of sets (coalitions) N and S respectively. Homogeneity yields

$$\begin{aligned} P_{hom}\{'i \text{ is crucial to the passage; of a proposal}'\} &= \int_0^1 f_i(t,...,t)dt \qquad (3) \\ &= \sum_{S \in \mathcal{M}_i} \frac{(s-1)!(n-s)!}{n!} \\ &= \Phi_i \end{aligned}$$

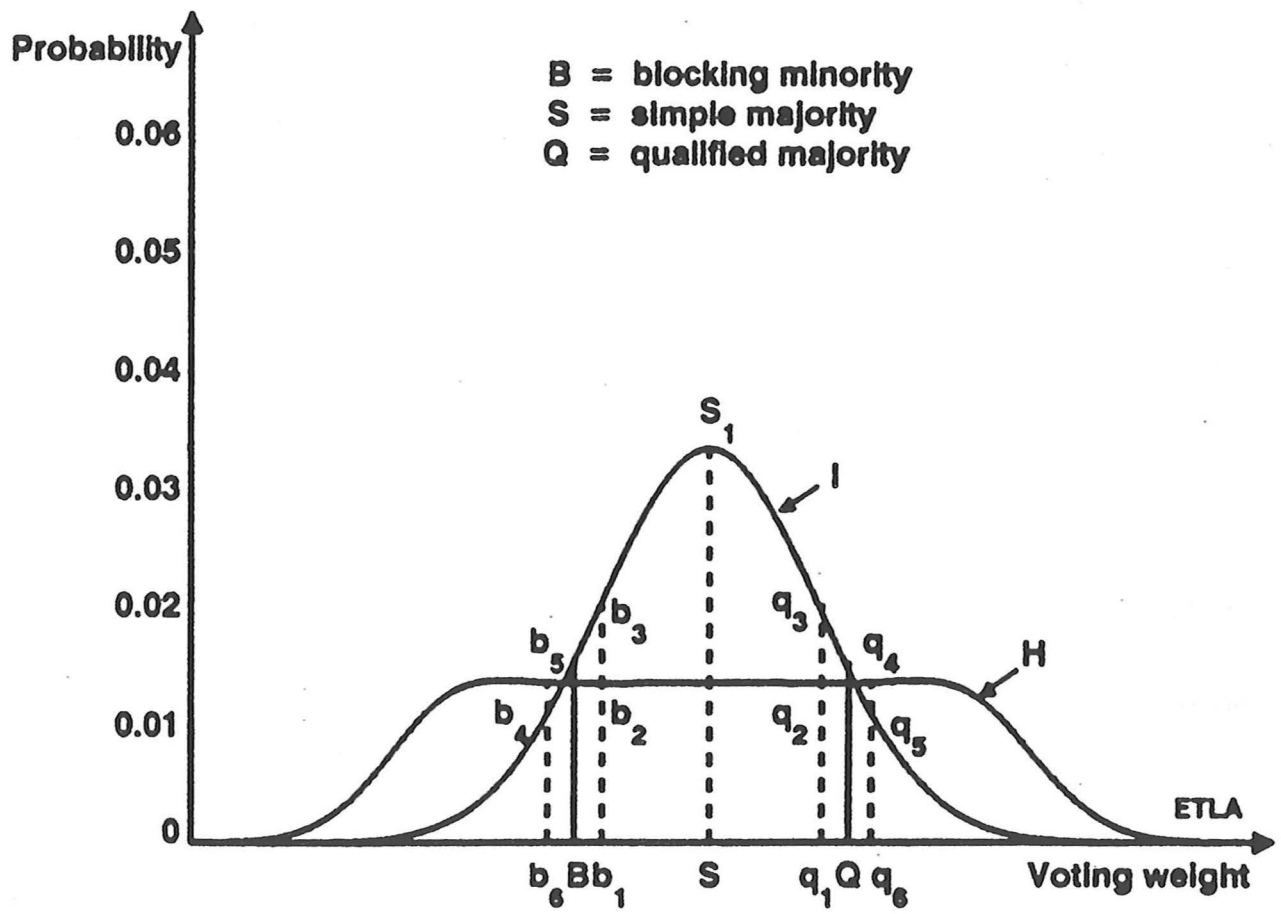
where the subscript "hom" stands for homogeneity. Equation (3) is referred to as the Shapley-Shubik power index (SSI). It is a more complicated measure than the BI. Intuitively speaking - as can also be seen in the second row of (3) - the homogeneity assumption turns the combinations (outcomes or coalitions) into permutations. The second row of (3) can be interpreted as a probability that the voters form a 'yes' vote coalition in the order of their probability of acceptance of each question (i.e. we choose a random order of voters) and i is the one who turns the 'yes' vote coalition into a winning one (see Shapley 1953).

Probabilistically, the main difference between the two indices is that under the homogeneity assumption there is a common standard t by which the ministers evaluate the Commission proposal and thus the probabilities of the voters' decisions are correlated in a specific way (Straffin 1988). For example, the event that 'voting behavior of two independent voters is similar' has a probability 1/2 while it increases to 2/3 if the voters are homogeneous. When assuming independence we suppose that on average each voter tosses a coin to decide whether to vote 'yes' or 'no'. When assuming homogeneity, only a single coin is tossed. It determines whether a group of homogeneous voters accepts a proposal or not. However, knowing the result (i.e. the majority of 'yes' votes to be formed) does not tell us anything about individuals' voting behaviour. It is like a necessary condition for a certain kind of behaviour. The sufficient condition is that we know each voters willingness to support the proposal. It defines an order of voters and thus in general we take into account all possible orders of voters. Drawing whether a proposal is accepted or not and random orders together forms the homogeneity assumption.

One important difference, which also enlightens one of the basic differences between the independence and homogeneity assumptions, is that when assuming the former the number of 'yes' votes (or 'no' votes) is binomially distributed and when assuming the latter it is uniformly distributed. This implies that under independence it is more probable to get an approximately a "50-50" result than under homogeneity, which gives equal probability to all numbers of 'yes' votes (or 'no' votes) between zero and n, the number of voters.

Let us call the coalition of 'yes' votes *the supporting coalition*. Figure 1 presents density functions for the size of the yes-vote coalition measured by the voting weight under independence, denoted by I, and under homogeneity, denoted by H. The sum of voting

Figure 1. Homogeneity, independence and the size of the yes-vote coalition



weight in the supporting coalition is presented on the horizontal axis and the probability on the vertical axis. Figure has been plotted by using the weights, etc. in an expanded EU(15). Also the density functions have been plotted by applying normal distribution approximations[11]. According to the central limit theorem, the distribution of the sum of random variables (here, voting weights) converges to the normal distribution if the variance of the variables does not exceed a certain limit. The smaller the variance, the faster the convergence. In the EU, it can be shown that the convergence is very fast and the approximation errors are no more than 10^{-3} in the EU of 16 members (see Widgrén 1994b and for the method Owen, 1982). The power measures and most of their properties can be illustrated by using figure one. Assuming qualified majority voting the SSI is the probability bordered by the rectangle (q_1, q_2, q_4, q_6) and the BI is the area (q_1, q_3, q_5, q_6). Probabilistically, they both are the probability that a supporting coalition with the voting weight a little over the required majority is formed minus the probability that a supporting coalition with the voting weight not too much under the required majority is formed. Naturally, the voting weight that a country has affects the distance between q_1 and q_6. Figure also tells us what we should expect for our results in sections 3 and 4. It is easy to see that the power when measured assuming independence should increase while the majority rule decreases. Under qualified majority there should be no remarkable differences between the indices.

The difference between the independence and homogeneity assumptions can also be characterised by using conceptualisation of the communication among the voters (Straffin, 1988). According to Straffin, the homogeneity assumption is more appropriate for the analysis of the voting bodies where there is considerable communication among the representatives. Interpreted in another way, it can be said that homogeneity (common standard in voting behaviour) can be reached by amending the original proposals, and thus they are likely to be more or less compromises after the bargaining process, which also increases the homogeneity between the originally heterogeneous voters. In other words homogeneous voters negotiate whether a proposal is acceptable (t is high) or not (t is low). Homogeneity thus also takes into account the proposals for which the voting will never be taken. Naturally, one has power also in these questions. It can also be thought that there are groups of voters who are originally more homogeneous than others and thus there is a partition of the representatives into different homogeneous groups which are independent of each other. The independence assumption, in contrast, implies that there is no communication of any significance to speak of among the voters and thus they do not negotiate to amend the proposal and the common standard is not likely to be reached. Roughly one can imagine that the voters are independent when the draft proposal is given and their homogeneity increases if they do have a possibility of bargaining and revising proposals. It is worth noting, however, that the increased homogeneity can be reached by compromises between the member states and thus the draft proposal may change significantly during the process.

This kind of illustration can also be used to characterise the different voting groups. It can be assumed that there is a group of voters, denoted by S, supporting the proposal

in the sense of homogeneity, i.e. they have reached a compromise about the voting standard t, and another group, denoted by R, which is opposes the proposal, i.e. having a voting standard $1-t$. In addition to this, there is a group of voters, denoted by U in which the voters are independent of each other and also of the homogeneous groups. This kind of setup is a special case of the partial homogeneity and it yields

$$P_{par}\{'i \text{ is crucial to the passage of a proposal}'\} \tag{4}$$
$$= \underbrace{\int_0^1 \int_0^1 \dots \int_0^1}_{u+1} f_i(\overbrace{t,\dots,t}^{s}; p_{s+1},\dots,p_{s+u}; \overbrace{(1-t),\dots,(1-t)}^{r}) dp_{s+1}\dots dp_{s+u}dt = \pi_i,$$

where n, s, u and r denote the cardinal numbers of sets N, S, U and R respectively and $f_i(\cdot)$ is the i^{th} partial derivative of function (probability) f defined earlier. It is worth noting that the sum of BIs or any partial homogeneity indices is not one as it is for SSIs. That is why these indices are often normalised by forcing their sum to unity but we do not intend to do this here because it ruins the probabilistic interpretation of the indices used in this paper. The so-called inconsistency property mentioned above is due to the permutations and combinations. For example, if the order in which the voters form a yes-vote coalition is known, the voter who is crucial can also be defined uniquely whenever a majority is formed, but if only the outcome is known, there can be several crucial voters. Also for partially homogeneous voters forming a majority may become more difficult and this status quo solution implies that there are no crucial voters. Particularly, when assuming a partial homogeneity with opposite groups as in (5), the distribution of the 'yes' vote coalition's size in figure 1 would concentrate more around the simple majority. Intuitively speaking we may imagine that there is a "cake" of total power which should be divided among the voters. Homogeneous voters can always share the whole cake while partially homogeneous or independent voters may hope too much (the sum of power indices exceeds one) or suffer from inefficiency losses (the sum of power indices is below one). We call voters who share the "cake" properly $group-consistent$.

Power indices measure an individual's direct influence on outcome. In addition to this voters have control over decisions as members of different coalitions. In analysing the voting bodies with an asymmetric majority rule it is interesting to decompose the idea behind the control since, as it was noted earlier in this paper preventing and accomplishing decisions differs considerably in bodies like the Council of Ministers of the EU. Assuming homogeneity, the probability that the proposal is accepted on condition that one votes 'yes' can be written as follows,

$$P\{a \text{ proposal is accepted} \mid i \text{ votes } 'yes'\} = \int_0^1 f(\underbrace{t,\dots,t}_{i-1}, 1, \overbrace{t,\dots,t}^{n-i})dt \tag{5}$$

where i is a positive integer smaller than n and assuming independence respectively by using indifference - an implication of the independence assumption as noted earlier in this paper - and letting $t = 1/2$[12]. To analyse one's possibilities for pursuing negative control, i.e. the probability that a group decision rejects a bill one votes against, we use the complement probability of (5) on condition that $p_i = 0$ as follows,

$$P\{a\ proposal\ is\ rejected \mid i\ votes\ 'no'\} = \int_0^1 1 - f(\underbrace{t,...,t}_{i-1}, 0, \overbrace{t,...,t}^{n-i})dt \qquad (6)$$

where i is a positive integer smaller than n and assuming independence $P\{\cdot\}$ can be written respectively by letting $t = 1/2$. Turning back to figure 1 gives us a graphical illustration of control measures. Assuming a qualified majority positive control can be defined to be the area to the right of q_1 between the distribution (H or I) and the horizontal axis. It is the probability that i gets enough support and the majority is formed when its sure 'yes' vote is added. Similarly the negative control is the area to the left of q_6 between the chosen distribution and the horizontal axis. It is the probability that the no-vote coalition can block the decision with i's sure 'no' vote.

When analysing power one crucial question is: "How concentrated is the power?". To analyse the concentration of power the control measures are often used to make conclusions. The leading coalition is defined in cooperative game theory as an alliance of the m largest players (countries). The coalition is said to be weakly controlling if it can control the decisions by a probability higher than 0.95 and it is said to be controlling if the probability exceeds 0.99[13].

3 The Distribution of Voting Power

The new entrants' share of the population in the EU of 15 members is 5 per cent, but they get 11.5 per cent of the votes. This is due to the apparent logarithmic relationship between the votes and population which favours the smallest members of the EU. Thus the expansion of the Community by the EFTA countries could potentially have significant consequences for the distribution of power.

In weighted voting, however, the relationship between power and voting weights is not necessarily straightforward. Let us define a concept which elaborates on this phenomenom. We refer to the ratio between the normalised power index and voting weight as *the power coefficient* (PC), which can be intepreted as a measure for one's relative power. It tells us how effectively voters can use their votes to exert power. The PC illustrates how important a voter strategically is. It has values over one if a voter has

Table 1: Voting Power in the Council of Ministers of the EU(9) and EU(12) and the Voting Weight Elasticies of Power

Member state	Shapley-Shubik index			Banzhaf index		
	EU(9)	EU(12)	$\epsilon_{\Phi,w}$	EU(9)	EU(12)	$\epsilon_{\Phi,w}$
GERMANY	0.179	0.134	1.07	0.207	0.139	1.39
ITALY	0.179	0.134	1.07	0.207	0.139	1.39
UK	0.179	0.134	1.07	0.207	0.139	1.39
FRANCE	0.179	0.134	1.07	0.207	0.139	1.39
SPAIN	..	0.111	..	..	0.118	..
NETHERLANDS	0.081	0.064	0.89	0.113	0.073	1.50
PORTUGAL	..	0.064	..	..	0.073	..
GREECE	..	0.064	..	..	0.073	..
BELGIUM	0.081	0.064	0.89	0.113	0.073	1.50
DENMARK	0.057	0.042	1.12	0.082	0.049	1.71
IRELAND	0.057	0.042	1.12	0.082	0.049	1.71
LUXEMBOURG	0.010	0.012	-0.84	0.020	0.019	0.21

higher voting power than voting weight. The voter then has then effectively more votes than the actual number would show. The usual well-known result is that voters with large number of votes tend to have higher PCs than voters with a small number of votes. This phenomenon can be illustrated by calculating the effective number of votes which can be defined to be the actual number of votes multiplied by the PC.

When analysing the consequences of an enlargement of the EU (or any other institution where voting takes place) it would be interesting to investigate the changes in voters' relative positions. For this we may use ordinal elasticies. Let us define a voting weight elasticity of power to be the ratio between the relative change in the power index and relative change in the voting weight. Intuitively the elasticities should be positive (i.e. loss of voting weight implies loss of power). As usual, it can be said that power is elastic if it exceeds one and inelastic if it lies below one. A voter loses relative power if the elasticity exceeds one and gains relative power if the elasticity is smaller than one. Negative elasticities indicate that a voter gains absolute power while his voting weight decreases. This phenomenon is often referred to as the paradox of new members.

