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Reihe Ökonomie
Economics Series

**Unifying EU Representation
at the IMF Executive Board**
A Voting and Veto Power Analysis

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Founded in 1963 by two prominent Austrians living in exile – the sociologist Paul F. Lazarsfeld and the economist Oskar Morgenstern – with the financial support from the Ford Foundation, the Austrian Federal Ministry of Education and the City of Vienna, the Institute for Advanced Studies (IHS) is the first institution for postgraduate education and research in economics and the social sciences in Austria. The **Economics Series** presents research done at the Department of Economics and Finance and aims to share “work in progress” in a timely way before formal publication. As usual, authors bear full responsibility for the content of their contributions.

Das Institut für Höhere Studien (IHS) wurde im Jahr 1963 von zwei prominenten Exilösterreichern – dem Soziologen Paul F. Lazarsfeld und dem Ökonomen Oskar Morgenstern – mit Hilfe der Ford-Stiftung, des Österreichischen Bundesministeriums für Unterricht und der Stadt Wien gegründet und ist somit die erste nachuniversitäre Lehr- und Forschungsstätte für die Sozial- und Wirtschaftswissenschaften in Österreich. Die **Reihe Ökonomie** bietet Einblick in die Forschungsarbeit der Abteilung für Ökonomie und Finanzwirtschaft und verfolgt das Ziel, abteilungsinterne Diskussionsbeiträge einer breiteren fachinternen Öffentlichkeit zugänglich zu machen. Die inhaltliche Verantwortung für die veröffentlichten Beiträge liegt bei den Autoren und Autorinnen.

Abstract

The consequences of consolidating EU representation at the IMF Executive Board by regrouping the 27 Member States into two EU constituencies, euro area and non-euro area, are discussed. In particular we contrast voting power as proposed by Penrose-Banzhaf (PBI) and Shapley-Shubik (SSI), and other respectively related measures of blocking (or veto) power and decision efficiency as proposed by Coleman and Paterson. Hitherto, IMF-specific literature is PBI-based. However, theoretical reasons and empirical plausibility arguments for the SSI are compelling. The (SSI) voting power of the two large constituencies – U.S.A. and euro area – reflects their corresponding voting shares over a range of majority thresholds, whereas PBI voting power reduces to only half of vote share at the majority threshold of 85% needed for some Executive Board decisions. SSI-related estimates of veto power are generally lower than the Coleman indices. Correspondingly, the efficiency of collective decision-making is considerably underestimated by the Coleman measure.

Keywords

International Monetary Fund, European Union, voting power analysis, veto power

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Comments

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1. Introduction

The global financial crisis feels like a déjà vu replay: Most of the conclusions at which international policymakers have arrived lately were already listed in the “*Report on the international monetary system – how to make it work better and avoid future crisis,*” submitted by the Committee on Economic and Monetary Affairs of the European Parliament in 2001. In particular, with reference to EU representation at the IMF the report – with strong rhetoric – states that

To counterbalance the invasive influence of the United States, EU Member States would do well to bring Europe’s weight in the world to bear in the IMF. That would mean insisting on an intelligent realignment of the different ‘constituencies’, in particular those on which some EU States are somewhat isolated.

The discussion on consolidating representation of EU Member States at the IMF has a long tradition and has only gained additional momentum in the current global financial crisis. As pointed out by Bini Smaghi (2006a), Europe has been slow to improve its external representation in the field of international economic policy for two reasons. First, the degree of European integration varies considerably across countries with regard to structural and financial policies; moreover, the fact that only 16 of 27 EU Member States have the same currency is an added complication. Second, joint representation presupposes giving up a certain number of seats in international forums, a fact that some Member States might see as a loss in international prestige.

With international representation being fragmented, the EU arguably exerts much lower influence on international policy issues than it might do given its economic weight. In addition, the number of seats held by EU representatives in international forums prevents other countries – especially emerging market economies – from actively shaping discussions, thereby creating tensions between advanced and emerging market economies on the one hand and damaging the legitimacy of international financial organizations, such as the IMF, on the other hand (Bini Smaghi, 2006a).

With reference to the external representation of the EU, Almuñia (2009, p.5) stated that

... The Commission has long called for a consolidation of European representation on the boards of the IFIs. In the case of the IMF, the argument for a single consolidated euro-area chair is quite obvious. Yet, Member States concerned jealously guard their seats ...

When discussing EU representation at the IMF Executive Board, it is important to focus not only on technical issues such as the number of seats on the Board or the size of IMF quotas

assigned to individual countries, but also on the implications of those conditions for actual power. Political power does not only depend on a member's share in the votes alone, but also on its *a priori* voting power, i.e. its ability to cast decisive votes under majority voting rules. In an organization, members with a large voting share may have even larger voting power at the expense of members with smaller voting shares, whereas other members might have no voting power at all notwithstanding their nominal voting shares.¹ Moreover, individual voting power is also closely linked to the voting power of all other members and to the voting or majority rules. In fact, a country may have the incentive to join a group as the loss of individual power would be outweighed by the gain achieved as a member of a more powerful group. In this respect, the political discussion on consolidating EU representation at the IMF seems to ignore that *a priori* voting powers are not identical with voting shares within a weighted-voting system, as evidenced by IMF-related empirical analysis (Leech, 2002a; Bini Smaghi, 2006b).

According to the IMF's Articles of Agreement, which also provide the legal basis for the IMF's voting system, a member's voting power should reflect its financial contribution. Therefore, IMF decision-making should be built on voting weights that confer adequate voting power in line with original intentions. Following an overview of the current governance structure of the IMF (sections 2 and 3), we analyze the voting and blocking power implications of consolidating EU representation at the IMF Executive Board on the basis of the new quota formula, agreed upon in 2008 and still to be ratified by many IMF member countries (sections 4 and 5). The literature on these issues, however, almost exclusively focuses on a power index proposed by Penrose-Banzhaf, and on a blocking (or veto) index proposed by Coleman that is of structurally related to it. Since results based on the Shapley-Shubik index and a related blocking (veto) index suggested by Paterson significantly differ from the results when the Penrose-Banzhaf and Coleman index is applied (as in the literature), this paper also provides new insights from a methodological point of view.

¹ The voting power of Luxembourg in the EEC Council of Ministers before 1973 is an often cited classical example. Although formally having one vote, Luxembourg did not have the power to swing decisions in the Council given the prevailing majority rules and distribution of votes – i.e. Luxembourg's voting power was actually zero.

2. Overview of Governance Structures at the IMF

2.1. Representation at the IMF under the IMF's Articles of Agreement

The IMF was established in 1944 at the Conference of Bretton Woods, with the number of founding members totaling 44 states. At that time, membership in most international organizations was traditionally based on statehood. Article II, Section 1 ("Original members") of the Articles of Agreement stipulates that

The original members of the Fund shall be those of the countries represented at the United Nations Monetary and Financial Conference whose governments accept membership before December 31, 1945.

Section 2 ("Other members") of the Articles of Agreement adds:

Membership shall be open to other countries at such times and in accordance with such terms as may be prescribed by the Board of Governors. These terms, including the terms for subscriptions, shall be based on principles consistent with those applied to other countries that are already members.

However, according to Gold (1974), a former legal IMF counsellor, the IMF should not preclude from membership "a single entity in international law" having the scope of a country.

Hornig (2005) analyzes legal and institutional implications for an IMF membership of the ECB and assesses the relevant provisions of EC Treaty and the Articles of Agreement. He basically acknowledges that the IMF is a state-based institution, but mentions that in the Balance of Payments Statistics (IMF, 2000), the term "country"

... does not in all cases refer to a territorial entity that is a state as understood by international law and practice; the term also covers some non sovereign territorial entities, for which statistical data are maintained and provided internationally on a separate and independent basis

A frequently cited legal difficulty for consolidating EU representation at the IMF concerns Article XII, Section 3,² which stipulates that the five countries holding the largest IMF quota must appoint an Executive Director. They must not form a joint representation ("constituency") with other member countries at the Executive Board. Hence, consolidation of

² The second Amendment of the Articles of Agreement in 1978 framed the size of the Board at 20 Directors, however with the proviso that "... for the purpose of each regular election of Executive Directors, the Board of Governors, by an eighty-five percent majority of the total voting power may increase or decrease the number of elected Directors." See van Houtven (2002).

EU representation which affects any of these five countries would only be feasible under an amendment of the Articles of Agreement. According to Article XXVIII (a), this amendment would need to be agreed upon by three-fifths of the members and 85% of the total voting share.

The formation of constituencies is not formally guided by the Articles of Agreement. In the past, formal rules (*“Decisions”*) have been passed to safeguard some equality of power between constituencies, but over time these rules have gradually lost effectiveness and are not applied any more. According to Martin and Woods (2005), elected directors were originally supposed to have a minimum voting power of 19% and a maximum voting power of 20%. By 1970 the margins had been altered to 6% and 13%. The maximum percentage of votes to be wielded by an elected Director is currently 9%. At present, 15 Executive Directors represent constituencies whose voting share is below 4%.

2.2. The System of IMF Constituencies

Table 1 shows the current representation of the 27 EU Member States at the Executive Board, based on the old quota formula. EU Member States are represented in ten (out of the total of 24) constituencies, three single-state (Germany, France, United Kingdom) and seven mixed-state constituencies. Presently, EU Member States hold eight chairs, with euro area Member States accounting for six chairs (Germany, France, Italy, Netherlands, Belgium, Spain) and non-euro area EU Member States for two (United Kingdom, Sweden). The two other mixed-state constituencies with an EU Member State are chaired by Canada and Switzerland. In sum, EU Member States have an aggregate voting share of 32.1% (euro area Member States: 22.9%; non-euro area EU Member States: 9.2%).

Within the seven mixed-state constituencies, there are five constituencies which are dominated by one country, namely Italy (77.8% voting share of the constituency’s total voting shares), Netherlands (49.0%), Belgium (40.6%), Canada (79.3%) and Switzerland (56.3%). The two other mixed-state constituencies are more balanced; Spain – with a relative voting share of 31.1% – chairs the “South-American” constituency, followed by Venezuela (27.2%) and Mexico (32.2%). Finland currently chairs the “Nordic” constituency under a biannual rotation scheme, with a relative voting share of 16.9%. In the same constituency, Sweden has a relative voting share of 31.7% and Norway of 22.2%.

The dispersion of EU Member States across constituencies complicates the pursuit of a common strategy at the IMF. Phillips (2006) argues that EU Member States are simply incapable of following a common position given the mixed nature of their constituencies. In

the present situation, this is likely to be most difficult for Spain, Poland and Ireland, which are the sole EU Member States in their constituencies.

McNamara and Meunier (2002) argue that, given the single monetary policy, it would be reasonable for the euro area countries to reorganize themselves at the IMF as a more coherent and streamlined grouping. However, the larger euro area countries would tend to keep the status quo, since unlike within the EU where they may well remain dominant players even as euro area members, they are unlikely to influence decisions in international organizations such as the IMF to a similar extent otherwise. Smaller EU Member States, on the contrary, would be more inclined to pool representation at the IMF, although Belgian and Dutch policymakers could be reluctant to give up their chairs.

