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**IMPLICATIONS OF THE QUOTA  
& VOICE REFORM OF THE IMF:  
THE ASPECT OF POWER**

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анализа решений в экономике,  
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«Математические методы анализа решений в экономике,  
бизнесе и политике»

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In this paper I investigate the results of the recent Quota and Voice Reform, adopted by the International Monetary Fund in April 2008, by means of formal voting power analysis. Using classical and preference-based power indices, I demonstrate that although the relative changes in power of some members are basically in line with the stated goals of the Reform (e.g., more voice for the low-income countries), the resulting power re-distribution is hardly significant, if viewed in absolute terms. I argue that the main reasons for this situation are the current distribution of quota shares and the substantially limited ability of the Fund to act, which results from the super-majority decision making rule requiring an immense degree of support among members for any reallocation of the quotas to come into force.

Keywords: IMF, quota and voice reform, voting power, preference-based power index

JEL classification codes: C71, D72, F33

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## 1 Introduction<sup>1</sup>

The Quota and Voice Reform of the International Monetary Fund (IMF) has been pending for more than ten years. The Executive Directors expressed their intention to use a new quota formula<sup>2</sup> in December 1997. Since 2000 the new formula and related issues have been discussed in many publications, originating both from the IMF and independent researchers (see IMF (2009) for an overview). The reform was put on the agenda in 2006, and in April 2008 the agreement among the members was finally reached. At the time of writing this paper, the 2008 Reform is yet to be ratified by more than 60 members to come into force.

On the one hand, a mere outline of the process indicates how important the issue is. Quotas play multiple key roles in the Fund (namely, define a member's subscriptions, number of votes and access to financing) and any change in the way they are distributed requires careful scrutiny as well as many discussions by experts.

On the other hand, however, it may also indicate severe problems with efficient decision making in the Fund's governing organizations. The results of voting power analysis reported in the present paper partly support this view. Note that as I consider just a single aspect of the multi-faceted Reform package, in no way does it provide grounds to assess the impact of the Reform as a whole. Nevertheless, I argue that one of the key objectives of the Reform, i.e., to enhance the participation and voice of low-income countries (IMF, 2008) is unlikely to be reached as a result of the proposed changes.

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<sup>2</sup> International Monetary Fund, *Alternative Quota Formulas: Considerations*, (SM/01/293,9/27/01), 2001.

The paper is organized as follows. Section 2 describes the Quota and Voice Reform (henceforth referred to as QVR) in more details and provides the necessary background from the theory of voting power to be applied to the analysis of the IMF governing structures. The formal model is given in Section 3; Section 4 reports the main results of the analysis; Section 5 concludes.

## 2 Reform, voice and power

In April 2008 the Board of Governors, the supreme IMF authority, adopted the reform of quota and voice.<sup>3</sup> The reform package comprises the following elements:

1. The new quota formula. The formula serves as the basis for determining a member's actual quota share and is supposed, at least theoretically, to reflect the country's relative economic and financial weight within the world economy. It is well known that at the time of the IMF creation in 1944 the original, so-called Bretton Woods, formula was based on political rather than economic considerations (see Mikesell (1994) for details). As such, later it was replaced by a system of five formulae, which has been used to date. The problem of finding a new formula that would be a reliable and an easily interpretable indicator of a member's relative economic power is certainly not a trivial matter, and as such, has attracted great attention from researchers and the general public (see, e.g., (IMF, 2000, 2001, 2003)). The new formula is a kind of a weighted sum of four macroeconomic variables<sup>4</sup> where the weighting coefficients are supposed to reflect the relative importance<sup>5</sup> of each variable in the total value of the quota. Arguably, this is a simplification over the existing scheme of five formulas with obscure

<sup>3</sup> See Press-release No. 08/93 at <http://www.imf.org/external/np/sec/pr/2008/pr0893.htm>.

<sup>4</sup> In particular, the calculated quota share makes use of a country's average GDP (part of which is converted at market rates, while the rest uses PPP exchange rates); the annual average of the sum of current payments and current receipts (goods, services, income, and transfers); the variability of current receipts and net capital flows; and an average of official reserves. IMF (2008) presents a discussion on the formula and the set of variables used.

<sup>5</sup> Although commonly used in multi-criteria decision making, weighted transformations like this one are not free of certain shortcomings, perhaps, the major one being that they imply that the additive structure of the criteria is preserved in the generalized value. For a recent development in the formal theory of criteria importance, see Podinovski (2009).

choice of weights. One should note, however, that the calculated quota shares generally differ from the actual ones; and since any change in a member's quota can only be done upon their consent<sup>6</sup>, the drift of quotas towards a more adequate distribution is a slow and gradual process.

2. Ad-hoc quota increases to all 54 countries that were underrepresented under the new quota formula. According to the proposal, the aggregate shift in quota shares for these 54 members amounts to 4.91 percentage points (and aggregate shift in voting shares for the total of 135 members that will receive an overall increase in their share is 5.42 percent). While it does not seem to be too much, depending on the actual redistribution, this action could have resulted in a significant change in representation. For instance, the aggregate quota share of the two African constituencies<sup>7</sup>, representing in total 43 countries, is currently about 3.36 percentage points. The joint effect of this and the next proposed amendment is analyzed in Section 4.

