A New Analysis of A Priori Voting Power in the IMF :
Recent Quota Reforms Give Little Cause for Celebration

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A New Analysis of *A Priori* Voting Power in the IMF: Recent Quota Reforms Give Little Cause for Celebration

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Abstract: The weighted voting system used by the International Monetary Fund creates problems of democratic legitimacy since each member's influence or voting power is not in general equal to its voting weight. Using voting power analysis to analyse both the Board of Governors and the Executive Board, we show that it tends to enhance the power of the United States at the expense of all other members. We investigate the constituency system as a form of representative democracy, idealizing it as a compound voting body, and find that it gives disproportionately large power to some smaller European countries, particularly Belgium and Netherlands. We also find that many countries are effectively disenfranchised. Separate analyses are done for 2006 and 2012, before and after recent reforms, which have been billed as being radical, enhancing the voice of the poor and emerging markets, but the effects are disappointingly small.

1. Introduction

The governance of the Bretton Woods institutions (the International Monetary Fund and the World Bank) is by means of a system of weighted voting. All member countries have a voice but cast different numbers of votes depending on their quotas (the IMF term for the country's financial stake), or their shareholdings (the term used by the World Bank). In the IMF each country's number of votes is determined by a formula that gives it a number of so-called basic votes that each country has plus a number proportional to its quota.[1] The rules require that all countries that are members of the World Bank must also be members of the IMF, and their shareholdings depend very strongly on their IMF quotas. It is therefore not necessary to make separate analyses of voting power for the two institutions and our findings about the IMF can therefore be taken as broadly applying to the World Bank also.

Weighted voting in the IMF is problematic because it results in a severe democratic imbalance with the distribution of voting power being massively biased against the developing and poor countries. This dominance by the industrialized countries has been criticised by the developing countries and others as leading the organization to adopt policies that have taken insufficient notice of the interests of those countries, especially the imposition of conditions on borrowers derived from extreme neo-liberal economics in the so-called Washington Consensus. (See eg. Buira, 2003, Woods, 2006.) The need for reform of the governance of the international financial organisations was accepted by all countries as part of the Monterrey Consensus agreed in 2002 and again at the follow-up meeting in Doha in

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[1] One vote for every 100,000 special drawing rights of quota. Each country's quota is its financial stake in the IMF and theoretically meant to reflect its importance in the world economy.

2008. Changes aimed at giving greater voice to poor countries and emerging economies have now started to be implemented and it is of interest to study how effective they are.

Besides this inequality in the voting arrangements – inequality that has historically been intended as part of the design of an institution on the principle that those who contribute most should have the most say - there exists a *further* bias, resulting from the use of weighted voting. The idea of weighted voting is that each country's voting power should be predetermined and that it should be proportional to its voting weight. However, a member's voting *power* is not the same as its *weight*: its *power* is its ability to be decisive whenever a vote is taken – to make a difference to the outcome - whereas its *weight* is just the number of votes it has been allocated by the rules.

It follows that voting power is a fundamental property of the rules by which decisions are taken, together with the weights of all voters, and this can only be revealed by detailed analysis that looks at outcomes, using voting power indices, Because this important distinction is often ignored in practice, designing constitutions that use weighted voting often leads to undesired or unexpected consequences in terms of the distribution of voting power among countries.

The voting weights in the IMF are very unequal: the USA has more than two and a half times as many votes as the country with the next-largest voting weight, Japan. We use power indices to measure each member's voting power. The USA turns out to have much more voting power than weight. This disproportionality is another argument for reforming the weights in a more radical direction than has

hitherto been suggested. More generally the lack of a direct link between power and weight adds to the case for decoupling the allocation of votes from both the provision of and access to finance.

Defenders of the present voting system claim it embodies democratic accountability if one accepts the principle that voting rights should be attached to the supply of capital. For example, when he was Managing Director Horst Köhler said: "I would also like to underline that still we are a financial institution, and a financial institution means you need also to have someone who provides capital and I think there is a healthy element in the fact that the provision of capital and voting rights is, in a way, combined, because this is also an element of efficiency, of accountability."[2] The distorting effect of weighted voting that we describe below makes this claim far from being true.

As a general principle weighted voting is an attractive idea because it offers the prospect of designing an intergovernmental decision-making body that could have a real claim to democratic legitimacy – for example, in an institution of world government where a country's voting power reflects its population. But it is important to be clear about what we mean by weighted voting. Systems based on the use of a *bloc vote* where a country (or group of countries acting together) casts all its voting weight as a single unit, as in the IMF, cannot be relied on to work like that and in general they do not, as we will show. On the other hand, if the rules are such that a country is represented by a *number of delegates* each with one vote that they are allowed to cast individually, rather than having to vote together as a unit, then this problem does not arise. The latter is simply a representative democracy and the

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[2] House of Commons Treasury Select Committee, 4th July 2002.

number of votes or delegates is equivalent to the country's power. The argument we are advancing here is only relevant when the votes cannot be split.

We will use the method of voting power analysis to explore the relationships between the voting weights, the decision rule and the resulting voting powers of the members. This requires us to analyse all the voting outcomes that can occur, and investigate the ability of every member to be decisive, to be able to decide whether the vote leads to a decision or not. We will use voting power indices to compare the powers of different members.

Our principal finding is that the voting power of the USA is far greater than its voting weight. That is, its actual power over decision-making far exceeds its nominal voting power. We also use the method for two important analyses: first the effect of the *ad hoc* increase in voting weight that occurred in 2008 for four emerging economies (China, Korea, Mexico and Turkey) that were previously very badly unrepresented, second the more radical reforms agreed at the Singapore meeting in 2008. Secondly we consider the Executive Board as a representative body in which the directors are elected by constituencies of countries by majority voting. We find that the constituency system considerably enhances the power of certain smaller European countries, especially Belgium, the Netherlands and Switzerland.

We begin with an outline of the principles of voting power analysis in the next section. Then in section 3 the system of governance of the IMF is described, in sections 4 and 5 we present the analyses of the Board of Governors and the Executive Directors, in 6 we consider the voting power implications for treating the constituency system that underpins the Executive Board as form of democratic representation

assuming formal voting within constituencies.

2.   Weighted Voting and Voting Power Analysis

A country's voting power is its potential to be decisive in a decision taken by vote, measured by the probability with which it can change what would otherwise be a losing vote to a winning one. In general this has a rather imprecise relation with its weight. In reality its power depends on all the other members' weights as well as the voting rule by which decisions are taken. A case that shows the issue starkly is that of the European Economic Community which also employed weighted voting in the council of ministers: the distribution of voting power among the six members was far from proportional to voting weight between 1958 and 1972. See Leech and Leech (2005b) for the details. (Brams and Affuso,1976, were the first to show it.)