Table 1 presents the Shapley-Shubik and Banzhaf power indices for qualified majority voting in the EC(9) and EU(12) and the voting weight elasticies of voting power in the enlargement of the 1980s. Table 2 shows the respective figures for an expansion of the EU by the three EFTA countries. It seems that both measures of power (SSI and BI) have approximately the same level in the EU(12) or in the EU(15), but before the accession of the Mediterranean countries the Banzhaf index gave higher estimates.

Table 2: The Distribution of Voting Power in the EU Council after the Entry of Austria, Sweden and Finland and the Voting Weight Elasticities of Power for the Old Members

Member state	Shapley-Shubik index	$\epsilon_{\Phi,w}$	Banzhaf index	$\epsilon_{\beta,w}$
GERMANY	0.119	1.02	0.113	0.93
ITALY	0.119	1.02	0.113	0.93
UNITED KINGDOM	0.119	1.02	0.113	0.93
FRANCE	0.119	1.02	0.113	0.93
SPAIN	0.093	0.96	0.093	0.90
NETHERLANDS	0.056	1.00	0.059	0.92
PORTUGAL	0.056	1.00	0.059	0.92
GREECE	0.056	1.00	0.059	0.92
BELGIUM	0.056	1.00	0.059	0.92
SWEDEN	0.044	..	0.048	..
AUSTRIA	0.044	..	0.048	..
DENMARK	0.033	0.90	0.036	0.84
FINLAND	0.033	..	0.036	..
IRELAND	0.033	0.90	0.036	0.84
LUXEMBOURG	0.021	-2.00	0.023	-1.39

Widgrén (1994b) has shown that in the EU(12) it seems that there is no clear relationship between PCs and voting weights, but the new entrants make the PC an increasing function of voting weight[14]. The countries with the largest power coefficients lose most in relative terms, while the reverse holds for the small countries. However, the slope of the relationship between voting power and voting weight does not differ significantly from one. It can be thus argued that the enlargement of the Community by the EFTA countries equalizes the fluctuations in the PC and the effective number of votes do not differ remarkably from the real ones despite the slightly increasing relationship. There are, however, no differences higher than 0.5 votes between the actual and effective votes (Widgrén 1994b). After all, in the EU Council of Ministers a voting weights seem to be at least satisfactory proxies for member states' power. This is, indeed, exceptional for a body where weighted voting takes place. It even seems that there is a dose of brain work behind the determination of voting weights and the choice of majority rule.

The elasticies in tables 1 and 2 also show this interesting difference between the enlargements analysed. It seems that old members' voting power is more elastic with respect to the voting weight in the enlargement of the 1980s when we assume independent voters than when we assume homogeneous voters, but for the accession of the EFTA countries

this does not hold true. Thus in the 1980s voters lost more independent power in proportion to their voting weight than in an expansion of the EU by small EFTA countries. Intuitively this can be interpreted by arguing that the Mediterranean countries made it more necessary for the Community to reach compromises since the independent power (Banzhaf index) decreased almost to the same level as the homogeneous power. If the independent power is higher than the homogeneous power, a country has a higher probability of being crucial without communication with other countries (see section 2). A country has an incentive to push its own views through without remarkable admissions. In contrast, if the homogeneous power is higher there is an incentive to seek cooperation and compromises. We may call a voting body where independent power is high competing, while the one with high homogeneous power could be called conciliatory. The results in tables 1 and 2 show that the Mediterranean enlargement turned the Community from a competing towards a conciliatory direction. Hence a single country's prospects[15] of wielding influence on decision making without compromises notably decreased.

In the enlargement of the EU by the EFTA countries the loss of power for the old members would be 12 per cent when measured by the SSI. In the 1980s the expansion of the Community by Greece and the Iberian countries yielded a 24 per cent loss of voting power for the members of the Community. For the most important decisions unanimity was needed more often in the 1970s than in the latter half of the 1980s. It is interesting, however, that the loss of voting power for the members in the EU(9) is almost exactly the same when we compare the majority or unanimity voting in the EU(9) to the majority or unanimity voting in the EC(12). This does not hold true for the step from the EU(12) to the EU(15) since the loss of power in unanimity voting would be one-fourth for the old members due to the new entrants' small size.

Table 3 presents the power indices for the EU(12) and the EU(15) when simple majority and a double majority rules are used. It is surprising that the SSI gives almost exactly the same distribution of power in simple majority voting as in qualified majority voting. It is even more suprising that in double majority voting the smallest countries seem to gain somewhat. The double majority rule has been analysed in detail in Widgrén (1994a). It is shown therein that countries with a population smaller than 7 million would gain if double majority rule was used instead of the qualified or simple majority rule.

Independence gives much more power to each member in simple or double majority games when compared to qualified majority voting. If we normalize the BI, the distribution is, however, almost identical to the distribution of the normalized index in the qualified majority game. We can base our interpretation of this phenomenon on subjective probabilities and on the phases of the decision making process. In the first phase a draft proposal is given and voters can be considered independent since there has been no communication of any significance to speak of between them. As noted earlier in this paper, power indices can be interpreted as players' prospects from participating in voting games. The result in table 3 shows that a decrease in a voting rule implies that

Table 3: Voting Power in the EU Council Before and After the Entry of Austria, Sweden and Finland: Simple and Double Majority Rules

Member state	Shapley-Shubik index Simple Majority		Banzhaf index Simple Majority		Shapley-Shubik index Double Majority	
	EU(12)	EU(15)	EU(12)	EU(15)	EU(12)	EU(15)
GERMANY	0.135	0.116	0.336	0.365	0.144	0.134
ITALY	0.135	0.116	0.336	0.365	0.115	0.108
UNITED KINGDOM	0.135	0.116	0.336	0.365	0.115	0.103
FRANCE	0.135	0.116	0.336	0.365	0.115	0.103
SPAIN	0.107	0.091	0.268	0.285	0.104	0.087
NETHERLANDS	0.063	0.055	0.160	0.174	0.061	0.052
PORTUGAL	0.063	0.055	0.160	0.174	0.059	0.048
GREECE	0.063	0.055	0.160	0.174	0.059	0.048
BELGIUM	0.063	0.055	0.160	0.174	0.059	0.048
SWEDEN	..	0.043	..	0.138	..	0.046
AUSTRIA	..	0.043	..	0.138	..	0.046
DENMARK	0.038	0.032	0.100	0.103	0.057	0.044
FINLAND	..	0.032	..	0.103	..	0.044
IRELAND	0.038	0.032	0.100	0.103	0.056	0.044
LUXEMBOURG	0.023	0.021	0.061	0.069	0.055	0.042

independent prospects (i.e. without compromises) become more optimistic, but also that they become unrealistic in the sense of group-consistency (see section 2). Hence on the basis of table 4 we may argue that voting power increases but also that voters seem to overestimate their abilities during the early phases of the decision making process. This leads to more stringent competition since the decision making moves to the direction of "may the best proposal win" while the independent power increases. In the EU Council of Ministers, the independent power seems to exceed the homogeneous power when the voting rule is larger than a blocking minority and smaller than a qualified majority (see figure 1). Another question which arises is a question of increased risk of being outvoted in simple majority voting (see section 4).

The results concerning the loss of power do not support the hypothesis that the increased role of majority voting in the 1980s was a consequence of the fear of power losses for the members of the EU(9). It seems also that the distribution of power does not give any reason to claim a move from a qualified to a simple majority rule for any of the current Union members. Although the move from a qualified to a simple majority rule increases voting power for each member it also increases significantly the risk of losing. It also

seems that under the qualified majority rule independent and homogeneous power are in balance.

4 Decision Making Control

Tables 4 and 5 show the probabilities of blocking decisions and of ensuring acceptance of proposals for the leading coalition (i.e. a coalition with m largest countries) when assuming a qualified majority. It can be seen that the decision making can be weakly controlled by the five largest countries, assuming independence, when assuming homogeneity, a qualified majority is needed to control decisions.

The negative control can be pursued by small coalitions with 2-3 members[16]. The probabilities in tables 4 and 5 show two basic characteristics of EU decision making. First, proposals have hurdles to pass without significant compromises and, second, national control is high and based on the negative part of control. The immediate consequence of these properties is that they limit the competence of the EU to the issues where member states can reach high homogeneity and make compromises. Also while maintaining the current decision making rules (i.e. voting weights and majorities) the high national control indicates that the Union cannot take new members with very different views from the average "Community standard". To get homogeneous ministers member states have to be similar. The third consequence of a high degree of national negative control is that the decision making can be ineffective. There is a danger that significant decisions cannot be made before a wide homogeneity is reached (see section 5). A very important consequence of the third implication is that the decision making system in the EU in practice secures the role of the subsidiarity principle. The decision making process makes it too difficult, and above all too ineffective, to make decisions regarding the areas where there is no enough homogeneity between member states.

It can be seen in tables 4 and 5 that after a certain limit the measure of control increases faster under the independence than under the homogeneity assumption. The technical explanation for this lies in the probability model behind the indices. Asssuming independence implies that the support for the leading coalition exceeds the limit needed for a blocking minority more readily than under the homogeneity assumption.

Intuitively, it is quite clear that negative control decreases when voters negotiate and amend proposals. The conclusion that control increases faster under independence than under homogeneity implies that the negative part of control dominates. For compromises, member states have to give more of their negative control than they gain positive control. For the EU Council of Ministers, it seems that the dominance of negative control holds for coalitions of more than three to four of the largest members.

Table 4: The leading coalition's control over decision making in the EU(12)

n	Homogeneity		Independence	
	Prob. of accompl.	Prob. of preventing	Prob. of accompl.	Prob. of preventing
1	0.35	0.78	0.17	0.97
2	0.41	0.90	0.28	1.00
3	0.48	1.00	0.46	1.00
4	0.59	..	0.71	..
5	0.74	..	0.91	..
6	0.86	..	0.98	..
7	1.00	..	1.00	..

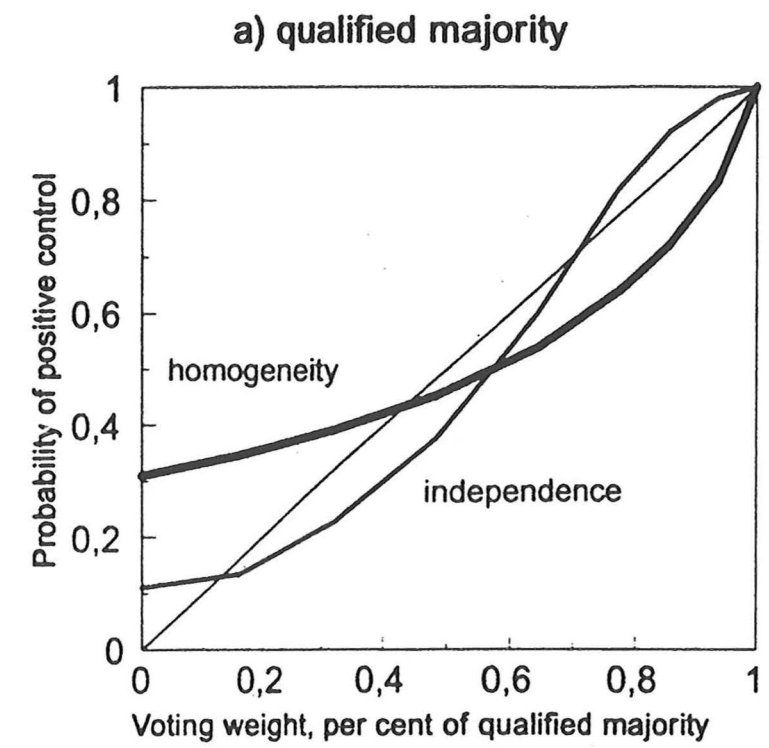
Table 5: The leading coalition's control over decision making in the EU(15)

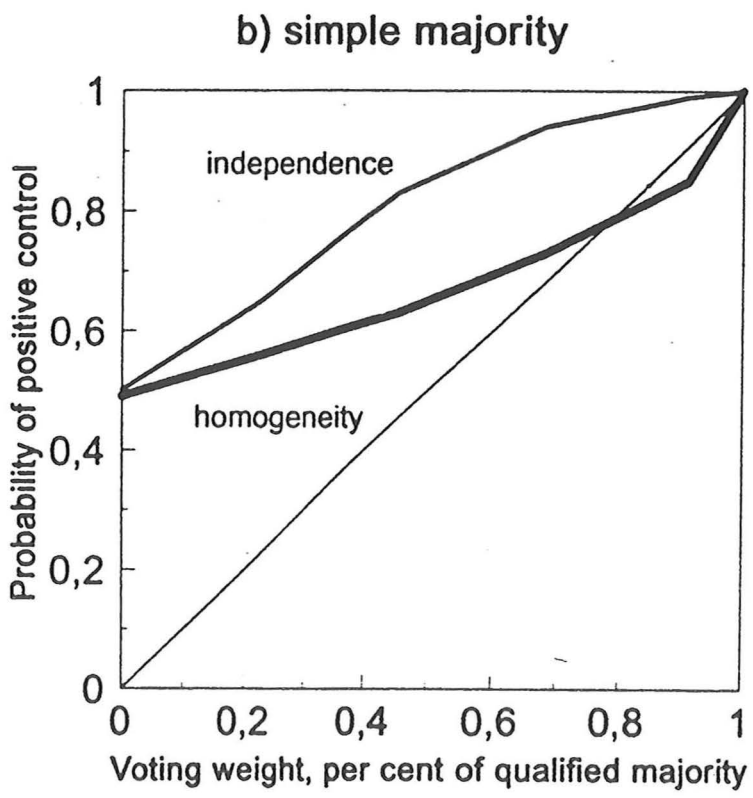
n	Homogeneity		Independence	
	Prob. of accompl.	Prob. of preventing	Prob. of accompl.	Prob. of preventing
1	0.35	0.77	0.13	0.98
2	0.39	0.87	0.23	1.00
3	0.45	1.00	0.38	1.00
4	0.54	..	0.60	..
5	0.64	..	0.82	..
6	0.72	..	0.92	..
7	0.83	..	0.98	..
8	1.00	..	1.00	..

Another side of this phenomenon is shown in figure 2. It presents the positive control as a function of the leading coalition's votes as a share of the majority. The figures are quite similar regardless of whether the EU(12) or the EU(15) is investigated and that is why we present only the latter. The first common feature is that in qualified majority voting independent voters have higher positive control if the size of the leading coalition exceeds 60 per cent of that majority. Beyond this limit a leading coalition cannot gain positive control by compromises. Simple majority voting changes the figures remarkably. To gain positive control there is no need for compromises. Also the control is much more concentrated, i.e. the control curve lies above the 45 degree line, and the two largest countries could control decisions with a probability of 0.8.

The main conclusion of the measures concerning decision making control is that the qualified majority rule with a voting weight determination favouring small countries

Figure 2.
Leading coalition's share of majority and control in the EU(15)





insures high national control for both the large and small members. The control is based on its negative side, i.e. on blocking decisions. Moving towards a simple majority, although it has a neglible effect on voting power, would change the control measures significantly. In simple majority voting the control would be based on the positive side and in the sense of higher control the compromises would become useless. This also holds for double majority voting.

5 Policy Change

The conclusions made in sections 3 and 4 were based on the assumption that voters behave similarly regarding voting distributions (i.e. they are all either independent or homogeneous). Typically, this kind of analysis concentrates on a voting body itself, not on voters or particular questions of voting. The analysis is said to be abstract. We have argued in this paper (see Straffin, 1988) that voting assumptions can be interpreted as consequences of different levels of communication among the voters. This illustration can be used to model certain qualitative cooperation structures in a voting body. The cooperation structures may arise from differences in preferences and thus they may vary from vote to vote, e.g. regarding the issue of voting. In this paper, however, we do not intend to analyse different issues of voting[17], but rather a more general setting which also arises from different preferences. On the basis of our analysis we can make conclusions about the magnitude of possible policy shifts after the three EFTA countries have joined the EU.