3. Tripling the number of basic votes<sup>8</sup> to increase the voice of low-income countries, as well as a procedure that fixes the share of the basic votes within the total votes. This change is supposed to revive the once existent situation when the basic votes accounted for about 11 percent of a member's quota. Since the 1940s the quotas of all members have been regularly increased, while the number of basic votes has remained the same, which resulted in the situation where the value of basic votes in a member's total voting share diminished for most countries, except the low-income ones. The proposed amendment would guarantee that basic

<sup>6</sup> Articles of Agreement, Article III, Section 2(d).

<sup>7</sup> A *constituency* in the IMF terminology is a group of countries represented by a single Executive Director (ED) in the Executive Board, the main managerial body of the IMF, responsible for carrying out the Fund's daily business. Out of the total of 24 EDs currently on the Board, five are appointed by the countries with the largest quotas (USA, Japan, Germany, France and the UK), while the remaining nineteen are elected by the Board of Governors. There are several rules of elections of the EDs in the Articles of Agreement that make most countries having insufficient shares of the total votes form constituencies to be represented by the 19 elected EDs. These constituencies are not fixed structures, though: at the biannual elections of Executive Directors any country can change a constituency by simply casting its votes for another ED. Woods & Lombardi (2006) present several examples of such precedents.

<sup>8</sup> Basic votes are assigned to every member upon joining the IMF and do not require additional contributions. At the present time, every IMF member has 250 basic votes plus 1 additional vote for each part of its quota equivalent to 100,000 Special Drawing Rights (SDRs).

votes retain their role in the voting share at some constant level in case of further quota increases.

4. Providing resources for an additional Alternate Executive Director for the two African chairs represented on the Executive Board. This seems to be a technical measure that is out of the scope of formal voting power analysis, as the Alternate Directors cannot vote if their Executive Director is present on the Board.

For the package of reforms to become effective, acceptance of the amendment on Voice and Participation by three-fifths of the member countries representing at least 85 percent of total votes is required. There are 185 members in the Fund, so the first part of the requirement corresponds to acceptance by 111 countries. As for the second one, i.e., the minimum number of votes to make a decision, it is conventionally viewed as a “double-edged sword of protection as well as hindrance against change” (van Houtven, 2002) meaning that it guarantees that both the US and the smaller countries (if act as a group) have veto power. Note that if we take countries in their groups on the Executive Board, then the 85% majority requirement implies that the requirement on the minimum number of countries is fulfilled by default: for the present Executive Board composition there is no combination of constituencies such that it has 85% or more of total votes and at the same time, comprises less than 111 countries. I refer to this rule as the qualified majority of 85% and investigate its impact on efficient decision making in Section 4.

There are also other majority rules used by the Fund: in particular, the simple majority, and the majority of 70 percent of total votes. Although no formal voting usually takes place, the reported thresholds are important in determining the outcome. As noted in IMF (2009), a consensus is formed “in the shadow” of the voting rules, meaning that a decision is accepted when the informal agreement of the required majority is met (van Houtven, 2002).

As was announced in the press-release about the reform, “...the new structure represents an important step toward a redistribution of voting shares toward dynamic emerging market and developing countries”, and the aim of this paper is to ascertain this fact formally. So, I shall now turn to the methodology used to estimate the voting power distribution within the IMF.

Formal analysis of power distribution in the voting bodies is based on the likelihood of a situation in which a voter is *decisive*, i.e., is able to swing a division of the body into those voting ‘yes’ and ‘no’ in the voter’s preferred direction. One can argue that this is when the actual power is revealed. On

the other hand, a member’s voting power is still commonly associated with their share of the total votes. In particular, in most IMF publications voting shares are directly referred to as voting power. Although intuitively compelling, this statement is inconsistent with the aforementioned idea of power since having a non-zero voting share is not sufficient for being able (at least formally) to affect the collective decision. The following trivial example reveals this discrepancy.

Suppose we have a voting body where not all voters have the same voting shares and the decision making rule is simple majority, i.e., a proposal needs at least half<sup>9</sup> of the total votes to be accepted by the body. Select any voter and assume that her power is measured by her voting share. Consider a situation in which the voting body remains the same, but the decision making rule has been changed to unanimity. Clearly, in the latter case everybody has equal power to affect a collective decision: all votes are needed. The voting shares, however, remain the same as in the previous case. This example shows that power also depends on the threshold required for a decision to pass in addition to the distribution of voting shares.

To capture all factors defining power it is generally accepted to use a special measure called *power index*. The most widely known classical power indices are those introduced by (Penrose, 1946; Banzhaf, 1965; Coleman, 1971; Shapley & Shubik, 1954). It should be noted that these indices do not use any additional information about the voting body, just vote distribution and the decision making rule, and thus are often referred to as *a priori* power indices. For an analysis of functioning voting bodies to have this basic information is not enough: one also needs to know the probability distribution on possible divisions of the body.

