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APPROACH TO QUOTA
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The Principal Components Approach to Quota Formulation at the IMF

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Abstract

This paper explores and supports the use of the principal components analysis to objectively establish countries' relative economic size and determine variables' weights in a new IMF quota formula. This approach shows a rebalancing of quotas shares in favor of developing countries over time but suggests that PCA-generated quota formulas can only guide and not determine IMF quota structure. The simulation of ad hoc quota increases using PCA-generated quota formulas indicates that a rebalancing of actual quota shares and voting power in favor of developing countries, while preserving low-income countries voting share, is achievable if advanced economies forego increases in their quotas and total basic votes are at least tripled.

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¹ Advisor to the Executive Director, International Monetary Fund (IMF). The views expressed in this paper are my own and should not be attributed to the IMF, its Executive Directors and the countries they represent, or its Management. I am grateful to Aurélie Demba, Laura dos Reis, Abdel Ismael, Paulo Mauro, Ydahlia Metzgen, and Emmanuel Pinto Moreira for helpful discussions and useful comments on previous versions of this paper. I would like to thank also colleagues at the Executive Board of the IMF that gave inputs to this document. I am solely responsible for any errors and omissions. Comments are welcome.

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I. INTRODUCTION

The issue of quota formulation has been on the agenda of the International Monetary Fund (IMF) for several years now, demonstrating the difficulty for its members to find a common ground thereon. This situation is mainly due to the multiple functions assigned to quotas at the creation of the Fund. Indeed, quotas serve four functions. First, a quota is equal to the member's capital subscription to the IMF. Second, it serves also as a reference for the determination of the amount of credit that a member may obtain from the Fund in case of balance of payments crisis. Third and certainly the most important function, quota determines the member's voting power at the Executive Board of the Fund. Fourth, it is the relative share in a general allocation (creation) of Special Drawing Rights (SDRs) the member can expect.²

Quotas are currently determined by a set of five formulas.³ Although the quota formulas have evolved over time, the quota structures themselves did not keep pace with the changes in the world economy, reflecting a complex quota adjustment mechanism and other political constraints. As a result, many countries that have experienced a rapid economic development find themselves with a quota that does not represent their real economic importance in the global economy (for example China).

Consequently, criticisms on the way quotas are determined have been mounting over time, as more and more countries are asking for a better representation in the quota structure. A Quota Formula Review Group (QFRG) was even appointed in 1999 to review the existing quota regime. Unfortunately, the quota formula it has proposed was rejected by a majority of countries as they view that the variables retained in the formula mostly favor industrial countries. Since then, IMF Executive Board meetings on the issue essentially focused on the variables to be included in the formula, with a consensus on the need to limit the size of the definitive set to a few variables. However, an agreement on these variables and corresponding weights –hence on a new quota formula– is yet to be reached.

Nevertheless, by launching in 2004 the implementation of a medium term strategy with a view to redefining its role in a changing and more globalized economic and financial world, the International Monetary Fund (IMF) expressed strong resolve to address the issue of governance within the institution. The objective in this area is to ensure that every member country has a fair voice and quota with a view to enhancing legitimacy and effectiveness of the Fund. To this end, a two-stage approach has been developed and the Board of Governors approved in September 2006 a resolution (thereafter referred to as the Resolution) that endorses this approach. As a result, the (supposedly) most underrepresented members benefited from an ad hoc quota increases as part of the first stage of the above-mentioned

² A detailed presentation of quotas is available at : <http://www.imf.org/external/np/exr/facts/quotas.htm> .

³ See IMF 2000, for a detailed presentation of the quota formulas and their evolution.

approach. The second stage is to address many other issues relevant to the governance of the Fund such as increases in basic votes and a new quota formula by the 2007 annual meetings.⁴

The objective of the paper is to contribute to the debate on quota formulation by proposing a new approach, the principal components approach. This approach consists in using the principal components analysis (PCA) to determine countries' relative position in the world economy and assign weights to variables in a new quota formula. Along with this approach is also proposed a quota adjustment framework for ad hoc quota increases.

The remainder of the paper is organized as follows. Section II presents the principal component approach, which is then applied to six sets of variables in Section III. A simulation of ad hoc quota increases is undertaken in Section IV. Section V concludes.

II. THE PRINCIPAL COMPONENTS APPROACH

A. The Principal Components Approach vs. the Current Approach

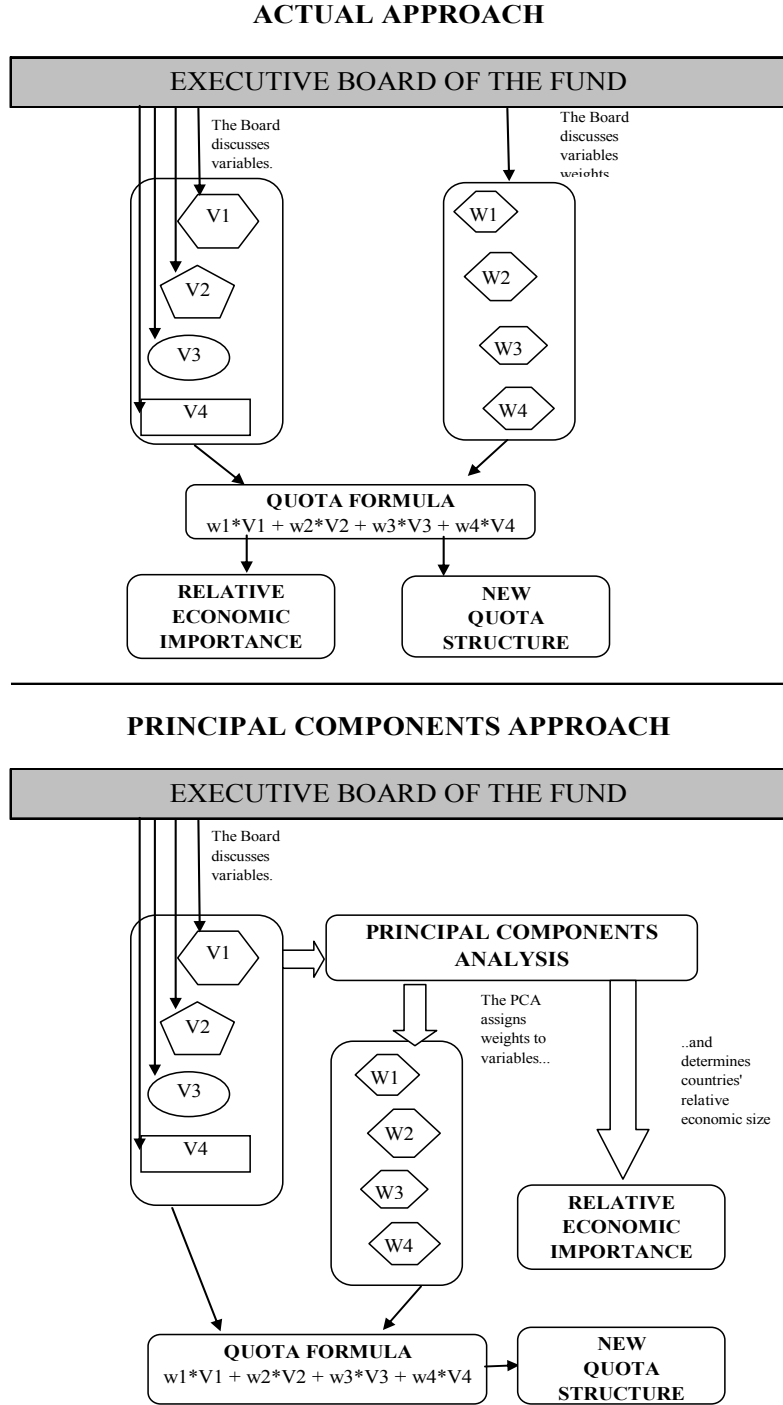
In the approach currently followed in the ongoing quota formulation exercise as shown in Figure 1, the Executive Board of the Fund has to determine the variables entering the new quota formula and assign a weight to each variable. The resulting quota formula should in principle provide a simple and more transparent means of capturing members' relative positions in the world economy, in accordance with the Resolution.

Under the proposed principal components approach, the variables retained by the Board are being applied the PCA to (i) establish members' relative economic importance in the world through an indicator of economic size and (ii) allocate unbiased corresponding weights. The main differences with the previous approach are that weights are the outcome of the PCA – hence the Board would be no more involved in their determination but can always change them– and that the quota formula is no more considered as an indicator of economic size.

To our best knowledge, the idea of using the PCA in quota formulation issues was put forward by Mr. Sengupta, former Executive Director for India, at the time of the Ninth General Quota Review in 1988 (see IMF 1988a). His proposal was to broaden the set of variables with the inclusion of new “need-based” indicators such as a poverty index, and foreign debt and capital account variables, in order to bring about a balance in the quota distribution. To this end, he suggested the use of the PCA to include either an additional formula –that of the first principal component– to the existing set of formulas or an additional variable –the first principal component itself– in a new quota formula.

⁴ The full text of the Resolution is available in Appendix I

Figure 1. The principal components approach vs. the current approach



Source: Author

IMF Staff's assessment of that proposal was that the use of the principal component analysis "*...does not yield quota formula equations that are particularly close approximations of individual members' shares either in calculated quotas or in actual present quotas. Furthermore, an important element of judgment is needed in deciding on the number of principal components to be used in developing such equations and it is difficult to attach economic significance to principal components as variables in a new quota formula*" (See IMF 1988b).

While such an assessment was motivated by the need to avoid significant changes in the quota structure, we are of the view that any quota formula should not aim to reflect preconceived quota distribution, and contrary to what Fund's Staff thought at that time, weights derived from the PCA may have a sense. We do recognize that political considerations cannot be put aside in devising a quota formula and accordingly they are discussed throughout the paper.