By considering all possible voting outcomes the method of power indices is technically that of *a priori* voting power: each member's power index is its decisiveness as a fraction of the theoretically possible outcomes without regard for the likelihood of their occurring. The method can be thought of as an analysis of the implications for power of the voting rules, considered in the abstract, as giving what can be called constitutional power[3]. Probability calculus is used as a tool for calculating the power indices. Technically the probability of a voter being decisive is the Penrose index (also known equivalently as the Penrose measure, Penrose-Banzhaf index, Absolute Banzhaf index). This is a measure of the a priori probability of the voter being decisive and is the simplest index for the purpose. Other power indices

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[3] No consideration is given here for the members' preferences, which would determine the likelihood of particular members voting in the same way as each other, which would produce an analysis of empirical voting power. Some coalitions look less likely than others from a game-theoretic point of view. Such an analysis is beyond the scope of the present study.

could be used, but we take the view that the superiority of the Penrose-Banzhaf index is established on both theoretical and empirical grounds. See Felsenthal and Machover (1998), Leech (2002c) for a comparison with the other so-called classical power index, the Shapley-Shubik; see also Coleman (1971). However since our purpose is to investigate changes in relative voting power among the member countries, we use the normalized version, generally known as the Banzhaf index (or Normalised Banzhaf index), that has the property that the indices over all the voters sum to one, and therefore it provides a distribution of voting power. We will refer to values of this index as voting powers.

Voting power analysis will be used in two ways. First it will be used to analyse power relations in the existing governance structures of the IMF, the Board of Governors and the Executive Board, and also the effects of recent reforms. These will be the main empirical results of the paper.

Second, we also use it to study the properties of indirect or two-level voting procedures implied by the IMF constituency system where countries are placed in a series of groups, each containing a number of members, where each group's Executive Director casts all its members' votes *en bloc* in the second stage the Executive. The Penrose index described above provides a simple methodology for doing such analysis, since any member's (indirect) power index is simply obtained as the product of the two relevant power indices in the two stages, each of which is an independent probability. These absolute indices are then normalized to sum to one as before to provide a distribution of indirect voting power for this voting body. The theory is described in Leech and Leech (2006); the method in terms of game theory is presented in Owen (1995).

This method follows that proposed in Coleman (1973) to address the general question of why social actors give up power to join groups. By joining with others in a group, an actor gives up his power as an independent voter in favour of more limited power over group decisions, but may nevertheless gain overall if the group's 'power of combined forces' is sufficiently greater that it offsets that loss of power. The use of power indices permits results to be obtained very easily since it allows us to combine the power of the actor within the group and the power of the group. Analytically this can be thought of as equivalent to a compound voting game. This approach lends itself naturally to the analysis of intergovernmental weighted voting where there is accountability to a lower body, such as a country's electorate, parliament or a regional intergovernmental grouping. It can be generalized to compound voting games with three or more levels. It is a useful tool for the analysis of voting power implications of changes to the architecture of voting in the international institutions. We emphasise that such scenarios are very stylized and open to criticism for their realism.

3. Weighted Voting in the IMF

All countries are members of the Board of Governors, and as such have direct representation at the highest level of formal decision-making, but the real management is done by the Executive Directors (also known as the Executive Board).

In the Board of Governors and in the election of Executive Directors the voting weight of each country is made up of two components: a fixed component of so-called 'basic' votes which is the same for each country, and a variable component that depends on the country's quota. This formula for determining voting weight is intended as a compromise between two principles: the equal representation of member countries (via the basic votes), analogous to the UN General Assembly, and

voting power based on contributions in the manner of a joint stock company. Over time the basic element has become severely eroded and the quota - or share-based votes - have become dominant. This is an important factor behind the disempowerment of the poor countries. The restoration of the basic votes to their original level is a main aim of the reform movement.

There are currently (in 2012) 188 members, of whom the USA has by far the largest voting weight, with 421,965 votes, 16.75 percent of the total, and the smallest is Tuvalu with 759 votes, 0.03 percent. The second-highest voting weight is held by Japan with 6.23 percent, Germany 5.81 percent, France and UK with 4.29 percent and so on.

The Executive Board consists of 24 members, some of whom are appointed by their governments and some elected by member states. Five directors are appointed by the members with the largest quotas: USA, Japan, Germany, France and UK. The remaining 19 directors are elected..

In meetings when a vote is taken on an issue, the Executive Board uses weighted voting exactly like the Board of Governors: the appointed directors cast the number of votes of the member that appointed them, and the elected directors cast the combined number of votes of the countries that voted for them. There is no provision for executive directors to split their vote to reflect the views of the countries that voted for them, when they are not unanimous on the issue, although they are allowed to abstain, which in a sense is equivalent to splitting their voting weight equally and voting for both sides.

There are elections for directors every two years. Each eligible member country votes for a single director and directors are elected in order of the number of

votes they receive. The rules for electing directors lay down a minimum and maximum number of votes that can be cast for each elected director, and hence sizes of the weighted votes that they can cast at Executive Board meetings which prevent any elected director becoming too powerful. Eliminating ballots are taken until all the vacant directorships are filled. [4]

The result is a pattern of voting power generally similar to that of the governors.[5] Three directors are elected by a single country, so are in effect appointed: China, Russia and Saudi Arabia. The rest are elected by groups of countries.

A variety of decision rules are used for different types of decisions. Ordinary decisions are made by simple (weighted) majority of the votes cast (the quorum for meetings of the Board of Governors being a majority of members having not less than two-thirds of the voting weight; that for the Executive Board being a majority of directors having not less than one-half of the total voting weight). A number of matters require decisions to be taken by a supermajority of 85 percent. This supermajority, taken in conjunction with the weight of the USA, 16.75 percent, means that the USA is the only member that possesses a veto.

It is customary for official spokespersons to say that decisions in the Executive are normally taken by consensus and formal votes are avoided. However

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[4] The rules are laid down in Schedule E of the Articles of Association. They state that, in order to be elected, a director must receive at least four percent and no more than nine percent of the eligible votes. If the number of directors elected by this procedure is less than the number required, then there are further ballots with voting eligibility restricted to (i) those members who voted for a candidate who received less than four percent and (ii) those members who voted for a director who was elected but whose votes are deemed to have taken the votes for the director above nine percent.
[5] The voting weights as proportions vary slightly between the Board of Governors and Executive Directors because of differences in participation in votes by countries with small weights.

this claim is not universally accepted, many writers pointing out that the absence of

formal voting is not the same thing as consensus decision making. In practice

decision making during a debate where there is contention involves the secretary

informally keeping a tally of the weighted votes held by the executive directors who

speak on each side according to the sense of their contribution, a 'consensus' being

deemed to have been found when the required majority has been reached. Thus

although a formal vote is usually avoided, the rule may be closer to weighted majority

voting than consensus building. See Buira (2005), Woods (2001).

The American veto has always been an important aspect of the governance of

the institutions, and continues to be so, the articles having been amended to increase

the supermajority threshold for special decisions from 80 to 85 percent when the USA

decided to reduce its quota. The existence of this veto power does not mean that the

USA can be said to *control* the institutions, however. On the contrary, although it

gives it absolute unilateral blocking power, at the same time it also limits that

country's power because it equally ensures a collective veto for small groups of other

countries. Formally, in terms of Coleman's terminology, while the supermajority rule

gives the United States complete *power to prevent action*, it also limits its *power to

initiate action* (Coleman, 1971). Therefore its voting power – and its power index

(which is an average of these two) - is limited. The existence of the 85 percent

supermajority can be seen to give veto power to three other countries acting together

(for example, Japan, Germany and France). The developing countries, if they acted as

a bloc, or the EU countries, or many other similar small groups, obviously have a

veto[6]. The 85 percent rule tends to equalize voting power. Taking the argument to its

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[6] This point about the difference between veto power and the power of control was
made very clearly by Keynes in opposition to the proposed American veto based on

limit, the case of a unanimity rule (i.e. a supermajority requirement of 100 percent) would give every member a veto and equalise power, making voting weight irrelevant. For these reasons the power analysis in this study considers only ordinary decisions that require a simple majority vote. Analysis of power under supermajorities has been made in Leech (2002a).