A fairly reasonable, but not indisputable, way to derive this distribution is by introducing voters’ preferences to coalesce into the model (Aleskerov, 2006). The major assumption of the approach is that these preferences substantially influence voters’ willingness to vote together and hence to form coalitions. There are some recent findings supporting this idea at least in laboratory experiments (Aleskerov, Belianin & Pogorelskiy, 2009).

With regard to the IMF, there are several papers that performed *a priori* voting power analysis of the IMF governance structures (see, among others, Leech, 2002; Alonso-Mejide & Bowles, 2005), while another strand of literature used the same approach (i.e., classical power indices) for anal-

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<sup>9</sup> Strictly speaking, this number must be 50% +1 vote.

ysis of changes in voting power distribution arising from modification of the Fund’s structures as well as decision making rules (e.g., Dreyer & Schotter (1980) used voting power approach to investigate the results of the Second Amendment to the Articles of Agreement, which, inter alia, introduced the 85% majority rule. See also a recent work by Leech & Leech (2009)). Concerning the preference-based power indices, however, the only paper to employ this methodology for analysis of power in the IMF was Aleskerov, Kalyagin & Pogorelskiy (2008). Aleskerov, Kalyagin & Pogorelskiy (2010) follows this approach using a new model of the countries’ preferences to coalesce.

The present paper focuses on the analysis of the QVR effects on power distribution, carried out by means of comparing the results of the proposed changes with the benchmark case taken from Aleskerov, Kalyagin & Pogorelskiy (2010), which reports the status quo as of May 2009. The analysis is limited to the Executive Board as the primary governing body of the IMF to which the Board of Governors has made the maximum possible delegation of authority (van Houtven, 2002). IMF (2009) also notes that for the most part, members exercise control over the decision making process through the Executive Board. For this reason, constituencies and their Executive Directors are the primary objects of my research.

It is worth noting that according to the Articles of Agreement, each appointed ED can cast as many votes as was allotted to her state, while each elective ED can cast as many votes as was received by her during elections. Nevertheless, all such votes can only be cast as a unit and cannot be split, if for some reason the countries of a constituency disagree on the issue. In the author’s view, aside from the voting share allocation, this is a major source of problems with representativeness, especially for low-income countries. Indirect evidence that indicates the importance of this feature of the Fund’s design is the transitions of countries between constituencies that occasionally happen. More details on this process can be found in Woods & Lombardi (2006).

### 3 The model

I shall start by listing the main assumptions regarding the governance of the Executive Board. In what follows, I partly repeat Aleskerov, Kalyagin & Pogorelskiy (2010) in order to make this paper self-contained.

- It is assumed that the decision making process is a two-stage one: first, a common position on the issue is developed in each constituency, using the simple majority rule; next, the proposal is decided upon by the Executive Directors on the Board.
- All the three types of majority rules used at the level of the Executive Board (namely, simple, qualified 70%, and 85% of the total votes) are analyzed separately.
- All members have profiles of preferences to coalesce with other countries of their constituency, which are used as a basis for determining a country’s power index within the constituency.

A preference profile is a set of intensities of connection – these are interpreted as country  $i$ ’s wish to form a coalition with country  $j$  – defined by bilateral trade with the country  $j$  in the following way<sup>10</sup>:

$$p_{ij} = \frac{X_{ij} / TX_i}{\sum_{k \in V, k \neq i} X_{ik} / TX_i} = \frac{X_{ij}}{\sum_{k \in V, k \neq i} X_{ik}} \quad (1)$$

Here  $i, j \in V$  (both countries belong to the same constituency  $V$ ),  $X_{ij}$  is the absolute value of total exports from country  $i$  to  $j$ ;  $TX_i$  is the total exports from country  $i$  to the world. The intensity of connection represented by (1) is defined as the share of exports from country  $i$  to country  $j$  in the total exports from country  $i$  to all other countries in their respective constituency. Hence it depends on the entire constituency composition, and not just the identities of other countries. The assumption is that a greater value of  $p_{ij}$  defines a more salient partner for country  $i$  in their respective constituency.  $i$ ’s preference profile is then given by a vector  $\vec{P}_i = (p_{i1}, \dots, p_{i\bar{l}}, p_{i\bar{l}+1}, \dots, p_{il})$ , where  $\bar{l}$  is the number of countries in  $i$ ’s constituency. The factual data on exports are of 2005, taken from the official IMF database “Direction of Trade Statistics”, accessible at <http://www.imfstatistics.org/dot/>. It is also assumed that no substantial changes happen in trade flows in the observable future<sup>11</sup>.

Let  $V$  be a generic constituency comprising  $l$  countries that uses a decision making rule with a threshold  $q$  to accept a decision. Assume that no country is allowed to abstain from voting. A *coalition* here is convention-

<sup>10</sup> The idea was suggested by Fuad Aleskerov.