B. The Construct of the Composite Indicator

Economic size and quotas

One of the main criticisms to the existing quota regime is its inability to reflect adequately members' relative economic importance in the global economy despite changes since the creation of the Bretton Woods institutions. We share that criticism, but for the following specific reasons. First, in the present context, the notion of economic size and that of quota are distinct. For many, a country's relative economic size refers to the significance of its participation in the world economy, i.e. the share of its output in the world output and in some instances its share in the external trade volume. Quotas, on the other hand, as recalled in the introduction, serve many purposes at the same time, which are not all related to or based on the economic size – even though quotas are sometimes described as a composite indicator of relative economic size of members. Indeed, economic size does not matter much when it comes to accessing IMF resources as the Fund has developed a range of instruments that are essentially based on the type and the magnitude of balance of payments needs a country faces rather than on its economic size. The adoption of a policy on exceptional access cases further evidences this fact. The second reason, which is the consequence of the first reason, is that both notions are not measured on the same basis. Economic size, in the sense abovementioned, is one variable, among others, in the quota formulas.

One would have noticed that the international debate on the quota issue is currently carried on by those fast-growing countries, notably emerging market countries, arguing that they should have a larger say in the decision-making process of the BWIs given their increasing importance in the world economy. And the fact that due consideration is given to this issue is, in our view, an indication that the voting power function of the quotas weighs more than

the other functions and is the main reason motivating that debate. Ultimately therefore, the notions of economic size and quotas cannot be de-linked. However, we think that this link should be strengthened and a first step in this regard would be to measure both notions on the same basis. For quotas to better reflect relative economic size, the latter should be determined before quotas are actually calculated. In other words, there should be a measure of what is a country's relative economic importance or size in the world –in a broader sense– before attempting to translate it into a quota.

Given that there is no measure of such a concept in the Fund, we propose to construct a composite indicator that translates the best this broader notion of economic size. The rationale is that if all differences among countries are reflected in the variables chosen to describe them, then a composite indicator of these variables should reflect these differences as much as possible. This is why we will be using the PCA, which is a method to reduce the dimensionality of a data set by finding a much smaller set of weighted linear composites of original variables (called principal components) that account for most of the variation among the set of original variables –or in other words for most of the diversity among countries.

Dimension reduction

To construct a composite indicator by the PCA, the dimension of the set of variables must be meaningfully reducible to 1, which means retaining only one principal component or composite variable: the first principal component. The reason is that, in the PCA, the first principal is always the weighted linear composite of the original variables with weights chosen so that it accounts for the maximum variation in the original data.

Criteria to decide on the number of principal components to retain

There are several criteria to decide how many principal components to retain (they are well exposed in Jolliffe (2002)). A criterion widely used by practitioners of the PCA is to retain the first principal components which account for a given percentage of the variation in the data set. In order to retain only the first principal component, the latter should account for a significantly high percentage of the total variation among original variables. Here there is an element of judgment about what “significantly high” means in practice. A threshold of 80 percent is usually chosen, but lower thresholds have also been used depending on the circumstances.

Criteria to decide on the variables to retain

The most important element of the PCA is the choice of the data set or variables. The variables to be chosen have to satisfy certain conditions, which are: (i) the variables should be measurable in all countries (if possible) and their measurement should meet the minimum of international standards; and (ii) given the purpose of the exercise, that is the construct of a

composite indicator, the variables should relate to the same concept or notion, which is in the present paper that of economic size or importance. In this paper, all data are supposedly produced according to the international standards, and that the variables under consideration to enter a new quota formula all relate to the same concept.

The Indicator of economic size

Countries' scores on the first principal component will constitute the indicator of economic size (IES). The ranking of countries according to our indicator will determine countries' relative position in the global economy. Hence, the country with the highest score will be considered as having the most important weight in the global economy; the country with the second highest value as being the second most important country economically and so forth.

C. Quota Formula

Weights of the variables in the quota formula

In previous work on quota formulas at the Fund, the choice of weights lacked objectivity as proposed alternative formulas aimed at achieving specific objectives such as a predetermined country ranking (see Mirakhor, 2006) or replication of prevailing quota distributions (see IMF, 2000). In addition, weights assigned to variables in proposed Fund quota formulas outside the IMF were generally the result of authors' judgment and not that of a statistical method.

We argue that a significant part of judgment is avoided when the PCA is used to generate the weights of the variables entering a new formula. Indeed, weights are determined by the analysis itself, given the data set provided, irrespective of any other consideration. No reference is made to existing quota formulas or prevailing quota distributions in that process. Hence, the PCA brings some objectivity about the relative weights of the variables, which could serve as starting point to advance discussions on a definitive set of weights.

Quota formula

As indicated earlier, the first principal component is always the weighted linear composite of the original variables with weights chosen so that the composite accounts for the maximum variation in the original data. Using the weights of this component, a quota formula is derived as follows:

$$\text{Quota formula: } \alpha_1 * x_1 + \alpha_2 * x_2 + \dots + \alpha_p * x_p \quad (1)$$

where $\alpha_i = w_i / (w_1 + w_2 + \dots + w_p)$ with w_1, w_2, \dots, w_p the weights determined by the PCA and $x = (x_1, x_2, \dots, x_p)$ is the set of the original variables, expressed in terms of countries' shares in global totals.

With variables expressed in terms of countries' shares in global totals (as in the QFRG) and the sum of the weights equal to one, the output of the formula is not the amount of quotas but the quota shares, which sum to one. The quota formula is therefore linear in shares. In addition, it keeps invariant the ranking of the IES.

Properties of the quota formula

As expressed in equation (1), the quota formula has all the characteristics the Executive Board of the Fund requested regarding the specification of a new quota formula, that is (see IMF 2001):

- ***simple and transparent*** as it is parsimonious in the number of variables; and
- ***homogeneous*** in the sense that a uniform change in all variables leaves calculated quotas shares unchanged.

Assessment criteria for the quota formula

The acceptance of a quota formula faces two types of constraints: political and technical. Some political constraints are explicitly expressed in the Resolution. As regards the weights of the variables, the Resolution provides that in devising a new quota formula “*consideration should be given to placing higher weight on members' gross domestic product, together with ensuring that other variables, in particular the openness of member countries, also play an important role.*” Therefore any quota formula should respond positively to this provision i.e. ensure that the ***GDP variable has the highest weight*** in the new quota formula. Moreover, there exist other constraints, though not explicitly formalized in an official Fund document but repeatedly mentioned that need to be taken into account when developing a new formula. Among these constraints are:

- ***the quota share of the major shareholder*** should not be lower than 15%;
- ***emerging market economies*** (EMEs) quota shares should increase; and
- a new quota formula should lead to a ***rebalancing of quota shares*** from advanced countries to developing and transition countries;

The technical constraints relate more to the consequences of a new formula on the size of the Fund. Indeed, as it is generally agreed (since the conclusion of the 12th General Review of Quotas) that the size of the Fund is adequate, a new quota formula should not require a significant increase in the total of quotas for the resulting quota distribution to be approved by the membership as the definitive applicable distribution. Hence, one constraint will be ***the minimum rate of increase in total quotas***, defined as the maximum of all rates that would at least maintain individual countries' level of quotas –assuming that no country would accept a decline in its level of quotas. A moderate rate will be considered acceptable.

Moreover, the acceptance of a new quota formula by the membership could prove difficult if it entails significant changes in the quota structure and in rankings. The *average change in ranking*, measured as the root square of the squared differences between the IES ranking and that of the actual quota structure, is proposed to assess the degree of change in the ranking.

III. APPLICATION

A. Variables

As noted earlier, there have been many discussions on the variables to be included in a new quota formula. Some Directors would like four variables to be considered while others Directors think that fewer variables be included. In particular, while all Directors agreed that GDP must be included in the new quota formula, there was less an agreement regarding whether it should be converted in market exchange rate or in purchasing power parity (PPP). Likewise, the variability measure as it is proposed has been criticized and alternative measures of the variability have been proposed (see for example dos Reis, 2005). The proposed openness variable has been seen by some Directors as a duplicate of the GDP, and adjustments were suggested to include financial openness to better reflect integration in the global economy. Its inclusion in the formula has even been questioned as it favors mostly countries with high values in these variables. There has been a debate on whether keeping Reserves in the formula, as some Directors are of the view this variable is no more an indication of a country's ability to contribute to the resources of the Fund.

To illustrate the principal components approach, different sets of data with the four variables abovementioned but measured differently will be explored. In particular, two new measures of GDP and variability never proposed before are introduced:

- a hybrid GDP measure (HGDP) which is defined for each country as the highest of the GDP measured at market exchange rate and the GDP converted in PPP (PPPGDP).
- a hybrid variability variable (HVAR) defined as the highest of the variability of currents receipts (VREC) and that of the variability of current receipts and net capital inflows (VAR)

Since some countries expressed a preference to the PPPGDP over the traditional GDP, and other favour the traditional GDP, it seems logical that the hybrid GDP as proposed leaves each country the opportunity to choose the GDP measure that could increase their quota shares. The hybrid variability is justified on the grounds that for some countries, mainly commodity-exporting countries, the potential need for Fund resources that variable is deemed to reflect is more likely from current account shocks than from capital account shocks. Hence

letting the countries choosing the type of measure that reflects the most their potential need for Fund resources seems a best option.

The data sets that will be used are:

- Data Set I (DS I) : GDP, Reserves (RES), Openness (OPEN) and VAR
- Data Set II (DS II) : GDP, RES, OPEN and VREC
- Data Set III (DS III) : GDP, RES, OPEN and HVAR
- Data Set IV (DS IV) : HGDP, RES, OPEN and VAR
- Data Set V (DS V) : HGDP, RES, OPEN and VREC
- Data Set VI (DS VI) : HGDP, RES, OPEN and HVAR

Data are provided by the Fund. These data are those available at end-2004 and concern the whole membership of the Fund (184 countries) as of end-2004 (Statistical Appendix I). All IMF statistical methodologies and terminologies are implicitly adopted in this paper. A distribution of all variables with respect to regional country groupings is presented in Table 1 below. Countries' classifications are detailed in Appendix V.

B. The Indicator of Economic Size

Interpretation of the output of the PCAs

Table 2 shows that the proportion of total variance accounted for by the first principal component for each of the data sets is high, between 75 and 77 percent⁵. This means that the first principal component objectively explains 75 to 77 percent of the differences among countries and that 23 to 25 percent of the information contained in the original variables is lost by aggregating them in one composite variable. Nevertheless, the first component clearly indicates an overall size dimension among the countries; which in our case, given the nature of our variables, could be interpreted as the country's relative economic size or importance in the global economy.⁶ Therefore, this principal component will serve as the indicator of economic size and the proportion of total variance it explains indicates a high level of objectivity of the indicator.