In the past, countries have changed constituencies quite often. The search for a more influential role within a constituency (Director, Alternate Director, Senior Advisor, Advisor) and geographical considerations seemed to play major roles.

2.3. Decision-Making

The IMF is governed by two decision-making bodies: the Board of Governors and the Executive Board. The Board of Governors is the highest decision-making body of the IMF. It consists of one Governor and one alternate Governor for each member country. While the Board of Governors has delegated most of its powers to the IMF's Executive Board, it retains the right to approve quota increases, special drawing right (SDR) allocations, the admittance of new members, compulsory withdrawal of members, and amendments to the Articles of Agreement and By-Laws. The Board of Governors also elects or appoints Executive Directors and is the ultimate arbiter on issues related to the interpretation of the IMF's Articles of Agreement. The Board of Governors is advised by the International Monetary and Financial Committee (IMFC). The IMFC has 24 members, drawn from the pool of currently 186 Governors. Its structure mirrors that of the Executive Board and its current 24 constituencies. The IMFC discusses matters of common concern affecting the global economy and also advises the IMF on the direction of its work. The second decision-making body is the Executive Board, which takes care of the daily IMF business. For this purpose Executive Board exercises all the powers delegated to it by the Board of Governors.

The IMF decisions are taken by weighted voting. The individual voting share depends on the quota and the number of basic votes assigned to each member country.³ According to

³ The underlying intention was the original fundamental IMF principle that each member country should be able to influence decision making in the institution in line with its financial contribution. In April 2008, the Board of

Article XII, Section 5(a), each IMF member has 250 basic votes plus one additional vote for each SDR 100,000 of quota. Section 5(c) stipulates that all decisions of the IMF shall be made by a majority of the votes cast.

However, decisions are generally not taken by formal voting but by consensus at the Board of Governors and the Executive Board. This is a long-standing tradition. When the IMF was founded with the U.S.A. and the U.K. as the two dominant countries in terms of voting and political power, the view prevailed that – because of the variety in membership – decision-making had to be done in a consensual way. A cooperative decision-making framework evolved that generally led to “middle-of-the road solutions” where differing interests of the member countries had to be reconciled and, in particular, the interests of the developing countries need to be protected (see Van Houtven, 2002).⁴

This cooperative decision-making framework is reflected in the By-Laws, Rules and Regulations (see IMF, 2006). Section C stipulates that:

C-10. The Chairman shall ordinarily ascertain the sense of the meeting in lieu of a formal vote. Any Executive Director may require a formal vote to be taken with votes cast as prescribed in Article XII, Section 3(i), or Article XXI (a) (ii).

C-11. There shall be no formal voting in committees and subcommittees. The Chairman of the committee and subcommittee shall determine the sense of the meeting (including alternative points of view) which shall be reported.

The “*sense of the meeting*” is generally regarded as a position that would have sufficient votes to come to a decision if a vote were taken. Although “consensus” normally circumscribes “unanimity,” a large majority is generally regarded as sufficient for many decisions. However, this does not necessarily mean that voting shares are irrelevant. Formal voting shares exert a substantial influence on the de facto decision-making process.⁵

In case complex issues are on the table, the Chairman of the Executive Board⁶ urges the Board to consider matters at least until a broad majority has emerged on the issue under

Governors approved a package, including – inter alia – the agreement on a new quota formula; a second round of ad hoc quota increases based on a new quota formula that will give ad hoc quota increases to 54 countries and a tripling of basic votes to increase the voice of low-income countries.

⁴ In order to safeguard the tradition of consensual decision-making, van Houtven (2002) points out that the major industrial countries which hold approximately one-half of the voting power have tended to act as a “self-appointed steering group” or “Directoire” of the IMF in recent years. Reports of the finance ministers to the heads of state and government would not give the Executive Directors of these states enough room for compromise in the Board discussions. This would contradict the spirit of the IMF.

⁵ The impact an Executive Director can have on IMF decision making nevertheless is not only contingent on his voting share but also on his persuasiveness, technical expertise, diplomatic skills and period of service. This phenomenon can also be observed at the Governing Council of the ECB or the Council of Ministers at the EU level.

⁶ According to the Articles of Agreement, Article XII Section 4(a), “*The Managing Director shall be chairman of the Executive Board, but shall have no vote except a deciding vote in case of an equal division. He may participate in meetings of the Board of Governors, but shall not vote at such meetings.*”

discussion. It is a generally accepted principle that “nothing will be decided until everything is agreed upon.” This principle which equals a *de facto* potential veto power for smaller countries ensures that – even without a formal voting – minority views are protected in important decisions where special majority thresholds are formally needed.⁷

Ordinary decisions, which are the bulk of decisions taken by the Executive Board, require a simple (weighted) majority of the votes cast. There are several other cases, specified in the Articles of Agreement, which are subject to special majorities. The reason for the existence of special majorities is mainly historical: At the Bretton Woods conference, the U.S.A. aimed at reserving the right to exercise a veto over the most important decisions and proposed a special majority of four-fifths for major decisions.

Board discussions on tricky issues such as surveillance and general policy formulation generally end with a *Chairman’s Summing Up* or *Chairman’s Concluding Remarks*. While the *Chairman’s Concluding Remarks* aim at capturing, for instance, the progress of a policy debate in a more tentative sense thereby suggesting how the debate can be moved on, the *Chairman’s Summing Up* entails the main different opinions of Executive Directors during a Board discussion as well as differences between the Board’s views and the position of the staff.⁸ The parts of a *Summing-up* that mirror the *sense of the meeting* have the character and the effect of a Board decision. However, decisions which require a special voting majority of 70% or 85% are submitted by the Chairman to the Board for a straight up or down voting before the meeting is closed (Van Houtven, 2002). Hence, in practice, IMF decisions are rarely brought to a voting. As Leech (2002a, p. 379) notes, a formal voting is impeded with the intent *to avoid the element of confrontation associated with a contested vote*.

Decisions which require special majorities range from cases that occur only on rare occasions, for instance the suspension of voting rights or a country’s compulsory withdrawal, to more frequently occurring cases.⁹ These – highly sensitive – decisions (13 categories) are to be taken by the Board of Governors and cannot be delegated to the Executive Board. The Executive Board, as the main decision-making body of the IMF in day-to-day work, can decide upon around 40 categories of decisions requiring special voting majorities. 16 categories fall under the 85% majority rule, the remaining categories, which refer mainly to financial and operational issues, have a majority rule of 70%.¹⁰

⁷ Decision-making at the Board is, however, not a 100% consensual. For instance, when the Board approved Mexico’s request for a Stand-by Arrangement on February 1, 1995, several Board members from Western European countries abstained for various reasons.

⁸ In case the members of a constituency cannot reach a common understanding on the opinion the Executive Director may express at the meeting of the Board, the Executive Director can request the different views to be mentioned in the minutes of the meeting and remain free to abstain from or object to a particular decision.

⁹ Adjustment of quotas, allocation/cancellation of SDRs and the size of the Executive Board.

¹⁰ For special majority rules in the context of financial operations see for instance IMF (2001, p. 172).

With a voting share of 16.78%, the U.S.A. is the only country able to veto major decisions. However, as Leech and Leech (2005) point out, the veto power does not necessarily mean that the U.S.A. would be able to control the IMF completely. The 85% majority threshold would rather tend to balance voting power to a considerable extent. Indeed, it gives the U.S.A. the power to prevent action/hinder initiatives by other countries but also restricts the U.S.A.'s power to initiate action, since a group of countries with a sufficient voting share would be able to block any U.S. effort.

3. External Representation of the EU and EU Representation at the IMF

The idea to consolidate EU representation at the IMF has been launched several times in the past. For instance, Ahearne and Eichengreen (2007) recommend consolidating Europe's representation at the IMF either by creating a single chair for the EU as a whole or a pair of chairs, one for the euro area Member States and one for the other EU Member States. They argue that a single EU seat or even a pair of seats would make the EU, with its cohesive block of votes, a key swing voter. Eurodad (2006) argues along the same lines. Truman (2006) mentions that under EU consolidation, Europe would be better able to speak with one voice and could potentially exert greater influence. He puts forward a four-step procedure under which the EU Member States would be grouped in two constituencies (euro area Member States and the remaining EU Member States) and eventually form a single combined EU constituency. The remaining chairs currently held by EU Executive Directors could go to new constituencies, or the overall size of the Executive Board could be reduced.

3.1. The EU's External Representation according to the EC Treaty

The legal basis for the external representation of the EU is Article 111(4) of the EC Treaty, stating that

Subject to paragraph 1, the Council, acting by a qualified majority on a proposal from the Commission and after consulting the ECB, shall decide on the position of the Community at international level as regards issues of particular relevance to economic

and monetary union and on its representation, in compliance with the allocation of powers laid down in Articles 99 and 105.¹¹

Reference to Article 99 means that – in case economic policies are concerned – EU external representation should reflect the obligation of Member States to regard their economic policies as a matter of common concern and to coordinate these policies within the Council. The reference to Article 105 means that the ECB has to be involved in case monetary and foreign exchange operations are discussed (Horng, 2005).

According to the Treaty of Nice, which entered into force on February 1, 2003, the Council is entitled to define arrangements on the external representation more precisely by qualified majority voting. In brief, the Council, the Commission and the ECB are involved in various matters of the external representation, whereby the Commission and the ECB have the right to initiate on the one hand the formulation of exchange rate agreements of the euro in relation to non-Community currencies and on the other hand the formulation of general exchange rate policies with third countries.¹² In addition to the aforementioned Article 111, the EC Treaty contains several other specific provisions which stipulate that EU Member States are obliged to closely cooperate in international forums.

It is, however, clear that EU Member States would need a strong common political consensus to set the process of consolidating IMF representation in motion. At the December 1998 European Council in Vienna, the Heads of State or Government agreed

... that, while trying to reach early solutions pragmatically with international partners, these solutions should be further developed over time adhering to the following principles:

- the Community must speak with one voice;*
- the Community shall be represented at the Council / ministerial level and at the central banking level;*
- the Commission will be involved in the Community external representation to the extent required to enable it to perform the role assigned to it by the Treaty ...*

On this basis, the Council agreed on concrete arrangements related to the G-7 and the IMF:

... The President of the ECOFIN Council, or if the President is from a non-euro area Member State, the President of the Euro 11, assisted by the Commission, shall participate in meetings of the G7 (Finance) (see Annex 2). The ECB, as the Community body competent for monetary policy, should be granted observer status at the IMF

¹¹ Amended by Article 2(6) of the Treaty of Nice, OJ C 80/1/2001.

¹² As the short discussion above shows, the division of power and responsibility between EU institutions is rather complex. A thorough legal analysis, though, is clearly beyond the scope of this paper, hence we refer to more comprehensive surveys, such as Steinki (2003) or Herrmann (2002).