<sup>11</sup> Note that this is equivalent to assume that the trade volumes change uniformly for all members of a constituency; hence only the relative structure of exports matter.



ally understood as a subset of countries voting in the same way. A subset  $\omega \subseteq V$  is a *winning* coalition, if it can determine the collective decision of  $V$  without other countries' votes, i.e., the sum of the votes of countries from  $\omega$  is not less than  $q$ . Otherwise, the respective coalition is a *losing* one.

A winning coalition  $\omega$  is a *swing* for a country  $i$  if the coalition ceases to be winning in case of this country's exit. A country  $i \notin \omega$  is called *pivotal*, if  $\omega$  is a losing one, while  $\omega + \{i\}$  is a winning one. Concerning the assumed two-stage decision making process, each country's total power is defined as a product of its power in a given constituency, and the power of the constituency considered as a bloc in the Executive Board. This construction follows the approach from Felsenthal & Machover (2002). Formally, the power index  $\pi(i, V)$  representing  $i$ 's total power in the Board (where  $i$  belongs to constituency  $V$ ) is the arithmetic product of the country's power index in the given constituency (denoted by  $\alpha(i)$ ) and the power index of constituency  $V$  in the Executive Board (denoted by  $\kappa(V)$ ). The Board itself is denoted by  $N = \{V \mid V \text{ is a constituency}\}$ .

At the constituency level we used a modification of the Penrose power index that explicitly takes into account the agents' preferences to coalesce. Namely, given a preference profile  $\bar{P}_i$ , the mean intensity of country  $i$ 's connection with other members of the same coalition  $\omega$  is defined as follows (Aleskerov, 2006):

$$f_i^+(\omega) = \frac{\sum_{j \in \omega} p_{ij}}{|\omega| - 1} \quad (2)$$

Next, define the mean intensity of connection of other countries of  $\omega$  with  $i$  by

$$f_i^-(\omega) = \frac{\sum_{j \in \omega} p_{ji}}{|\omega| - 1} \quad (3)$$

and the mean intensity of connection within a coalition by

$$f(\omega) = \frac{\sum_{i \in \omega} \frac{1}{2} (f_i^+(\omega \setminus \{i\}) + f_i^-(\omega \setminus \{i\}))}{|\omega|} \quad (4)$$

The intensity  $f_i^+(\omega)$  may be interpreted as a likelihood of country  $i$  joining  $\omega$  (if this coalition has formed) based on  $i$ 's propensity to join each country of the coalition. The intensity  $f_i^-(\omega)$  is similar to (2) with the dif-

ference that it takes into account the preferences of other countries about  $i$  joining their coalition. The intensity  $f(\omega)$  characterizes the average intensity of connection among the countries of coalition  $\omega$ . We interpret it as likelihood that coalition  $\omega$  acts as a bloc, i.e., all the members of the coalition vote in the same way.

Then,  $i$ 's power index  $\alpha$  for a given constituency  $V$  is defined as

$$\alpha(i) = \begin{cases} \sum_{\substack{\omega \subseteq V: \\ \omega \text{ is a swing for } i}} \frac{f_i^+(\omega)}{2^{|\omega|-1}} & \text{if } v(i) < q \\ 1 & \text{otherwise} \end{cases} \quad (5)$$

where  $v(i)$  is the number of votes of country  $i$ ,  $q$  is the threshold for a decision to be taken (simple majority for all constituencies). This is an *absolute power index* in the sense that the sum of indices for all countries in a constituency does not have a fixed total and generally can be different from 1. Note that if for all coalitions  $\omega$   $f_i^+(\omega) = 1$ , then (5) becomes the classical Penrose (1946) power index. Further, for every country the Banzhaf (1965) power index can be derived from the Penrose one by normalizing the respective value by the total sum of the Penrose indices for all countries of a constituency. I refer to the normalized indices as *relative*, since they add up to 1.

Index (5) is a ratio of the total intensity of  $i$ 's potential connections with those coalitions which are swings for  $i$ , to the maximum possible value for the total intensity of connection in a given constituency, providing that  $i$  is not a dictator, i.e.,  $v(i) < q$ . If, on the other hand, the number of  $i$ 's votes exceeds the threshold, her preferences over coalescing other members lose their meaning, because  $i$  can determine the decision all by herself. Hence, in such case voting power of other members is always zero (they cannot swing any vote), and  $i$  is decisive (i.e., completely define the outcome of the ballot) with certainty.

At the level of the Executive Board we define power of a constituency in probabilistic terms. We assume that constituencies vote independently, while their probabilities to vote for, or against, a decision depend on their members' preferences to coalesce in the following way: the probability for constituency  $V$  to vote "yes" is given by

$$Pr(V \text{ votes 'yes'}) = \sum_{\omega \text{ is winning}} \frac{f(\omega)}{2^{|V|}} \quad (6)$$

In other words, for every winning coalition  $\omega$  the function  $f(\omega)$  defines a degree of inner consistency reflected in the probability that such a coalition is formed. Note that if for all coalitions  $f(\omega)=1$ , then (6) reduces to “The Power of the Body to Act” (PTA) – a power index devised by Coleman (1971).