⁵ PCAs have been performed with the SPAD software. More information on this software is available at www.spadsoft.com. PCAs can also be performed in other softwares such as Eviews, SPSS, Givewin.

⁶ The second component in such circumstances highlights contrasts between the countries. As Reserves is highly correlated with that component in all six cases, it therefore displays contrast between the most important countries, with respect to the level of reserves. See Appendix II for a more detailed analysis.

Table 1. Distribution of variables in world totals by country groupings

	Quota	Quota	Calculated quotas (F5)	GDP		PPPGDP		Hybrid	Reserves	Current payments	Current receipts	Current payments plus current receipts	Variability of current receipts and net capital inflows	Variability of current receipts	Hybrid Variability
	shares before Singapore	shares after Singapore		2004	2002-04	2004	2002-04	2002-2004							
				2004	2002-04	2004	2002-04	2002-2004							
Advanced economies	61.59	60.51	67.08	76.27	76.90	50.49	51.53	52.48	43.35	70.89	69.13	70.01	61.34	58.14	59.94
Major Advanced (G7)	46.03	45.22	47.32	63.64	64.88	42.36	43.22	43.85	34.36	50.32	47.66	49.00	43.12	36.86	40.53
USA	17.38	17.08	16.80	28.72	30.35	20.47	20.69	20.26	2.71	18.14	13.42	15.80	20.37	11.83	17.37
Other advanced	15.56	15.29	19.76	12.63	12.02	8.13	8.31	8.64	8.99	20.57	21.47	21.02	18.22	21.27	19.40
Developing countries	30.87	32.08	27.61	20.00	19.72	43.29	42.38	41.55	48.80	24.01	25.58	24.79	31.98	34.93	33.46
Africa	5.49	5.40	2.43	1.68	1.56	3.37	3.37	3.29	3.27	1.96	2.10	2.03	4.11	4.42	4.39
Asia	10.29	11.50	15.27	10.38	10.28	28.63	27.74	27.17	33.19	13.37	14.31	13.84	13.52	15.14	13.25
Middle East	7.63	7.60	4.73	3.03	2.90	3.77	3.71	3.70	5.84	3.53	4.12	3.82	6.30	9.15	8.52
Western Hemisphere	7.46	7.59	5.18	4.91	4.98	7.52	7.55	7.39	6.50	5.15	5.06	5.11	8.06	6.22	7.30
Transition economies	7.54	7.41	5.31	3.72	3.38	6.21	6.09	5.97	7.86	5.11	5.29	5.20	6.68	6.93	6.60

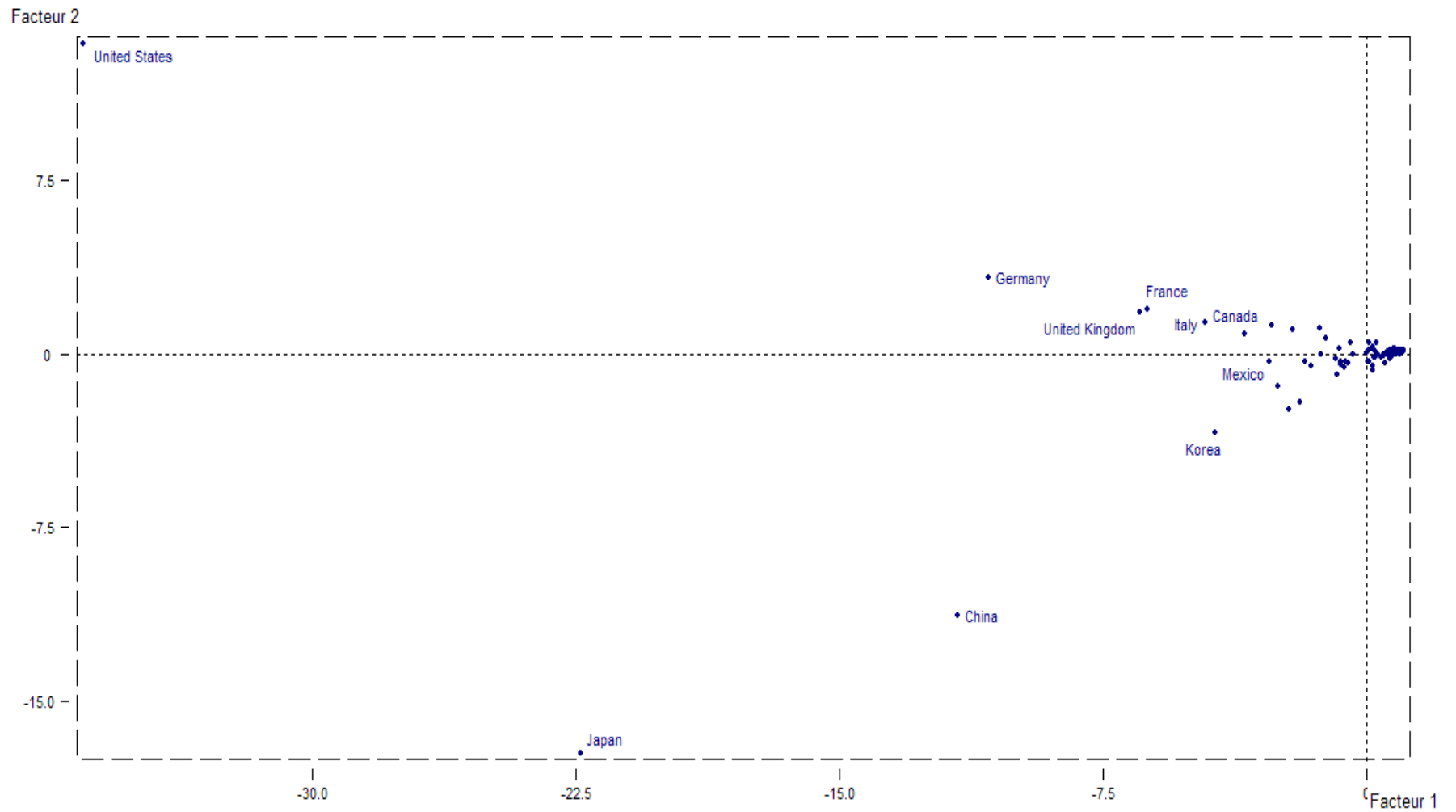
Source: IMF

Table 2. Principal Component Analysis - Output

	Data Set I		Data Set II		Data Set III		Data Set IV		Data Set V		Data Set VI	
	2nd		2nd		2nd		2nd		2nd		2nd	
	1st Principal Component	Principal Component	1st Principal Component	Principal Component	1st Principal Component	Principal Component	1st Principal Component	Principal Component	1st Principal Component	Principal Component	1st Principal Component	Principal Component
Eigenvalues (Variance)	13.01	3.59	12.39	3.45	12.45	3.53	10.98	3.08	10.61	2.86	10.53	2.95
Proportion of variance explained	0.76	0.21	0.76	0.21	0.76	0.22	0.75	0.21	0.76	0.20	0.75	0.21
Cumulative proportion	0.76	0.98	0.76	0.97	0.76	0.98	0.75	0.96	0.76	0.96	0.75	0.96
Variables highly correlated with the principal component	GDP OPEN VAR	RES	GDP OPEN VREC	RES	GDP OPEN HVAR	RES	HGDP OPEN VAR	RES	HGDP OPEN VREC	RES	HGDP OPEN HVAR	RES

Source: Author's calculations

Figure 2. Swarm of countries in the plane formed by the first two principal components



Source: Author

Figure 2 shows the swarm of countries in a plane formed by the first two principal components using the Data Set I. The two components account for 98 percent of the differences among countries. The swarm indicates countries' relative positions and those of the top 10 countries are indicated. Scores of the indicator are obtained by an orthogonal projection on the first principal component (which is the dotted horizontal line in the figure).

Ranking

The scores of the composite indicator are used to establish a ranking of the countries (Statistical Appendix II). Table 3 shows that the six rankings are broadly similar for the top 20 important countries.⁷ A striking finding is that the top 6 countries are the same in all data sets, with a slight but significant change compared to the actual ranking. While the two most important countries remain the same (US and Japan), China stands firm at the third rank in all data sets, confirming its strong dynamism in the international scene. In all sets, France exits the top 5 to stand at the 6th place, behind United Kingdom (5th) and Germany (4th). Another finding is that the top 9 rankings are the same for data sets including GDP.

Sixteen countries remain in the top 20 in the six variants of our indicator. One country (Singapore) which has experienced a strong economic growth over the past decades is entering the top 20 in the six sets. Ireland enters the top 20 in four sets. Korea ranks at least 8th in any set from the 19th place in the actual ranking. Mexico experienced the second greater jump within the top 20 with at least 4 places gained and China is the third country to get the highest jump with a gain of 3 places.

The impact of the hybrid GDP is obvious with respect to the developing countries in the top 20. With the exception of Venezuela and Saudi Arabia, all developing countries have a better ranking in the top 20. In particular, India and Brazil gains at least 5 and 3 places respectively, in data sets with HGDP.

There is also a similarity of results when it comes to the most important gains in economic importance. The top 20 jumps show that actually four countries, namely Botswana, Equatorial Guinea, Estonia and Turkmenistan, are among the five countries with the highest gains in all sets. In general, the reasons behind these top 20 gains are diverse ranging from sound macroeconomic policy implementation to discovery and exploitation of natural resources.

On the other hand, many factors including conflicts over the past decades may explain the most important declines in ranking. One could notice that most of the countries dropping in the ranking are from Africa.

⁷ If we consider that actual quotas reflect the position in the global economy.

Overall, the six rankings give a very good picture of countries relative importance in the world economy, especially in the top twenty spots. In addition, those rankings are quite similar, which allows us to conclude that the use of the PCA to establish countries' relative economic weights is worth doing and hence, the IES, in its various specifications, is objective.