Our analysis in this section is based on partial homogeneity (see section 2). We simply assume that the Mediterranean countries (Spain, Portugal and Greece) form one homogeneous group and the new entrants another one. Intuitively it is reasonable to believe that these groups have common interests and that they are thus among themselves more homogeneous than member states on average. It has also been assumed that Germany, the Netherlands, Belgium, Denmark and Luxembourg will have deeper communication with the group of new entrants. Partial homogeneity is used to model this setting so that the Southern and the Nothern coalitions are considered as oppositions to each other. This is quite a realistic situation in many issues of voting in the EU (see Widgrén, 1995, Hamilton, 1991). However, it is worth noting that also inter-coalition cooperation is still permitted [18].

Table 6 shows the partial homogeneity power indices for the EU(12) and the EU(15). As was mentioned earlier, it has been assumed that there are two homogeneous groups, the first of which contains the new entrants (case 1) or the new entrants supported by Germany, the Netherlands, Belgium, Denmark and Luxembourg (case 2), and the second of which contains the three Mediterranean countries. It has also been assumed that there lies a group of individual voters between the opposite groups. In table 6 F

Table 6: Voting Power in the EU Council of Ministers Before and After the Entry of Austria, Sweden and Finland in two Setups

Member state	New entrants vs. Mediterranean countries			New entrants and 5 Northern members vs. Mediterranean countries		
	EU(12)	EU(15)	Group	EU(12)	EU(15)	Group
GERMANY	0.147	0.107	I	0.132	0.101	F
ITALY	0.147	0.107	I	0.112	0.115	I
UNITED KINGDOM	0.147	0.107	I	0.112	0.115	I
FRANCE	0.147	0.107	I	0.112	0.115	I
SPAIN	0.118	0.091	A	0.130	0.118	A
NETHERLANDS	0.074	0.057	I	0.074	0.054	F
PORTUGAL	0.074	0.056	A	0.039	0.063	A
GREECE	0.074	0.056	A	0.039	0.063	A
BELGIUM	0.074	0.057	I	0.074	0.054	F
SWEDEN	..	0.051	F	..	0.040	F
AUSTRIA	..	0.051	F	..	0.040	F
DENMARK	0.052	0.034	I	0.051	0.032	F
FINLAND	..	0.036	F	..	0.032	F
IRELAND	0.052	0.034	I	0.058	0.033	I
LUXEMBOURG	0.019	0.022	I	0.021	0.017	F

stands for the 'For' group, i.e. members in this group favour a certain proposal with the probability t, A stands for the 'Against' group, i.e. members in this group favour proposals with the complement probability $1 - t$ and finally I stands for an indifferent country.

Table 6 reveals two interesting results. First, it seems that there are no notable gainers except the Mediterranean countries in case 2. It is counterintuitive that they gain although their opposition becomes stronger in terms of votes. Deeper analysis shows, however, that this result is intuitively reasonable (see Figures 4 and 5). The second conclusion concerning the indices in table 6 is, once again, that proposals have remarkable difficulty in passing. The homogeneous cooperation may even decrease the voting power of countries in the 'For' group, while for the opposition the reverse may hold. This is due to the high negative control which has already been noted earlier.

Let us now define a distribution of each voter's own power with respect to voting probabilities and let us call this distribution a *power profile*. The easiest way to calculate the profiles is to take the integrals in equation (4) for separate intervals with equal length. For example we may take integrals from zero to 0.2, from 0.2 to 0.4 and so on to the

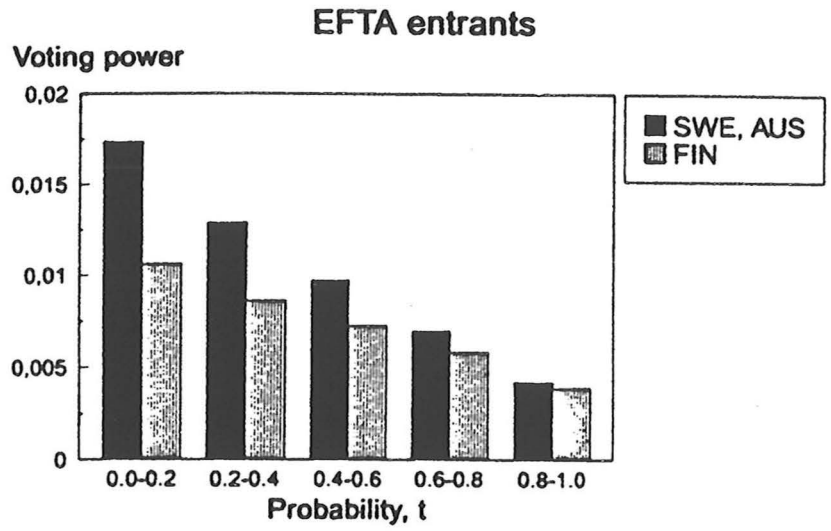
final interval from 0.8 to 1. The five integrals should sum up to the partial homogeneity power index. They thus define its distribution with respect to t.

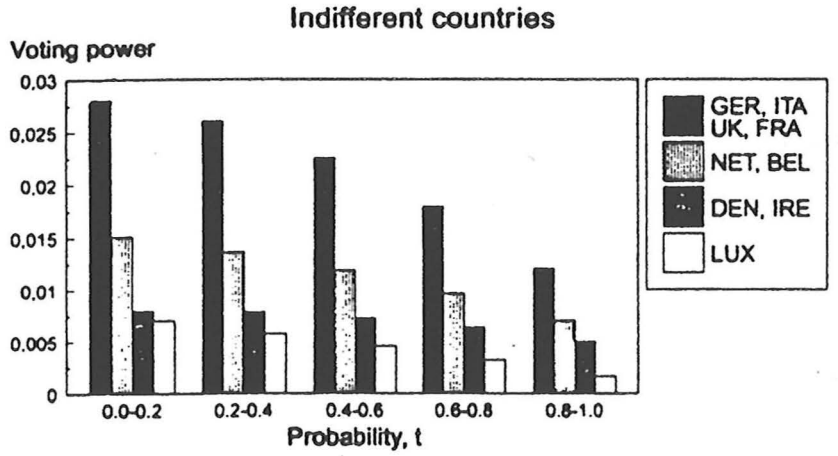
The purpose of the profiles is to reveal what kind of power different voters do have under different set-ups[19]. By analysing these profiles we can reveal what kind of voting behaviour an individual needs to be powerful, or less normatively, what kind of proposals an individual has the best chances to influence. If an individual has most of his power in questions that he supports with a small probability, this can be interpreted as blocking power. In contrast, if an individual's power is based on questions that he supports with a high probability, it can be interpreted as power to promote the passage of decisions. If the former type of distribution holds for both sides, the semi-coalition structure can, on the other hand, be interpreted as unstable but then significant decisions cannot be made. On the other hand, low intensities to push through proposals increase stability. Hence this kind of set-up is quite unclear. If the latter type of setting holds true for both sides, the semi-coalition structure can be stable but there is also more potential for remarkable decisions by making package deals. Figures 4 and 5 present the power profiles for the EU(15) in cases 1 and 2.

In the EU(12) it seems that the Mediterranean countries wield the more influence the tighter opposition policy they pursue if we assume that the other members behave homogeneously. Although the Mediterranean countries do not form a blocking minority they seem to have a high enough possibility to have an additional member to support their views and to form a blocking minority coalition. If, however, the other members behave independently, the need for cooperation to pursue a policy they prefer decreases. It is interesting that in a set-up where Germany, Denmark and the Benelux countries behave homogeneously, Spain becomes as powerful as Germany.

Figures 3 and 4 show an interesting result concerning new entrants' possibilities to change the direction of pursued policies (see also Widgrén 1995). It seems that the new entrants have a significant risk of being outvoted when trying to push through policies they prefer. The Mediterranean countries do not have a need to pursue a tight opposition policy against the new entrants. Figure 4 presents a set-up where the new entrants collaborate with five other members (Germany, the Netherlands, Belgium, Denmark and Luxembourg) and they together form a homogeneous group. The profiles change significantly for all groups. The 'For' group including the three former EFTA countries seems to have much higher incentives to push through the policies they prefer and for the opposition it seems that it would be reasonable to pursue a tight opposition policy. As regards the influence on the direction of policies in the EU Sweden, Austria and Finland cannot make significant policy shifts without collaborating with other countries.

Figure 3.
Power profiles in the EU(15):
New entrants vs. Mediterranean countries





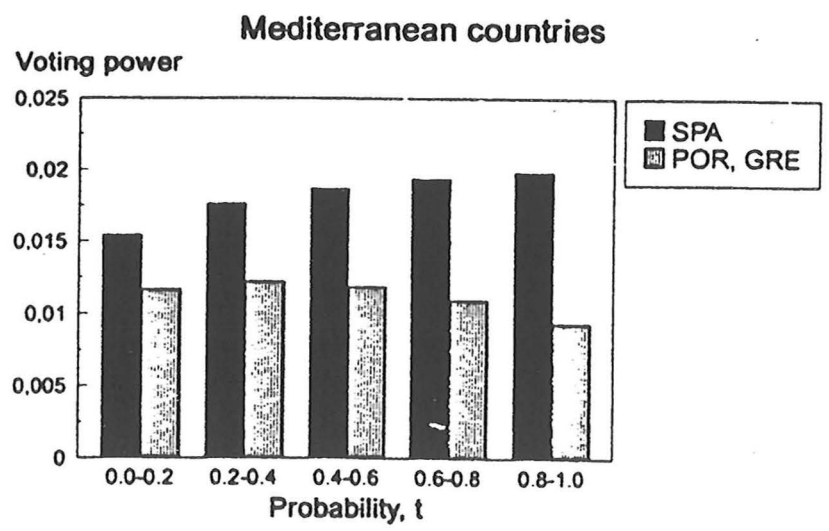
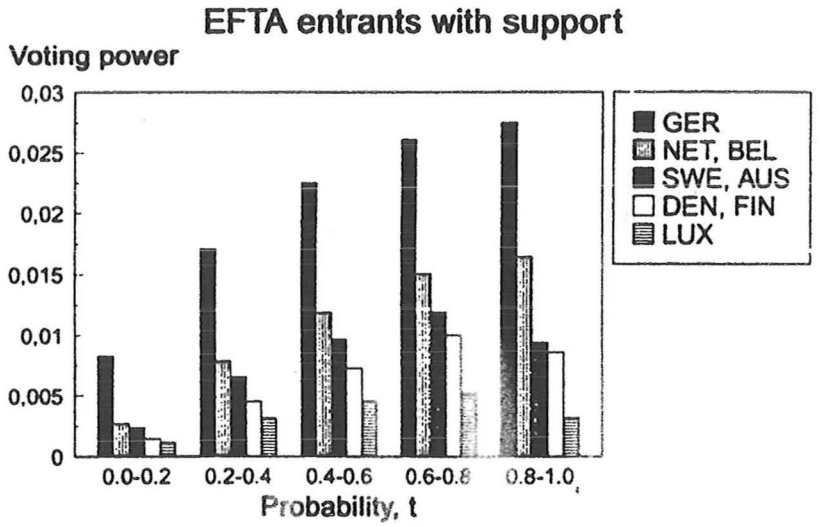
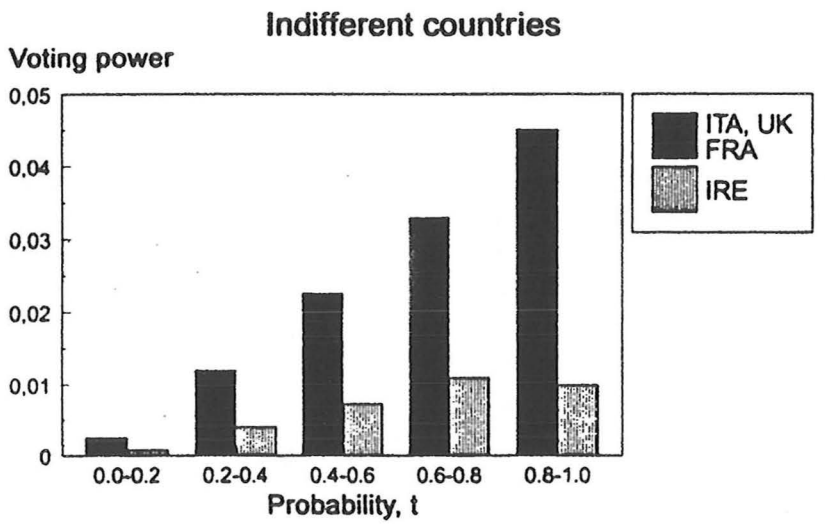
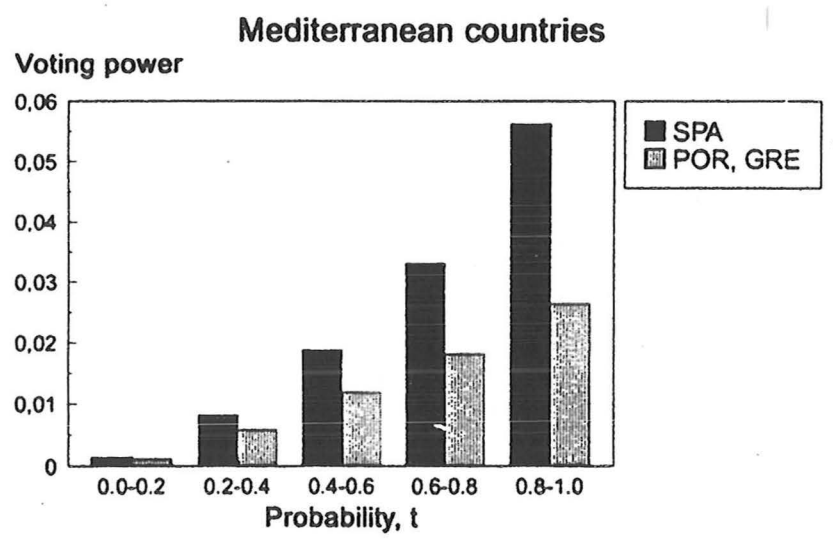


Figure 4.
Power profiles in the EU(15): Supported new entrants vs. Mediterranean countries







6 Conclusions

In this paper, we have investigated the change in the balance of power in the EU Council of Ministers when it is expanded by three former EFTA countries and when voting rules are assumed to alter.

The decision making process in the EU strongly favours small countries. It was shown in this paper that the new entrants would get 12 per cent of the total power in the EU Council of Ministers. Relative to their share of the population in the EU of 15 members the new entrants' share of power is over twice higher. The new entrants would have a strong position in the EU decision making. However, the loss of power for the current members is smaller than in the enlargements of the Community in 1973 or in the 1980s. It can also be argued that the Mediterranean enlargement in the 1980s changed the EU decision making more than the EFTA entrants. In the 1980s the need for compromises increased significantly. Strengthening the role of qualified majority voting was a necessary reform to reach a balance between compromises and competition. This balance does not change due to the EFTA entrants.