Board. The views of the European Community / EMU on other issues of particular relevance to the EMU would be presented at the IMF Board by the relevant member of the Executive Director's office of the Member State holding the euro Presidency, assisted by a representative of the Commission. The European Council invites the Council to act on the basis of a Commission proposal incorporating this agreement

In sum, from a legal point of view, even if all EU Member States were to join the same IMF constituency, each Member State would retain its own rights and responsibilities according to the Articles of Agreement. The Executive Director would then cast the vote for the constituency as a whole. Alternatively, the EU or the “euro area” could also become a fully-fledged IMF member in its own right. This, however, would not only change the composition of the Executive Board and the Board of Governors, but deeply affect the governance structure of the IMF in many other respects, for instance in terms of surveillance under Article IV or balance of payments support, since funds could then only be transferred to the new legal entity instead of individual countries.

Mathieu et al. (2003) cite two possibilities of setting up a single quota. In a first scenario, EU Member States would join a single EU constituency while either maintaining individual quotas, or following the example of the United Arab Republic, aggregating individual quotas to a single quota. In a second scenario, the EU would become a “fully fledged” single member with a new quota¹³ that would, however, be smaller than the sum of the individual quotas, but still considerably higher than the current U.S. quota. The authors doubt whether an EU quota that is nearly twice the size of the U.S. quota would be politically feasible. This would endow the EU, for instance, with the power to veto major IMF decisions, even for 70% majority votes.¹⁴

3.2. Intra-EU Coordination at the IMF

In principle, coordination of EU positions at the IMF takes place at the *EURIMF*, an informal group of representatives of EU Member States in Washington D.C., which comprises Executive Directors, alternates and counsellors. Moreover, a representative from the Commission Delegation and the European Central Bank, each seated in Washington, participate in EURIMF meetings. An additional forum in Washington is the so-called *mini EURIM*, which includes only the Executive Directors of EU Member States. Another formal

¹³ In this case, the new calculated EU quota does not correspond to the aggregated individual quotas, since – in particular – intra-EU-trade would have to be eliminated.

¹⁴ A 70% majority is for instance required for a lot of financial and operational decisions and the suspension of voting rights.

coordination mechanism is the *SCIMF* (*Sub-Committee on IMF*) invoked in 2001 as a substructure to the *EFC* (*Economic and Financial Committee*), which prepares the meetings of the *Ecofin* (*The Council of Economic and Financial Affairs Ministers*). In the end, according to Article 111 of the EC-Treaty the *Ecofin* is formally in charge of major IMF issues. For a detailed discussion of the *EURIMF* and the *SCIMF* see for instance Eurodad (2006).

4. Voting Power Analysis and Consolidating EU Representation

4.1. Voting Power Analysis

Voting power analysis is useful for understanding decision-making processes in collective bodies that are governed by voting rules, as it provides measures of players' *a priori voting power*. *A priori* voting power is a component of the actual (or *a posteriori*) voting power that voters derive solely from the voting rule itself. Thus, it is computed without regard to (or in ignorance of) information about the voters (preferences, complex interaction of real-world factors, etc.) and the nature of the issues put up for a vote (Felsenthal et al., 2003).

Power index methodology is widely used in social sciences to measure the *a priori* voting power of members of a committee. As Felsenthal and Machover (2004) observe, the Penrose-Banzhaf measure and the Shapley-Shubik index are by far the most important measures of *a priori* voting power, and hence, are also the most widely used. Penrose (1946, 1952) proposed a probabilistic measure of *a priori* voting power, to be interpreted as the probability that the given voter can be decisive (or "critical"). Banzhaf (1965) took the same approach as Penrose, but focused on the relative power of each voter (as compared to Penrose's absolute measure). Originally, the Shapley and Shubik (1954) measurement of voting power was derived from the theory of cooperative games with transferable utility.

Power measurement theory and its game-theoretic extensions rely either on an axiomatic approach or on a probabilistic approach.

In an axiomatic approach, each power index is interpreted as a unique measure embodying a set of properties that characterizes it. While this approach has attracted much attention in the literature, it has been criticized for its abstract nature: Axiomatizations may give plausible conditions for the outcome prediction, but they pay little attention to the meaning of the axioms in terms of the voting situation that underlie simple games.

In a probabilistic approach (Niemi and Weisberg, 1972; Straffin, 1977, 1988), the concepts underlying the power indices have a direct probabilistic interpretation, an interpretation disregarded in the game-theoretic literature. Paterson (2006), building on the work of Straffin (1977), demonstrated that if the *number of members voting in favor of (or against) the issues discussed is equally likely* – i.e. the uniform distribution on $\{0, 1, \dots, n\}$ – then the voting power of individual members corresponds to the Shapley-Shubik index. If the members of the voting body each vote with a *probability of 0.5 for – and against – regardless of the issue discussed*, then the voting power of individual members corresponds to the Penrose-Banzhaf index. In other words, the Penrose-Banzhaf measure assumes that all coalitions are equally likely whereas the Shapley-Shubik index assumes that all sizes of coalitions are equally likely.

Laruelle and Valenciano (2001) developed a more general measure of voting power as a probability of the corresponding voter becoming crucial in a precise sense. Their general concept of voting power measurement takes both the voting rule and the probability distribution over the voting configurations as inputs and is not limited to any particular power index or measure in the traditional sense (see also Laruelle and Valenciano, 2004).

A similar definition of voting power that also encompasses the two major power indices of Shapley-Shubik and Penrose-Banzhaf was developed by Paterson (2006). He regards the output of a yes/no voting process in terms of the number of participants who vote in favor of the discussed issues (“voting poll”). Paterson (2006) then defines the voting power of a voting body member as the expected decisiveness of his/her vote for a given distribution of the voting poll; the Shapley-Shubik and Penrose-Banzhaf indices are uniquely defined by their corresponding poll distributions.

Recently, Turnovec (2007) showed that both the Shapley-Shubik and Penrose-Banzhaf measure could be successfully derived as cooperative game values, and at the same time both of them can be interpreted as probabilities of being in some decisive position (pivot, swing – see below) without using cooperative game theory at all.

4.2. Measuring Voting Power

Formally, decision-making at the IMF (as a voting body) can be thought of as a weighted voting game, which is a subclass of simple games. A simple game, introduced by Von Neumann and Morgenstern (1944), is a n -person cooperative game (N, v) where the n members of the voting body are represented by a finite set $N = \{1, \dots, n\}$ and a characteristic

function $v: 2^N \rightarrow \{0,1\}$ such that $v(\emptyset) = 0$ and $v(S) \leq v(T)$ whenever $S \subseteq T$, the subsets S and T representing coalitions of members (a voting configuration). A coalition is winning if $v(S) = 1$, and losing if $v(S) = 0$; let W denote the set of all winning coalitions. The weighted voting game is represented by $[q; w_1, \dots, w_n]$ with $0 < w_i < q$ for all i where w_i represents the voting weight of member i and q is the quota needed to win. Now the characteristic function is defined by $v(S) = 1$ if $w(S) \geq q$, and $v(S) = 0$ otherwise, where $w(S) = \sum_{i \in S} w_i$.

A power index is defined in terms of the number of times that a player can “swing” the decision by transferring his/her vote to a coalition that is losing without – but winning with – his/her vote. A (negative) swing for voter i is defined as a pair of voting configurations $(S_i, S_i \setminus \{i\})$ such that S_i is winning but $S_i \setminus \{i\}$ is losing. In terms of voting weight, S_i is a swing if $w(S_i \setminus \{i\}) < q \leq w(S_i)$. A voter i is “pivotal” if in a sequence of one of the $n!$ possible orderings of the n voters he/she casts the vote that puts the total vote at or over the required quota.

The Penrose index (PI) (or absolute/non-normalized Banzhaf index) for voter i is the proportion of votes which are swings for voter i and is defined as

$$\beta_i = \frac{1}{2^{n-1}} \sum_{S \subseteq N: i \in S} (v(S) - v(S \setminus \{i\}))$$

The Shapley-Shubik index (SSI) for voter i is the probability that voter i is “pivotal” and is defined as

$$\phi_i = \sum_{S \subseteq N: i \in S} \frac{(s-1)!(n-s)!}{n!} (v(S) - v(S \setminus \{i\}))$$

Both indices measure the absolute power of each voter i as a probability. Since $\sum_{i=1}^n \phi_i = 1$, the SSI may itself also be treated as defining a probability distribution over all voters: the power index is then a probability of a voter being critical for the outcome of the voting decision. A corresponding statement is not true for the PI, as it does not in general sum to unity (Paterson, 2006). Normalizing the PI with the total number of swings for all voters yields the Penrose-Banzhaf index (PBI, or normalized Banzhaf index). The PBI is interpreted as the share of voter i in the power of all voters to influence decisions by means of a swing.

With the probabilistic interpretation in mind, what is the difference between PI (PBI) and SSI? The answer can be found by examining the respective voting poll distributions. Following Paterson (2006), the decisiveness d_i of a voter i for a particular poll (i.e. with $s = |S|$ voters in favor, $0 \leq s \leq n$) is the potential of his/her vote (for/against) being critical for the outcome

of the voting decision. Considering voting configurations S , i.e. voting coalitions that have exactly s members who vote in favor, and the sets S_i^* , defined as

$$S_i^* = \begin{cases} S \setminus \{i\} & \text{if } i \in S \\ S \cup \{i\} & \text{if } i \notin S \end{cases}$$

then decisiveness is defined as

$$d_i(s) = \sum_{S \in S_s} |v(S) - v(S_i^*)| / \binom{n}{s}.$$

Decisiveness $d_i(s)$ is thus the share of voting configurations (coalitions) that are (positive or negative) swings for each voter i , and depends only on the parameters represented by voting weights and the threshold that defines a winning coalition or majority. It does not itself depend on any probabilistic aspects – and it is identical for the Shapley-Shubik or the Penrose-Banzhaf approaches.

Our preference for the SSI as opposed to the PBI is based on the following analysis of Paterson (2006). He defines *expected* decisiveness δ_i of voter i for a *poll distribution* $p(s)$, i.e. in terms of the probability of $s = |S|$ voters being in favor, as

$$\delta_i = \sum_{s=0}^n d_i(s) \cdot p(s) \quad \text{[Voting power as expected decisiveness]}$$

This allows differentiating between SSI and PBI voting power indices solely in terms of the poll distribution. He shows that for the SSI,

$$p_{SSI}(s) = 1/(n+1), \quad s = 0, \dots, n,$$

i.e. a uniform or “random” distribution of poll outcomes on $\{0, \dots, n\}$, and for the PI (absolute PBI),

$$p_{PI}(s) = \binom{n}{s} / 2^n, \quad s = 0, \dots, n,$$

i.e. the binomial distribution on $\{0, \dots, n\}$ with probability $\frac{1}{2}$.

The consequences of the underlying poll distributions (uniform versus binomial distribution) are discussed in section 5.3.: The binomial distribution leads to voting results that hover around 50% when the number of voters is increased, whereas the uniform distribution does not influence the probability of poll outcomes with an increasing number of voters.

We note that the formula for *both* SSI and PI may also be written concisely in terms of a *general swing formula* that takes into account positive as well as negative swings:

$$\phi_i, \beta_i = \sum_{S \subseteq N, i \in S} [v(S + \{i\}) - v(S \setminus \{i\})] \cdot \Pr_{\phi, \beta}(S) \quad \text{[General swing formula]}$$

where $\Pr_{\phi, \beta}(S)$ is the *a priori* probability distribution chosen for coalitions $S \subseteq N$.