C. Quota Formulas

Weights of the variables

A look at variables weights in Table 5 shows that the GDP variable is assigned a higher weight by the PCA in all sets, which is due to the fact that this variable in all sets has the highest variance.⁸ However, this weight varies only between 0.29 when the hybrid form of the GDP is used and 0.35 when GDP is expressed at market exchange rate.

Whatever the set, the weight of the openness variable is non negligible and is interestingly fixed at around 0.22-0.23. Similarly, the 3 Variability measures have the same weights in the two formulas they each enter in. For example, the current receipts and net capital inflows have a constant weight of 0.21 with either form of GDP. Consequently, Reserves appears as being given the residual weight, which varies from 0.20-0.23 when GDP at market exchange rate is used to 0.26-0.27 with HGDP. Overall, GDP has the highest weight in all formulas. Openness has an important weight too, though this weight does not differ significantly from those of Variability and Reserves.

Quota distributions

The diverse sets of weights are used to calculate individual quota shares. Countries' quota shares vary across formulas. Nevertheless, regarding the top 20 countries, the USA has lower than actual quota shares in data sets with HGDP and those shares are lower than 15 percent. Among G7 countries, Japan is the only country always experiencing an increase in its quota share while those of France, UK and Italy always decline (see Statistical Appendix III). In the three data sets including GDP, Japan ends up with a doubling of its actual quota share. At least four out of the five countries that are recording the highest increases in their quota shares are from Asia, confirming assertions that this region is a rising economic power.

⁸ From an economic standpoint, GDP should probably have the highest weight, independently of whether the cross-country variability of GDP is higher or lower than that of the other variables in the data sets. However, the PCA would give the largest weight to the variable with the greatest cross-country variation –irrespective of other considerations–, which happens to be GDP in all our data sets.

Table 3. Indicator of Economic Size – The top 20 rankings

Ranking	Actual	Data Set I		Data Set II		Data Set III		Data Set IV		Data Set V		Data Set VI	
	Country	Country	Gain(+) / Loss (-)	Country	Gain(+) / Loss (-)	Country	Gain(+) / Loss (-)	Country	Gain(+) / Loss (-)	Country	Gain(+) / Loss (-)	Country	Gain(+) / Loss (-)
1	United States	United States	0	United States	0	United States	0	United States	0	United States	0	United States	0
2	Japan	Japan	0	Japan	0	Japan	0	Japan	0	Japan	0	Japan	0
3	Germany	China	3	China	3	China	3	China	3	China	3	China	3
4	France	Germany	-1	Germany	-1	Germany	-1	Germany	-1	Germany	-1	Germany	-1
5	United Kingdom	United Kingdom	0	United Kingdom	0	United Kingdom	0	United Kingdom	0	United Kingdom	0	United Kingdom	0
6	China	France	-2	France	-2	France	-2	France	-2	France	-2	France	-2
7	Italy	Italy	0	Italy	0	Italy	0	India	6	Korea	12	Korea	12
8	Saudi Arabia	Korea	11	Korea	11	Korea	11	Korea	11	India	5	India	5
9	Canada	Canada	0	Canada	0	Canada	0	Italy	-2	Italy	-2	Italy	-2
10	Russia	Mexico	6	Netherlands	1	Netherlands	1	Russia	0	Russia	0	Russia	0
11	Netherlands	Spain	6	Mexico	5	Mexico	5	Canada	-2	Canada	-2	Canada	-2
12	Belgium	Russia	-2	Russia	-2	Spain	5	Mexico	4	Mexico	4	Mexico	4
13	India	India	0	Spain	4	Russia	-3	Brazil	5	Netherlands	-2	Brazil	5
14	Switzerland	Netherlands	-3	India	-1	India	-1	Spain	3	Singapore	34	Netherlands	-3
15	Australia	Singapore	33	Singapore	33	Singapore	33	Singapore	33	Brazil	3	Singapore	33
16	Mexico	Brazil	2	Switzerland	-2	Brazil	2	Netherlands	-5	Spain	1	Spain	1
17	Spain	Switzerland	-3	Belgium	-5	Switzerland	-3	Switzerland	-3	Switzerland	-3	Switzerland	-3
18	Brazil	Ireland	32	Australia	-3	Belgium	-6	Ireland	32	Belgium	-6	Belgium	-6
19	Korea	Australia	-4	Brazil	-1	Australia	-4	Indonesia	4	Malaysia	11	Malaysia	11
20	Venezuela	Belgium	-8	Malaysia	10	Ireland	30	Malaysia	10	Indonesia	3	Indonesia	3

Source: Author's calculations

Table 4. Indicator of Economic Size – The top 20 jumps in country rankings

Ranking	Data Set I		Data Set II		Data Set III		Data Set IV		Data Set IV		Data Set IV	
	Country	Gain	Country	Gain	Country	Gain	Country	Gain	Country	Gain	Country	Gain
1	Botswana	63	Botswana	67	Botswana	63	Botswana	63	Botswana	68	Botswana	64
2	Estonia	49	Estonia	54	Estonia	50	Turkmenistan	46	Turkmenistan	53	Turkmenistan	48
3	Turkmenistan	45	Turkmenistan	51	Turkmenistan	49	Estonia	43	Estonia	49	Estonia	47
4	Equatorial Guinea	43	Albania	42	Equatorial Guinea	42	Equatorial Guinea	42	Equatorial Guinea	41	Equatorial Guinea	41
5	Albania	38	Equatorial Guinea	42	Albania	41	Ethiopia	65	Albania	65	Albania	65
6	Luxembourg	36	Luxembourg	36	Luxembourg	35	Cambodia	35	Luxembourg	36	Cambodia	35
7	Bahrain	35	Bahrain	36	Bahrain	34	Albania	35	Bahrain	36	Luxembourg	34
8	Singapore	33	Cambodia	35	Singapore	33	Luxembourg	34	Ethiopia	36	Bahrain	34
9	Ethiopia	33	Singapore	33	Lebanon	32	Singapore	33	Cambodia	36	Singapore	33
10	Ireland	32	Lebanon	33	Ethiopia	31	Bahrain	33	Singapore	34	Ethiopia	33
11	Lebanon	32	Ethiopia	33	Cambodia	31	Ireland	32	Nepal	34	Lebanon	31
12	Cambodia	31	Lithuania	31	Ireland	30	Lebanon	32	Lebanon	32	Nepal	30
13	Lithuania	27	Ireland	29	Lithuania	29	Nepal	29	Lithuania	29	Lithuania	27
14	Cyprus	24	Malta	29	Oman	26	Lithuania	25	Ireland	26	Ireland	26
15	Nepal	24	Oman	26	Cyprus	24	Bhutan	23	Oman	24	Oman	25
16	Macedonia, FYR	24	Macedonia, FYR	24	Malta	24	Turkey	21	Bhutan	24	Bhutan	24
17	Turkey	21	Latvia	23	Swaziland	24	Oman	21	Malta	22	Slovenia	20
18	Malta	21	Nepal	23	Macedonia, FYR	23	Jordan	20	Paraguay	22	Cyprus	20
19	Bhutan	21	Swaziland	23	Nepal	22	Cyprus	19	Burkina Faso	21	Malta	20
20	Oman	20	San Marino	23	San Marino	22	Macedonia, FYR	19	Swaziland	21	Burkina Faso	20

Source: Author's calculations

No African country appears in the top quota increases but many of them are experiencing the most significant declines in quota shares. Another interesting finding is that many of those countries that see their quotas share shrinking are oil-producing countries. While the appearance of Kuwait or even Iraq could be understandable given the turbulences in that region, this finding may seem counterintuitive as one would expect them among the most dynamic countries given their significant natural resources.

Country groupings and Executive Board constituencies

The new quota structure in terms of country groups and Executive Board constituencies are shown in Table 5. The quota structures show an increase in the share of advanced economies when GDP at market exchange rate is used. Conversely, when the Hybrid GDP is included in the formula, advanced countries are losing quota shares in favor of developing countries –and hence, there is quota rebalancing. In all quota formulas, the transition countries as a group have a lower quota shares but this decrease is lower with HGDP.

The increase in the share of advanced economies is essentially owing to those of Japan, Ireland and Spain. In the developing and transition countries groups, many African, Middle East and Transition countries would lose a significant size of their quota shares. Conversely, Asian developing countries would benefit from the sharp increase in China's share and those of Korea and Singapore. When the Hybrid GDP is included in the formula, the group of developing Asian countries at the IMF tops the United States.

Implications for the size of the Fund

Should any PCA-derived quota structure be retained as such, this would imply a significant increase in total quotas. As shown in Table 5, the size of the quotas would have to be at least 27 times higher than what it is presently. It would be the case because many countries with already a small quotas shares would have them further reduced, thus adding to the increase of the Fund size to maintain their number of quotas. This increase in the size is unfortunately not a desired outcome as the Executive Board agreed that the actual size of the Fund is broadly adequate.

D. Alternative Quota Formulas

The facts that a quota rebalancing is only achieved when HGDP is included in the formula and that all quota distributions require a significant increase in total quotas to be applicable may rightly question the appropriateness of the PCA-generated sets of weights for the purpose of weight determination. Consequently, it could be useful to explore alternative sets of weights to see whether it is possible to improve these findings.