The conclusion concerning control was twofold: first, it seems to be very difficult to promote the passage of proposals, while for preventing decisions the reverse seems to hold and second, accomplishing a decision seems to be the more difficult in an expanded EU the more independently the voters act. However, old members do not lose their control in the expansion of the Union but there will be three new members with a significant control positions regarding blocking decisions. Also it can be argued that high national control over decisions implies more power to the officials in preparatory bodies. Significant decisions will need a deep homogeneity between the member states which can be reached only by negotiating and by preparing proposals properly. This implies that there is a danger that decision making will be ineffective. National control and need for deep homogeneity are together an effective watch-dog for the subsidiarity principle. As far as decision making efficiency is concerned the current qualified majority rule gives too much negative control to the member states. One cannot, however, argue that the new entrants create the inefficiency problem. It already exists. In terms of negative control the increased inefficiency due to the new entrants could be eliminated by reducing the majority requirement by 3 votes. In general terms, avoiding the problem of easy blocking and inefficiency requires lower majority rules. This would decrease member states negative control over decisions significantly. However, it is surprising that the balance of voting power remains almost unchanged if the decision making rule is lowered from a qualified to simple or double majority. The latter, even improves small countries' positions.

It was shown that negative control is the main element for new entrants' to have an effect on policies pursued. Thus it is unlikely that there will be a significant policy change. That is why the new entrants and also the other members should concentrate on their

most important interests. The Mediterranean countries maintain their key role and it is profitable for them to deepen their cooperation. However, the Northern members' incentives to try to push through proposals that they prefer will also increase.

If common policies create positive externalities for member states, lower majority rules should be used to improve efficiency and the Union's capabilities. As regards national influence, improving efficiency is not a matter of power distribution. The double majority is an exception as it increases small countries' and Germany's power, although the reason for such a proposal is, without doubt, based on entirely different arguments. Since in the current context lower majority rules give more weight and power to the supranational Union and its Commission and less weight to national interests, the improvement of EU decision making efficiency is a matter of centralisation and not a matter of the distribution of national influence.

Notes

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1) The relation between the voting weight w and population p can be described with the regression equation $logw = 0.0063(logp)^{2.465}$ with $R^2 = 0.972$. The criteria for this particular equation was to fit the estimates for the numbers of votes to the right ones.

2) In this paper we concentrate on a simple and a qualified majority. They seem to be the relevant alternatives in the EU Council of Ministers. Thus we do not concentrate on voting power as a function of the voting rule (see Nurmi 1992).

3) This approach can also be criticised. It can be argued that voting behaviour should not affect the measures of power.

4) Note that negative control is a conditional probability. There are four outcomes where C votes 'no' and four outcomes where C votes 'yes'.

5) It worth noting, however, that the vector $(1/2, 1/2, 1/2)$ is an implication of a wider range of acceptability vectors, as is shown later in this paper.

6) These joint probability distributions (jpds) are different from the usual one that assigns probabilities directly to events. Each acceptability vector describes the n probability distributions that assign probabilities to the vote-yes and vote-no events for each of the n voters. The jpd's discussed here assign probabilities to each possible acceptability vector. Thus the jpds assign probabilities to probability distributions.

7) Since we assumed that the voting is simply of the "yes or no" type the list of 'no' vote coalitions is the same. That is why, for the measures of influence there is no difference whether we analyse 'yes' vote or 'no' vote coalitions.

8) See Owen (1982) for fuller explanation of this. Intuitively it should be quite clear. Also it is interesting that the sum of these kinds of terms is always one no matter whether the p_i's are probabilities or not. We can even choose complex numbers for p_i's and the property holds (Owen 1964).

9) A class of coalitions is no more than a set of coalitions. In mathematics the sets of sets are usually referred to as classes of sets.

10) For an unbiased coin this illustration holds true only for simple majority voting. For weighted majority voting we also need a weighted coin.

11) Actually, the exact distributions are unknown since we are analysing weighted voting. In the case of a symmetric voting game (one man, one vote) the theory tells us that the distributions should be uniform under homogeneity and binomial under independence.

12) Slightly modified versions of these probabilities can be used to analyse the concentration of power (Leech 1987a, 1987b, Pohjola 1988). It is then assumed that a coalition of the m largest players votes for the proposal and the probabilities are calculated for these alliances by letting $m = 1, ..., p$, where p is the number of the largest players needed for a majority.

13) The choice of these particular limits is, of course, arbitrary. Here, as usual in control analysis, we use the analogy of significance levels in statistics.

14) For a more detailed discussion about the PCs, see Widgrén (1994b).

15) Power indices can also be interpreted by using subjective voting probabilities when an individual voter is assessing her/his prospects from participation in the game (Weber 1988).

16) For example sub-systems are such coalitions (see Schoutheete 1990). The role of the Franco-German axis, Benelux-countries, Mediterranean and Nordic countries have been analysed in Widgrén (1993a, 1993b, 1994b).

17) For voting power in trade policy and social regulation, see Widgrén (1995).

18) Technically this is insured by the probability model which gives t and $1 - t$ probabilities for the two homogeneous groups to support a random proposal.

19) Partial homogeneity makes profile analysis interesting since the power profiles differ from individual to individual. Homogeneity and independence imply similar and symmetric profiles (see Widgrén 1995).

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Chapter 4

Voting Power in the EC an the Consequences
of Two Different Enlargements
European Economic Review 38, 1153-1170

PART II

1 Introduction

For the EFTA countries participation in the decision making process is one of the main differences between the would-be European Economic Area (EEA) accord and membership in the European Community. As noted in Hamilton (1990) there is a clash between the legal form and the economic substance of the EEA accord, which he sees as a significant reason for Nordic EFTA countries to apply for membership in the EC. The EEA agreement does not guarantee the EFTA countries proper influence on the decisions in the Community.

As long as the governments of the member states have powers in the Community's decision making process, national aspects and the balance of national powers in the decision making play an important role. The analysis in this paper seeks to measure the voting power of the EC member states in the decision making which takes place in the Council of Ministers and the structural change of this balance of power after the EFTA enlargement. Two different expansions are presented; the one with four new member states: Austria, Finland, Norway and Sweden and the one with all the seven EFTA countries joining the EC. Particular attention has been paid to sub-systems within the Community which consist of two or more member states cooperating more likely than the others [see Schoutheete (1990)]. Since the analysis in this paper investigates the role of the member states in the decision making it disregards the role of the European Parliament, althrough the cooperation procedure in the Single European Act (SEA) gave it a stronger role in decision making than before [see e.g. Fitzmaurice (1988)].

Voting power is here measured with the two best known power indices of game theory, the first one of which was inroduced by Shapley and Shubik (1954) and the second one by Banzhaf (1965). Their theoretical background lies in the cooperative game theory which does not model explicitely the coalition formation process but rather the possible pay-offs each alliance could obtain. In the voting games it is assumed that there are only two kinds of coalitions: losing ones and winning ones. These two best known indices measure the power in the abstract sense, i.e. they do not concentrate to any particular question of voting, and it is often argued, that the power indices analyse the voting body rather than the actual game played in it [Straffin (1988)]. But since in the institutions where voting takes place, like the Council of Ministers of the EC, the voters and the Governments of the member states change and one can not know the issues to be voted in the future, the probabilistic approach offered by the power indices is rather effective. Although it does not model the players' behaviour, it does measure each player's potential abilities to change the result alone. The main difference between the two best known indices lies in the probability model behind them. When there is information telling that some unions are more likely to cooperate than the others, it can be used to modify these probability models of voting [e.g. Owen (1972)].

The power indices have been mostly applied to political institutions or elections, which

can be modelled as weighted voting games, e.g. regarding parliaments [e.g. Holler (1981)], the U.S. Senate [Shapley and Shubik (1954)], the U.N. Security Council, [e.g. Laakso (1977)] or the presidential elections in the U.S. [Owen (1982)]. In the eighties the voting power of shareholders in large companies in the U.K. were analysed by Leech (1985), in Finland by Pohjola (1987) and in Sweden by Rydqvist (1987). One of the main results in these three studies was that the voting power tended to exceed the voting share for the largest shareholders, while for the minor ones the reverse seemed to be true. This is a rather common feature of the distributions of power in weighted voting games. For the game played in the Council of Ministers of today's EC this property does not, however, hold true, but it will be shown in section four that the relationship between the power and voting weight become monotonically increasing, although not very sharply, after the EFTA enlargement.

The rest of the paper is organized as follows. The EC decision making process is described in Section 2. The analysis is confined to the Council of Ministers. In section 3 the Shapley-Shubik and the Banzhaf power indices and their modified version of the former for games with a priori unions are defined and presented. The results obtained for today's Community and for one with two different EFTA enlargements are presented in Section 4. It is shown that power increases with respect to the population of the member state, but the growth is inelastic with elasticity 0.47 for today's Community and 0.40 and 0.31 for the EC of 16 and 19 respectively. It is also shown that there is no clear relation between the power voting weight ratio in the EC of 12 members, but after the entry of the small EFTA countries the power seems to increase faster than the voting weight. The blocking minorities are shown to be critical coalitions in the sense of power.

2 Decision Making Process in the EC

The Council of Ministers, where member countries' Ministers represent national Governments and interests, is the main decision making body in the European Community. According to the Treaty of Rome it has three possible voting rules for taking decisions: simple majorities, qualified majorities and unaminity. In majority votings the member countries' votes are related to their population as follows: Germany, Italy, the UK and France have 10 votes each; Spain 8 votes; the Netherlands, Portugal, Greece and Belgium 5 votes each; Denmark and Ireland 3 votes each and Luxembourg 2 votes. The relation between the voting weight and population is when estimated multiplicative rather than linear in accordance with the following regression equation:

$$\begin{aligned} LogW &= 0.00633 \cdot (LogP)^{2.465}, \quad R^2 = 0.972 \\ &\quad (0.00009) \end{aligned} \tag{1}$$

where W denotes the number of votes, P denotes population in thousands. The standard error of β-coefficient is shown in parenthesis. It is assumed in section four, that the new members will have votes according to this regression equation. When the qualified majority is required, 54 votes out of the total of 76 must be achieved in favour. In qualified majority voting absentions have the same effect as voting against but unaminity can be obtained with absentions.

The decision making process of the EC begins formally in the Commission, which consists of 17 Commissioners (two from each of the five largest countries and one from each of the other member states) appointed by the member governments [Nicoll and Salmon (1990)]. The Council of Ministers doesn't have the direct right to initiate but as noted in Lodge (1989) the member governments do have certain indirect powers over the Commissioners and legislative proposals because they can refuse to reappoint a Commissioner if she/he is not 'loyal' enough for the national government. Theoretically the Commission is independent of the member states' Governments and it has been seen as representative of the whole Community in the decision making. As the Commission speeds up the integration process, the Council of Ministers is portrayed as a delaying body.

Until the mid-eighties searching for unaminity was the rule rather than an exeption in the Council of Ministers. This was mainly due to the so-called Luxembourg Compromise, which was agreed in 1966. After this 'agreement to disagree' the decision making process was marked mainly by negotiations to amend the Commission proposals in the Council and its preparatory bodies until unaminity could be reached [Nicoll and Salmon (1990)]. The Single European Act, which was signed in 1986 and which entered into force in 1987, changed the mechanism and raised the importance of coalition formation remarkably. The member countries' frustration at the old consensus-based system compounded with the Greek and Iberian enlargement and the plans for the single market program made it clear that decision making under the Luxembourg Compromise would not work and the role of qualified majority was strengthened [Wallace (1990)]. Particularly the legislation related to the single market program was submitted to qualified majority rule. For very important matters such as taxation unaminity is, however, still required.

Under the Single European Act coalitions became one of the most important elements of the EC decision making process. As noted in Wallace (1990) what matters in the negotiations is not whether a vote is actually taken but the knowledge that a vote could be taken and this leads to active coalition formation during the preparatory work which consists of both formal and informal negotiations between government representatives. All this preparatory work rests on the understanding that the Council makes the final decisions and sums of voting weights of different coalitions play the key role when alliances are compared with each other.

An interesting dimension in coalition formation in the EC is permanent and predictable cooperation between two or more member states. It is clear that certain member states have more in common and cooperation between these countries is deeper than between

the others. In Schoutheete (1990) the concept of a sub-system is defined and analysed. The best known sub-systems in the EC of twelve are the Franco-German axis and the Benelux countries but also the Mediterranean countries, i.e. Spain, Portugal and Greece, are often considered as one. After the possible EFTA enlargement of the EC the Nordic countries would form an additional sub-system [Stålvant (1990)]. It is interesting to note that this kind of close cooperation in the form of these sub-systems within the Community is fully accepted by the other member states, although it changes the conditions of coalition formation remarkably.

3 The Measures of Voting Power

Let N be the set of n government representatives in the Council of Ministers of the EC and $w = (w_1, w_2, \ldots, w_n)$ the vector of voting weights $p_i / \sum_{i=1}^{n} p_i$, where p_i is the number of votes belonging to member state i arranged in the order of size so that $p_i \geq p_{i+1}\ \forall i$. The decision making game in the Council of Ministers can be presented as a cooperative weighted majority game $u = [q; w_1, w_2, \ldots, w_n]$, where $q \in [0, 1]$ is the voting weight which is needed for majority. If we classify the coalitions in the power set of N, denoted by $\mathcal{P}(N)$, only on the basis of winning, u is *simple* and the *characteristic function* $v : \mathcal{P}(N) \mapsto R_+$ of the game will be *superadditive*, i.e. $v(S \cup T) \geq v(S) + v(T)\ \forall$ $S, T \subset N$ and $S \cap T = \emptyset$, with two possible values. Thus we can choose $v(S) = 1$ if $\sum_{i \in S} w_i \geq q$ and $v(S) = 0$ otherwise; for a textbook presentation of cooperative game theory [e.g. Owen (1982)].

When measuring the individual effect in certain voting body the most natural question to ask is , "What is the difference that one's vote will make?" [Straffin (1988)]. Player $i's$ individual effect for arbitary coalition S can be measured by the difference $\Delta_i v(S) = v(S \cup \{i\}) - v(S)$ if $i \notin S$ and $\Delta_i v(S) = v(S) - v(S - \{i\})$ if $i \in S$, which is often called the *marginal contribution* of player i to S. It can be easily seen that for simple games $\Delta_i v(S)$ is either 1, when i swings a coalition from losing to winning, or 0 otherwise. To answer the question of individual effect generally to all coalitions in $\mathcal{P}(N)$, we need to specify a probability model for the voting process.

Let x_i be the probability that minister i favours a given Commission proposal and x a n-vector of these probabilities called *the acceptability vector* which characterizes a vote [Straffin (1988)]. If we randomize the voting question, the acceptability vector defines the probabilities that player i belongs to an arbitary coalition $\mathcal{S}$, i.e. the probabilities that he/she will vote for a random bill. Supposing that each player votes 'yes' or 'no' independently of each other, we can write for any fixed $S \subset N$, the probability $P\{\mathcal{S} = S\} = \prod_{i \in S} x_i \prod_{i \notin S} (1 - x_i)$. If we take the sum of these probabilities multiplied by values of characteristic function over all possible coalitions, we will have the mathematical expectation for the value of function v. This expectation is often called the *multilinear*

extension $f(x_1, \ldots, x_n)$ of v defined by Owen (1972). In particular for the voting games defined above $f(x_1, \ldots, x_n)$ can be interpreted as a probability, because v is an indicator variable, and the summation is taken over the class $\mathcal{W}$ of winning coalitions only. It can be shown that the ith partial derivative of f is the expected value of the marginal contribution of player i for the coalition S, where the summation is taken over the class $\mathcal{M}_i$ of *minimum winning alliances* with respect to player i in voting games [Owen (1972)]. Thus each $\mathcal{M}_i$ contains the coalitions in which i is crucial and hence

$$E[\Delta_i v(S)] = \sum_{S \in \mathcal{M}_i} \prod_{i \in S - \{i\}} x_i \prod_{j \in N - S} (1 - x_j), \tag{2}$$

which can be interpreted as the expectation of the individual effect in the simple voting game defined above.