4.   Voting Power in the Board of Governors

Table 1 shows three analyses which reveal the weighted voting effect and give a picture of the effects of the quota reforms:

(1) for 2006 before the reforms;

(2) for 2008 after the *ad hoc* adjustments to the quotas for four emerging economies that were seriously out of line: China, Korea, Mexico and Turkey; and

(3) for 2012, after the partial implementation[7] of the reforms agreed in 2010.

The table shows, for each of the main countries, (1) its relative voting weight and (2) its normalized power index or vote share[8], in each of the years. Significant changes in weights in the reforms are highlighted in bold. The table also shows the Gini coefficient of inequality for both the voting weights and the voting power

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supermajorities in a speech to the House of Lords in 1943 when the Bretton Woods institutions were being planned. See Moggridge (1980), p. 278; also his Letter to J. Viner, p. 328. Keynes advocated simple majority voting.

[7] Quotas change when countries make the payments, which not all have done at the time of writing.

[8] These power indices have been calculated using the computer program *ipmmle* (accessible online at www.warwick.ac.uk/~ecaae) which implements the algorithm for computing power indices for voting bodies that are large both in having many members and where the voting weights are large numbers, described in Leech (2003a). For an overview of computing power indices see Leech (2002b).

indices. Inequality is very high in 2006 and the reforms reduce it by very little .

Inequality in voting power is slightly higher than it is for weight.

Table 1. Voting Weights and Voting Powers in the Board of Governors
(Largest weight countries)

	2006			2008			2012	
	Weight	Power		Weight	Power		Weight	Power
USA	17.09	24.49	USA	16.77	23.80	USA	16.75	24.29
Japan	6.13	5.46	Japan	6.02	5.41	Japan	6.23	5.50
Germany	5.99	5.35	Germany	5.88	5.30	Germany	5.81	5.18
France	4.95	4.48	France	4.86	4.42	UK	4.29	3.89
UK	4.95	4.48	UK	4.86	4.42	France	4.29	3.89
Italy	3.25	2.97	China	3.66	3.35	China	3.81	3.46
Saudi	3.22	2.94	Italy	3.19	2.93	Italy	3.16	2.88
China	2.94	2.69	Saudi	3.16	2.90	Saudi	2.80	2.56
Canada	2.94	2.69	Canada	2.89	2.65	Canada	2.56	2.34
Russia	2.74	2.50	Russia	2.69	2.47	Russia	2.39	2.18
Neth.	2.38	2.18	Neth.	2.34	2.15	India	2.34	2.14
Belgium	2.13	1.95	Belgium	2.09	1.92	Neth.	2.08	1.90
India	1.92	1.76	India	1.89	1.74	Belgium	1.86	1.70
Switz.	1.60	1.46	Switz.	1.57	1.45	Brazil	1.72	1.57
Australia	1.50	1.37	Australia	1.47	1.35	Spain	1.63	1.49
Spain	1.41	1.29	Mexico	1.43	1.32	Mexico	1.47	1.35
Brazil	1.41	1.29	Spain	1.39	1.28	Switz.	1.40	1.28
Venezuela	1.23	1.13	Brazil	1.38	1.27	Korea	1.37	1.25
Mexico	1.20	1.10	Korea	1.33	1.23	Australia	1.31	1.20
Sweden	1.11	1.02	Venezuela	1.21	1.11	Venezuela	1.09	1.00
Argentina	0.98	0.90	Sweden	1.09	1.01	Sweden	0.98	0.90
Indonesia	0.97	0.89	Argentina	0.97	0.89	Argentina	0.87	0.80
Austria	0.87	0.80	Indonesia	0.95	0.87	Austria	0.87	0.80
S. Africa	0.87	0.80	Austria	0.86	0.79	Indonesia	0.86	0.79
Nigeria	0.82	0.75	S. Africa	0.85	0.79	Denmark	0.78	0.71
Norway	0.78	0.71	Nigeria	0.80	0.74	Norway	0.78	0.71
Denmark	0.77	0.71	Norway	0.77	0.70	S. Africa	0.77	0.71
Korea	0.76	0.70	Denmark	0.75	0.69	Malaysia	0.73	0.67
Iran	0.70	0.64	Iran	0.69	0.63	Nigeria	0.73	0.67
Malaysia	0.69	0.63	Malaysia	0.68	0.63	Poland	0.70	0.64
Kuwait	0.65	0.60	Kuwait	0.63	0.58	Iran	0.62	0.57
Ukraine	0.64	0.59	Ukraine	0.63	0.58	Turkey	0.61	0.56
Poland	0.64	0.59	Poland	0.63	0.58	Thailand	0.60	0.55
Finland	0.59	0.54	Finland	0.58	0.54	Singapore	0.59	0.54
Algeria	0.59	0.54	Algeria	0.58	0.53	Kuwait	0.58	0.53
Iraq	0.56	0.51	Turkey	0.55	0.51	Ukraine	0.57	0.52
Libya	0.53	0.49	Iraq	0.55	0.50	Finland	0.53	0.49
Thailand	0.51	0.47	Libya	0.52	0.48	Ireland	0.53	0.49
Hungary	0.49	0.45	Thailand	0.50	0.46	Algeria	0.53	0.49
Pakistan	0.49	0.45	Hungary	0.48	0.44	Iraq	0.50	0.46
Romania	0.49	0.45	Pakistan	0.48	0.44	Libya	0.48	0.44
Turkey	0.45	0.41	Romania	0.48	0.44	Greece	0.47	0.43
…	…	…	…	…	…	…	…	…
	100.00	100.00		100.00	100.00		100.00	100.00
Gini	0.7780	0.7958		0.7819	0.7990		0.7584	0.7767

Power indices have been calculated using the program *ipmmle* available on the website www.warwick.ac.uk/~ecaae.

The table shows that the voting power of the United States is considerably out of line with its weight. In 2006 its voting weight of just over 17 percent gave it 24 percent of the voting power. Its weight went down slightly in 2008 and again in 2012 but it was still massively dominant giving it much greater voting power. All other members have less power than their weight. Thus we can say that the weighted voting system has a hidden tendency to enhance the power of the USA at the expense of all other countries.

The 2006 table also brings out a number of glaring anomalies pointing to the need for reform. Canada and China had the same number of votes, and voting power, despite the economy of China being much bigger than that of Canada. This bias against developing countries is seen, also, in the comparison of the voting weight of some rich countries like Belgium, Netherlands and Spain with large emerging economies especially India, Brazil and Mexico. A particularly glaring juxtaposition is that between Denmark and Korea, the former having more voting weight than the latter despite its economy being much smaller than.