Table 5. Quota formulas : Weights, Quotas shares by country groupings and Executive Board constituencies, and Assessment criteria

	Quotas before Singapore	Quotas after Singapore	Calculated quotas	DS I	DS II	DS III	DS IV	DS V	DS VI
<i>Weights of variables</i>									
Hybrid GDP, 2002-2004							0.29	0.30	0.30
GDP, 2002-2004				0.35	0.36	0.35			
Reserves				0.20	0.23	0.21	0.26	0.29	0.27
Openness				0.22	0.23	0.22	0.22	0.22	0.22
Variability of receipts and net K				0.23			0.23		
Variability of receipts					0.18			0.18	
Hybrid variability						0.21			0.21
<i>Quota shares, in percent</i>									
Advanced economies	61.591	60.512	67.080	64.969	64.118	64.630	56.052	54.780	55.493
Major Advanced (G7)	46.027	45.222	47.323	50.170	49.081	49.697	42.372	40.938	41.732
USA	17.382	17.077	16.795	19.273	17.251	18.490	14.792	12.570	13.903
Other advanced	15.563	15.291	19.757	14.800	15.037	14.933	13.681	13.842	13.762
Developing countries	30.869	32.080	27.610	29.578	30.403	29.951	37.497	38.694	38.065
Africa	5.493	5.397	2.427	2.603	2.584	2.628	3.197	3.209	3.233
Asia	10.292	11.497	15.274	16.445	17.298	16.573	22.603	23.724	22.890
Middle East	7.628	7.599	4.725	4.492	4.933	4.925	4.882	5.358	5.321
Western Hemisphere	7.456	7.586	5.184	6.038	5.588	5.825	6.816	6.403	6.621
Transition economies	7.540	7.408	5.313	5.453	5.479	5.420	6.451	6.526	6.441
Emerging markets	20.290	21.685	22.157	25.221	25.498	25.047	32.617	33.218	32.633
IMF Low-income countries	7.705	7.570	3.590	4.124	4.138	4.131	6.129	6.226	6.180
WB Low-income countries	6.666	6.549	3.011	3.631	3.637	3.631	5.553	5.636	5.596
USA	17.382	17.077	16.795	19.273	17.251	18.490	14.792	12.570	13.903
Japan	6.229	6.120	7.525	12.010	12.675	12.092	11.582	12.303	11.701
Germany	6.086	5.980	6.953	6.062	5.590	5.811	5.174	4.640	4.894
United Kingdom	5.025	4.937	5.176	3.855	4.198	4.116	3.177	3.470	3.414
France	5.025	4.937	4.334	3.740	3.847	3.776	3.078	3.143	3.092
Belgium	5.109	5.124	7.009	4.799	4.773	4.834	4.863	4.829	4.890
Netherlands	4.791	4.707	4.402	3.090	3.400	3.357	3.138	3.440	3.398
Venezuela	4.257	4.443	4.853	4.576	4.505	4.472	4.362	4.277	4.251
Italy	4.174	4.101	4.540	3.942	3.899	3.894	3.440	3.362	3.375
Canada	3.633	3.569	4.896	3.658	3.667	3.672	3.390	3.382	3.389
Sweden	3.476	3.415	3.972	3.505	3.627	3.551	3.342	3.460	3.382
Australia	3.226	3.764	4.482	4.627	4.872	4.702	4.820	5.084	4.904
Egypt	3.164	3.108	2.465	2.249	2.479	2.423	2.374	2.621	2.549
Saudi Arabia	3.269	3.211	1.063	0.747	1.015	0.995	0.744	1.014	0.989
Indonesia	3.089	3.035	5.395	4.571	4.625	4.476	5.480	5.582	5.408
Kenya	3.162	3.107	1.364	1.311	1.354	1.333	1.623	1.682	1.650
China	2.980	3.719	5.197	6.513	7.019	6.667	9.903	10.547	10.145
Switzerland	2.800	2.751	2.527	2.435	2.417	2.378	2.533	2.520	2.479
Russia	2.782	2.733	1.519	1.834	1.911	1.844	2.280	2.380	2.301
Iran	2.429	2.387	1.275	1.547	1.689	1.641	2.049	2.217	2.156
Brazil	2.404	2.362	1.518	2.055	1.764	1.958	2.537	2.265	2.450
India	2.391	2.349	1.381	1.859	1.970	1.881	3.254	3.416	3.309
Peru	1.960	1.926	0.942	1.240	1.068	1.161	1.484	1.324	1.411
Rwanda	1.158	1.138	0.420	0.500	0.386	0.477	0.580	0.471	0.558
<i>Assessment criteria</i>									
GDP weight is the highest				Yes	Yes	Yes	Yes	Yes	Yes
The share of the US > 15%				Yes	Yes	Yes	No	No	No
EMEs quota shares is higher				Yes	Yes	Yes	Yes	Yes	Yes
Rebalancing of quotas				No	No	No	Yes	Yes	Yes
Increase in Fund size (times)				27	28	28	30	32	32
Average change in ranking				18	19	18	17	18	17

Sources: IMF and Author's calculations

In order to achieve quota rebalancing, more weight is to be put on variables where developing countries have higher shares, which are Reserves and Variability. However, these two variables are already assigned a total weight of 0.42 by the PCA when considering Data Set I, whereas their weight is 0.21 in the (existing) five formulas. Moreover, the Resolution explicitly provides that GDP and Openness should have together a significantly high weight. Therefore, any set of weights that leans towards higher weight for Reserves and Variability would appear as moving away from the content of the Resolution. On the other hand, increasing the weight of either GDP or Openness would seem to be more in line with the spirit of the Resolution. Accordingly, we propose to examine such alternative sets.

In the PCA, alternative sets of weights are treated as perturbations to the set generated by the analysis. In particular attributing specific values to weights leads to a reduction of the objectivity and stability of the IES. Krzanowski (1984) shows that perturbations do not affect significantly the stability of the first principal component as long as, geometrically speaking, the angle θ between the PCA-calculated vector of weights (eigenvector) and the alternative vector of weights is less than θ_m defined as follows:

$$\cos \theta_m = \left[1 + \frac{\lambda_1 - \lambda_{1p}}{(\lambda_1 - \lambda_2)} \right]^{-1/2} \quad (2)$$

where λ_1 is the PCA-calculated variance of the first principal component;
 λ_{1p} is the perturbation-calculated variance of the first principal component; and
 λ_2 is the PCA-calculated variance of the second principal component.

In line with previous findings on weights, we assume that weights of Openness and Variability are well estimated by the PCA and are fixed at 0.22 and 0.23 respectively. Then, the weight of GDP is increased progressively until stability of the principal components is no more maintained according to Krzanowski's criterion. Since the weights must add up to one, Reserves has the residual weight.

Table 6 shows that the Krzanowski's criterion is observed up to a weight of GDP between 0.45 and 0.50. Nevertheless, it is a close call as angles θ are very close each time GDP weight is changed. In addition, the rebalancing of quota shares is not achieved in the alternative quota formulas as predicted earlier and the increase in the Fund size needed to make these alternative quota formulas applicable remains significantly high. We conclude that changing the set of weights is not an appropriate way to meet the conditions on quota shares and hence the weights generated by the PCA can be considered as the most objective weights for a new quota formula.

Table 6. Alternative quota formulas for Data Set I

	DS I	AQF 1	AQF 2	AQF 3
<i>Weights of variables</i>				
GDP, 2002-2004	0.35	0.40	0.45	0.50
Reserves	0.20	0.15	0.10	0.05
Openness	0.22	0.22	0.22	0.22
Variability of receipts and net K	0.23	0.23	0.23	0.23
<hr/>				
Variation explained by 1st PC (in %)	76.49	75.34	72.59	68.85
Variation explained by 2nd PC (in %)	21.12			
<hr/>				
<i>Assessment criteria</i>				
Maximum angle θ_m (in degrees)		8.76	15.16	20.56
Effective angle θ (in degrees)		7.90	14.73	20.85
GDP weight is the highest	Yes	Yes	Yes	Yes
The share of the US > 15%	Yes	Yes	Yes	Yes
Rebalancing of quotas	No	No	No	No
Increase in Fund size (times)	27	26	26	25
Average change in ranking	18	18	17	17

Source: Author's calculations

Table 7. Evolution of variables weights for Data Set I

	1999	2004		2005
Number of countries	183	184	185	185
<hr/>				
Proportion of variance explained by the 1st principal component (in percent)	87.09	76.49	76.50	75.13
<hr/>				
<i>Weights of variables, in percent</i>				
GDP	37.35	34.71	34.71	33.92
Openness	24.27	21.56	21.56	21.56
Variability of receipts and net K	21.01	23.49	23.49	24.26
Reserves	17.38	20.24	20.25	20.27
<hr/>				
<i>Quota shares, in percent</i>				
Advanced economies	67.49	64.97	64.96	63.16
Major Advanced (G7)	51.46	50.17	50.17	48.02
USA	18.78	19.27	19.27	18.49
Other advanced	16.03	14.80	14.80	15.14
Developing countries	27.57	29.58	29.58	30.90
Africa	2.24	2.60	2.60	2.57
Asia	14.03	16.45	16.45	17.64
Middle East	4.82	4.49	4.49	4.67
Western Hemisphere	6.49	6.04	6.04	6.01
Transition economies	4.94	5.45	5.46	5.94
<hr/>				
Emerging markets	22.61	25.22	25.22	26.88
IMF low-income countries	3.58	4.12	4.12	4.02
WB low-income countries	3.08	3.63	3.63	3.53

Source: Author's calculations

E. Evolution of Variables Weights

A note of caution is necessary regarding the use of the PCA. Its output holds only for the period of interest. Indeed, the output of a PCA (particularly ranking and weights) is similar to a snapshot. It is unlikely to remain the same in other periods. To illustrate this point, the principal components approach has been applied to Data Set I at different dates (Table 7).

At the outset, we can see that the output of the PCA for 2004 does not change if there are 184 or 185 countries in the data set. The proportion explained by the first principal component has been on a downward path between 1999 and 2005, although it remains relevant to reflect differences between countries. Regarding weights, GDP has the highest weight at all years and Reserves the lowest. Interestingly, the weights of GDP and Openness are declining over time while those of Variability and Reserves have an opposite trend.

The changes in weights over time are clearly in favor developing and transition countries. Indeed, advanced countries, especially G7 countries, are losing economic importance, whereas developing and transition countries, notably emerging Asian countries, are increasing their presence in the world economy. These findings reinforce the assertion that a rebalancing of economic power at country grouping level is taking place and further confirms that the PCA yields objective results regarding countries' relative position in the global economic and weights of the variables used for this purpose.

F. Preliminary Assessment of the Principal Components Approach

The principal components approach yields objective results regarding countries' relative economic importance and the weights of the variables, captures very well developments in the world economy. However, using these weights in quota formulas leads to quota distributions requiring a significant increase in the size of Fund, whereas the Executive Board of the Fund found no need for such increase. Moreover, the political constraints, notably the rebalancing of quotas, are not always met. Consequently, we conclude that quota formula is likely to continue to guide but not determine the quota structure of the Fund.