For the calculation purposes we have to define the x_i probabilities explicitly. In the literature there are two following standard assumptions of the joint probability distribution for x_i:s:

- *Independence assumption* : Probabilities x_i are independently uniformly distributed on [0, 1].
- *Homogeneity assumption* : Each $x_i = t$ and t is uniformly distributed on [0, 1],

[Straffin (1988)]. The main difference between these assumptions is that under the homogeneity assumption there is a common standard by which the ministers evaluate the Commission proposal and thus the probabilities of the voters' decisions are correlated. It is worth noting that although the probabilities of the acceptability vector are correlated, the events $A_i = \{$ i will vote 'yes' $\}$ are not, because we have assumed that $P\{$ i votes 'yes' $|$ j votes 'yes' $\} = P\{$ i votes 'yes' $\}$ $\forall$ $i \neq j$. If we calculate the expectation of individual effect measured by one's marginal contribution, assuming independence we have

$$E_i\Big[\Delta_i v(S)\Big] = \sum_{S \in \mathcal{M}_i} (1/2)^{n-1} = \beta_i, \tag{3}$$

where $\mathcal{M}_i$ denotes the class of minimum winning alliances with respect to player i and assuming homogeneity we have

$$E_i\Big[\Delta_i v(S)\Big] = \sum_{S \in \mathcal{M}_i} \frac{(n-s)! \cdot (s-1)!}{n!} = \Phi_i, \tag{4}$$

where n and s denote the cardinalities of sets N and S respectively. Equation (3) is usually referred to as the unnormalized Banzhaf index (BI) which is often normalized, although its probabilistic interpretation is then destroyed [Straffin, Davis and Brams

(1981)]. Equation (4) is referred to as the Shapley-Shubik power index (SSI), which is the best known special case of the Shapley value defined for cooperative games in Shapley (1953). It can be shown that Φ is the only probabilistic value for characteristic function games which has the consistency property, i.e. the sum of individual indices is always $v(N)$ and specially $\sum_{i=1}^{n} \Phi_i = 1$ for the voting games [Dubey, Neyman and Weber (1981)]. The difference between the indices is often described in terms of permutations and combinations, since assuming homogeneity means that players' permutations are equally likely and assuming independence means that all coalitions are equally probable to form. According to Straffin (1988) this permutation-combination distinction is illusory, because both indices can be derived from a probability model in which the permutations of players play no role.

In standard analysis there are no constraints in coalition formation. It means that the size of the coalition measured by the sum of voting weights matters but not particularly who belongs to the alliance. Player i is equally likely to cooperate with players j and k $\forall\, j \neq k$. This assumption often serves as the first approximation, when the additional information of players' cooperation behaviour is not used or it is not available. If we take into account the possibility that some players may be more likely to cooperate than the others, the idea of coalition structures is useful [e.g. Owen (1977)].

Let N be the player set and $\mathcal{I} = \{M_1, \ldots, M_p\}$ a partition of N to a priori coalition structure, i.e. a collection of alliances which have made a prior commitment to pool their endowments in the game. For the union M_j the total power Φ_j can be easily calculated from the *quotient game* (u, P), where $P = \{1, 2, \ldots, p\}$ denotes the set of unions and $u(S) = v\big(\bigcup_{j \in S} M_j\big)$ $\forall\, S \subset P$. There is no reason to assume that the union would lose the power it could obtain. Because of this efficiency requirement of sub-systems it seems natural to set the sum of individual power indices in each union to the total power of that union [Schoutheete (1990)]. Hence we have $\sum_{i \in M_j} \Phi_i = \Phi_j$. For determining the distribution of power in coalition M_j we have to define a subgame w_j among the players in M_j which reflects the possibilities of different sub-unions when defecting from the sub-system M_j. Let K be a sub-union of M_j and K' its complement relative to M_j. The characteristic function of the game w_j played in the coalition M_j can be now defined [Owen (1977)], as power indices of sub-unions of M_j in the game $v_{M_j|K}$, where the coalition M_j is replaced by sub-union K in the quotient game, i.e. $u(S) = v\big(\bigcup_{j \in S} M_j - K'\big)$ and $w_j(K) = \Phi_K[v_{M_j|K}]$. Owen (1977) suggests that the value for the individual players in the game with a priori unions should be calculated as a value in the game w_j. Hence we have

$$\Phi_i[u; \mathcal{I}] = \Phi_i[w_j]. \tag{5}$$

As it is shown in Owen (1977) the SSI for the games with coalition structures can be calculated as a weighted average of the terms $\Delta_i u(Q \cup K) = u(Q \cup K \cup \{i\}) - v(Q \cup K)$, where Q is an arbitary union of quotients M_j $(j \neq k)$, $K \subset M_k$, $i \in M_k$ and $i \notin K$. The SSI for the game u with a coalition structure $\mathcal{I}$ (CSSI) can be now written

$$\Phi_i^{CS}[u;\mathcal{I}] = \sum_{S\subset P, j\notin S} \sum_{K\subset M_j, i\notin K} \frac{s!(p-s-1)!k!(m_j-k-1)!}{m_j!p!}\Delta_i u(Q\cup K), \qquad (6)$$

where p, s, k and m_j are the cardinalities of the sets P, S, K and M_j respectively. The marginal contribution term is more complicated than in the games without coalition structures, since although u is a simple game, w_j is not. Owen (1981) has also modified BI for the games with a priori unions, but this will not be analysed here.

These modified versions of power indices answer the question of the individual effect in voting games if a certain coalition structure exists and there is no cooperation between sub-unions across the union lines. In practice this approach often overestimates the powers of members in a priori unions, since the cooperation may not be permanent. Despite this overestimation, coalition structure indices (CSI) are useful measures, when one is approximating the effects of coalition formation both individually and structurally.

4 Results

In this study it is assumed that national interests in the EC's decision making are presented in the Council of Ministers, which is also the main decision making body in the EC. Since the monumental preparatory work done in working groups and committees and especially at the informal stage cannot be modelled, we instead choose a cooperative approach which does not model the negotiations of coalition formation but separates all possible alliances on the basis of pay-offs. The member states' influence on the decisions is approximated by each country's voting power in the simple majority voting game played in the Council of Ministers. Under the qualified majority rule the characteristic function of this game can be written

$$v(S) = \begin{cases} 1, & \text{if } \sum_{i\in S} p_i \geq 54 \\ 0, & \text{otherwise} \end{cases} \qquad (7)$$

where p_i denotes the quantity of votes of the member i. Equation (7) is essentially no more than a list of winning coalitions.

The multilinear extensions for simple games are easy to write for a game with 12 players, but every additional player doubles the size of the function. In the game of 19 players there are over half million coalitions and that is why the approximation methods are often used to calculate the power indices for larger games. In this paper the indices for the EC of 12 and 16 members are calculated by using the exact multilinear functions, but the indices for EC of 19 members in Table 6 are approximations. The best known method to approximate the power indices which is also used here is introduced by Owen (1982).

Table 1: The SSIs and the BIs for the members of the EC12 under the qualified majority rule

Country	Φ_i	Φ_i/cap $1/10^6$	Φ_i/Voting weight	β_i	β_i'
GERMANY	0.134	1.720	1.018	0.139	0.129
ITALY	0.134	2.332	1.018	0.139	0.129
UNITED KINGDOM	0.134	2.347	1.018	0.139	0.129
FRANCE	0.134	2.397	1.018	0.139	0.129
SPAIN	0.111	2.842	1.055	0.118	0.109
NETHERLANDS	0.064	4.354	0.977	0.073	0.067
PORTUGAL	0.064	6.173	0.977	0.073	0.067
GREECE	0.064	6.417	0.977	0.073	0.067
BELGIUM	0.064	6.474	0.977	0.073	0.067
DENMARK	0.042	8.249	1.072	0.049	0.045
IRELAND	0.042	11.960	1.072	0.049	0.045
LUXEMBOURG	0.012	30.780	0.439	0.019	0.018
EC TOTAL	1.000	2.929	1.000	1.083	1.000

The method is based on the asymptotic theory of the sum of uniformly distributed random variables, i.e. normal distribution. In the EC of 16 members there were no approximation errors larger than 0.001.

It is worth noting, that although the game defined in (7) stresses the winning coalitions, the SSI and the BI analyse this game on two sides. Let T be a coalition which is not winning but blocking in the sense that its complementary coalition with respect to the player set cannot win either. Such coalitions are usually called the *blocking minorities*. The *dual* game for v is defined as $v^* = v(N) - v(N-S)\ \forall\ S \subset N$, where it can be easily seen that $v^* = 1$ if S is a blocking minority or winning coalition. It is shown in Bolger (1979) that the SSI and the BI are identical in monotonic games and their duals and, since superadditive simple games are always monotonic, i.e. $v(S) \geq v(T)\ \forall\ T \in S$, this also holds true here [Weber (1988)]. In simple games the SSI and the BI measure the power to swing a coalition which is neither winning nor blocking to a blocking minority or the power to swing a coalition which is losing to a winning alliance.

The values of the SSI and the BI are presented in Table 1. The relationship between the power-vote ratio, i.e. power per voting weight, and voting weight which is often observed to be monotonically increasing in weighted voting games [e.g. Pohjola (1987)], is not very clear-cut in the EC decision making, but the ratio between power and population tends to grow increasingly while the population figures decrease. The relationship between power and population under the qualified majority rule is multiplicative in accordance

with the following regression equation

$$Log\Phi = \underset{(0.0777)}{0.470114 \cdot LogP - 7.147}, \quad R^2 = 0.989 \tag{8}$$

where Φ denotes the SSI and P denotes population. In Figure 1 the fitted curves for the SSIs for qualified majority and unaminity voting with respect to population are presented. As we do not know the distribution of votes taken by each rule, i.e. the share of questions that can be solved by qualified majority and by unaminity, we can only say that the true voting power lies somewhere between these lines. The absolute majority game in the Council of Ministers leads to almost identical voting powers with qualified majority rule and that is why it is omitted.

The unification of Germany leads to interesting consequences to the balance of power, since the 'new' population of Germany moves the German point (GER) in Figure 1 away from the fitted curve to GER'. Having 12 votes which is the number of votes Germany would have according to the regression equation (1) instead of the current 10 would change the balance of power remarkably. If the qualified majority were 55 out of 78 votes Germany would gain 0.037 and Spain would lose 0.014 and Denmark and Ireland would lose 0.008 in terms of the SSIs. It is worth noting that in this game Luxembourg would gain 0.017. The gains and losses are however quite different if we set the qualified majority rule to 56 votes. This would decrease the gain for Germany to 0.013 and there would be no remarkable losers.

Under the unaminity rule there is only one winning coalition and the SSI and the normalized BI will be equal. In these unaminity games the essential difference between the probability models behind the indices can be seen. For the BI every coalition is equally likely to form and, since there is only one unanimous coalition the probability, that a certain player i will swing the alliance of 11 members to a winning one is very small. For the SSI it is equally likely that the coalition is of any size. Since there are only 13 possible sizes for coalitions in the EC of 12, the unaminity is over 300 times more probable under homogeneity than under independence. If we normalize the BI, the results presented in Table 1 are, however, very similar.

Table 2 summarizes the results obtained by applying the assumption of certain a priori unions, i.e. sub-systems, to form. It is assumed that no counter blocks are formed. The Mediterranean block includes Spain, Portugal and Greece. The results reveal that the total gain for the Franco-German axis and the Mediterranean countries will be approximately 3 percentage points, but only 0.3 percentage points for the Benelux countries. Larger sub-systems seem to gain more than the small ones. This is quite natural result, since the Franco-Geman axis and the Mediteranean block are closer to form a blocking minority than the Benelux countries.

It seems to be a common feature for these a priori blocks that the large members outside these sub-systems lose more than the small ones. In particular small countries like

Figure1. SSI and population in the EC12

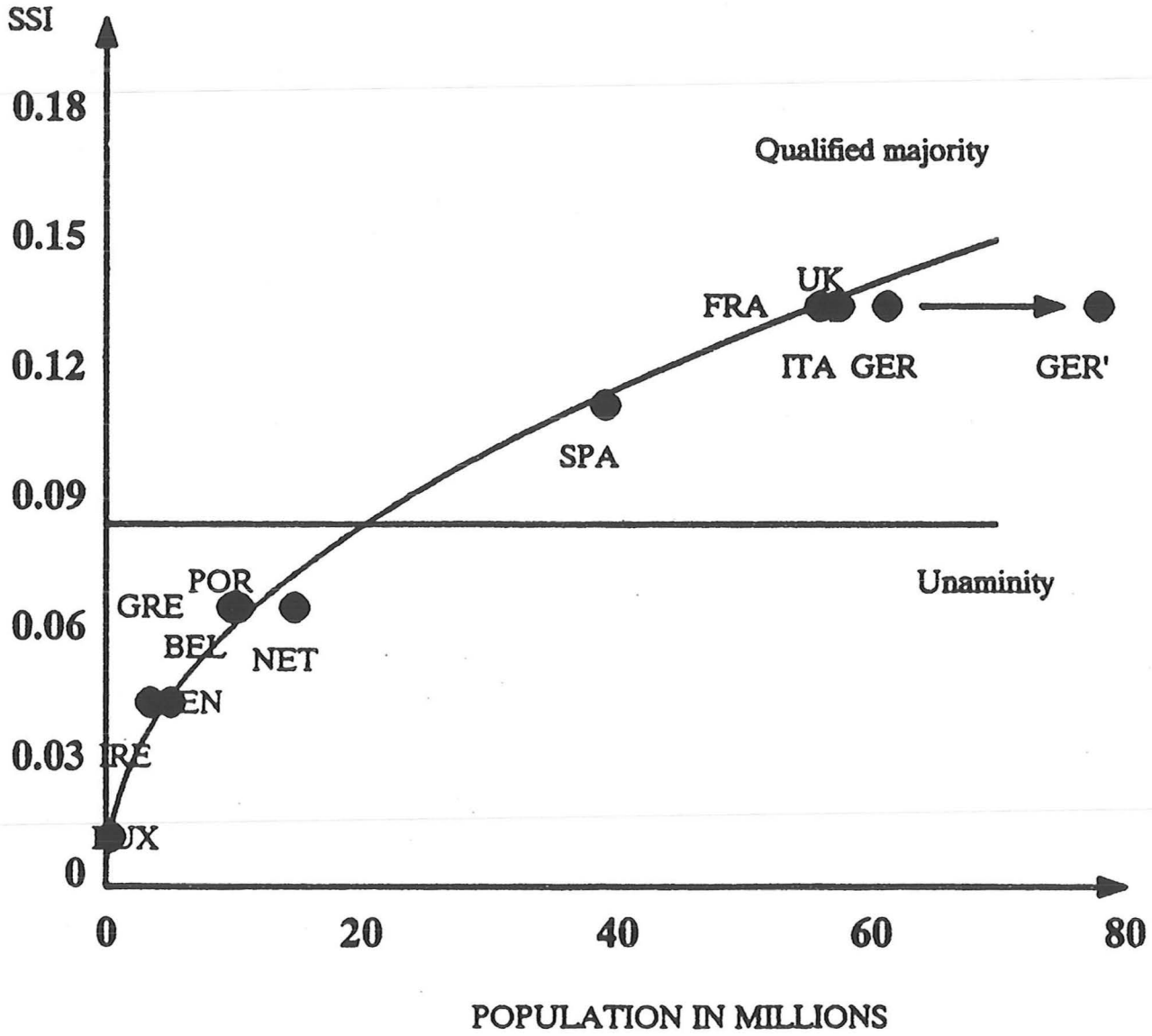

Table 2: The influence of three different blocks to the SSIs under qualified majority rule assuming no counter blocks to be formed

Member state	Franco-German axis		Benelux countries		Mediterranean countries	
	Φ_i	Φ_i/w_i	Φ_i	Φ_i/w_i	Φ_i	Φ_i/w_i
GERMANY	0.153	1.161	0.132	1.001	0.122	0.929
ITALY	0.125	0.947	0.132	1.001	0.122	0.929
UK	0.125	0.947	0.132	1.001	0.122	0.929
FRANCE	0.153	1.161	0.132	1.001	0.122	0.929
SPAIN	0.102	0.965	0.104	0.988	0.131	1.244
NETHERLANDS	0.062	0.936	0.066	1.001	0.059	0.899
PORTUGAL	0.062	0.936	0.068	1.038	0.069	1.050
GREECE	0.062	0.936	0.068	1.038	0.069	1.050
BELGIUM	0.062	0.936	0.066	1.001	0.059	0.899
DENMARK	0.042	1.067	0.044	1.126	0.051	1.297
IRELAND	0.042	1.067	0.044	1.126	0.051	1.297
LUXEMBOURG	0.013	0.499	0.012	0.452	0.021	0.814

Denmark and Ireland seem to gain when these blocks are formed. Perhaps the most interesting result is that under the Mediterranean cooperation Spain will be the most powerful member in the decision making of the Community of 12 members assuming that no counter blocks are formed. This result does not, however, hold true in the EC of 16 members.