The implications of the quota reforms are also illustrated in Figure 1 which shows the changes in voting power indices plotted against the changes in weights. The reforms have been in two stages: first the *ad hoc* increases for China, Korea, Mexico and Turkey implemented in 2008, then the changes resulting from the more radical reforms implemented in 2012. The latter reforms were: (1) the introduction of a more transparent, simpler formula to replace the previous complicated five-fold system; (2) tying the quotas more closely to the formula; (3) tripling of basic votes for all members; (4) a second round of *ad hoc* increases for the four countries mentioned above. This second round of reforms was accompanied by an increase in general

quotas. The main changes in relative voting weights were increases for China, Korea, India, Brazil, Mexico and some others at the expense of the USA, some European countries notably the UK and France, Saudi Arabia and Canada. None of the changes was greater than one percent of the total voting weight, so perhaps it is not surprising that the voting power effects are very small.

Figure 1 shows a common pattern for all countries, except the two with the largest quotas. For all countries except the USA and Japan, the voting power change is proportional to the weight change; they all lie on a straight line through the origin with a gradient of less than 1. Those countries whose weight increases gain slightly less voting power while those whose weight falls lose less voting power. China gains 0.87% in weight but only 0.78% in voting power, while the UK and France lose 0.65% weight but only 0.58% voting power. The exceptions are the USA and Japan which lie above and below the line respectively. Japan gains 0.1% in weight but only 0.04% in voting power. The United States loses 0.32% weight but only 0.2% in voting power; it loses about the same voting weight as the Netherlands (0.30%) but does not lose comparable voting power (0.28%). These are unexpected weighted voting effects due to the great inequality in weights.

However these effects are all small. They provide little to support the claim of the then IMF Managing Director, Dominique Strauss-Kahn that, "Taken together, it's a big shift in quotas and accordingly in voting power. It's a very important increase in the voice and representation of the emerging market and developing countries ... it is a historical reform of the IMF."[9]

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[9] Press Release: "IMF Board Approves Far-Reaching Governance Reforms", 5 November 2010, IMF Washington.

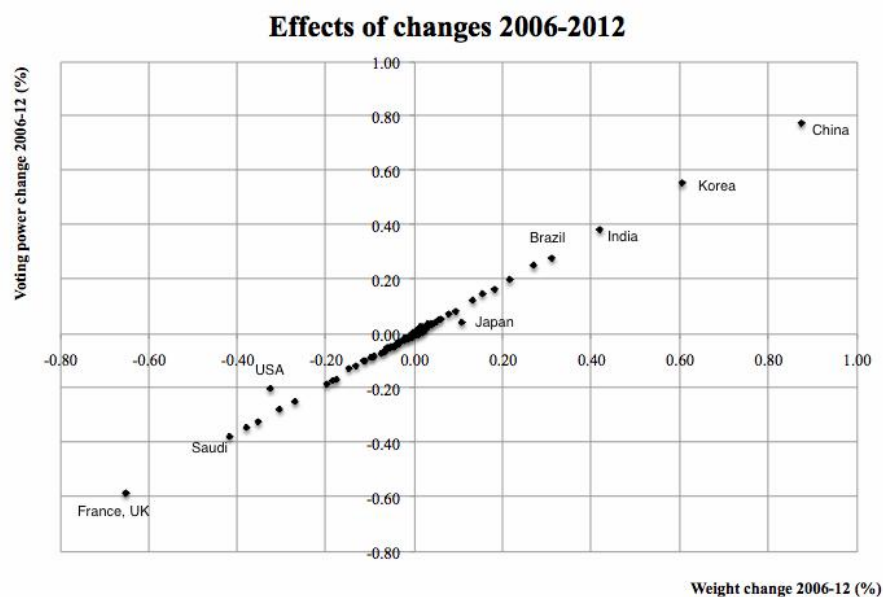**Figure 1: Voting power implications of the quota reforms**

Figure 2 shows the changes in voting power and weights that followed the *ad hoc* quota increases for the four countries implemented in 2006. These changes did not involve changes to the voting weights of the other members. The main effect was that the USA lost weight and power while China, Korea, Mexico and Turkey all gained. Interestingly the USA lost more in power (0.69%) than in weight (0.31%). The second phase of the reforms are shown in Figure 3, which compares 2008 with 2012. Now we see that the USA gained in voting power (0.5%) as a result of the reforms although its relative weight hardly changed at all. The biggest gainers from this phase were India, Brazil and Spain, while the biggest losers were the UK and France.

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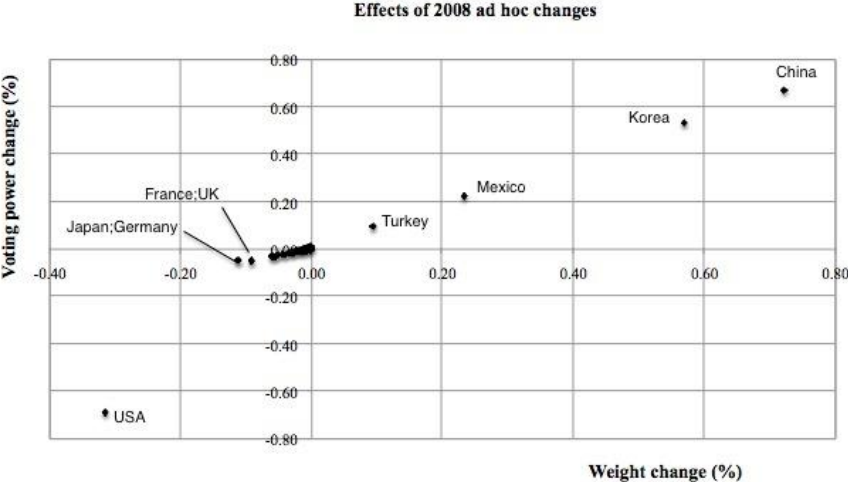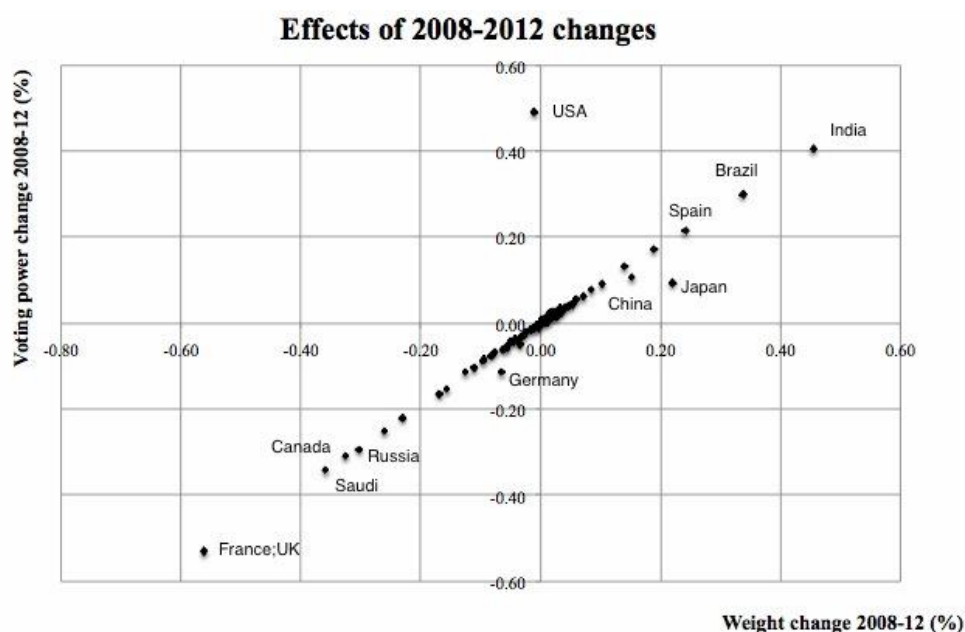**Figure 2: The ad hoc increases in quota for China, Korea, Mexico and Turkey**