For SSI,

$$\Pr_{\phi}(S) = \frac{1}{n+1} \cdot \frac{1}{\binom{n}{s}} \equiv \frac{1}{n+1} \cdot \frac{1}{{}^n C_{|S|}} = \frac{(n-s)! \cdot s!}{(n+1)!},$$

using an alternative notation for combinations; and coalition size; and for PI,

$$\Pr_{\beta}(S) = \frac{1}{2^n}.$$

Since there are ${}^n C_{|S|}$ coalitions of size $|S| = s$, it follows that the corresponding *a priori* probability distributions of coalition size on $\{0, 1, \dots, n\}$ are given by

$$p_{SSI}(|S|) = \frac{1}{n+1}$$

for the Shapley-Shubik index, which is discrete uniform, and

$$p_{PI}(|S|) = \frac{1}{2^n} \cdot {}^n C_{|S|}$$

for the Penrose Index („absolute” Banzhaf index), which is the binomial distribution for repeated Bernoulli trials with success probability of $\frac{1}{2}$.

4.3. Measuring Blocking Power and the Efficiency of Voting

There are two further concepts besides voting power that are useful for expressing related features of group decision-making, as in the voting system of the IMF, namely efficiency and blocking probability.

The topic of *efficiency* (also appearing under a variety of other names, such as “workability”) entered prominently into the discussions on the voting system of the Council of Ministers of the EU in the years prior to the drafting of the Constitutional Treaty. Leaving aside the appropriateness of the name, efficiency turns out to be Coleman’s (1971) index on the power of a collectivity to act. This index indicates the ability of the voting body to pass a bill, motion or decision. In a voting body of n members there are always 2^n different coalition possibilities (voter combinations including the empty coalition as well as the grand coalition)

of members favoring or not favoring the passage of a decision. Using the characteristic function we can measure the efficiency as

$$\sum_{S \in N} v(S) / 2^n \quad \text{[Coleman power of a collectivity to act]}$$

in other words, the fraction of coalitions that are winning coalitions.

This definition of efficiency is enticingly “obvious” – until it is realized that in probabilistic terms it is a “Banzhaf”-type function. In other words, it is based on the very assumption made in calculating the (absolute) Penrose power indices and the (relative) Banzhaf power indices – namely the assumption that each coalition has exactly the same probability. For this reason we refer to this measure as Coleman~PBI efficiency.

Paterson (2006) first introduced a measure that mirrors Coleman~PBI efficiency, except that it is related to the voting power measure of Shapley and Shubik. For this reason we refer to this measure as Paterson~SSI efficiency. In the case of voting in the EU Council of Ministers there is a large and significant difference between results obtained using the Paterson~SSI efficiency measure and the Coleman~PBI efficiency measure (Paterson and Silárszky, 2003). Expressed in terms of the characteristic function $v(S)$ Paterson~SSI efficiency is

$$\sum_{S \in N} v(S) \cdot \frac{(n-s)! \cdot s!}{(n+1)!} \quad \text{[Paterson~SSI efficiency]}$$

Basically, both Coleman~PBI and Paterson~SSI efficiency measures return the answer – under different *a priori* assumptions – to the question: what is the probability that the “coalition” made up of those members voting in favor will actually be a winning coalition that can pass the issue under discussion?

Experience of the assessment of voting systems in the EU by interested parties showed that Member States are not only (maybe not even primarily) paying attention to their power as assessed by the classical power indices, but are concerned about their *ability to block* (“*veto*”) unfavored decisions. A similar interest in blocking possibilities can be assumed to be present for the case of IMF reform. A real analysis of this factor would take into account the perceived structure of voting among fellow Member States (e.g. to identify “allies”); in this paper we are concerned with *a priori* constitutional aspects of voting, and hence we restrict our attention to the blocking probability, or power, of each player on its own.

The concept of blocking power was introduced by Coleman (1971). The Coleman preventive power index measures individual voters' possibilities to block a vote. The index is defined as the number of winning coalitions where a voter is a decisive. In other words, a voter's

negative swings are divided by the number of winning coalitions. Formally voter i 's power to block action is calculated as

$$\frac{\sum_{S \in N} [v(S) - v(S \setminus \{i\})]}{\sum_{S \in N} v(S)} \quad \text{[Coleman preventive power]}$$

The Coleman concept expresses the probability of a member being able to block a decision and it is readily seen to be based on the same principles as the Penrose-Banzhaf measure of voting power (see Section 4.2). We therefore refer to this index as the Coleman~PBI blocking probability (or power). Paterson (2006) developed a measure of blocking power which is directly based on the same principles as the Shapley-Shubik measure of voting power. We therefore refer to this measure as the Paterson~SSI blocking probability (or veto power¹⁵): it is defined as

$$1 - \frac{\sum_{S \in N} [v(S \setminus \{i\})] \cdot \frac{s!(n-s)!}{(n+1)!}}{\sum_{S \in N} v(S) \cdot \frac{s!(n-s)!}{(n+1)!}} \quad \text{[Paterson~SSI veto power]}$$

Basically, both Coleman~PBI and Paterson~SSI blocking power return the answer to the question: what is the probability that member i exercises an effective veto by defecting from an otherwise winning coalition? It represents the conditional probability of being able to veto.

4.4. Consolidating EU Representation at the Executive Board

In order to conduct the empirical analysis, we have to adapt the current constituency structure and establish EU constituencies.¹⁶

Kenen (2007) launches the idea to reorganize the 27 EU Member States in six constituencies (one each for Germany, France, and the United Kingdom and three multi-country constituencies). The total number of constituencies, under this proposal, would only be reduced by one from 24 to 23.

We, however, follow suggestions made by Eurodad (2006), Truman (2006), Bird and Rowlands (2006) and Ahearne and Eichengreen (2007), among others, and establish two EU constituencies, a euro area EU constituency (EAC), which consists of the 16 EU Member States that form the euro area, and a non-euro EU constituency (NonEAC), which includes

¹⁵ In Paterson (2006) blocking probability is also termed "blocking leverage."

¹⁶ In this paper we do not elaborate a "constituency agreement" for the euro area constituency. We explicitly do not address issues such as procedures for decision preparation, reporting, etc. Also, we do not make any suggestions on distributing the chair or other posts within the constituency, although we are well aware that this will be a major issue/obstacle in forming a euro area constituency. Dealing with these primarily political questions is beyond the scope of this paper.

the remaining 11 Member States that have not yet adopted the euro. Apart from necessary changes implied by the withdrawal of EU Member states from their current constituencies, we aim at keeping the current constituency structure unchanged to the highest extent deemed appropriate.

Under our approach, the five countries with the highest calculated quotas that are entitled to appoint an Executive Director are the U.S.A., Japan, China, Saudi Arabia and Canada, with the latter three countries replacing Germany, France and the United Kingdom as they move to the two new EU constituencies.

In the current structure of the Executive Board, three countries (China, Saudi Arabia and Russia) are considered large enough to elect an Executive Director. On the basis of the size of the quota we replace China and Saudi Arabia, which are now under the five countries that may appoint an Executive Director, by India and Brazil. Russia remains the third single-country constituency. Moreover we reduce the size of the Executive Board from 24 to 20 seats, acting on a proposal that has often been brought forward as one way to increase efficiency in IMF decision-making.

As a result of our proposed Board composition, a number of countries have to change constituencies. First, we regroup these countries geographically and second, make an effort to balance the size of the constituencies in terms of voting shares. For technical purposes, the chairs of the constituencies are allotted to the countries with the highest calculated quota within the constituency. This purely technical assumption only serves the envisaged consolidation of EU Member States and is not intended to propose a new country-specific structure of the Executive Board.

However, though this is not the main focus of this paper, we also pay due attention to the current discussion of increasing the representation of emerging market economies and developing countries at the IMF.¹⁷ For instance, according to the G-20 (2009)¹⁸ as one of the most recent contributions, “... *emerging and developing economies, including the poorest, should have greater voice and representation and the next review of IMF quotas should be concluded by January 2011 ...*”. Accordingly, in their official Statement which was prepared in addition to the aforementioned G-20 document, the BRIC countries (Brazil, China, Russia and India) called for

¹⁷ The efforts of emerging market economies to gain a higher share in IMF decision-making are also fuelled by a shift of quotas that was largely felt inadequate by many emerging market economies in 2008. In spring 2008 the IMF changed the quota formula and adopted a new quota formula, which entailed a shift in calculated quotas of 1.8% from “advanced economies” to “emerging market and developing countries.” This was well below the expectations of many emerging market economies, which would rather have seen a shift around 4%. In sum, the total of quotas was increased by 11.5%, 54 countries received an increase in their quota shares on an ad hoc basis. The ad hoc quota increase for these countries amounted to a shift of total quota shares of 1.1% and voting shares of 2.7% from “advanced economies” to “emerging market and developing countries.”

¹⁸ G-20 Communiqué Meeting of Finance Ministers and Central Bank Governors, United Kingdom, March 14, 2009.

*... urgent action with regard to voice and representation in the IMF, in order that they better reflect their real economic weights. In the Fund, a significant realignment of quota should be complemented not later than January 2011. This is necessary to enable members more equitable and fuller participation in the Fund's efforts to play its mandate role. A rebalancing of representation on the Executive board and DVIFC would lead to a more equitable representation on the membership*¹⁹

For illustrative purposes, Table 2 shows the *current* and the *proposed* composition of the Executive Board, regrouping the chairs of the constituencies in *advanced countries*, *emerging market economies* and *developing countries*. We present figures (in absolute values and percentage shares) of the current number of chairs, calculated quotas (on the basis of the new quota formula) and voting shares. It should be noted that the *proposed* composition leads to a loss of (nominal) influence of the advanced economies and a strong increase (31%) of voting shares for the emerging market economies, which then would hold half of the chairs at the Executive Board.

5. Empirical Results

5.1. Voting Power Distribution at the Executive Board

In this section we analyze the voting power distribution of the 24 constituencies at the Executive Board in the *current* composition and in the *proposed* composition with 20 constituencies. We differentiate between majority thresholds of 50% ("mt50"), 70% ("mt70") and 85% ("mt85") and calculate the PBI and the SSI. We compare the relative gain/loss in voting power of the 27 EU Member States when changing the constituency structure of the Executive Board to the *proposed* composition.

Table 3 presents the voting power of all 24 constituencies under the current constituency structure; the voting shares are based on the new quota formula. With reference to the frequently mentioned dominance of the U.S. our results confirm the evidence in the literature (Bini Smaghi, 2006b, and Leech, 2002a) that the voting power of the U.S.A. is higher than its (nominal) voting share at mt50. In contrast, the voting power of all other 23 constituencies is below their nominal voting shares. This result holds for both indices.²⁰

¹⁹ See G-20 Information Centre, Statement of the Finance Ministers of Brazil, China, Russia and India, March 14, 2009. It is evident that emerging market economies are striving for more influence in the G-20 and the IMF. However, it is still a matter of fact that major decisions at the IMF are prepared by the G-7 countries.

²⁰ The only exception is Japan which slightly gains voting power under the SSI.