This finding regarding the guidance role of the quota formula is not surprising as the Resolution hints that one purpose of a new quota formula is to guide further ad hoc quota increases in the second phase of the reform on quota and voice. Therefore, we propose to examine in the next section this guidance role by simulating ad hoc quota increases, using the framework of the Resolution.

IV. SIMULATION OF AD HOC QUOTA INCREASES

The Resolution stipulates that the new quota formulation and increases in basic votes are to be undertaken simultaneously during the second phase of the quota and voice reform, with a view to undertaking a new round of ad hoc quota increases at the end of this phase. We propose to simulate ad hoc quota increases when the PCA-derived quota formulas are used and the number of basic votes is augmented. The assessment will be based on the same criteria than those used in the previous section plus four new criteria:

- the *voting power of low-income countries is to be preserved* at the completion of the reform,
- the *voting power of EMEs is to increase*,
- a *15 percent floor for the voting power of the US*, and
- a *rebalancing of the voting power* from advanced countries to developing and transition economies.

However, before undertaking the simulation, a method to identify countries that are the most out-of-line and thus eligible for quota increases is proposed and a quota adjustment procedure is then presented.

A. Quota Adjustment Framework

Eligibility for quota increases

What would certainly matter the most in a quota adjustment exercise is the method to select eligible countries for quota increases. Eligible countries are those that are the most out-of-line and underrepresented with respect to the actual quota distribution. One measure of out-of-lineness consists in calculating differences between calculated and actual quotas (CAD, Table 8). Another measure is the calculated-to-actual ratio (CAR, Table 9). We argue that both measures capture very well countries' out-of-liness. Applying these measures shows that 11 countries are in the top 20 underrepresented countries in both difference and ratio.

To get a better view of the out-of-lineness, a scatter plot representation of the two above-mentioned measures is presented in Figure 3 using Data Set I. The figure displays clear outliers, which could be identified as either the most underrepresented or overrepresented countries according to both measures.

To select the underrepresented countries, we propose the **radar screen** or radius method, which consists in drawing a circle whose center would be the intersection of the two axes in the scatter plot representation, as presented in Figure 3. Countries outside the circle in the upper right quadrant –i.e. whose CAD and CAR are positive and distance to the origin of the

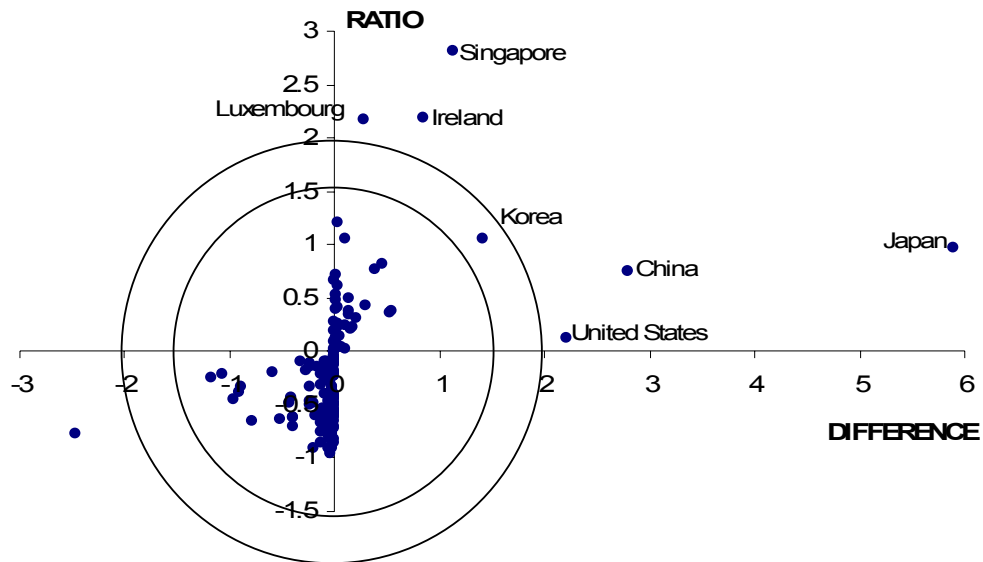
scatter plot representation is greater than the radius– will be considered as the most out of line and underrepresented. Conversely, countries within the circle will be considered as broadly in line with the relative position in the world economy. The ideal would be if all countries get together (graphically speaking) with a small radius, after quotas adjustment.

Specifically, the distance of any point to the origin of scatter plot representation is calculated as follows:

$$Distance = [CAD^2 + (CAR - 1)^2]^{1/2} \quad (3)$$

The advantage of the radar screen is that it gives a clear visualization of out-of-line countries and is based solely on the outcome of the new formula. It is therefore neutral as it treats all countries the same way. Another advantage is that it can be applied to any pair of quantitative indicators from which a decision is to be made.

Figure 3. The radar screen for Data Set I



Source: Author

Adjustment procedure

To bring quotas of most out-of-line countries more in line with their relative position in the world economy, we propose to use the *uniform proportional reduction* (UPR) adjustment methodology used for the September 2006 ad hoc quota increases. The objective is to have a uniform proportional reduction in the gap between calculated and actual quota shares. In

Table 8. Quota formulas – Calculated to actual differences: the top 20 out-of-line countries

Data Set I		Data Set II		Data Set III		Data Set IV		Data Set V		Data Set VI	
Country	Diff	Country	Diff	Country	Diff	Country	Diff	Country	Diff	Country	Diff
Japan	5.89	Japan	6.55	Japan	5.97	China	6.18	China	6.83	China	6.43
China	2.79	China	3.30	China	2.95	Japan	5.46	Japan	6.18	Japan	5.58
United States	2.20	Korea	1.59	Korea	1.46	Korea	1.60	Korea	1.80	Korea	1.66
Korea	1.41	Singapore	1.12	United States	1.41	Singapore	1.26	Singapore	1.28	Singapore	1.20
Singapore	1.12	Ireland	0.64	Singapore	1.05	India	1.04	India	1.20	India	1.10
Ireland	0.84	Mexico	0.49	Ireland	0.69	Ireland	0.78	Ireland	0.58	Ireland	0.63
Spain	0.53	Spain	0.44	Spain	0.47	Thailand	0.57	Thailand	0.56	Thailand	0.54
Mexico	0.51	Malaysia	0.37	Mexico	0.44	Turkey	0.54	Malaysia	0.51	Turkey	0.47
Turkey	0.45	Thailand	0.35	Turkey	0.38	Mexico	0.52	Mexico	0.49	Malaysia	0.46
Thailand	0.38	Turkey	0.29	Thailand	0.34	Malaysia	0.42	Turkey	0.38	Mexico	0.45
Malaysia	0.30	Luxembourg	0.28	Malaysia	0.33	Brazil	0.41	Luxembourg	0.27	Brazil	0.35
Luxembourg	0.28	Denmark	0.23	Luxembourg	0.27	Poland	0.28	Poland	0.25	Luxembourg	0.26
Poland	0.20	United Arab Emii	0.18	Denmark	0.21	Spain	0.27	Brazil	0.21	Poland	0.25
Denmark	0.17	United States	0.17	United Arab Emii	0.17	Luxembourg	0.27	Denmark	0.21	Spain	0.19
Norway	0.16	Norway	0.17	Poland	0.16	Indonesia	0.19	Indonesia	0.21	Denmark	0.18
Czech Republic	0.14	Poland	0.16	Norway	0.14	Czech Republic	0.19	United Arab Emii	0.19	Indonesia	0.18
United Arab Emii	0.14	Israel	0.13	Czech Republic	0.12	Denmark	0.15	Philippines	0.16	Czech Republic	0.18
Greece	0.13	Lebanon	0.10	Israel	0.11	United Arab Emii	0.14	Spain	0.16	United Arab Emii	0.17
Israel	0.10	Czech Republic	0.10	Lebanon	0.10	Philippines	0.14	Czech Republic	0.16	Philippines	0.15
Lebanon	0.10	Slovak Republic	0.06	Greece	0.09	Norway	0.13	Norway	0.15	Israel	0.13

Source: Author's calculations

Table 9. Quota formulas – Calculated to actual ratios: the top 20 out-of-line countries

Data Set I		Data Set II		Data Set III		Data Set IV		Data Set V		Data Set VI	
Country	Ratio	Country	Ratio	Country	Ratio	Country	Ratio	Country	Ratio	Country	Ratio
Singapore	3.82	Singapore	3.83	Singapore	3.65	Singapore	4.18	Singapore	4.23	Singapore	4.03
Ireland	3.19	Luxembourg	3.16	Luxembourg	3.14	Luxembourg	3.10	Luxembourg	3.09	Luxembourg	3.06
Luxembourg	3.16	Ireland	2.67	Ireland	2.79	Ireland	3.03	China	2.84	China	2.73
Botswana	2.21	Botswana	2.34	Botswana	2.22	China	2.66	Botswana	2.79	Botswana	2.66
Lebanon	2.05	Korea	2.18	Korea	2.09	Botswana	2.63	Ireland	2.52	Ireland	2.63
Korea	2.05	Lebanon	2.12	Lebanon	2.03	Lebanon	2.21	Korea	2.34	Korea	2.24
Japan	1.96	Japan	2.07	Japan	1.98	Korea	2.19	Lebanon	2.30	Lebanon	2.20
Turkey	1.82	China	1.89	China	1.79	Bhutan	2.17	Bhutan	2.28	Bhutan	2.17
Thailand	1.76	Equatorial Guine	1.81	Equatorial Guine	1.78	Thailand	2.15	Equatorial Guine	2.17	Equatorial Guine	2.13
China	1.75	Bhutan	1.75	Turkey	1.69	Equatorial Guine	2.06	Thailand	2.12	Thailand	2.08
Equatorial Guine	1.71	Thailand	1.71	Thailand	1.68	Turkey	1.98	Japan	2.01	Japan	1.91
Bhutan	1.67	Turkmenistan	1.69	Bhutan	1.66	Japan	1.89	Turkmenistan	1.97	Turkmenistan	1.91
Bahrain	1.61	Bahrain	1.67	Bahrain	1.64	Ethiopia	1.76	Estonia	1.77	Turkey	1.86
Estonia	1.52	United Arab Emii	1.64	Turkmenistan	1.63	Turkmenistan	1.75	Vietnam	1.75	Estonia	1.72
United Arab Emii	1.49	Estonia	1.64	Estonia	1.59	Estonia	1.65	Malaysia	1.74	Vietnam	1.71
Turkmenistan	1.48	Malaysia	1.54	United Arab Emii	1.59	Bahrain	1.63	Turkey	1.70	Malaysia	1.68
Malaysia	1.43	Turkey	1.52	Malaysia	1.48	Malaysia	1.62	Bahrain	1.70	Bahrain	1.66
Ethiopia	1.41	Oman	1.47	Oman	1.44	Vietnam	1.61	Kiribati	1.67	Ethiopia	1.62
San Marino	1.39	San Marino	1.44	San Marino	1.42	India	1.55	United Arab Emii	1.66	United Arab Emii	1.61
Spain	1.38	Timor-Leste	1.36	Spain	1.33	Czech Republic	1.51	Ethiopia	1.66	India	1.57