Effects of 2008 ad hoc changes

Figure 3: The second phase of the quota reforms in 2012

5. Voting Power in the Executive Board

Table 2 shows the analyses, for 2006 and 2012,[10] for the Executive Board, which has twenty four executive directors who cast weighted votes. The directors of the countries with the biggest five quotas (USA, Japan, Germany, UK and France) together with those of China, Russia and Saudi Arabia, are directly appointed by their governments and the rest are elected to represent other countries which are arranged into constituencies around the candidate they voted for. The table shows, for the country of each director, the number of countries it represents, its voting weight in the Executive Board, its voting power, and the ratio of power to weight.

The USA dominates again but the inequality here, expressed by the Gini coefficient, is less than it is in the Board of Governors because most directors cast the

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[10] We omit 2008 because the changes were so small.

combined votes of their constituency members. The power ratios show that all directors lose power to the USA and have less power than weight. The USA has 25 percent more voting power than weight. There is a slight reduction in inequality between 2006 and 2012, the weight of the USA falling from 17.09 to 16.79 percent. Inequality of voting power is slightly greater, falling slightly, that of the USA falling from 21.45 to 20.95 percent. The Gini coefficient of the distribution of voting weight falls from 0.28 to 0.27 and that of the voting power indices from 0.317 to 0.304.

In so far as direct comparisons are meaningful, the results are similar to those for the Governors. We can make direct comparisons of power indices for the directly appointed directors, but they are not so straightforward for the elected directors because it is necessary to take account of the power distribution within the constituency. Some of the constituency directors can be thought of in the same way as the appointed directors because they dominate their constituencies, and therefore have the absolute power to cast the combined votes. They are – to use the language of the voting power literature - technically *dictators* within their constituency.[11] But others are elected and it is necessary to allow for the distribution of voting power within the constituency as well as the bloc vote cast by the elected director. We provide a fuller analysis of this feature of the Executive Board in section 6 below. Here we simply treat the Executive Board as a single weighted voting body.

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[11] The constituencies are formed endogenously during the voting process: they have no objective status in the rules of the IMF. Members are free to leave and join another constituency by voting for another candidate in the biennial election of the board. Although voting patterns and therefore constituency membership are stable over time, migrations do occur. For example Kazakhstan and Uzbekistan both changed constituency between 2006 and 2012, the former moving from the Belgian to the Swiss constituency, the latter from the Swiss to the Australasian constituency.

Table 3 shows the analysis for the 16 directors who represent a constituency with more than one member. The table shows, for the country of each director, for 2006 and 2012, its voting weight as a member of the Board of Governors, its voting weight as an executive director (the combined weight of all its constituency members) and the difference. The countries are ordered by the difference, which measures the gain in voting weight due to the constituency system. The table also includes the voting power of the country in its constituency assuming an election by simple majority vote (columns (3) and (6))[12]. Countries which are 'dictators' in their constituency have a voting power of 100 per cent.

The results show the countries that gain most in voting weight by the constituency system: Mexico (casting the votes of Venezuela, Spain and the Central American republics), Belgium (representing ten east European countries including Austria, Turkey, Hungary), Finland (representing the Nordic group), Tanzania (representing the Anglophone African group), and so on. In all constituencies where there is a member with over half the votes, and is a 'dictator', that member is always elected (Switzerland, Brazil, Italy, Canada, India). The gain in voting power is less in these cases simply because their voting power is high anyway. Where there is a member who is dominant in the constituency, such as the Netherlands (voting power index in the constituency 98.9 percent in 2006, 89.1 in 2012), Belgium (voting power 68.0 percent and 53.0 percent, respectively), Argentina (75 percent) it is elected although not technically a 'dictator'. Other constituencies operate a more open system of representation, with different countries providing the elected executive director (for example, the Nordic, Anglophone/Lusophone African and Francophone African constituencies). These conclusions are drawn from the observed voting weights and

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[12] Normalised Banzhaf index.

not from analysis of the operation of the constituencies in practice, which exist outside the formal rules of the IMF, and have adopt their own procedures.

The main result for the Executive Board is the same as for the Board of Governors: a strong tendency for weighted voting to enhance the voting power of the United States at the expense of all the other directors. The effect is not so great: here the ratio of voting power to voting weight for the USA is 1.248, showing that the USA gains a hidden extra share of voting power of almost 25 percent more than its weight, compared with 45 percent in the Board of Governors in 2012.

Table 2. Voting Weights and Voting Powers in the Executive Directors

		2006					2012			
		No.	Voting weight (%)	Voting power (%)	Ratio		No.	Voting weight (%)	Voting power (%)	Ratio
1	USA	1	17.09	21.45	1.255	USA	1	16.79	20.95	1.248
2	Japan	1	6.13	5.82	0.949	Japan	1	6.25	5.95	0.952
3	Germany	1	5.99	5.69	0.949	Germany	1	5.82	5.55	0.952
4	Belgium	10	5.13	4.87	0.948	Belgium	10	4.98	4.74	0.951
5	France	1	4.95	4.69	0.948	Mexico	8	4.66	4.43	0.951
6	UK	1	4.95	4.69	0.948	Nether.	13	4.53	4.30	0.950
7	Neth.	12	4.85	4.59	0.948	France	1	4.30	4.09	0.950
8	Mexico	8	4.27	4.05	0.948	UK	1	4.30	4.09	0.950
9	Italy	7	4.18	3.96	0.948	Italy	7	4.27	4.06	0.951
10	Canada	12	3.71	3.51	0.947	Singapore	13	3.94	3.75	0.950
11	Finland	8	3.51	3.32	0.947	China	1	3.82	3.63	0.949
12	Korea	14	3.33	3.15	0.947	Australia	15	3.63	3.45	0.950
13	Egypt	13	3.26	3.08	0.947	Canada	12	3.61	3.43	0.950
14	SaudiAr.	1	3.22	3.05	0.946	Denmark	8	3.41	3.23	0.949
15	Malaysia	12	3.17	3.00	0.946	Lesotho	21	3.23	3.06	0.950
16	Tanzania	19	3.00	2.84	0.947	Egypt	13	3.19	3.03	0.949
17	China	1	2.94	2.78	0.946	India	4	2.81	2.67	0.949
18	Switz.	8	2.84	2.69	0.946	Brazil	9	2.81	2.67	0.949
19	Russia	1	2.74	2.60	0.946	SaudiAr.	1	2.81	2.67	0.949
20	Iran	7	2.47	2.33	0.946	Switz.	8	2.78	2.64	0.949
21	Brazil	9	2.47	2.33	0.946	Russia	1	2.39	2.27	0.949
22	India	4	2.40	2.27	0.946	Iran	7	2.27	2.15	0.947
23	Argentina	6	1.99	1.89	0.945	Argentina	6	1.84	1.75	0.947
24	Equ.Guinea	24	1.41	1.34	0.945	Togo	22	1.55	1.47	0.947
	Total	181	100.00	100.00			184	100.00	100.00	
	Gini		0.280	0.317				0.270	0.304	
	Power indices have been calculated using the method of generating functions using the program *ipgenf* on the website www.warwick.ac.uk/~ecaae.									