The power of a constituency  $V$  at the level of the Executive Board is then defined as its probability of being decisive, given by

$$\kappa(V) = \sum_{\substack{S \subseteq N: \\ V \text{ is pivotal}}} \prod_{C \in S} \Pr(C \text{ votes 'yes'}) \prod_{\substack{C \in N \setminus S \\ C \neq V}} (1 - \Pr(C \text{ votes 'yes'})) \quad (7)$$

The sum in (7) is taken over all those partitions of the Executive Board (into those coalitions voting “yes” (the subset  $S$ ) and “no” (the complement  $N \setminus S$ ) in which constituency  $V$  is pivotal. For more details on derivation of this formula, see Aleskerov, Kalyagin & Pogorelskiy (2008).

Now for each country  $i \in V$  the total power index is a product of  $\alpha$  and  $\kappa$ , i.e.,

$$\pi(i, V) = \alpha(i) \kappa(V) \quad (8)$$

## 4 Main results

For each country, their voting shares according to the QVR proposal were taken from the respective table 1 of IMF (2008). These shares are based on the expected final outcomes of the QVR, including the use of the new quota formula, planned ad hoc increases, a tripling of basic votes, etc, so that all amendments are taken into account.

In order to make the results directly comparable to the pre-reform benchmark case, for every majority rule used by the IMF I calculated<sup>12</sup> all the indices, defined in the previous section (and their normalized versions) assuming that the total number of votes of all Fund members remains the same. This is a technical assumption that has almost no influence on the power distribution, since when the decision making rule is fixed, it is the

<sup>12</sup> All reported calculations were done using the author’s program Pwr\_Calc, available upon request.

voting shares that matter for voting power, not the absolute number of votes.<sup>13</sup>

The results obtained can be viewed from two relatively different perspectives. The first one concerns the question how distribution of individual countries’ power within the Executive Board (and the IMF in general), expressed by  $\pi$  indices, depends on the majority rule, and what possible changes occur due to the QVR. The second one deals with the power distribution at the constituency level and its expected transformation.

In the author’s view, the former aspect is not of much interest, because for large majority thresholds (i.e., 70 % and 85 % of the total votes), absolute power of any country almost vanishes. The reasons for that are clear: for the present distribution of votes, the probability that any single country swings the outcome of the vote is close to zero. This property of the design might also indicate a need for a measure that would enable to take group power into account, thereby extending power analysis to the case where probabilities of individual swings are low; but further development of this idea is out of the scope of the present paper. As for the simple majority case, however, it is worth noting that some countries’ ability to appoint their EDs does not necessarily result in their having more power than other countries: in particular, it turns out that power of those countries which are “dictators”<sup>14</sup> in their constituencies, can be greater.<sup>15</sup>

Hence, I shall concentrate on the analysis of the power distribution among constituencies in the Executive board, and not individual countries.<sup>16</sup>

Table 1 Presents the power distribution among constituencies as is expected to form after the post second round of the QVR.

<sup>13</sup> The effect of rounding the number of votes to the nearest integer (the only non-equivalent part of the respective transformation to vote quantities from voting shares) on power is negligible, given the great number of votes of each member.

<sup>14</sup> By “dictator” here I mean countries with the number of votes exceeding 50% of total votes of their respective constituency. That all constituencies use the simple majority rule is an important assumption of this paper; not unreasonable, though, for it is mentioned in the statement from the Articles of Agreement, Article XII, Section 3(f) about re-elections of an Executive Director.

<sup>15</sup> For example, Switzerland represents a group of 8 countries and has power that exceeds that of Russia, which owns a single-chaired constituency.

<sup>16</sup> The archive containing all calculated power indices for all countries can be downloaded from the website of the Decision Choice and Analysis Laboratory at <http://hse.ru/data/2009/12/16/1230162638/PwrCalculations.zip>.

Table 1. The case of simple majority (QVR)