Source: Author's calculations

other words, the ratio of the difference between the final and the actual quota shares to the difference between the calculated and the actual quota shares is the same to eligible countries. Let g be that constant; g is defined as follows (see Annex VIII):

$$g = \frac{1 - \sum_{i=1}^p \alpha_i}{\sum_{i=1}^p (\beta_i - \alpha_i)} * \frac{x}{(1+x)} \quad (4)$$

where α_i and β_i ($i=1, \dots, p$) are the actual quota share and the PCA-calculated quota share respectively for eligible countries; and x is the rate of increase in the Fund size;

Size of total quota increases

For the adjustment procedure to work, the size of total quota increases –or the rate of increase in the size of the Fund– has to be first determined. In Table 9, lists of eligible countries are drawn according to different radiuses for the set of traditional variables. In addition, corresponding UPR reduction factors are presented according to various rates of total quota increase. The group of eligible countries is diverse in terms of regional representation. An interesting finding is the eligibility of advanced countries, notably Japan and the United States. One could imagine that those countries will be willing to forego their quotas increases in favor of developing countries. The only inconvenience is that both countries, especially Japan, would remain significantly underrepresented.

Foregoing of quota increase

This adjustment procedure will be performed with the option that a group of advanced countries agrees to forego their increases in quota shares. In this paper, we choose the G7 countries. Their acceptance to forego increases by the G7 is referred to as “G7 goodwill”.

B. Application and Results

In this simulation, an increase of 10 percent of the total quotas is assumed for all data sets and a radius of 0.5 percent is adopted for eligibility purposes. For Data Set I, this entails an underrepresentedness reduction (factor g) of around 35 percent for 19 eligible countries out of 45 countries with positive CAD and CAR (Table 10). In fact, if eligible G7 countries forego their quota increase, the reduction factor g would be higher. Total basic votes are increased discretely until a data set satisfies all the constraints set in our approach. Table 11 shows the results of this simulation exercise when total basic votes are tripled and there is G7 goodwill. Total basic votes would now represent a share of total voting rights of 5.45 percent up from 2.1 percent currently.

In the previous section on the formulation of quota, no data set met all quota-related constraints. Surprisingly, when constraints on voting power are considered, Data Set I (with the four traditional variables) and Data Set III satisfy all the conditions that are:

- GDP has the highest weight;
- a rebalancing of quotas is achieved (after adjustment);
- the quotas and voting power of the emerging market economies has increased (even when China is withdrawn from the group);
- the quotas and voting power of the main shareholder is higher than 15%;
- a rebalancing of voting power is achieved; and
- the voting power of LICs is higher.

This finding shows that stand-alone discussions on quotas and simultaneous discussions on quotas and basic votes could lead to different decisions. Hence, we conclude that discussions on quota formula and basic votes must take place simultaneously in order to better inform decision on both issues.

However, this is not free lunch. Indeed, the members' relative position in the world economy as reflected by the IES does not hold anymore. The rankings after quota adjustment are closer to the actual rankings than to those of the IES. This suggests that a consensus on a new quota structure would come at the cost of a continued misrepresentation of countries' relative economic weights. Hence, it would take several quota reviews to achieve a quota structure that reflects real countries' position in global economy.

C. Additional Remarks

Number of principal components to retain

At the outset, it may be arguable that only the first principal component be retained for the purpose of our analysis, as it accounts for only 75% of the diversity among countries. Therefore, one could wonder whether the second principal component could also be considered in establishing the IES. This is possible but this would require a special treatment of the two sets of weights to derive only one.

Quota adjustment procedure and ranking

In the previous section, priority was to address the out-of-lineness of some countries over the preservation of the IES rankings during quota adjustment. The opposite is also feasible but a

Table 10. Out-of-line countries and UPR reduction factors using Data Set I

Radius	1	0.5	0.3	0.1
Countries	Japan Singapore China Ireland United States Luxembourg Korea Botswana Lebanon Turkey Thailand Eq. Guinea Bhutan Spain Mexico Bahrain Malaysia Estonia U. A. Emirates	Japan Singapore China Ireland United States Luxembourg Korea Botswana Lebanon Turkey Thailand Eq. Guinea Bhutan Spain Mexico Bahrain Malaysia Estonia U. A. Emirates	Japan Singapore China Ireland United States Luxembourg Korea Botswana Lebanon Turkey Thailand Eq. Guinea Bhutan Spain Mexico Bahrain Malaysia Estonia U. A. Emirates Turkmenistan Ethiopia Czech Republic San Marino Poland Greece	Japan Singapore China Ireland United States Luxembourg Korea Botswana Lebanon Turkey Thailand Eq. Guinea Bhutan Spain Mexico Bahrain Malaysia Estonia U. A. Emirates Turkmenistan Ethiopia Czech Republic San Marino Poland Greece Denmark Timor-Leste Israel Norway Slovenia Slovak Republic Kiribati Oman Lithuania Portugal Yemen, Republic of Cambodia Cyprus Angola
Number of countries	9	19	25	39
Sum of actual quota shares ($\sum\alpha$), <i>in percent</i>	29.29	34.26	35.75	38.88
Sum of calculated to actual differences ($\sum(\beta-\alpha)$), <i>in percent</i>	14.66	17.04	17.55	18.17
Underrepresentedness reduction factor, in percent				
Radius	1	0.5	0.3	0.1
Rate of increase in FS, <i>in percent</i>				
5	23.0	18.4	17.4	16.0
6	27.3	21.8	20.7	19.0
7	31.5	25.2	23.9	22.0
8	35.7	28.6	27.1	24.9
9	39.8	31.9	30.2	27.8
10	43.8	35.1	33.3	30.6
15	62.9	50.3	47.7	43.9