Table 3. Elected Executive Directors' votes

	2006					2012			
	Weight (%)	ED wt. (%)	diff	Const. VP (%)		Weight (%)	ED wt (%)	diff	Const.VP (%)
	(1)	(2)		(3)		(4)	(5)		(6)
Mexico	1.2	4.27	3.07	33.3	Singapore	0.59	3.94	3.35	15.1
Belgium	2.13	5.13	3.00	68.0	Mexico	1.47	4.66	3.19	33.3
Finland	0.59	3.51	2.92	13.7	Lesotho	0.04	3.23	3.19	1.5
Tanzania	0.1	3	2.9	4.3	Belgium	1.86	4.98	3.12	53.0
Egypt	0.45	3.26	2.81	12.9	Egypt	0.4	3.19	2.79	12.9
Korea	0.76	3.33	2.57	13.3	Denmark	0.78	3.41	2.63	25.0
Malaysia	0.69	3.17	2.48	18.8	Netherlands	2.08	4.53	2.45	89.1
Netherlands	2.38	4.85	2.47	98.9	Australia	1.31	3.63	2.32	29.4
Iran	0.7	2.47	1.77	32.1	Iran	0.62	2.27	1.65	32.1
Equ.Guinea	0.03	1.41	1.38	1.8	Togo	0.06	1.55	1.49	3.7
Switzerland	1.6	2.84	1.24	100	Switzerland	1.4	2.78	1.38	100
Brazil	1.41	2.47	1.06	100	Italy	3.16	4.27	1.11	100
Argentina	0.98	1.99	1.01	75.0	Brazil	1.72	2.81	1.09	100
Italy	3.25	4.18	0.93	100	Canada	2.56	3.61	1.05	100
Canada	2.94	3.71	0.77	100	Argentina	0.87	1.84	0.97	75.0
India	1.92	2.4	0.48	100	India	2.34	2.81	0.47	100

Columns (1) and (4) are the country's weight share, (2) and (5) the combined constituency weight share of all countries in the constituency, the votes that the executive director casts, (3) and (6) voting power shares of the country within the constituency.

6. The Executive Board as a Representative Democratic Body

Executive directors have a dual role: on the one hand they are professional officers of the IMF who are permanently based in Washington, experts charged with designing and implementing policies that are supposed to be technically objective and politically neutral, and on the other they are either appointed or elected by member countries and therefore political representatives or delegates. The latter set of roles are our concern in this section: our focus is on the power relations between member countries.

Although the Articles prescribe a set of formal rules for electing directors, which do not mention constituencies at all, in practice the constituencies are a real

force. There are no formally laid down rules governing the relationships between directors and their constituents that we can study. But in practice those member countries which do not have the right to appoint their own director are arranged into geographical groupings, whose members vote for the executive director who represents them. It is therefore natural to treat them as constituencies, since they are defined by the fact of the members voting for the executive director who casts their votes on their behalf.

Many of the constituencies have a powerful dominant member whose director is invariably elected - not least because (in five cases) his or her country has an absolute majority of the constituency votes - and so in effect these have become permanent board members. In these cases the other constituency members have no voting power in relation to the Executive Board. Two other constituencies have a practically dominant member who is not technically a dictator: those represented by Belgium and Netherlands. The other nine constituencies have no single dominant member and the chair rotates or changes otherwise.

In the discussion of the IMF it is customary to refer to the constituencies as if they operated just like any other in a representative democracy. Spokesmen for the IMF often refer to constituencies in these terms. Directors meet their constituencies at the annual IMF/World Bank meetings.

However there appears to be an issue of democratic legitimacy when one reads in the authoritative work on the governance of the IMF: "When members belonging to a given constituency hold different views on a subject, the executive director can put differing views on record but cannot split his or her vote. The resolution of such conflicts is for each director to decide and any director remains free

to record an abstention or an objection to a particular decision. The system has a tempering impact and evidence shows that the decisions that finally result may well be the best that could be taken under the circumstances" (Van Houtven, 2002).

We can distinguish two types of constituencies in terms of their composition by types of countries that make them up. Seven are mixed industrial, middle income and developing or transitional countries and nine are developing countries. Many of them, especially the mixed groups, have a member with a very large weight, usually an industrial country, which is dominant within the group and whose representative is invariably elected. Some constituencies have different arrangements for selecting their director and the office rotates; this may be the case where there is no one member who is dominant in terms of weight, such as the Nordic-Baltic constituency and also the two African constituencies; alternatively there may be two or three relatively dominant members among whom the office rotates but excluding the smaller members, for example the Mexican-Venezuelan-Spanish group where there are three dominant members.

The Articles do contain one explicit provision for majority voting within constituencies: the procedure for a by-election for an executive director when there is a casual vacancy. The members of the relevant constituency elect the replacement director, by a simple majority of the votes cast, using eliminating ballots if necessary.[13] There has been at least one case where a constituency has actually elected its director by open voting. The Middle Eastern constituency in the IMF, which includes Egypt, Iraq, Kuwait and ten other Arab countries, has selected its executive director by open election between candidates from different countries. We

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[13] Article XII, Section 3 (f), and By-Law 17.

therefore consider it is of interest and appropriate to investigate the voting power of the member countries using voting power analysis on the stylized model of representative democracy suggested by the constituency structure.

The first result of this analysis is that five members are formally 'dictators' within their constituency, all the other members are powerless. This applies to the constituencies of Italy, Canada, Switzerland, Brazil and India. Those countries which are rendered powerless, in the sense that their *a priori* voting power is zero, are referred to in the voting power and game theory literature as technically *dummies*. Uzbekistan was a 'dummy' in 2006 when it was a member of the constituency represented by Switzerland, but ceased to be so in 2012 when it had moved to the constituency represented by Australia; Kazakhstan became a 'dummy' when it moved from having voting power as a member of the constituency represented by Belgium in 2006 to that represented by Switzerland in 2012.

The fact that countries are 'dummies' when there is a 'dictator' is perhaps not a surprising finding. However we have discovered that some countries have zero voting power although their constituencies do not have a dictator. This finding is illustrative of the value of the voting power approach because it is not obvious and could not have been discovered any other way. The countries are Estonia in 2006, and the five Central American countries, Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua. That the latter five countries are dummies follows from the fact that their constituency has three large members, Spain, Mexico, Venezuela, any two of which are needed to form a majority, which implies that none of the other five members can ever be decisive. However the finding that Estonia was a 'dummy' in the Nordic constituency is not at all obvious. It is a property of the voting weight the

country receives by virtue of its quota. Note that Estonia has positive voting power by 2012 following the quota reforms.