Constituency*	Vote share**, %	Number of votes***	Prob. to vote**** "yes"	Penrose power index ×106	κ power index ×106	Banzhaf power index, %	Normalized κ power index, %
US	16.732	370,548	0.5000	637,361.76	139,381.43	20.926	9.335
Japan	6.227	137,904	0.5000	181,205.03	89,833.20	5.950	6.017
Germany	5.805	128,558	0.5000	168,894.05	83,069.00	5.545	5.564
France	4.288	94,962	0.5000	124,490.50	63,033.80	4.087	4.223
UK	4.288	94,962	0.5000	124,490.50	63,033.80	4.087	4.223
Belgian_C	5.115	113,277	0.0602	148,636.58	100,842.42	4.880	6.754
Dutch_C	4.519	100,078	0.0466	131,384.85	87,170.36	4.314	5.838
Mexican_Spanish_C	4.653	103,046	0.0756	135,178.09	89,257.18	4.438	5.978
Italian_C	4.257	94,276	0.5000	123,602.15	62,818.25	4.058	4.207
China	3.807	84,310	0.5000	110,499.14	55,905.74	3.628	3.744
Canadian_C	3.600	79,726	0.5000	104,387.52	54,026.55	3.427	3.618
Indonesian_C	3.932	87,078	0.0478	114,076.85	73,285.84	3.746	4.908
Australian_C	3.458	76,581	0.0583	100,310.80	62,136.37	3.294	4.162
Swedish_C	3.400	75,297	0.0844	98,656.89	60,568.85	3.239	4.057
Egyptian_C	3.218	71,266	0.0429	93,232.39	58,269.72	3.061	3.903
Saudi Arabia	2.800	62,009	0.5000	81,099.27	41,240.91	2.663	2.762
South_African_C	3.114	68,963	0.0312	90,270.04	55,672.29	2.964	3.729
Swiss_C	2.746	60,813	0.5000	79,570.06	40,485.23	2.613	2.712
Russia	2.387	52,863	0.5000	69,121.36	33,618.28	2.270	2.252
Iranian_C	2.266	50,183	0.0819	65,661.19	38,000.19	2.156	2.545
Brazilian_C	2.806	62,142	0.5000	81,278.80	41,288.31	2.669	2.765
Indian_C	2.806	62,142	0.5000	81,278.80	41,288.31	2.669	2.765
Argentinian_C	1.839	40,727	0.1150	53,305.39	30,577.11	1.750	2.048
Central_African_C	1.651	36,563	0.0239	47,733.31	28,301.13	1.567	1.896

\* The titles are formed from the names of the countries that either provide the Executive Directors for these constituencies, or have the largest voting shares in these constituencies, or represent a regional group (like, African constituencies); for those representing a group of countries, the title ends with the letter 'C'.

\*\* Source: IMF (2008). Voting shares of constituencies are computed as the sum of their members' voting shares.

\*\*\* Calculated as the voting share multiplied by the total number of votes as of May 2009 (rounded to the nearest integer).

\*\*\*\* For the constituencies of one country as well as those effectively controlled by one country (see footnote 14), there are no reasons to assume any particular bias in voting. Therefore, this probability is set to 0.5 in line with the general approach to *a priori* voting power analysis.

Concerning the absolute power of constituencies, Table 1 shows that the conventional swing probability distribution (the Penrose power index) generally corresponds to that of the total number of votes in each constituency (perfect rank correlation), but this is not the case for the κ power index. The latter also depends on probability that there occurs a division in which a constituency is pivotal (recall (7) from Section 3). Thus, if such probability is higher, then power of a country with a smaller number of votes can be greater than that of the country with more votes.<sup>17</sup> Note also that a relative increase in the number of votes does not always lead to a greater value of the κ index (see Table 2).

With regard to relative power as expressed by the Banzhaf and normalized κ indices, the QVR vote shares (Column 2 of Table 1) are generally in line with power shares for all constituencies, except that of the US.<sup>18</sup> This tendency does not hold for the qualified majority rules<sup>19</sup>, however.

Table 2. Relative differences (in percent) between the QVR proposal and the status-quo (simple majority rule)

Constituency	Difference in the number of votes, %	Difference in Penrose power index, %	Difference in κ power index, %	Difference in Banzhaf power index, %	Difference in normalized κ power index, %
US	-0.3215	<b>0.2330</b>	<b>-9.6837</b>	0.1112	-4.6192
Japan	3.3934	<b>3.8155</b>	<b>-3.2358</b>	3.6893	2.1900
Germany	-1.3611	<b>-0.9991</b>	<b>-8.1105</b>	-1.1201	-2.9581
France	<b>-11.7741</b>	<b>-11.5223</b>	<b>-17.0975</b>	<b>-11.6299</b>	<b>-12.4482</b>
UK	<b>-11.7741</b>	<b>-11.5223</b>	<b>-17.0975</b>	<b>-11.6299</b>	<b>-12.4482</b>
Belgian_C	-0.6072	-0.2565	-3.5013	-0.3783	1.9099
Dutch_C	-5.5306	-5.1110	-9.6803	-5.2257	-4.6155
Mexican_Spanish_C	4.4466	4.8751	1.4982	<b>4.7483</b>	<b>7.1895</b>
Italian_C	3.6364	4.0592	-0.0889	3.9316	5.5130
China	3.8927	<b>4.3389</b>	<b>-2.4679</b>	<b>4.2112</b>	<b>3.0002</b>
Canadian_C	-1.1285	-0.7415	-5.0647	-0.8636	0.2578
Indonesian_C	<b>11.5412</b>	<b>11.9654</b>	<b>10.1579</b>	<b>11.8286</b>	<b>16.3349</b>

<sup>17</sup> In some sense, this finding supports the idea of non-monotonicity of power measures (Holler & Napel, 2004).

<sup>18</sup> Normalized κ indices also substantially differ from vote shares for Belgian, Dutch and Mexican-Spanish constituencies, and to a smaller extent – for Indonesian constituency.

<sup>19</sup> These computations are not reported here, but are available on the Internet; see footnote 16 for more details.