At mt70 and mt85, the results depend on the index used. When using the PBI, the U.S.A. loses and the other constituencies gain voting power, whereas when the SSI is applied, the U.S.A. gains and the other constituencies lose voting power as compared to their nominal voting share.²¹

It is interesting to note that the difference in voting power gets even more pronounced the higher the majority threshold. These findings provide new insights: Bini Smaghi (2006b) and Leech (2002a) do not include the SSI in their analysis; they draw their conclusions only from calculations with the PBI. Leech (2002a), for instance, concludes that mt85 tends to balance voting power to a large extent, which is – as already pointed out – in contradiction to calculations if based on the SSI.

Table 4 displays the voting power results of the *proposed* constituency structure (two EU constituencies, reduced number of constituencies). As pointed out before, any consolidated voting share of EU Member States which exceeds the voting share of the U.S. constituency (USC) does not seem to be politically feasible. Hence, we distribute the difference between the votes (in absolute numbers) of the EU EAC and the USC to the remaining constituencies in a uniform way. As a result, the EU EAC and USC have an equal voting share of 16.78% of total IMF votes. Note that under this redistribution schedule constituencies with a smaller voting share benefit more than constituencies with a higher share.

At mt50, the two largest constituencies, the EU EAC and USC, gain voting power relative to their (nominal) voting shares at the expense of all other constituencies. This result holds for both the PBI and the SSI.²² This finding is in line with the results of table 4, where the U.S. gain voting power under the *current* composition of the Executive Board.

Under mt70 and mt85, the EU EAC and USC lose and all other constituencies gain voting power when the calculations are carried out with the PBI. These results are in line with Bini Smaghi (2006b). However, when applying the SSI, a completely different picture arises, which mirrors the SSI results at mt50: The USC and EAC still gain, whereas all other constituencies lose voting power.²³ As already observed in the results of the *current* constituency the difference between the PBI and SSI values widens the higher the majority thresholds. When applying the SSI, the EU EAC and USC – as compared to their voting share – gain even more voting power under the mt85 scenario than under the mt50 scenario.

Another interesting aspect is to compare the voting power of those *current* single-chair constituencies that retain their status in the *proposed* composition of the Executive Board

²¹ With the exception of Japan at mt85.

²² The only exception is the EU nonEAC, which slightly gains under the PBI.

²³ The only exception here is the EU nonEAC, which loses voting power under the PBI and gains under the SSI at mt85.

(U.S., Japan, China, Saudi Arabia, and Russia). Note, however that the PBI has to be replaced by the PI, which measures absolute voting power. The PBI can only be used to compare the voting powers of several voters under the same voting rule (because of the normalization, which depends on the voting game). The SSI is still a valid concept here; it can be used to compare voting power independently of the voting rule, since it is a probability of power and, hence, already measures absolute voting power. The calculations of the PI (not included in the tables) show that regardless of the majority threshold all five single-chair constituencies (U.S.A., Japan, China, Saudi Arabia, and Russia) gain voting power.²⁴ A somewhat mixed picture arises in case the SSI is taken for comparison.

In view of the differences in the results of the PBI (PI) and the SSI, the question arises which index should be used to measure voting power. Felsenthal and Machover (1998) note that in general the Shapley-Shubik and (normalized) Penrose-Banzhaf indices behave quite differently, although their values are often fairly similar. With the exception of Leech (2002b), the question whether the PBI or the SSI is more adequate is not explicitly dealt with in the empirical literature, which therefore gives little guidance in this respect. Hence, in case both indices are calculated, the results are presented without explicit comments on the differences. Leech (2002a), Leech and Leech (2005) build their analyses on the PBI and justify their preferences on the basis of Coleman (1971) and the empirical findings in Leech (2002b). Paterson (2006), however, presents convincing arguments in favor of the SSI.

In Chart 1 and Chart 2 we plot the differences between the two indices as the majority threshold is allowed to vary. Chart 1 shows that the PBI of the two large equal constituencies (EU EAC and USC) remains constant until a majority threshold of 60% is reached. The PBI then starts to decline and gradually approaches the value of 5, which is the value for a unanimity rule ($1/n$), where all constituencies have equal voting power. It is interesting to note that at an 85% majority threshold, the voting power of the EU EAC and the USC is just slightly above 8%. Based on these PBI-based results, Leech (2002a, p. 394) calculates that in order to equalize voting power to the (former U.S.) voting share of 17.55, the voting share of the USC and the EU EAC would have to be raised to 67.45%, and the share of all other constituencies would have to be reduced substantially.

The SSI, see Chart 2, shows a different picture: The voting power of the EU EAC and USC remains constant at approximately 18% until a majority threshold of 84% is reached, then jumps to 22 and falls sharply to a value of 5 (unanimity). Put differently, both constituencies

²⁴ U.S., Japan, and China are an exception at mt50.

have a fairly constant voting power²⁵ for majority thresholds between 50% and 85%, which is marginally above their voting share. The respective voting power of the other 18 constituencies shows the opposite behavior of the EU EAC and USC.

Given the empirical plausibility and taking theoretical considerations (Paterson, 2006) into account, we prefer the SSI and hence favor the voting power results based on the SSI.

To sum up the results of our voting power analysis on the Executive Board level, we point out that in the *proposed* composition of the Executive Board, the EU EAC and the USC both have the same voting share (16.78%) and both have a consistently higher voting power than voting share at all three majority thresholds. The EU nonEAC is the third-largest constituency with a voting share of 8.93%; their voting power is slightly below their voting share at mt50/mt70 and exceeds the voting share at mt85. All other constituencies have less voting power than their voting share indicates in the *proposed* composition. This, however, generally corresponds to the *current* composition of the Executive Board, where only the U.S.A. has more voting power than its voting share indicates. Hence, from an EU perspective, it would definitely be in the interest of EU Member States to consolidate their representation at the Executive Board, since even the EU EAC alone would find itself in the same position as presently the U.S.A. and could block major IMF decisions at an 85% majority threshold. Moreover, like the U.S.A. the EU EAC would have a voting power that is well above its voting share. Furthermore, in a common understanding, the EU EAC and the USC would be able to veto 70% majority decisions and if for instance, a third large country like Japan were to join the common understanding, the three countries would also be able to determine IMF decisions at a 50% majority rule.

5.2. Results on Blocking (Veto) Power for the Executive Board

In this section we analyze the blocking power distribution of the 24 constituencies at the Executive Board in the *current* composition (see Table 5) and in the *proposed* composition with 20 constituencies (see Table 6). As the power to block a decision is an *a priori* probability value, we may consider, for example, a blocking index of, say, 0.8 to represent an 80-percent veto i.e. if a member has a BI = 0.8 it means that in 80% of cases this member will be able to exercise a veto. Chart 3 and Chart 4 show the blocking indices of Coleman~PBI and Paterson~SSI, respectively, for the proposed reform of the IMF Executive Board. According to the Coleman~PBI blocking index the U.S. and the EU euro area Member States would both be able to exercise a near 100-percent veto for those decisions of the

²⁵ The relationship between SSI and the majority threshold was shown previously by Paterson and Silárszky (1999) in the context of the EU15.

Executive Board taken on the basis of a 70% majority threshold, and the non-euro area EU Member States would possess a 60-percent veto and Japan a near 50-percent veto. Whereas such high veto power would be coveted by its possessors it is intuitively clear that many decisions would be blockable (see section 5.3). This pessimistic scenario is of course even worse for decisions taken under the 85% majority threshold.

However, the situation is not so dramatic when the power to veto is measured with the Paterson~SSI blocking index. Under the 50% majority threshold the U.S. and euro area bloc have less than 20-percent veto power each (compared to 50-percent veto power according to the Coleman~PBI blocking index) and all other countries/blocs less than 10-percent veto power. Under the 70% majority threshold the U.S. and euro area bloc have less than 40-percent veto power, and all other countries/blocs less than 10-percent veto power. Further, under the 70% majority threshold only the U.S. and euro area bloc have a complete veto, while even the veto power of the next most able to veto country/bloc, the non-euro area EU, is under 50-percent.

5.3. Results on Efficiency of Decision-Making for the Executive Board

The efficiency of decision-making – i.e. the *a priori* probability that any vote taken will produce a qualified majority in agreement – is shown in Chart 5; this confirms that the Coleman~PBI efficiency sinks rapidly from 0.5 at the 50% majority threshold to under 0.1 at the 70% majority threshold, and is virtually zero at the 85% majority threshold. In contrast the Paterson~SSI efficiency sinks at a constant rate as the majority threshold rises; it is about 0.3 at the 70% majority threshold, and is still higher (at 0.18) at the 85% majority threshold than the value indicated by the Coleman~PBI efficiency measure at the 70% majority threshold.

The reason for the difference between Coleman~PBI efficiency and Paterson~SSI efficiency is illustrated in more detail in Chart 6 and Chart 7, respectively. In these charts the *a priori* probability of $N \in \{0, 1, \dots, 20\}$ members of the proposed Executive Board forming a qualified majority under majority thresholds of 50%, 60%, 70%, 80% and 90%, respectively, is plotted. The graph of Coleman~PBI efficiency under a 50% majority threshold shows that the distribution is single peaked around 10 i.e. half of the members.²⁶ In other words, decisions tend to be “contentious.” We note that there is no *a priori* justification for such an assumption. As the majority threshold increases, fewer and fewer coalitions of members

²⁶ The distribution is indeed binomial, hence approximates the normal distribution.

voting together for particular decisions are at disposal, so the joining graphs “rapidly collapse.” The overall efficiency for a particular majority threshold is the sum of the probabilities over all $N = 0, 1, \dots, 20$. (This is also approximated by the area under each graph.)

In contrast, the Paterson~SSI efficiency also reduces with increasing majority thresholds, but the effect is only due to the more stringent majority requirement, and not to the *a priori* distribution of the size of a winning coalition. This is noticeable by the fact that the probability of N members taking a decision (i.e. by unanimity) remains at its maximum value, as long as the sum of all combinations of voting weights represents a qualified majority, as is intuitively to be expected. After all, there is no reason why a 14-6 split, say, in favor of a decision should be more or less likely than a 19-1 or 20-0 (unanimity) split, etc. This last observation underscores once more the unacceptability of the Coleman~PBI approach (and its related PBI voting power).

6. Summary and Conclusions

We analyze the consequences of a consolidated EU representation at the IMF Executive Board. The 27 EU Member States are regrouped into two constituencies, a euro area EU constituency (EU EAC) and a non-euro area EU constituency (EU nonEAC). For the reason of political feasibility, the voting share of the EU EAC is downsized to align its voting share with that of the U.S. constituency (USC). In the voting power analysis we use Penrose-Banzhaf and Shapley-Shubik voting power measures and blocking power measures as proposed by Coleman (Coleman~PBI) and Paterson (Paterson~SSI). Our approach should not be taken too literally given the consensus-oriented decision-making process at the IMF, which is also mirrored in the formal lack of intra-constituency decision rules.

In the empirical literature on IMF voting power analysis, the results concerning the Executive Board are primarily based on the Penrose-Banzhaf index (PBI). Our results, which are based on the new quota formula and EU-27, confirm the PBI-based evidence in the literature, where the voting power of the two large constituencies (USC and EAC) exceeds the corresponding voting shares. The other smaller constituencies, vice versa, have a voting power that is below their voting shares. For majority thresholds higher than 67% the PBI and the SSI increasingly diverge. The difference is most pronounced at the qualified majority threshold of 85%, where the PBI has already plunged dramatically whereas the SSI remains more or less constant. For theoretical reasons and empirical plausibility arguments we favor the SSI.