Therefore in 2006 there were in total 42 member countries (23 percent of the membership), with zero voting power with respect to the Executive Board, in possession of some 4.19 percent of the voting weight. The reforms made little difference to this: by 2012 the number had fallen to 41 with slightly more, 5.55%, of the weight. These countries include some industrial countries but in the main they are developing countries. They are: Albania, Antigua and Barbuda, Azerbaijan, Bahamas, Bangladesh, Barbados, Belize, Bhutan, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Estonia (2006), Greece, Grenada, Guatemala, Guyana, Haiti, Honduras, Ireland, Jamaica, Kazakhstan (2012), Kyrgyz Republic, Malta, Nicaragua, Panama, Poland, Portugal, San Marino, Serbia, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Tajikistan, Timor-Leste, Trinidad and Tobago, Turkmenistan, Uzbekistan (2006). The six 'dummies' with the largest weight are Poland, Portugal, Ireland, Greece, Colombia, Bangladesh.

We now analyse the voting power of every member by considering the Executive Board as a two-level representative body. Each member's voting power is the product of voting power in two voting bodies: its power with respect to decisions taken by simple majority voting among constituency members within the constituency, and the power of the constituency in the Executive Board under simple majority voting. A member's power index is obtained by multiplying together these two Penrose indices[14].

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[14] The absolute (that is, non-normalised) power indices, which are probabilities, are used for this calculation. The normalised indices are then computed.

It is of interest to use this technique to investigate which members gain and which lose power in the Executive Board as a result of the way the constituency system is assumed to work, compared with their power in the Board of Governors. This comparison assumes away the differences in competence of the two bodies and focuses only the structural effects of the constituency groupings on formal voting power. Obviously the members who have been shown to be powerless in their constituencies are losers. However it is not clear that the countries that dominate their constituencies, including the 'dictators', necessarily gain since it depends on the power of their constituency.

Table 4 gives some results of this analysis. Only the results for the most powerful countries are presented. The power indices for the Board of Governors, from Table 1, are also presented as the basis of comparison with the indices for the two-level voting structure we have assumed. For each year the countries are ordered by their two-stage indirect voting power index. From these results we can infer that, in 2006, the countries that most benefited from the constituency system – that is with both a large indirect voting power index and with its indirect power index greater than its direct (the Board of Governors) power index - are the Netherlands (3.76% compared with 2.18%), Belgium (a very large increase: 3.69% compared with 1.95%), Italy, Canada, Switzerland. The same pattern was repeated in 2012.

Table 5 shows the biggest gainers and losers from the constituency system in terms of voting power. Here the countries are ordered by gain or loss, that is the difference between two-stage indirect power index for the Executive Board and the direct power index for the Board of Governors (labelled VP). The biggest gainers are

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the rich smaller European countries especially Belgium and the Netherlands. The biggest losers tend to be the countries that appoint their own Directors: the USA, Japan, Germany, UK, France. By 2012 China had become big enough for this effect to apply to it. The biggest losers also include 'dummy' countries Poland and Ireland.

Table 4. Voting power indices for the Executive Board as a democratic representative body (two-stage voting)
(Most powerful countries)

2006				2012			
	Weight (%)	2-stage VP (%)	BGVP (%)		Weight (%)	2-stageVP (%)	BGVP (%)
USA	17.09	17.57	24.49	USA	16.79	16.46	24.29
Japan	6.13	4.77	5.46	Japan	6.25	4.68	5.50
Germany	5.99	4.66	5.35	Germany	5.82	4.36	5.18
France	4.95	3.84	4.48	Nether.	2.08	3.33	1.90
UK	4.95	3.84	4.48	France	4.30	3.21	3.89
Nether.	2.38	3.76	2.18	UK	4.30	3.21	3.89
Belgium	2.13	3.69	1.95	Italy	3.17	3.19	2.88
Italy	3.25	3.25	2.97	Belgium	1.86	3.13	1.70
Canada	2.94	2.88	2.69	China	3.82	2.85	3.46
SaudiArab	3.22	2.50	2.94	Canada	2.56	2.70	2.34
China	2.94	2.28	2.69	India	2.35	2.10	2.14
Switz.	1.60	2.20	1.46	Brazil	1.72	2.10	1.57
Russia	2.74	2.13	2.50	SaudiArab	2.81	2.09	2.56
Australia	1.50	2.04	1.37	Switz.	1.41	2.07	1.28
Sweden	1.11	1.95	1.02	Russia	2.39	1.79	2.18
Brazil	1.41	1.91	1.29	Spain	1.63	1.74	1.49
India	1.92	1.86	1.76	Mexico	1.47	1.74	1.35
Spain	1.41	1.66	1.29	Venez.	1.09	1.74	1.00
Venez.	1.23	1.66	1.13	Sweden	0.98	1.47	0.90
Mexico	1.20	1.66	1.10	Korea	1.37	1.41	1.25
…	…	…	…	…	…	…	…
BGVP: Voting power in the Board of Governors (normalised Banzhaf index) ; 2-stage VP: normalised voting power index for idealised two-level voting in the Executive Board..							

Table 5. Voting power indices for the Executive Board as a democratic representative body (two-stage voting)
(Biggest gainers and losers)

2006				2012		
Gainers:						
	2-stage VP (%)	BGVP (%)	Diff.		2_stage VP (%)	BGVP (%)	Diff.
Belgium	3.69	1.95	1.74	Netherlands	3.33	1.90	1.43
Netherlands	3.76	2.18	1.58	Belgium	3.13	1.70	1.42
Sweden	1.95	1.02	0.94	New Zeal.	1.30	0.35	0.94
Indonesia	1.63	0.89	0.74	Switzerland	2.07	1.29	0.79
Switzerland	2.20	1.46	0.74	Venezuela	1.74	1.00	0.74
Australia	2.04	1.37	0.67	South Africa	1.30	0.71	0.59
Brazil	1.91	1.29	0.62	Indonesia	1.38	0.78	0.59
Kuwait	1.17	0.60	0.57	Sweden	1.47	0.90	0.57
Mexico	1.66	1.10	0.56	Brazil	2.10	1.57	0.52
Losers:						
Austria	0.30	0.80	-0.50	Ireland	0.00	0.49	-0.49
Ukraine	0.00	0.59	-0.58	China	2.85	3.47	-0.62
Poland	0.00	0.59	-0.59	Poland	0.00	0.64	-0.64
France	3.84	4.48	-0.63	France	3.21	3.90	-0.68
UK	3.84	4.48	-0.63	UK	3.21	3.90	-0.68
Germany	4.66	5.35	-0.69	Germany	4.36	5.19	-0.83
Japan	4.77	5.46	-0.69	Japan	4.68	5.51	-0.83
USA	17.57	24.49	-6.92	USA	16.46	24.33	-7.87
BGVP: Voting power in the Board of Governors (normalised Banzhaf index) ; 2-stage VP: normalised voting power index for idealised two-level voting in the Executive Board..						