The Mediterranean countries form quite a strong alliance. If they join together with Ireland and the Benelux countries and the Franco-German axis form a coalition, i.e. the Schengen group, the power indices will be 0.45 for both the Schengen group and the Mediterranean countries with Ireland and 0.03 for UK, Italy and Denmark. Ireland's contribution would be 0.187 to the Mediterranean group, since if it plays alone the power indices would be 0.267 for the Mediterranean countries and 0.467 for the Schengen group. If this kind of coalition structure exists, it is an interesting stalemate, since the Schengen group needs all three remaining players to win, but the Mediterranean countries with Ireland need only one of these players to form a blocking minority. Tables 3, 4 and 5 summarize the results obtained by applying the assumption of four new member states: Sweden, Austria, Finland and Norway and Table 6 when three additional countries: Switzerland, Iceland and Liechtenstein join the Community. It is assumed that the voting weights for each new member are determined according to the equation (1). Sweden, Austria and Switzerland would get four [1], Finland and Norway three, Iceland

[1] Hamilton (1990) assumes that Sweden will have five votes. In the EC of 16 members the qualified majority would then be 65. The gain for Scandinavian block would then increase to 0.018. The SSI for

Table 3: The SSIs and the BIs for the EC16 under the qualified majority rule

Country	Φ_i	Φ_i/cap	Φ_i/Voting weight	β_i	β_i'
GERMANY	0.116	1.493	1.046	0.101	0.108
ITALY	0.116	2.024	1.046	0.101	0.108
UNITED KINGDOM	0.116	2.036	1.046	0.101	0.108
FRANCE	0.116	2.080	1.046	0.101	0.108
SPAIN	0.090	2.322	1.017	0.082	0.088
NETHERLANDS	0.054	3.696	0.972	0.053	0.057
PORTUGAL	0.054	5.241	0.972	0.053	0.057
GREECE	0.054	5.448	0.972	0.053	0.057
BELGIUM	0.054	5.496	0.972	0.053	0.057
SWEDEN	0.043	5.097	0.968	0.043	0.046
AUSTRIA	0.043	5.661	0.968	0.043	0.046
DENMARK	0.032	6.234	0.959	0.032	0.034
FINLAND	0.032	6.466	0.959	0.032	0.034
NORWAY	0.032	7.598	0.959	0.032	0.034
IRELAND	0.032	9.039	0.959	0.032	0.034
LUXEMBOURG	0.020	53.251	0.898	0.022	0.024
EC TOTAL	1.000	2.727	1.000	1.108	1.000

two votes and Liechtenstein would get one vote. The qualified majority is assumed to be 64 out of 90 votes in the EC of 16 and 69 out of 97 votes in the EC of 19 members.

The BIs have been omitted in the last three tables, since their message seems to be quite similar to the one of the SSI's. It has also been argued in Straffin (1988), that SSI is more applicable to voting bodies in which there is considerable communication among the voters and coalition formation is active. As it was noted earlier in this paper in the EC active coalition formation plays an important role. The CSSIs are not presented in the case of the EC of 19, since the results were so similar to the ones presented for the EC of 16 members in Tables 4 and 5

It seems that the EC's enlargement containing these smaller countries turns the power voting weight ratio to be a monotonically increasing function of voting weight [see Tables 3 and 6]. In the EC of 19 members the relationship is stricly increasing as can be seen in Figure 2 in accordance with the following regression equation:

$$r = \underset{(0.030)}{0.932 + 1.101 \cdot p} \quad R^2 = 0.987, \tag{9}$$

Sweden would be 0.054 and 0.031 for the other Nordic countries.

Figure2. Power and voting weight in the EC19

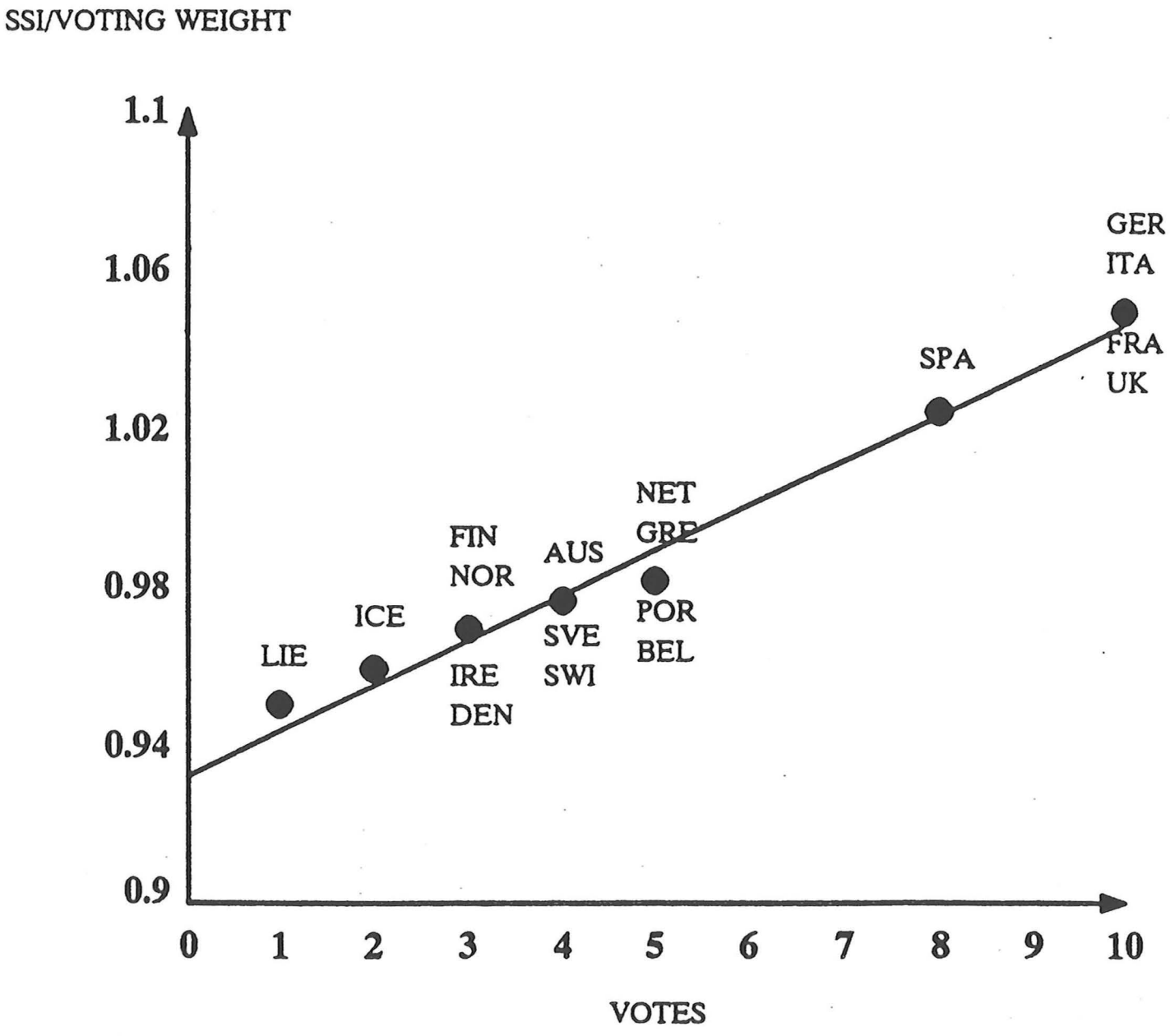

Table 4: The gains of four different blocks to their members in terms of the SSIs assuming no counter blocks to be formed

Member state	Franco-German axis	Benelux countries	Mediterra-nean countries	Nordic countries
	$\Delta\Phi_i$	$\Delta\Phi_i$	$\Delta\Phi_i$	$\Delta\Phi_i$
10 VOTE COUNTRIES	0.017			
8 VOTE COUNTRIES			0.011	
5 VOTE COUNTRIES		0.005	0.010	
4 VOTE COUNTRIES				0.005
3 VOTE COUNTRIES				0.004
2 VOTE COUNTRIES		0.004		
BLOCK TOTAL	0.034	0.014	0.031	0.017

where r denotes the power voting weight ratio and p voting weight which measures the size of the member state and the standard error of the β-coefficient is shown in the parenthesis. Large members tend to have little more power relative to their votes than the small ones. The relationship between the power and population in not as clear as it was in the EC of 12, since the power population ratio is not monotonically decreasing [see Tables 3 and 6]. The relationship is, however, rather similar in accordance with the folowing regression equation:

$$Log\Phi = \underset{(0.031)}{0.404 \cdot LogP - 6.693}, \quad R^2 = 0.924 \tag{10}$$

for the EC of 16 members and

$$Log\Phi = \underset{(0.022)}{0.311 \cdot LogP - 5.860}, \quad R^2 = 0.920 \tag{11}$$

for the EC of 19 members, where Φ denotes the power measured by the SSI, P denotes population and the standard errors of β-coefficients are shown in the parenthesis.

It is assumed in Table 4 that no counter blocks are formed. It seems that large members within each block gain little more than the small ones. This is natural because of the definition of the quotient game in each sub-system, see Section 3. Also it seems that the total gain for these blocks increases with respect to the size likewise in the EC of 12 members. In Table 5 it is assumed that counter blocks are formed. The gain is measured by the difference between the CSIs and the SSIs in Tables 1 and 3. It is interesting that in the EC of 12 the Franco-German axis would be the only sub-system to gain if the

Table 5: The gains for the sub-systems and for members outside these blocks in the EC12 and in the EC16 assuming that all sub-systems are formed

Country/ Sub-system	Gain in the EC12	Gain in the EC16	Difference
FRANCO-GERMAN AXIS	0.010	0.010	0.000
MEDITERRANEAN COUNTRIES	-0.028	0.041	0.069
SCANDINAVIAN COUNTRIES	..	-0.002	..
BENELUX COUNTRIES	-0.012	0.002	0.014
SUB-SYSTEMS TOTAL	-0.030	0.051	..
ITALY	-0.005	-0.010	-0.005
UNITED KINGDOM	-0.005	-0.010	-0.005
AUSTRIA	..	-0.019	..
DENMARK	0.020	..	..
IRELAND	0.020	-0.012	-0.032
EC TOTAL	0.000	0.000	..

counter blocks are formed. In this game with coalition structures the Franco-German axis is the only player which forms a blocking minority with any of the rest of the players. In this kind of stalemate the sub-systems would gain only by forming larger coalitions with members outside the blocks or with each other. It is worth noting that in the EC of 16 members the situation is quite different and the total gain for the sub-systems would be 0.051. The Franco-German axis and specially the Mediterranean block are in the strong position and the small countries outside the blocks are the ones who would lose. The marginal contributions in terms of the SSIs of possible additional members joining to these sub-systems are very high if they swing the coalition from losing one to a blocking minority. For example in the EC of 19 members the EFTA countries together with Denmark cannot block decision taken by qualified majority. The power for this extended EFTA coalition would be 0.301. If the UK joined this alliance it would swing the coalition from losing one to a blocking minority. The SSI would increase to 0.460 and thus the marginal contribution of the UK would be 0.159 which exceeds 0.108, the SSI for the UK in the EC of 19 members, remarkably [see Table 6].

The EFTA countries' share of the population in the EC of 19 members would be only 8.6 percent, but share of power 21 percent when measured by the SSI [see Table 6]. As it was noted earlier the population elasticity of power would decrease after enlargements and the small countries' share of power would increase. Since the EFTA countries are small their weight in the EC's decision making would be very high relative to their population in the EC of 19 members presented in Table 6. The EFTA enlargement seems to in some sense equalize the power voting weight ratio, since the largest losses relative to decrease in voting weight are the ones of Spain, Denmark and Ireland. These three counties have

Table 6: The SSIs for the EC19 and the difference between power indices in the EC12 and the EC19

Country	Φ_i	Φ_i/cap	Φ_i/Voting weight	$\Delta\Phi_i$	$\Delta\Phi_i/\Delta w_i$
GERMANY	0.108	1.387	1.049	-0.026	0.913
ITALY	0.108	1.880	1.049	-0.026	0.913
UNITED KINGDOM	0.108	1.892	1.049	-0.026	0.913
FRANCE	0.108	1.933	1.049	-0.026	0.913
SPAIN	0.084	2.151	1.024	-0.027	1.185
NETHERLANDS	0.051	3.456	0.981	-0.013	0.913
PORTUGAL	0.051	4.900	0.981	-0.013	0.913
GREECE	0.051	5.093	0.981	-0.013	0.913
BELGIUM	0.051	5.139	0.981	-0.013	0.913
SWEDEN	0.040	4.742	0.976	..	..
AUSTRIA	0.040	5.267	0.976	..	..
SWITZERLAND	0.040	6.145	0.976	..	..
DENMARK	0.030	5.840	0.969	-0.012	1.404
FINLAND	0.030	6.057	0.969	..	..
NORWAY	0.030	7.118	0.969	..	..
IRELAND	0.030	8.468	0.969	-0.012	1.404
LUXEMBOURG	0.020	78.800	0.959	-0.002	0.351
ICELAND	0.020	52.533	0.959	..	..
LIECHTENSTEIN	0.010	391.600	0.950	..	..
EC TOTAL	1.000	2.689	1.000	-0.209	0.965

the highest power voting weight ratios in the EC of 12 members.

5 Conclusions

Two explicit voting models were used to study the voting power in the EC. Since it is probable, that at least some of the EFTA countries will join the Community in this decade, two different enlargements were analysed. It seemed, that the relative loss of power of today's EC members would have been rather equal, but absolutely the largest countries would have lost more. There is no clear relationship between the power and voting right in the Community of 12, but the EFTA enlargement would change the situation. In the Community of 19 this relationship seemed to be monotonically increasing with the slope 1.1. This change is mainly due to the structure of the enlargement, since

the new members are small countries. Generally, it seems that the enlargements equalize the fluctuations in power voting weight ratio.