The blocking power analysis shows that the Coleman~PBI yields high estimates of blocking probability compared to the Paterson~SSI. The efficiency of making collective decisions is likewise considerably lower for Coleman~PBI than for Paterson~SSI. The source of the difference estimates is shown to be due to an implausible *a priori* distribution of coalition size by Coleman~PBI.

With a consolidated representation the euro area would be able to act as a second global player at the IMF, disposing of veto capabilities like the U.S.A. The euro area voting power would also exceed its voting share even if its voting share is reduced to that of the U.S. voting share.

A consolidation is more than ever important, since presently all constituencies involving EU (euro area and non-euro area) Member States have a voting power below their voting shares. Furthermore, because of the “mixed constituency” structure, the influence of EU (euro area and non-euro area) Member States on intra-constituency decision-making is heterogeneous, in some cases faint. However, whether individual EU (euro area and non-euro area) Member States are willing to join a common IMF representation crucially depends on the (future) design of the decision-making process within EU constituencies (Brandner and Grech, 2009).

Above all, by bundling individual euro area concerns, a consolidated euro area representation would act as a booster for the euro area as a whole since the voting share of the euro area as a whole would exceed the combined voting shares of the current single-constituency euro area members Germany and France. Likewise the proposed voting share of the EU non-euro area is greater than that of the current sole-constituency non-euro member UK.

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Table 2

IMF Executive Board: **current** and **proposed** composition

	Chairs/Executive Board		Calculated Quotas ¹⁾		Votes	
	number	percent	absolute	percent	absolute	percent
<i>current composition</i>						
Advanced economies	12	50.0	160,190.0	67.4	1,655,150.0	65.8
Emerging market economies	8	33.3	56,513.2	23.8	601,132.0	23.9
Developing countries	4	16.7	21,125.1	8.9	258,501.0	10.3
Total	24	100.0	237,828.3	100.0	2,514,783.0	100.0
<i>Memorandum:</i>						
U.S.	1	4.2	42,122.4	17.7	421,974.0	16.8
EU (euro area)	6	25.0	55,125.5	23.2	563,255.0	22.4
EU (non-euro area)	2	8.3	20,844.7	8.8	216,697.0	8.6
<i>proposed composition</i>						
Advanced economies	8	40.0	162,961.6	68.5	1,587,929.0	63.1
Emerging market economies	10	50.0	66,614.7	28.0	793,387.0	31.5
Developing countries	2	10.0	8,252.0	3.5	133,468.0	5.3
Total	20	100.0	237,828.3	100.0	2,514,784.0	100.0
<i>Memorandum:</i>						
U.S.	1	5.0	42,122.4	17.7	421,974.0	16.8
EU (euro area)	1	5.0	55,125.5	23.2	421,974.0	16.8
EU (non-euro area)	1	5.0	20,844.7	8.8	224,546.0	8.9

¹⁾ Based on the new quota formula adopted in April 2008, which is currently being ratified.

Table 3

IMF Executive Board (EB) - *current* composition
voting shares and *voting power* (in percent)

Constituency	Number of member countries	Voting share ¹⁾		Voting power					
				50 percent majority threshold		70 percent majority threshold		85 percent majority threshold	
				Penrose-Banzhaf	Shapley-Shubik	Penrose-Banzhaf	Shapley-Shubik	Penrose-Banzhaf	Shapley-Shubik
United States	1	16.78		20.93	18.55	11.02	19.24	6.33	19.51
Japan	1	6.24		5.95	6.25	6.55	6.22	5.76	6.27
Germany	1	5.82		5.54	5.80	6.14	5.77	5.60	5.81
France	1	4.30		4.09	4.21	4.60	4.20	4.76	4.17
United Kingdom	1	4.30		4.09	4.21	4.60	4.20	4.76	4.17
Belgium	10	5.13		4.88	5.08	5.45	5.04	5.28	5.08
Netherlands	13	4.53		4.30	4.44	4.83	4.42	4.94	4.47
Spain	8	4.67		4.44	4.59	4.98	4.58	5.01	4.57
Italy	7	4.27		4.06	4.18	4.56	4.17	4.74	4.14
China	1	3.82		3.63	3.72	4.10	3.70	4.39	3.67
Canada	12	3.61		3.43	3.52	3.87	3.49	4.21	3.45
Indonesia	13	3.94		3.75	3.85	4.23	3.83	4.49	3.79
Korea	13	3.47		3.29	3.37	3.73	3.35	4.08	3.32
Sweden	8	3.41		3.23	3.30	3.66	3.29	4.03	3.28
Egypt	13	3.23		3.07	3.13	3.47	3.11	3.86	3.08
Saudi Arabia	1	2.81		2.67	2.71	3.02	2.69	3.44	2.66
Sierra Leone	20	3.12		2.96	3.02	3.36	3.01	3.76	2.98
Switzerland	8	2.75		2.61	2.65	2.97	2.64	3.37	2.59
Russia	1	2.39		2.27	2.30	2.58	2.28	2.99	2.25
Iran	7	2.27		2.15	2.17	2.45	2.16	2.86	2.15
Brazil	9	2.81		2.67	2.71	3.03	2.70	3.44	2.67
India	4	2.81		2.67	2.71	3.03	2.70	3.44	2.67
Argentina	6	1.84		1.75	1.75	2.00	1.74	2.36	1.74
Rwanda	23	1.66		1.57	1.57	1.79	1.57	2.11	1.53

¹⁾ Based on the new quota formula adopted in April 2008, which is currently being ratified.

Table 4

IMF Executive Board (EB) - *proposed* composition
voting shares and *voting power* (in percent)

Constituency	Number of member countries	Voting share ¹⁾		Voting power					
				50 percent majority threshold		70 percent majority threshold		85 percent majority threshold	
				Penrose-Banzhaf	Shapley-Shubik	Penrose-Banzhaf	Shapley-Shubik	Penrose-Banzhaf	Shapley-Shubik
United States	1	16.78		17.55	18.36	15.34	18.27	8.31	20.76
Japan	1	6.56		6.43	6.36	6.83	6.37	7.34	6.14
China	1	4.13		3.98	3.91	4.26	3.99	5.38	3.47
Saudi Arabia	1	3.12		3.02	2.93	3.23	2.93	4.22	2.64
Canada	1	2.87		2.79	2.70	2.98	2.71	3.89	2.44
India	1	2.66		2.58	2.49	2.77	2.49	3.60	2.25
Russia	1	2.71		2.63	2.54	2.82	2.53	3.68	2.30
Brazil	1	2.03		2.01	1.94	2.17	1.95	2.66	1.63
EU (euro area)	16	16.78		17.55	18.36	15.34	18.27	8.31	20.76
EU (non-euro area)	11	8.93		9.17	8.89	9.63	8.76	8.05	9.31
Norway	16	3.88		3.75	3.67	4.01	3.71	5.15	3.31
Mexico	7	3.35		3.23	3.14	3.48	3.19	4.49	2.82
Colombia	20	2.23		2.18	2.10	2.35	2.09	2.96	1.81
Indonesia	13	4.26		4.09	4.03	4.38	4.10	5.52	3.57
Australia	14	3.81		3.68	3.60	3.94	3.65	5.06	3.23
Kuwait	13	3.54		3.42	3.33	3.66	3.35	4.75	3.04
South Africa	20	3.43		3.31	3.23	3.56	3.26	4.61	2.94
Switzerland	10	3.53		3.41	3.32	3.65	3.34	4.72	3.02
Argentina	7	2.33		2.27	2.19	2.44	2.17	3.14	1.93
Algeria	27	3.08		2.98	2.90	3.19	2.88	4.18	2.62

¹⁾ Based on the new quota formula adopted in April 2008, which is currently being ratified.

Table 5

IMF Executive Board (EB) - *current* composition
voting shares and *veto power* (in percent)

Constituency	Number of member countries	Voting share ¹⁾		Veto power					
				50 percent majority threshold		70 percent majority threshold		85 percent majority threshold	
				Coleman~ PBI	Paterson~ SSI	Coleman~ PBI	Paterson~ SSI	Coleman~ PBI	Paterson~ SSI
United States	1	16.78		63.75	19.23	98.88	44.26	100.00	100.00
Japan	1	6.24		18.12	6.20	58.78	13.55	90.92	29.87
Germany	1	5.82		16.89	5.75	55.10	12.55	88.50	27.61
France	1	4.30		12.45	4.18	41.26	9.11	75.11	19.71
United Kingdom	1	4.30		12.45	4.18	41.26	9.11	75.11	19.71
Belgium	10	5.13		14.88	5.03	48.89	10.94	83.32	24.08
Netherlands	13	4.53		13.10	4.41	43.38	9.58	78.00	21.14
Spain	8	4.67		13.52	4.56	44.66	9.93	79.14	21.61
Italy	7	4.27		12.36	4.15	40.96	9.04	74.79	19.54
China	1	3.82		11.04	3.70	36.75	8.01	69.38	17.30
Canada	12	3.61		10.46	3.50	34.78	7.57	66.50	16.21
Indonesia	13	3.94		11.42	3.83	37.94	8.31	70.92	17.84
Korea	13	3.47		10.03	3.35	33.45	7.27	64.47	15.59
Sweden	8	3.41		9.85	3.29	32.88	7.12	63.70	15.40
Egypt	13	3.23		9.34	3.11	31.14	6.74	60.92	14.45
Saudi Arabia	1	2.81		8.12	2.70	27.14	5.84	54.28	12.49
Sierra Leone	20	3.12		9.02	3.00	30.15	6.52	59.39	13.97
Switzerland	8	2.75		7.96	2.64	26.63	5.73	53.29	12.15
Russia	1	2.39		6.92	2.29	23.19	4.95	47.25	10.54
Iran	7	2.27		6.56	2.17	22.03	4.67	45.22	10.05
Brazil	9	2.81		8.14	2.70	27.19	5.85	54.38	12.52
India	4	2.81		8.14	2.70	27.20	5.85	54.40	12.53
Argentina	6	1.84		5.32	1.75	17.90	3.77	37.30	8.15
Rwanda	23	1.66		4.79	1.58	16.07	3.39	33.35	7.14

¹⁾ Based on the new quota formula adopted in April 2008, which is currently being ratified.