Table 2

Constituency	Difference in the number of votes, %	Difference in Penrose power index, %	Difference in $\kappa$ power index, %	Difference in Banzhaf power index, %	Difference in normalized $\kappa$ power index, %
Australian_C	0.3538	0.7389	-3.3777	0.6170	2.0414
Swedish_C	-1.2835	-0.8751	-4.8339	-0.9966	0.5022
Egyptian_C	0.5843	0.8680	-3.0743	0.7468	2.3603
Saudi Arabia	<b>-11.5484</b>	<b>-11.3455</b>	<b>-15.6741</b>	<b>-11.4521</b>	<b>-10.9462</b>
South_African_C	3.2952	3.7093	-1.2453	3.5832	4.2914
Swiss_C	-1.6401	-1.2671	-6.0891	-1.3885	-0.8237
Russia	<b>-11.4582</b>	<b>-11.1646</b>	<b>-19.8582</b>	<b>-11.2732</b>	<b>-15.3641</b>
Iranian_C	-6.4832	-6.0975	-12.2496	-6.2104	-7.3282
Brazilian_C	<b>15.8631</b>	<b>16.2913</b>	<b>8.3043</b>	<b>16.1481</b>	<b>14.3759</b>
Indian_C	<b>19.2470</b>	<b>19.7025</b>	<b>12.0763</b>	<b>19.5564</b>	<b>18.3609</b>
Argentinean_C	-6.1482	-5.6215	-11.1899	-5.7376	-6.2107
Central_African_C	<b>22.4686</b>	<b>22.9265</b>	<b>20.3823</b>	<b>22.7750</b>	<b>27.1350</b>

Table 2 shows the relative differences (in percent) between the QVR and the present distribution of power (taken from Aleskerov, Kalyagin & Pogorelskiy (2010)) for the case of the simple majority decision making rule. As it reveals (see numbers in bold), there is a distinct pattern in changes in power of constituencies that results from the QVR. Namely, absolute power as measured by the Penrose index increases by more than 10% for Indonesian, Brazilian, Indian and Central African constituencies. According to the  $\kappa$  index, the increase for these groupings is less, but still substantial.

Table 2 also demonstrates the indirect effect the preferences to coalesce exhibit on absolute power, which is especially pronounced if *a priori* Penrose index indicates that the expected change is supposed to be in the opposite direction. This is the case for the US, Japan, China, to name a few.

On the other hand, among developed and transition countries there are some that substantially lose in terms of percentage of their absolute power. In particular, France, the UK, Saudi Arabia, Russia, the Iranian constituency, all lose from about 11% of their absolute power even for the preference-free setting (the Penrose index) up to about 20% if preferences are taken into account (the  $\kappa$  index).

The pattern for the normalized indices is generally similar, i.e., countries receiving a relative increase/decrease in their absolute power also receive a gain/loss in their relative power share. There is a notable exception of China, gaining an increase by about 3% in its power share (the case of

normalized  $\kappa$  index), and South African constituency, also gaining some 4.3% of its power share, whereas their absolute power shares decline, as indicated by the  $\kappa$  index.

Altogether, this means that the Quota and Voice Reform indeed exhibits a positive effect on re-distribution of power in favour of several developing countries at the expense of the more developed ones, which corresponds to the stated goals of the Reform. Unfortunately, this is only a relative effect. In terms of absolute differences (see Table 3 below) there are no significant changes.

As Table 3 reveals, the maximal increase in a power share does not exceed 0.7 percentage points (normalized  $\kappa$  index, Indonesian constituency), and there are just four more constituencies that can be said to receive a non-negligible (about 0.35-0.4% of the total power) increase in their power shares: Central African, Brazilian, Indian and Mexican-Spanish ones. If measured by the Banzhaf power index, the increase is even less (e.g., the maximal increase is about 0.44% for Indian constituency). Compared with the overall aggregate shift of 5.42% of the voting share to the developed countries as advocated by the Reform (see Section 2), once could expect a greater change in power distribution.

Note also that the above result is obtained assuming the simple majority rule. As for the qualified majorities of 70% and 85% of the total votes, the changes (in absolute terms) are even smaller.<sup>20</sup> This is due to a higher threshold for a decision making rule that severely limits power of all constituencies and, more importantly, the power to act of the Executive Board as a whole.

To demonstrate the latter effect, I also computed the Coleman's PTA index (see (6) in Section 3), which assesses the probability that a voting body secures a required majority for a decision to pass (the share of winning coalitions in the total number of possible coalitions). For the post-reform Executive Board, PTA=0.0006 under the 85% supermajority rule, compared to 0.4958 if the simple majority one is used. This serves as an additional argument towards lowering the respective threshold. As mentioned in the recent IMF Public Information Notice no. 09/98, a number of EDs either supported, or were open to consider this alternative. A number of others did not, however, as this was seen as weakening the voice of minor-

<sup>20</sup> The character of differences in absolute and relative power is similar to the previous case and hence not reported here.