The modified versions of power indices were used to analyse the sub-systems in the Community. There were two main results. It seemed that the additional power an alliance could obtain increased with respect to the voting weight of the block when it was assumed that no counter blocks were formed. The gains and losses, however, seemed to change remarkably when counter blocks were allowed. The small countries seem to have an important role in the EC decision making in both the Community of 12 members and in the Community of 19 members. First, there are no blocking minorities among the known sub-systems of the EC and the small countries or other blocks are needed to form one. Second, although the power voting weight ratio tends to increase with respect of the size of the country, the determination of votes favours the small countries.

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Chapter 5

Probabilistic Voting Power in the EU Council:
The Cases of Trade Policy and Social Regulation
The Scandinavian Journal of Economics 97(2), 345-356

1 Introduction

In the EU, member states' preferences and national influence are important due to the inter-governmental decision making of the Union. The standard voting power analysis of national influence in the EU assumes that, when interpreted as voting probabilities, member countries' preferences are identically distributed.[1] In this paper we abandon this assumption and analyse how different national policy goals may change the distribution of voting power in the EU. We focus on two policy cases, namely trade policy and social regulation.

Widgrén (1993, 1994) takes into account that some member countries of the EU are more likely to collaborate than others. He extends the standard voting power analysis to cover the impacts of predetermined coalitions by applying games with coalition structures (CS games). In CS games cooperation between members from different groups is not permitted (see Owen 1977). Thus each group behaves like a single voter in games without coalition structures. Members in one group have identical preferences and the groups' preferences are identically distributed. It is easy to realize that theory of CS games is not a satisfactory way to analyse differentiated policy goals since coalition structures are permanent and they do not arise from voting issues. However, the basic idea of CS games can be easily extended by giving a richer structure to a partition.

The purpose of the present paper is to replace the assumption of identical preferences within a group with an assumption of identically distributed preferences within a group. Let us call the partition, where a possibility for inter-group collaboration exists, a semi-coalitionstructure (SCS). We divide the Union members into three semi-coalitions, first, those in favour of a proposal, second, those against, and, third, those indifferent. Thus we also abandon the assumption of identically distributed preferences of a priori groups.

The basis for the SCSs is made as in Hamilton (1991) according to newspaper articles, statements of national representatives, etc. This division is based on qualitative data and it is naturally subjective. Grounds can be found, however, to support the realism of this kind of groupings in the EU. They can be interpreted as examples giving light to patterns of voting power in the presented policy cases. Hamilton (1991) analyses possible outcomes in a similar setup in four issues of EU decision making. His analysis is purely qualitative and it does not allow inter-group cooperation. In this paper, we integrate Hamilton's qualitative data of voting patterns and probabilistic voting power approach. In order to do so we model member states' voting behaviour by applying the so-called partial homogeneity assumption (Straffin 1988, see section 2 below). Particularly our analysis concentrates on two questions: "What kind of decisions can be made?" and "Will new entrants change the direction of trade policy or social regulation in the European Union?".

[1] For studies on voting power in the EU/EC, see for example Brams, Doherty and Weidner (1991), Herne and Nurmi (1993), Hosli (1993) and Widgrén (1993, 1994, 1995) and the references therein.

2 Voting Power when Voters Are Partially Homogeneous

In cooperative game theory bargaining for forming coalitions, is not explicitly modelled. A weighted voting game, as voting in the EU Council, can be defined as a function $v = v[q; w_1, \ldots, w_n; p_1, \ldots, p_n]$, where $q \in [0, 1]$ is the share of votes required for a majority, w_i:s are the voting weights and p_i:s are probabilities that i votes for a random bill. These probabilities describe voters' preferences. The p_i-values close to one reveal that i is likely to support a proposal and hence it is important for him to obtain the proposal's aims.

The decisions of the EU are made in the Council, where Germany, Italy, France and the UK have 10 votes each; Spain 8 votes; the Netherlands, Greece, Portugal and Belgium 5 votes each; Denmark and Ireland 3 votes each and Luxembourg 2 votes. Most decisions are made by a qualified majority which is made up of 54 votes before the EFTA countries' entry. Among the new entrants Austria and Sweden have 4 votes and Finland has 3 votes. After the enlargement 62 votes out of 87 are required for a qualified majority. Let us denote the EU before the enlargement by EU(12) and after the enlargement by EU(15). The voting game in the Council of the EU(15) can be described as follows $v_{EU15} = v[62; 10, 10, \ldots, 3, 2; p_1, \ldots, p_{15}]$.

In weighted voting a player who makes a difference to an outcome wields influence. In voting games a voter makes a difference when his vote swings a coalition from a loser into a winner. Such a player is said to be *crucial*. In this paper we follow Straffin's probabilistic conceptualization of power and interprete the measures of voting power simply as probabilities. Let $\mathcal{S}$ denote a random coalition, $\mathcal{W}$ be the class of winning, $\mathcal{L}$ the class of losing and $\mathcal{M}$ the class of minimum winning coalitions, while $M \in \mathcal{M}$ is defined here as a coalition which comprises at least one crucial player. Let $\mathcal{W}_i$ denote the class of winning coalitions where i is a member and let $\mathcal{M}_i$ denote the class of minimum winning coalitions M_i where i is crucial. Voter $i's$ probabilistic power can now be defined as the difference between two probabilities as follows: $P\{\mathcal{S} \in \mathcal{M}_i\} = P\{\mathcal{S} \in \mathcal{W}_i\} - P\{\mathcal{S} - \{i\} \in \mathcal{L}\}$. For explicit calculation we need to specify a probability model for voting. Supposing that each player votes 'yes' or 'no' independently of each other, we can write for any fixed $S \subset N$, $P\{\mathcal{S} = S\} = \prod_{i \in S} p_i \prod_{i \notin S} (1 - p_i) = f(p_1, \ldots, p_n)$, which is called a power polynomial (Straffin 1988). Summation of these probabilities over different classes of coalitions yields the probabilities $P\{\mathcal{S} \in \mathcal{W}\}$, $P\{\mathcal{S} \in \mathcal{M}\}$, $P\{\mathcal{S} \in \mathcal{W}_i\}$, $P\{\mathcal{S} \in \mathcal{L}\}$. It is shown in Owen (1972) that the probability $P\{\mathcal{S} \in \mathcal{M}_i\}$ which defines individual voting power is equal to the i^{th} partial derivative of the power polynomial $f(\cdot)$.

For calculation purposes we have to define an explicit voting model (i.e. p_i probabilities). In the literature there are two standard assumptions for vector p's joint probability distribution, namely *independence* whereby p_i denotes independently uniformly distributed

random variables on [0, 1] and *homogeneity* whereby $p_i = t \; \forall \; i$ and t is uniformly distributed on [0, 1] (Straffin 1988).

The homogeneity assumption is a more appropriate for situations where voters can communicate with each other (Straffin 1988). Independence, in contrast, indicates that there is no communication of any significance to speak of among voters. The standard way to model voting games is to presume that all players are either homogeneous or independent.[2]. However, in real voting situations it is obvious that there are groups of homogeneous and independent voters within the body. This combination of the standard assumptions is referred to as *partial homogeneity*. As a special case we assume that there is, first, a group S of voters supporting the proposal in the sense of forming a homogeneous group with voting standard t and, second, an opposition R, which is formed by a group of voters with a complementary voting standard $1 - t$ and, third, there is a group of independent voters, denoted by U. This SCS yields the following formula for the probabilistic power index

$$\begin{aligned} \pi_i &= P\{i \; is \; crucial \; for \; the \; decision\} = P\{\mathcal{S} = S, S \in \mathcal{M}_i\} \qquad (3) \\ &= \underbrace{\int_0^1 \int_0^1 \dots \int_0^1}_{u+1} f_i(\overbrace{t, \dots, t}^{s}; p_{s+1}, \dots, p_{s+u}; \\ &\quad \overbrace{(1-t), \dots, (1-t)}^{r}) dp_{s+1} \dots dp_{s+u} dt \\ &= \int_0^1 f_i(\overbrace{t, \dots, t}^{s}; \underbrace{1/2, \dots, 1/2}_{u}; \overbrace{(1-t), \dots, (1-t)}^{r}) dt \end{aligned}$$

where n, s, u and r denote the cardinalities of sets N, S, U and R respectively and $f_i(\cdot)$ is the i^{th} partial derivative of function f defined earlier.

For example, consider a three-person simple majority voting game where each player has one vote. Let us assume that voter 1 forms one homogeneous group, voter 3 an

[2]If we calculate the probability that a voter swings the coalition from a losing to winning one, we have two following well-known formulas. Let f_i be the i^{th} partial derivative of power polynomial f. Independence yields

$$P_{ind}\{\mathcal{S} = S, S \in \mathcal{M}_i\} = \int_0^1 \int_0^1 \dots \int_0^1 f_i(p_1, \dots, p_n) dp_1 \dots dp_n = \sum_{S \in \mathcal{M}_i} (\frac{1}{2})^{n-1} = \beta_i', \qquad (1)$$

which is referred to as the Banzhaf power index (BI) and homogeneity yields

$$P_{hom}\{\mathcal{S} = S, S \in \mathcal{M}_i\} = \int_0^1 f_i(t, \dots, t) dt = \sum_{S \in \mathcal{M}_i} \frac{(s-1)!(n-s)!}{n!} = \Phi_i \qquad (2)$$

which is referred to as the Shapley-Shubik power index (SSI).

opposition and voter 2 is assumed to behave independently. The power polynomial can now be written as follows: $f(p_1,p_2,p_3) = p_1p_2(1-p_3)+p_1p_3(1-p_2)+p_2p_3(1-p_1)+p_1p_2p_3$ and taking the first partial derivates of f yields $f_i(p_1,p_2,p_3) = p_j + p_k - 2p_jp_k$, where $j,k \neq i$. Using (3) yields $\pi_1 = \int_0^1 \int_0^1 p_2 + (1-t) - 2p_2(1-t)dtdp_2 = 1/4 = \pi_3$ because of the symmetry. For an independent voter we have $\pi_2 = \int_0^1 t + (1-t) - 2t(1-t)dt = 2/3$. Thus the independent voter has more power than voters 1 and 3, which is intuitively reasonable in this simple example.

The SCSs imply that power accumulation is asymmetric with respect to the p_i-probabilities (i.e. the importance of proposals). It also varies from individual to individual as it is not the case when all voters have identically distributed preferences. Hence it is possible that some voters wield influence on less important questions where their probabilities of accepting a proposal lie around 0.5 on the unit interval, i.e. they are indifferent, while others wield influence on more important questions where their probabilities of accepting a proposal is either close to one or close to zero, i.e. they are strongly in favour of or against a proposal, respectively. In order to make quantitative assessments of this let us now restrict our analysis on an arbitrary interval (a, b] of voting probabilities p_i on [0, 1]. Voter $i's$ power on (a, b] can be written as follows

$$F_i(a,b] = F_i(b) - F_i(a) = \underbrace{\int_a^b \int_a^b \dots \int_a^b}_{u+1} f_i(\overbrace{t,\dots,t}^{s}; p_{s+1},\dots,p_{s+u}; \overbrace{(1-t),\dots,(1-t)}^{r})dp_{s+1}\dots dp_{s+u}dt = \pi_i(a,b], \tag{4}$$

where F_i has the following properties $F_i(0) = 0$ and $F_i(1) = \pi_i$ and hence $F_i(0,1] = \pi_i$ $\forall i$. In order to make probabilistic power comparisons in different types of questions let us standardize $F_i(a,b]$ by using restricted Shapley-Shubik -indices $\Phi_i(a,b]$ simply as follows

$$F_i^*(a,b] = \frac{F_i(a,b]}{\Phi_i(a,b]}. \tag{5}$$

Equation (5) standardizes voter i's partial homogeneity power (see equation (3)) on $(a,b]$ by using the SSI as a denominator. Let us now classify trade policy proposals according to the voting probabilities. A proposal is defined to be protectionist whenever $t \in [0.0, 0.2]$ and thus members of the liberal group have a very low intensity to vote for it. Moreover, a proposal is liberal when $t \in [0.8, 1.0]$ and thus members of the protectionist group have a very low intensity to support it. If $t \in [0.2, 0.4]$ or $t \in [0.6, 0.8]$, a proposal is defined to be slightly protectionist or slightly liberal respectively and, finally, the questions with $t \in [0.4, 0.6]$ can be characterized as neutral ones. As regards social regulation we may define a similar classification as above by replacing liberal with tight and protectionist with loose.

Equation (5) simply tells whether a country wields more or less influence in different trade policy (or social regulation) questions than on average when both a proposal and

a policy area are random and predetermined semi-coalitions do not exist. Consider that $(a, b] = (0.0, 0.2]$ and $F_i^*(0.0, 0.2] \geq 1$. Then a country wields at least as much influence on questions concerning protectionist trade policy (loose social regulation) as on a random question of the EU. In more general terms let us define the following set

$$\Pi_i = \{F_i^*(0.0, 0.2], F_i^*(0.2, 0.4], F_i^*(0.4, 0.6], F_i^*(0.6, 0.8], F_i^*(0.8, 1.0]\}, \qquad (6)$$

where $F_i^*(\cdot]$-terms are as in equation (5). Let us refer to Π_i as country i's *power profile* (see figures 1 and 2). The set Π_i evaluates how predetermined voting coalitions affect voting power compared to the situations without semi-coalitions on different proposal categories. Thus the elements of a power profile reveal what semi-coalitions can acchieve in terms of probabilistic power in various types of proposals.

3 Results

It is assumed, as suggested by Hamilton (1991), that Germany, the United Kingdom, the Netherlands, Belgium, Denmark and Luxembourg (35 votes) from among the old members plus the new entrants (10 votes) favour a liberal external trade policy and they stand in an opposition to the "sun-belt protectionists" formed by Italy, France, Spain and Portugal (33 votes). The remaining member states, Greece and Ireland, form a group of indifferent voters (8 votes). In social regulation we assumed that in addition to the new entrants Germany, the Netherlands, Denmark and Luxembourg (20 votes) favour tighter norms and Italy, Spain, Portugal, Greece and Ireland (31 votes) are against them. The group of indifferent voters is larger than in trade policy and it is formed by the United Kingdom, France and Belgium (25 votes). In the EU of 12 members the number of votes in the group in favour of tighter regulation falls below the limit for a blocking minority. However, the new entrants increase the number of votes in this group to 34 over the blocking minority limit.

Table 1 presents the partial homogeneity indices π_i in trade policy and social regulation. Figures 1 and 2 present the respective power profiles as defined for five different categories of proposals in equations (5) and (6). In trade policy of the EU(12) the assumed SCS generates power losses for all members in the probabilistic sense [3] with only Luxembourg as an execption when π is compared to SSI. In the EU(15) Spain seems to gain and Italy

[3]Note that the probabilistic power indices do not need to sum up to unity (Straffin 1988). Actually the sum is one if and only if SSI is used to measure power (Dubey, Neyman and Weber 1981). The probabilistic indices do, however, contain important information about voting bodies. Consider a symmetric three-person unanimity game. This setup yields the following BI-vector $(1/4, 1/4, 1/4)$ and the following SSI-vector (1/3, 1/3, 1/3). Thus the voters would lose power (in a probabilistic sense) by acting independently in a situation where they should communicate and make compromises as is the case when they behave homogeneously. By normalizing BIs this information is lost and the probabilistic interpretation of the measures is destroyed (Straffin 1988).