Table 6

IMF Executive Board (EB) - *proposed* composition
voting shares and *veto power* (in percent)

Constituency	Number of member countries	Voting share ¹⁾		Veto power					
				50 percent majority threshold		70 percent majority threshold		85 percent majority threshold	
				Coleman~ PBI	Paterson~ SSI	Coleman~ PBI	Paterson~ SSI	Coleman~ PBI	Paterson~ SSI
United States	1	16.78		47.66	18.38	95.79	40.08	100.00	100.00
Japan	1	6.56		17.45	6.36	42.66	13.61	88.28	27.01
China	1	4.13		10.80	3.91	26.61	8.48	64.73	15.05
Saudi Arabia	1	3.12		8.19	2.93	20.20	6.20	50.74	11.40
Canada	1	2.87		7.58	2.70	18.63	5.75	46.78	10.55
India	1	2.66		7.00	2.49	17.31	5.27	43.30	9.73
Russia	1	2.71		7.13	2.54	17.60	5.35	44.30	9.93
Brazil	1	2.03		5.46	1.94	13.55	4.11	31.94	7.00
EU (euro area)	16	16.78		47.66	18.38	95.79	40.08	100.00	100.00
EU (non-euro area)	11	8.93		24.89	8.88	60.14	18.74	96.78	41.77
Norway	16	3.88		10.18	3.67	25.03	7.87	61.88	14.33
Mexico	7	3.35		8.77	3.14	21.71	6.77	54.01	12.17
Colombia	20	2.23		5.91	2.10	14.65	4.41	35.59	7.76
Indonesia	13	4.26		11.12	4.03	27.34	8.73	66.37	15.46
Australia	14	3.81		9.99	3.60	24.61	7.75	60.82	13.99
Kuwait	13	3.54		9.29	3.33	22.87	7.09	57.13	13.14
South Africa	20	3.43		9.00	3.23	22.21	6.91	55.39	12.74
Switzerland	10	3.53		9.26	3.32	22.79	7.08	56.76	13.05
Argentina	7	2.33		6.17	2.19	15.23	4.57	37.80	8.32
Algeria	27	3.08		8.11	2.90	19.95	6.09	50.21	11.31

¹⁾ Based on the new quota formula adopted in April 2008, which is currently being ratified.

Appendix B

Chart 1

Penrose-Banzhaf voting power as a function of majority threshold

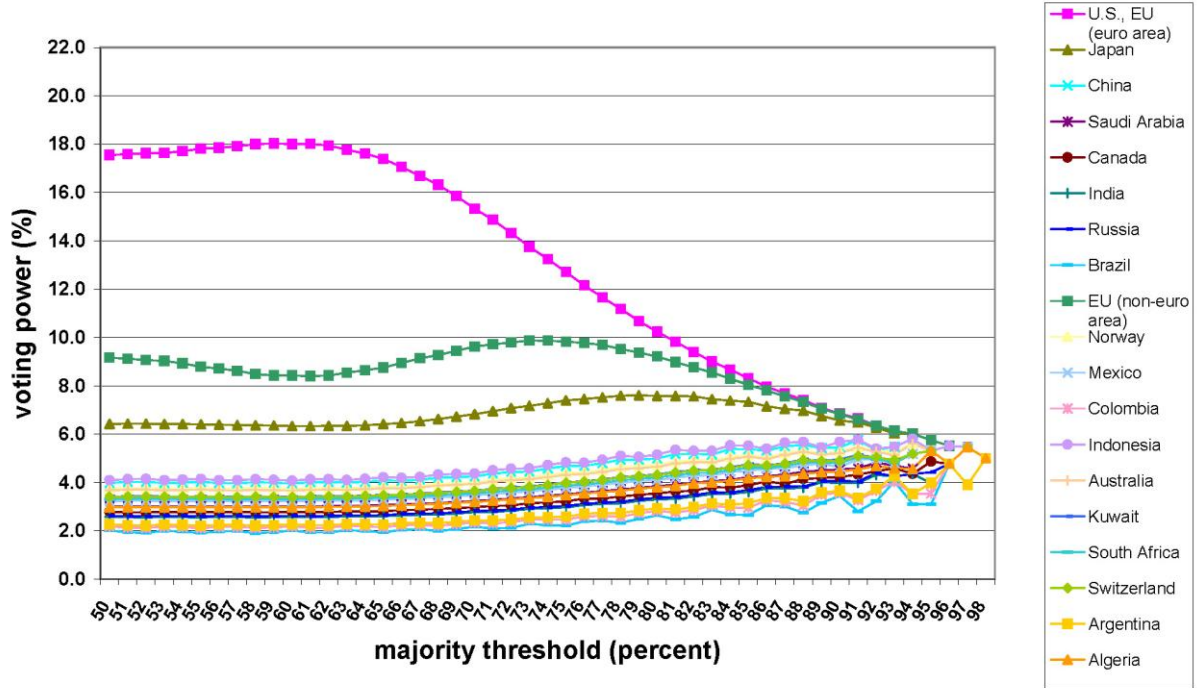


Chart 2

Shapley-Shubik voting power as a function of majority threshold

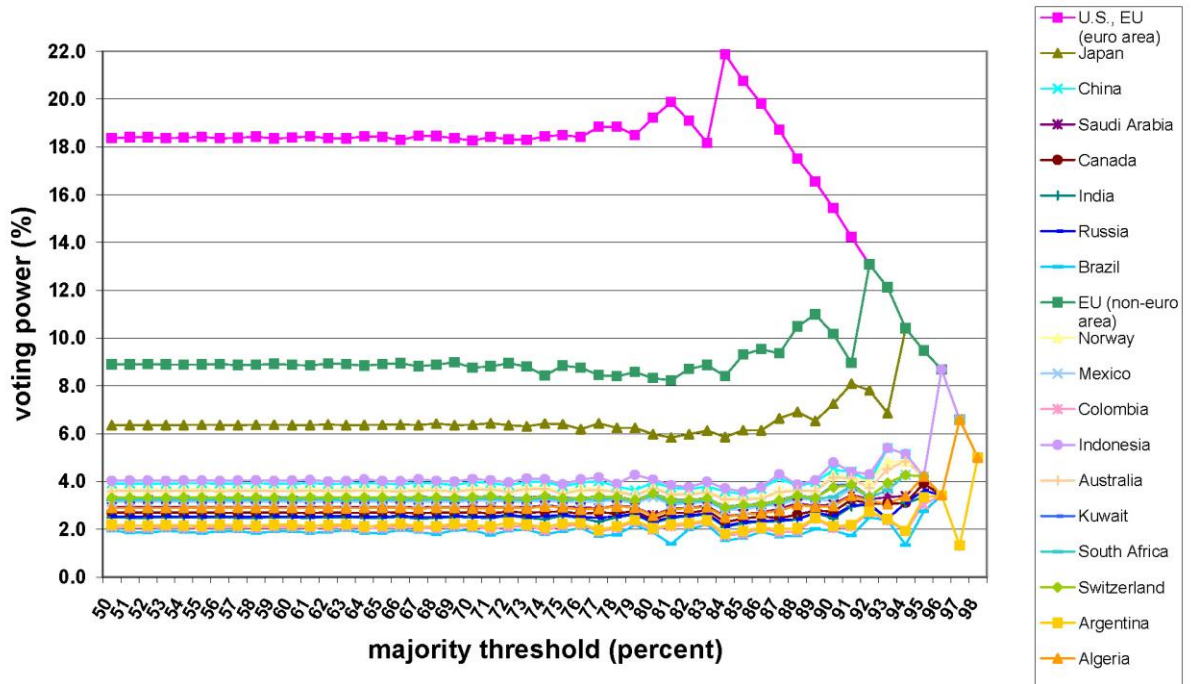


Chart 3

Coleman~PBI veto power as a function of majority threshold

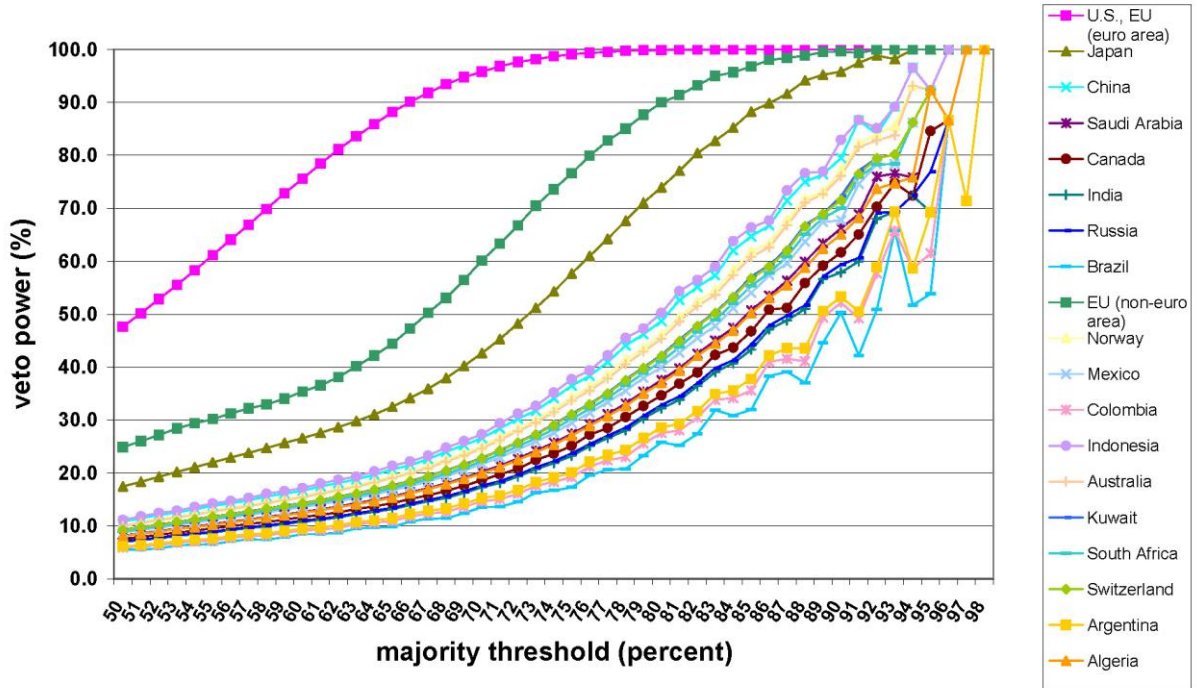


Chart 4

Paterson~SSI veto power as a function of majority threshold

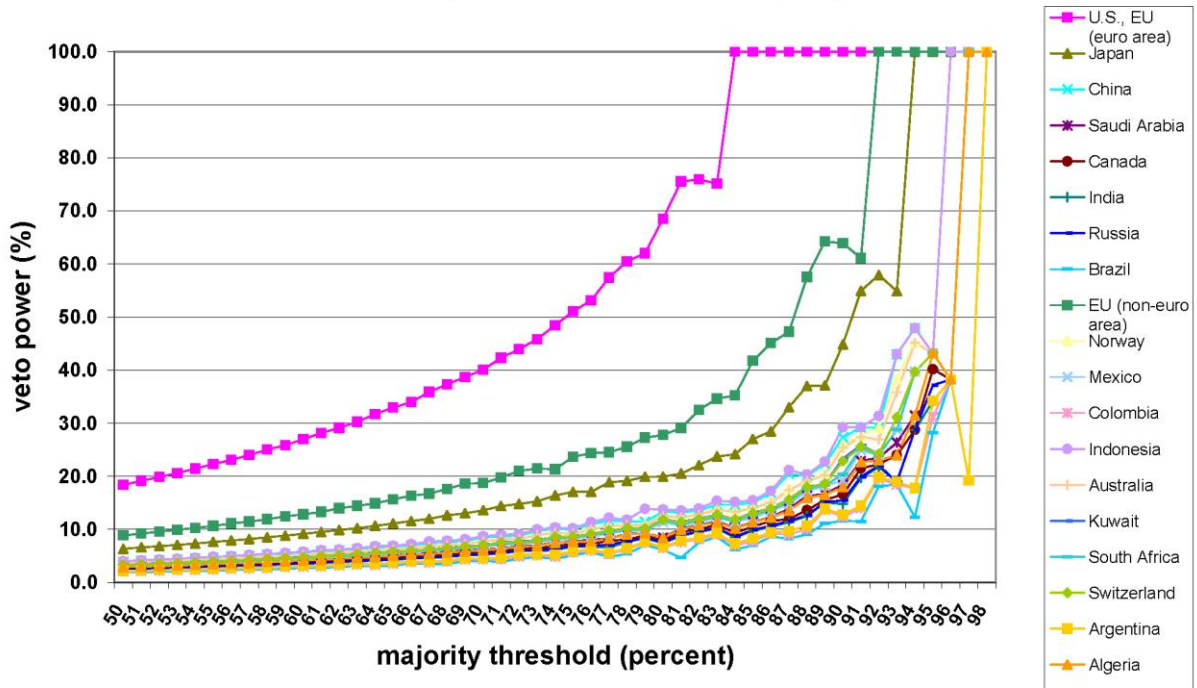


Chart 5

Probability of a Winning Decision = "Efficiency"