Table 6. Biggest gainers and losers in voting power 2006-12

Gainers	VP2012	VP2006	Diff.	Losers	VP2012	VP2006	Diff.
Governors							
China	3.47	2.69	0.786	Nether.	1.90	2.18	-0.272
Korea	1.25	0.70	0.556	Russia	2.19	2.50	-0.316
India	2.14	1.76	0.386	Canada	2.34	2.69	-0.345
Brazil	1.57	1.29	0.283	SaudiArab.	2.56	2.94	-0.376
Mexico	1.35	1.10	0.248	France	3.90	4.48	-0.577
Spain	1.49	1.29	0.200	UK	3.90	4.48	-0.577
Executive Board							
China	3.63	2.78	0.845	Nether.	4.30	4.59	-0.292
Sing./Mal.	3.75	3.00	0.743	Russia	2.27	2.60	-0.325
India	2.67	2.27	0.402	SaudiArab	2.67	3.05	-0.385
Mexico	4.43	4.05	0.377	USA	20.95	21.45	-0.505
Brazil	2.67	2.33	0.335	UK	4.09	4.69	-0.605
Austr./Kor.	3.45	3.15	0.302	France	4.09	4.69	-0.605
Executive Board as a representative body (2-stage voting)							
Korea	1.41	0.54	0.863	Congo,Rep	0.14	0.67	-0.532
New Zeal.	1.30	0.54	0.754	Belgium	3.13	3.69	-0.566
China	2.85	2.28	0.572	France	3.21	3.84	-0.630
Congo,DR	0.63	0.11	0.526	UK	3.21	3.84	-0.630
Singapore	0.92	0.50	0.420	Australia	1.31	2.04	-0.730
Malaysia	1.17	0.83	0.342	USA	16.46	17.57	-1.108

7.   Conclusions

We have used the method of voting power analysis and power indices to analyse the voting system by which the IMF is governed and the recent reforms that have been made to it. We argue, and hopefully have demonstrated, that this approach provides valuable insights that help us better understand weighted voting systems. The results for the voting power implications of the recent reforms are summarized in Table 6

We report three analyses of the reforms: first, their effect on the voting power relations in the Board of Governors, where all member countries have a voice; second, their implications for the distribution of voting power in the Executive Board

among the 24 countries that are members of that body; and third, their implications for voting power with respect to representation on the Executive Board, where it is regarded formally as a delegate body using a two-stage voting procedure. The principal finding, from the first analysis, is that the voting power share of the United States is always substantially much more than its weight, while for all other members, their voting power shares are slightly lower than their weights. Not only is the allocation of voting weight very unfair from the point of view of an ideal of "One person, One vote", with many large developing countries and emerging markets seriously under-represented, but this bias is compounded by the inequality in the distribution of weights and the voting rules.

Table 6 reports the six biggest gainers and six biggest losers in terms of voting power shares for each of these three analyses. First, while the biggest gainers from the reforms in the Board of Governors are the emerging markets including China, Korea, India, Brazil and Mexico, the effects are quite small: for example the largest increase is that for China which is less than one percent of the total voting power. These increases are mainly at the expense of the voting power of some of the industrial countries including the biggest losers UK, France, Canada, and the Netherlands. All these effects are small which suggests that the reforms do not live up to some of the claims that have been made for them.

The second analysis is of the changes in the Executive Board. Again the biggest gainers are the emerging markets, China, India, Mexico, Brazil and the South-East Asian constituency represented either by Singapore or Malaysia. The biggest losers in voting power are the large industrial countries, this time including the USA.

The third analysis, of changes to voting power of member countries in relation to the Executive as a delegate body, shows more mixed results, with the biggest gainers being Korea, New Zealand and China, and the biggest losers the USA, Australia, the UK and France. All these effects are small however, and the overall conclusion must be that the reforms are insubstantial.

The results for the idealized two-level voting system we have assumed for the Executive Board and its constituencies suggest that such a system tends strongly to benefit the smaller developed European countries, notably Belgium and the Netherlands.. Also, from this point of view, almost a quarter of all members, mostly small developing countries, are completely powerless.

These results point to a serious limitation in the democratic legitimacy of the governance of the institution. The recent quota reforms, while claimed as being a major step towards improving the voice and representation of the poor countries and emerging economies are nothing of the sort. The changes are very small and give no cause for celebration.

References

Brams, Steven J. and Paul J. Affuso (1976), 'Power and Size: a new paradox", *Theory and Decision,* 7(1-2), 29-56.

Buira, Ariel (2002), *A New Voting Structure for the IMF*, Washington: G24, www.g24.org/.

---------------(ed.) (2003) *Challenges to the World Bank and IMF : developing country perspectives,* London: Anthem Press.

--------------- (ed.) (2005), *The IMF and World Bank at Sixty*, London: Anthem Press.

----------------(ed.) (2006), *Reforming the Governance of the IMF and the World Bank*, London: Anthem Press.

Coleman, James S. (1971) "Control of Collectivities and the Power of a Collectivity to Act," in B.Lieberman (ed), *Social Choice*, New York, Gordon and Breach; reprinted in J.S. Coleman, 1986, *Individual Interests and Collective Action,* Cambridge University Press.

---------------------- (1973), "Loss of Power", *American Sociological Review*, 38,1-17.

Felsenthal, Dan S. and Moshe Machover (1998), *The Measurement of Voting Power*, Cheltenham, Edward Elgar.

Leech, Dennis (2002a), "Voting Power in the Governance of the IMF", *Annals of Operations Research*, vol.109, 2002, pp 373-395.

----------------- (2002b), "Computation of Power Indices", *Warwick Economic Research Papers*, No. 644, July 2002.

------------------(2002c), "An Empirical Comparison of the Performance of Classical Power Indices", *Political Studies*, vol. 50, no.1, March 2002, pp.1-22.

----------------- (2003a), "Computing Power Indices for Large Voting Games", *Management Science*, vol. 49, number 6, June 2003, pp 831-838.

----------------- (2003b), "The Utility of Voting Power Analysis", *European Union Politics*, 4:4, December 2003, 479-486.

----------------(2011), "Power Indices in Large Voting Bodies", *Public Choice*, Online First, 10 August 2011.

------------------ and Robert Leech (2003), Website: "Computer Algorithms for Voting Power Indices", www.warwcik.ac.uk/~ecaae/

--------------------------------------- (2005a), "Voting Power Implications of a Unified European Representation at the International Monetary Fund", *Warwick Economic Research Papers*, number 720, January 2005.

--------------------------------------- (2005b), "Voting Power in the Bretton Woods Institutions", *Homo Oeconomicus*, 22(4): 1-23.

--------------------------------------- (2006), "Voting Power and Voting Blocs", *Public Choice,* 127, 3-4, May 2006, pp. 285-303.

Moggeridge, D.(ed.) (1980), *Collected Works of John Maynard Keynes*, Vol. XXV Cambridge University Press.

Owen, Guillermo (1995), *Game Theory*, Academic Press.

Van Houtven, Leo (2002), *Governance of the IMF: Decision Making, Institutional Oversight, Transparency and Accountability*, IMF Pamphlet Series no. 53, IMF: Washington.

Woods, Ngaire (2001), "Making the IMF and the World Bank more accountable", *International Affairs*,. 77:1, 83-100.

------------------ (2006), The Globalisers: *The IMF, the World Bank and their Borrowers*, Cornell Studies in Money, Cornell University Press.