Table 1: Partial Homogeneity Power Indices in Trade Policy and in Social Regulation and Shapley-Shubik Indices for the EU12 and the EU15

Country	Trade policy π_i			Social regulation π_i			Shapley-Shubik indices Φ_i	
	Group	EU12	EU15	Group	EU12	EU15	EU12	EU15
Germany	L	0.102	0.075	F	0.153	0.098	0.134	0.119
Italy	P	0.107	0.113	A	0.131	0.098	0.134	0.119
UK	L	0.102	0.075	U	0.130	0.079	0.134	0.119
France	P	0.107	0.113	U	0.130	0.079	0.134	0.119
Spain	P	0.088	0.098	A	0.100	0.081	0.111	0.093
Netherlands	L	0.051	0.042	F	0.069	0.045	0.064	0.056
Portugal	P	0.055	0.049	A	0.068	0.044	0.064	0.056
Greece	U	0.048	0.044	A	0.068	0.044	0.064	0.056
Belgium	L	0.051	0.042	U	0.079	0.044	0.064	0.056
Sweden	L	..	0.035	F	..	0.038	..	0.044
Austria	L	..	0.035	F	..	0.038	..	0.044
Denmark	L	0.038	0.028	F	0.057	0.030	0.042	0.033
Finland	L	..	0.028	F	..	0.030	..	0.033
Ireland	U	0.033	0.031	A	0.050	0.029	0.042	0.033
Luxembourg	L	0.013	0.015	F	0.014	0.018	0.012	0.021
Trade policy: L=liberal, P=protectionist, U=undecided Social regulation: F=for tighter norms, A=against tighter norms, U=undecided								

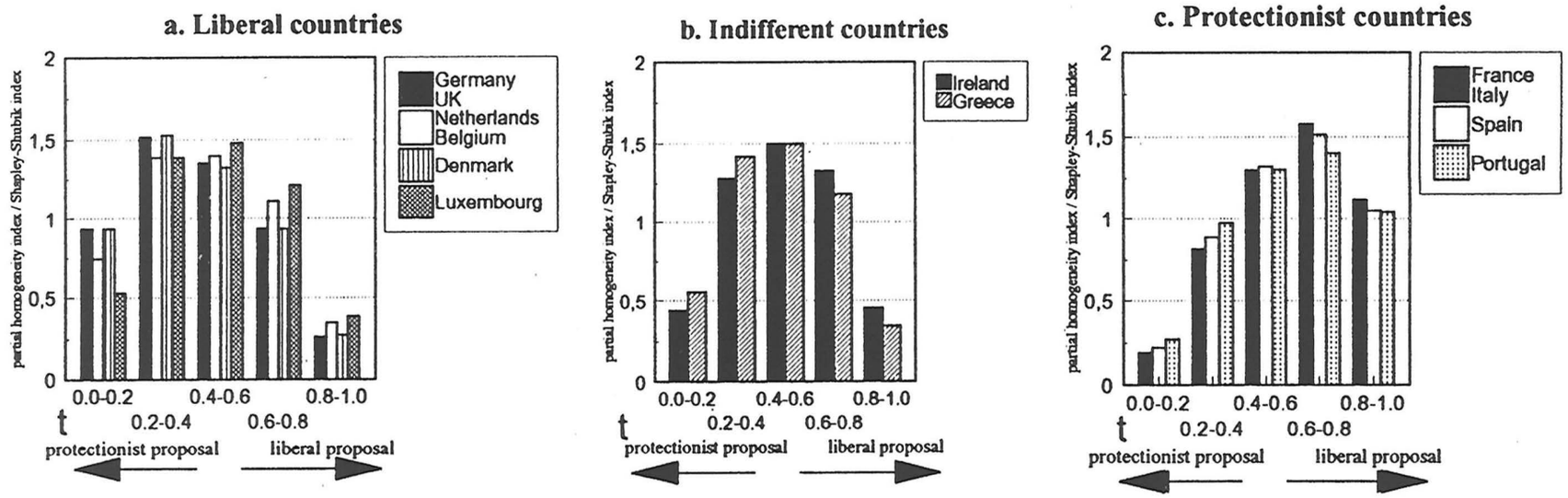
and France, the largest countries in the protectionist group, almost maintain their SSI level while countries in the liberal group lose significantly.

Power profiles in figure 1 (a, b, c) reveal that in the EU(12) the likelihood of a stalemate is high since countries in the protectionist group gain most when a proposal has slightly liberal or neutral goals (i.e. F_i^* exceeds one in these categories) while they seem to lose when a proposal is protectionist. Similarly, the liberals have a stronger position than on average when a proposal is slightly protectionist or neutral. Summing up, both groups seem to gain in situations where they are trying to block rather than to support proposals. This suggests a status quo solution. It is also true, however, that all three groups gain in questions with neutral policy aims and that is why breaking a stalemate by making compromises is possible. Also it seems that none of the three groups is decisive in the sense that the direction of the policies is not in the hands of any group [4].

[4]For a more extensive discussion about the EU and protection, see Winters (1994).

Figure 1. Power Profiles in Trade Policy

a)-c) EU12



d)-f) EU15

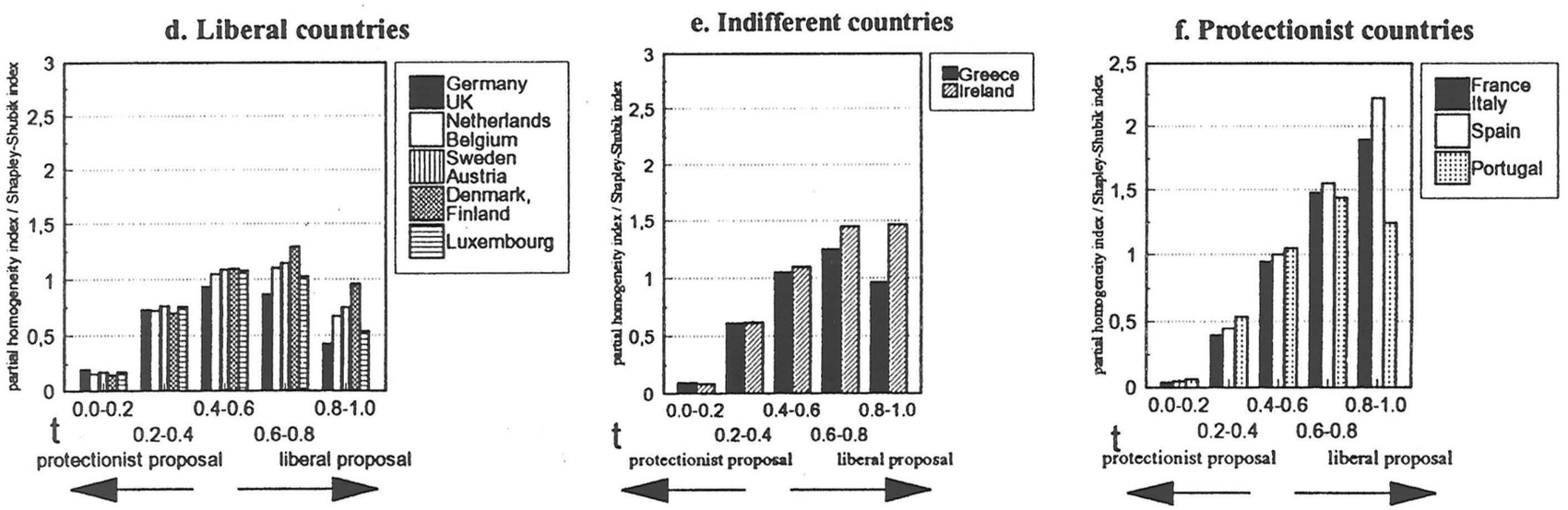
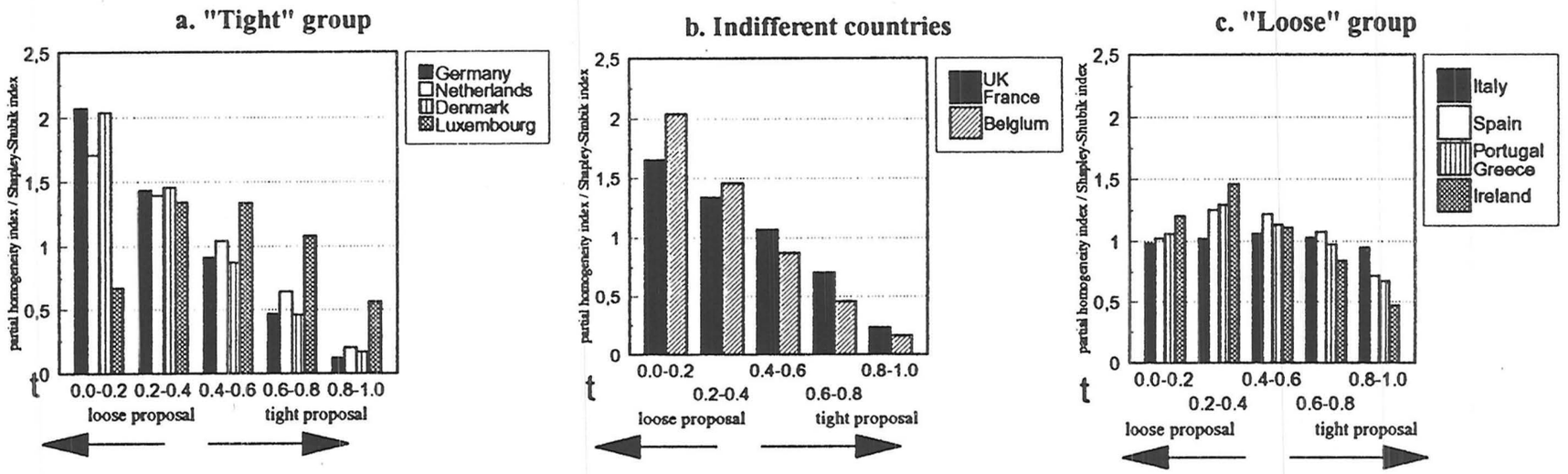
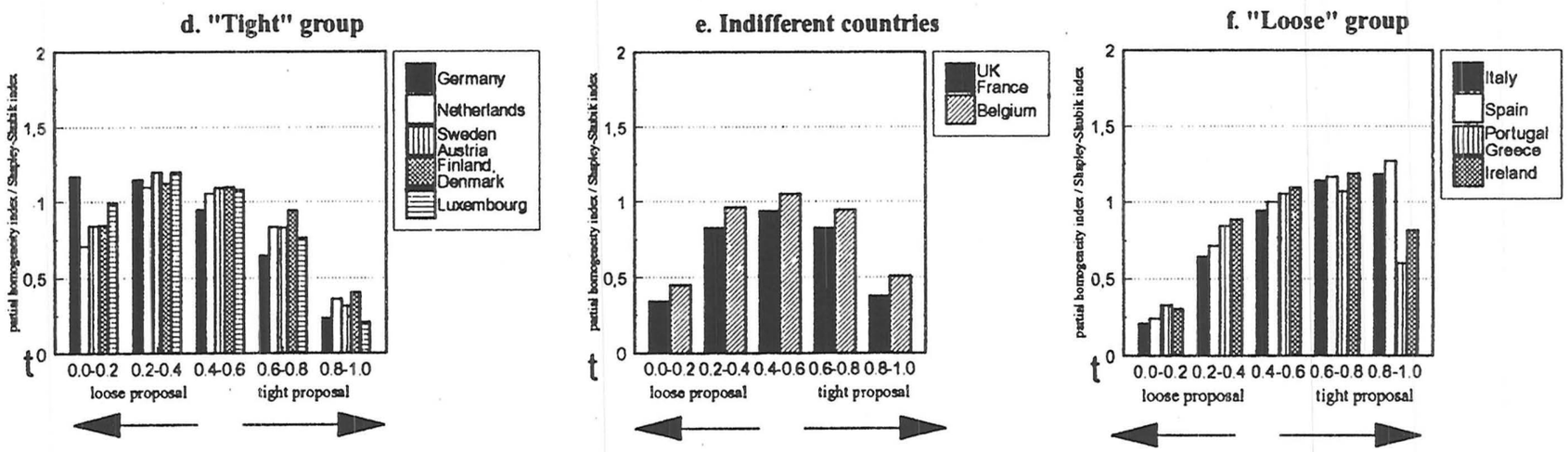


Figure 2. Power Profiles in Social Regulation

a)-c) EU12



d)-f) EU15



In an expanded EU the setup is more interesting (figure 1 d, e, f). As a group the liberal countries are more able to push through liberal trade policy than before the enlargement. On average the liberal group gains power when proposals have slightly liberal aims and its members seem to maintain their SSI level in policies with strongly liberal aims. Hence, in the sense of probabilistic power, it is profitable for the countries in the liberal group to collaborate in order to try to liberalize the common external trade policy of the EU. The pressure towards increasing liberalism gets also more support from the indifferent countries. The gains in pushing through more liberal policy goals are, however, moderate compared to the SSI. As regards the whole unit interval it is worth stressing that the countries in the liberal and indifferent group lose power. Also it seems that Germany has a different power profile from the rest of the countries in the liberal group.

Given that the new entrants are in favour of a liberal trade policy the profiles of figure 1 (d, e, f) suggest that general policy changes in the Union's common external trade policy are not likely but there is more potential for a liberal policy than before the entry of three EFTA countries. This is due to the protectionist countries' strong position, especially when a proposal has liberal policy aims. This holds, in particular, for France and Italy. Summing up, the new entrants diminish the risks of protectionist policy decisions but the protectionist group is highly decisive in a way towards increased liberalism. Whereas in the EU(12) both sides, the liberals and the protectionists, gained by defending the status quo, in the EU(15) the liberals gain by promoting more liberal policy goals and the protectionists are in a defensive position.

In social regulation the setup is different from trade policy. Table 1 shows that before the enlargement countries in favour of tighter norms gain in terms of probabilistic power when they form a semi-coalition. For the rest of the member states π is more or less equal to SSI. In an expanded EU all members lose power in the probabilistic sense. It is worth noting, however, that Spain exerts more power than the UK and France.

As regards the power profiles, figure 2 (a, b, c) shows that the countries in favour of tighter social norms lose power when a proposal has tighter goals for social regulation. Their gains concern the questions in which they have minor interests to support a proposal and thus it is profitable for them to stay in a defensive position. The opposition seems to exert slightly more power than in terms of their SSI level when policy aims are loose. There is no pressure towards tighter policy but there is pressure towards looser regulation. The indifferent countries form a decisive group as regards the direction of the policy. Figure 2 (d, e, f) shows that the new entrants change the setup somewhat. The most remarkable change is that members in the group against tighter regulation are better off than on average when they decide to defend the status quo.

4 Conclusions

In this paper, we analysed decision making in the common external trade policy and social regulation of the EU. We asked two questions: first, "What kind of decisions can the Union take if we believe in supposed differences in voting behaviour?" and, second, "What effect will the new entrants have on policy making?" In the EU(12) the results reveal that in trade policy all members with the exception of Luxembourg lose power in a probabilistic sense when compared to SSI without predetermined voting coalitions. Moreover, the analysis of different proposal categories suggests that in trade policy the assumed a priori partition of members produces a neutral rather than a protectionist or a liberal policy. In social regulation there is pressure towards looser norms although by forming a semi-coalition the countries in favour of tighter norms gain in terms of probabilistic voting power.

The accession of the three EFTA countries strengthens the coalition supporting a liberal external trade policy or tighter social regulation norms when measured in terms of votes. However, it is shown that this change is not enough to spur general policy changes. In social regulation the countries against tighter norms are able to defend loose norms successfully. In trade policy the new members increase the pressures towards a liberal policy. The fear of a protectionist policy seems to vanish but the course of EU's external trade policy to a liberal direction is, however, in the hands of the protectionist group.

In general the results of this paper show that coalition formation in the EU Council is profitable in terms of probabilistic voting power when the aim of cooperation is blocking proposals. When trying to push proposals through, coalitions of a reasonable size do not seem to ensure probabilistic power gains for those who collaborate.

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