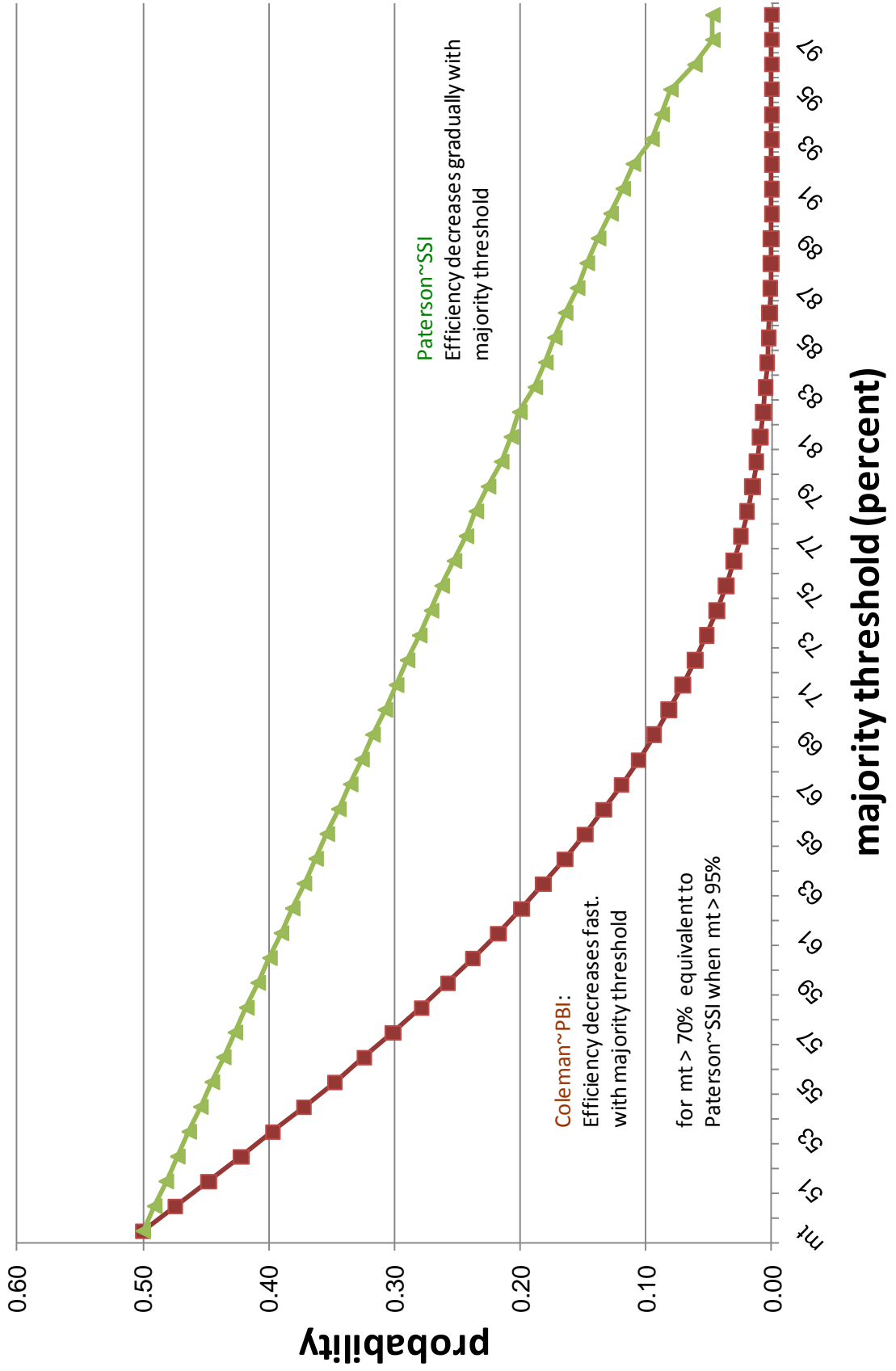


Chart 6

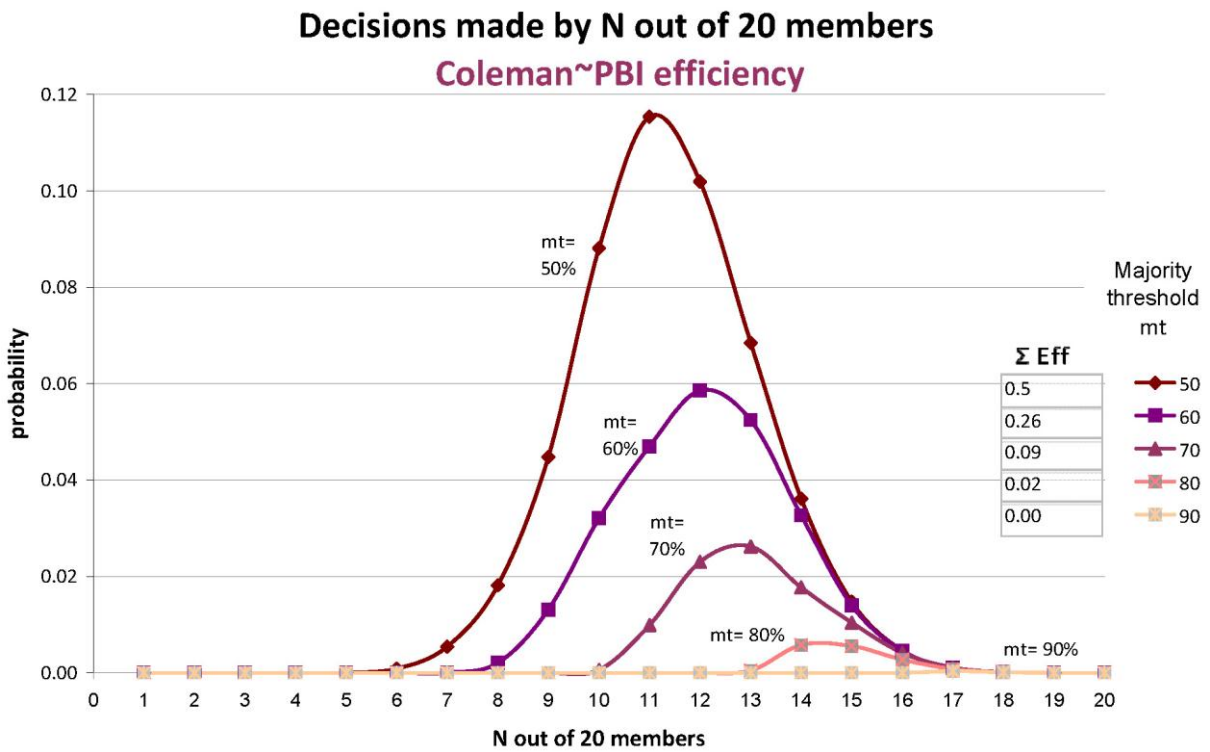
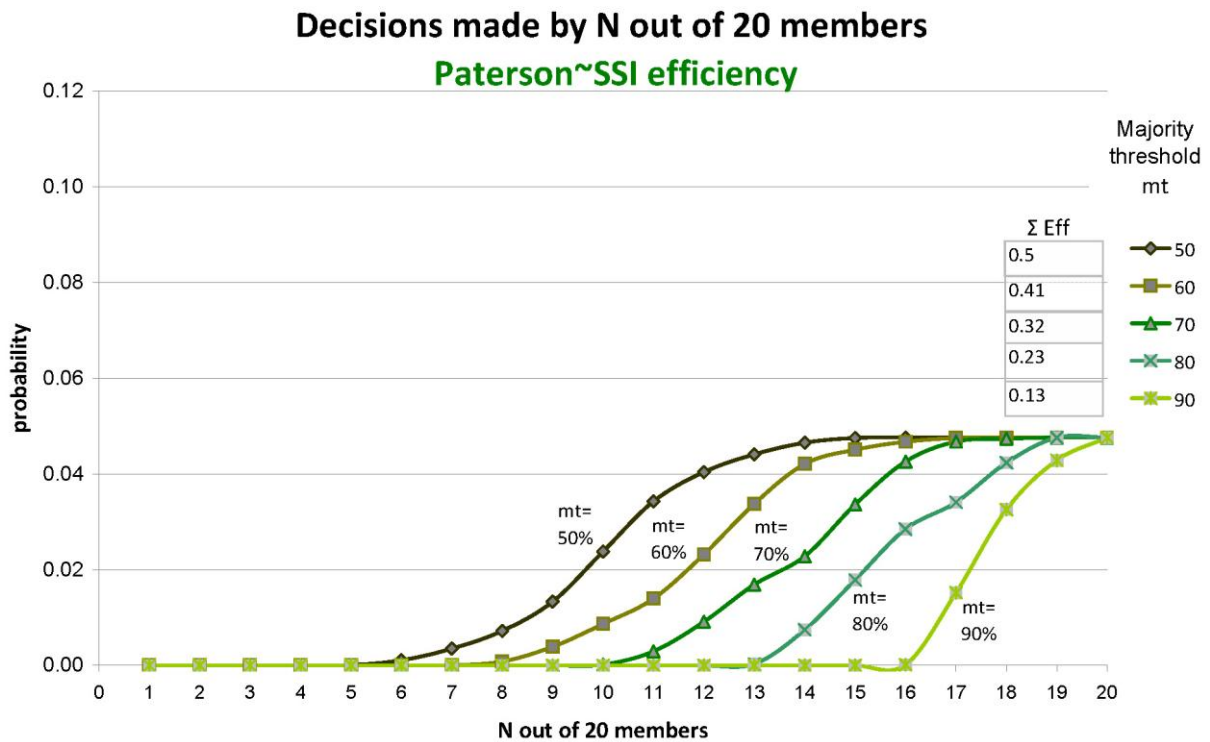


Chart 7



Authors: Peter Brandner, Harald Grech, Iain Paterson

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