Table 3. Absolute differences between the QVR proposal and the status-quo (simple majority rule)

Constituency	Difference in the number of votes	Difference in Penrose power	Difference in $\kappa$ power index	Difference in Banzhaf power index	Difference in normalized $\kappa$ power index
US	-1,195	0.0015	-0.0149	0.0232	<b>-0.4521</b>
Japan	4,526	0.0067	-0.0030	0.2117	0.1289
Germany	-1,774	-0.0017	-0.0073	-0.0628	-0.1696
France	<b>-12,673</b>	-0.0162	-0.0130	<b>-0.5379</b>	<b>-0.6002</b>
UK	<b>-12,673</b>	-0.0162	-0.0130	<b>-0.5379</b>	<b>-0.6002</b>
Belgian_C	-692	-0.0004	-0.0037	-0.0185	0.1266
Dutch_C	<b>-5,859</b>	-0.0071	-0.0093	-0.2379	-0.2825
Mexican_Spanish_C	4,387	0.0063	0.0013	0.2012	<b>0.4010</b>
Italian_C	3,308	0.0048	-0.0001	0.1535	0.2198
China	3,159	0.0046	-0.0014	0.1466	0.1091
Canadian_C	-910	-0.0008	-0.0029	-0.0299	0.0093
Indonesian_C	<b>9,010</b>	0.0122	0.0068	<b>0.3962</b>	<b>0.6892</b>
Australian_C	270	0.0007	-0.0022	0.0202	0.0833
Swedish_C	-979	-0.0009	-0.0031	-0.0326	0.0203
Egyptian_C	414	0.0008	-0.0018	0.0227	0.0900
Saudi Arabia	<b>-8,096</b>	-0.0104	-0.0077	-0.3444	-0.3395
South_African_C	2,200	0.0032	-0.0007	0.1025	0.1534
Swiss_C	-1,014	-0.0010	-0.0026	-0.0368	-0.0225
Russia	<b>-6,841</b>	-0.0087	-0.0083	-0.2883	<b>-0.4087</b>
Iranian_C	-3,479	-0.0043	-0.0053	-0.1428	-0.2013
Brazilian_C	<b>8,508</b>	0.0114	0.0032	0.3710	0.3476
Indian_C	<b>10,030</b>	0.0134	0.0044	<b>0.4365</b>	<b>0.4290</b>
Argentinean_C	-2,668	-0.0032	-0.0039	-0.1065	-0.1356
Central_African_C	<b>6,708</b>	0.0089	0.0048	0.2907	<b>0.4046</b>

ity groupings. At the same time, as the Coleman index shows, this (arguably intangible) benefit is achieved at a cost of substantial difficulty in passing important decisions, currently requiring quite a broad support of the 85% of total votes.

## 5 Conclusions

This paper analyzes the consequences of the 2008 Quota and Voice Reform of the IMF via voting power analysis of the Executive Board.

The main finding confirms that the Reform has a positive effect on redistribution of power in favor of several developing countries at the expense of the more developed ones, but only from a relative point of view. As the calculations indicate, in absolute terms this effect is almost negligible, meaning that in fact the voting power distribution does not change.

In addition to the unchanged voting power distribution, a major setback for an efficient reform of the IMF is the 85% majority rule. The Coleman index (“Power of the body to act”) demonstrates that under this rule and the proposed amendments in quota and votes, the Executive Board has severely limited ability to pass decisions, which is especially important at the time of reforms.

Finally, preference-based power indices, used in this paper, are shown to be insightful for the analysis of the (seemingly) unintended implications of the Reform, indicating a possible need to explicitly take into account existing country groupings in the process of developing new proposals for reforming the IMF governing structures.

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**Погорельский К.Б.**

Анализ последствий реформы квот и голосов участников МВФ с точки зрения распределения влияния: Препринт WP7/2010/01. — М.: Изд. дом Государственного университета — Высшей школы экономики, 2010. — 24 с. (на англ. яз.).

В работе исследуются изменения в распределении влияния между участниками Международного валютного фонда (МВФ), связанные со вступлением в силу положений реформы квот и голосов (Quota & Voice Reform), принятой в апреле 2008 г.

С помощью классических индексов влияния, а также индексов, учитывающих предпочтения участников по вступлению в коалиции (Aleskerov, 2006), показано, что хотя изменение относительного влияния в принципе соответствует обозначенным в положении о реформе целям (как, например, увеличение голоса стран с низким уровнем дохода), в абсолютном выражении данное перераспределение влияния едва ли существенно. По-видимому, основными причинами указанной ситуации являются текущее распределение квот и серьезные ограничения на способность Фонда действовать, возникающие вследствие правила принятия решений, требующего для любого изменения в распределении квот практически полной поддержки всеми участниками.

Результаты позволяют в определенной степени объяснить сложность и значительную продолжительность выработки согласованной позиции Исполнительного совета по ряду ключевых вопросов.

Ключевые слова: МВФ, реформа квот и голосов, влияние участников голосования, индексы влияния с учетом предпочтений

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## Notes

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