Source: Author's calculations

Table 11. Quota shares, adjusted quota shares and voting power, in percent

	Actual shares before		Actual shares after		DS I			DS II			DS III			DS IV		
	Quotas	Voting	Quotas	Voting	Quota shares before	After adjustment		Quota shares before	After adjustment		Quota shares before	After adjustment		Quota shares before	After adjustment	
						Quota shares	Voting power		Quota shares	Voting power		Quota shares	Voting power		Quota shares	Voting power
Advanced economies	61.59	60.59	60.51	59.55	64.97	58.40	55.98	64.12	56.85	54.52	64.63	58.27	55.86	56.05	56.14	53.84
Major Advanced (G7)	46.03	45.14	45.22	44.36	50.17	43.22	41.07	49.08	41.67	39.60	49.70	43.22	41.07	42.37	41.67	39.60
USA	17.38	17.03	17.08	16.73	19.27	17.08	16.18	17.25	15.52	14.71	18.49	17.08	16.18	14.79	15.52	14.71
Other advanced	15.56	15.45	15.29	15.19	14.80	15.18	14.91	15.04	15.18	14.92	14.93	15.05	14.79	13.68	14.47	14.24
Developing countries	30.87	31.71	32.08	32.88	29.58	34.85	36.81	30.40	36.38	38.25	29.95	34.96	36.91	37.50	36.77	38.62
Africa	5.49	5.96	5.40	5.86	2.60	4.94	6.18	2.58	4.95	6.19	2.63	4.94	6.18	3.20	4.97	6.21
Asia	10.29	10.43	11.50	11.61	16.45	15.06	15.16	17.30	16.51	16.53	16.57	15.23	15.32	22.60	16.78	16.79
Middle East	7.63	7.65	7.60	7.62	4.49	7.48	7.55	4.93	7.49	7.56	4.93	7.46	7.53	4.88	7.41	7.48
Western Hemisphere	7.46	7.67	7.59	7.79	6.04	7.37	7.92	5.59	7.42	7.96	5.82	7.33	7.88	6.82	7.61	8.15
Transition economies	7.54	7.70	7.41	7.57	5.45	6.75	7.21	5.48	6.78	7.24	5.42	6.77	7.23	6.45	7.09	7.53
Emerging markets	20.29	20.14	21.69	21.51	25.22	24.36	23.75	25.50	25.63	24.95	25.05	24.48	23.86	32.62	26.68	25.94
IMF Low-income countries	7.71	8.44	7.57	8.29	4.12	6.88	8.82	4.14	6.88	8.82	4.13	6.88	8.82	6.13	7.66	9.56
WB Low-income countries	6.67	7.13	6.55	7.01	3.63	5.95	7.20	3.64	5.96	7.20	3.63	5.95	7.20	5.55	6.73	7.94
USA	17.38	17.03	17.08	16.73	19.27	17.08	16.18	17.25	15.52	14.71	18.49	17.08	16.18	14.79	15.52	14.71
Japan	6.23	6.11	6.12	6.00	12.01	6.12	5.82	12.67	6.12	5.82	12.09	6.12	5.82	11.58	6.12	5.82
Germany	6.09	5.97	5.98	5.87	6.06	5.44	5.17	5.59	5.44	5.17	5.81	5.44	5.17	5.17	5.44	5.17
United Kingdom	5.02	4.93	4.94	4.85	3.85	4.49	4.27	4.20	4.49	4.27	4.12	4.49	4.27	3.18	4.49	4.27
France	5.02	4.93	4.94	4.85	3.74	4.49	4.27	3.85	4.49	4.27	3.78	4.49	4.27	3.08	4.49	4.27
Belgium	5.11	5.12	5.12	5.13	4.80	5.20	5.22	4.77	5.18	5.19	4.83	5.16	5.18	4.86	5.25	5.26
Netherlands	4.79	4.83	4.71	4.74	3.09	4.28	4.40	3.40	4.28	4.40	3.36	4.28	4.40	3.14	4.28	4.40
Venezuela	4.26	4.26	4.44	4.44	4.58	5.00	4.96	4.50	5.05	5.01	4.47	4.92	4.89	4.36	4.43	4.42
Italy	4.17	4.17	4.10	4.10	3.94	3.73	3.73	3.90	3.73	3.73	3.89	3.73	3.73	3.44	3.73	3.73
Canada	3.63	3.69	3.57	3.63	3.66	3.84	3.99	3.67	3.80	3.95	3.67	3.75	3.90	3.39	3.67	3.82
Sweden	3.48	3.49	3.42	3.43	3.51	3.12	3.18	3.63	3.12	3.19	3.55	3.12	3.19	3.34	3.12	3.18
Australia	3.23	3.32	3.76	3.84	4.63	4.49	4.66	4.87	4.83	4.98	4.70	4.54	4.71	4.82	4.34	4.52
Egypt	3.16	3.25	3.11	3.19	2.25	3.05	3.27	2.48	3.13	3.34	2.42	3.07	3.29	2.37	3.01	3.23
Saudi Arabia	3.27	3.21	3.21	3.16	0.75	2.92	2.79	1.01	2.92	2.79	1.00	2.92	2.79	0.74	2.92	2.79
Indonesia	3.09	3.16	3.03	3.11	4.57	4.10	4.23	4.63	4.40	4.51	4.48	4.07	4.21	5.48	4.08	4.21
Kenya	3.16	3.35	3.11	3.29	1.31	2.85	3.35	1.35	2.86	3.35	1.33	2.85	3.35	1.62	2.88	3.37
China	2.98	2.93	3.72	3.65	6.51	5.58	5.31	7.02	6.39	6.07	6.67	5.73	5.44	9.90	6.78	6.44
Switzerland	2.80	2.83	2.75	2.78	2.44	2.50	2.60	2.42	2.52	2.62	2.38	2.52	2.62	2.53	2.71	2.80
Russia	2.78	2.73	2.73	2.69	1.83	2.48	2.38	1.91	2.48	2.38	1.84	2.48	2.38	2.28	2.48	2.38
Iran	2.43	2.46	2.39	2.42	1.55	2.17	2.26	1.69	2.17	2.26	1.64	2.17	2.26	2.05	2.17	2.26
Brazil	2.40	2.46	2.36	2.41	2.06	2.15	2.30	1.76	2.15	2.30	1.96	2.15	2.30	2.54	2.48	2.61
India	2.39	2.39	2.35	2.35	1.86	2.14	2.14	1.97	2.14	2.14	1.88	2.14	2.14	3.25	2.83	2.79
Peru	1.96	1.99	1.93	1.95	1.24	1.75	1.83	1.07	1.75	1.83	1.16	1.75	1.83	1.48	1.75	1.83
Rwanda	1.16	1.41	1.14	1.38	0.50	1.04	1.70	0.39	1.05	1.70	0.48	1.04	1.70	0.58	1.04	1.70
<i>Assessment criteria</i>																
GDP weight is the highest						Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes
Rebalancing of quotas						No	Yes		No	Yes		No	Yes		Yes	Yes
EMEs share is higher						Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
The share of the US > 15%						Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No
Rebalancing of voting powers							Yes			Yes		Yes	Yes		Yes	Yes
LICs voting power is higher							Yes			Yes		Yes	Yes		Yes	Yes

Source: IMF and Author's calculations

specific quota adjustment procedure that preserves rankings will have to be developed. There are chances that this would require a larger quota adjustment.

Quota adjustment and economic dynamism

There is a belief that the most dynamic countries should benefit from ad hoc quota increases. Yet, the definition of the most dynamic countries is yet to be given. Some countries may seem dynamic but the dynamism of a few of them could be such that this smaller set of countries captures the bulk of quota increases at the expense of the other dynamic countries (see Appendix III for an illustration).

Quota adjustment and appointment of Executive Directors

The simulation exercise has shown that it is possible to reach a consensus on a new quota formula using the principal component approach, but only at the level of countries groups. It is likely that individual considerations render such a consensus less reachable. For example, France and United Kingdom might not be willing to accept that China overtake them in terms of voting power although it is clear from the IES that this should be the case. A simple reason is that one of these two countries, in our simulation, it would be France, is likely to lose the right to appoint an Executive Director in favor of China, should China enter the top 5 in quota shares (Article XII, Section (b) (i)). This could influence the way any ad hoc quota adjustment will be conducted.

Conditional foregoing

It is assumed in the simulation that G7 members forego any quota increase for the sake of meeting the constraints. It is clear that in the absence of such action, a higher increase in basic votes will be needed to preserve the voting powers of LICs and ensure a rebalancing of voting powers.

The problem of quota foregoing is that it may send a wrong signal about countries relative economic size and the case of Japan illustrates clearly such case. Specifically, Japan is the most underrepresented G7 member and among the most underrepresented countries in general with a calculated to actual difference in voting power of at least 5.46 percent, more than the increase in LICs voting power. Therefore, this country's decision to forego or not its quota increase will be instrumental to the completion of reform on quota and voice.

However, one consequence with Japan agreeing to forego quota increases might be that it will allow China, an eligible country, to get closer, in terms of quota shares –and hence voting power– to Japan, whereas China is likely to be far from reaching Japan's real level of quotas according to the PCA-derived formula. Promoting a conditional foregoing, whereby a country agrees to forego part of its quota increases on specific conditions, may help solve this

problem. Such conditions could be a predetermined quota share for the country in question and/or the earmarking of forgone quotas for a selected group of countries.

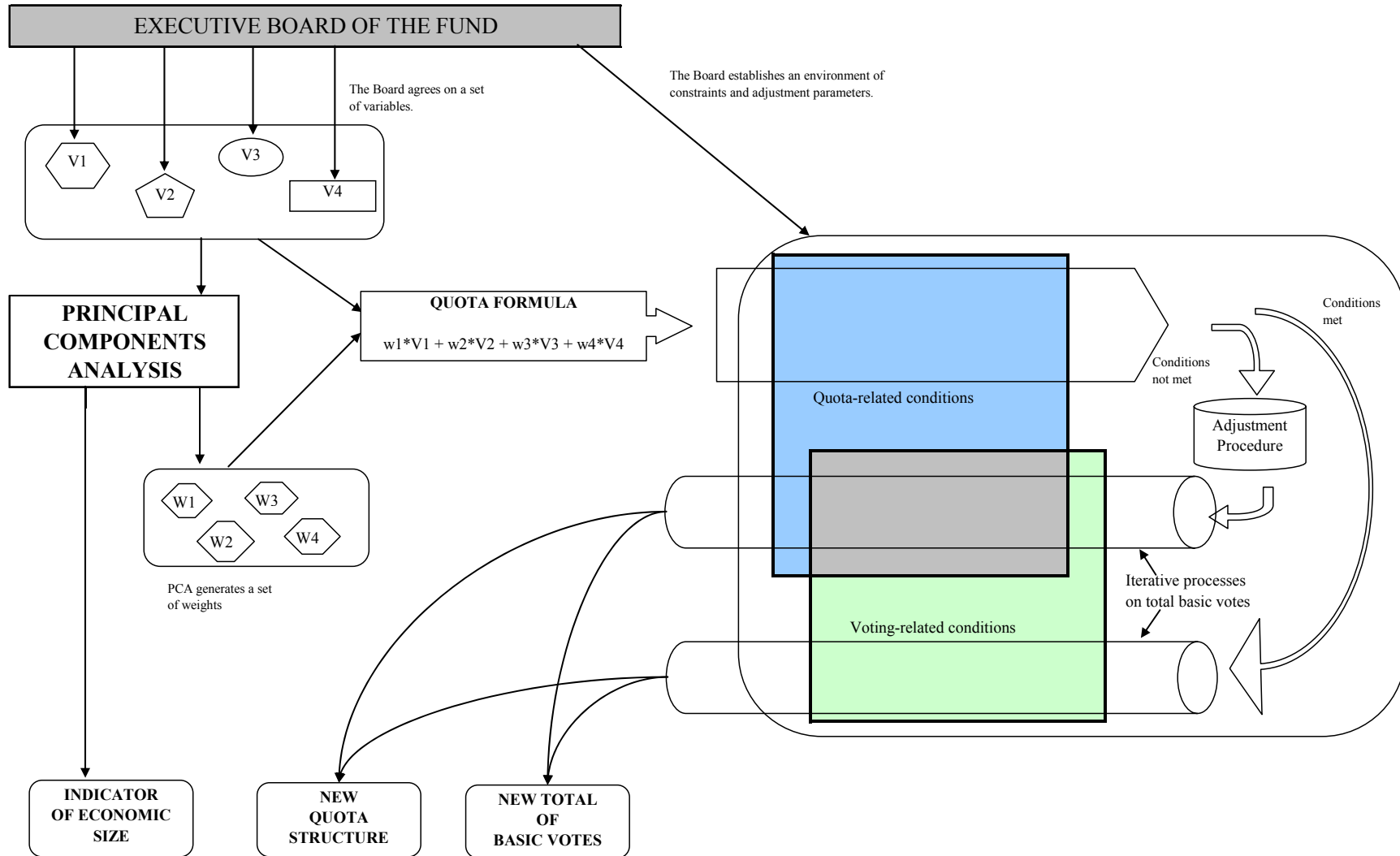
Second-round eligibility

It is worth stressing that, during the quota adjustment process, eligible countries will get a quota share increase of $g(\beta_i - \alpha_i)$, whereas non-eligible countries will have their quota shares reduced by a factor of $(1+x)^{-1}$, x being the rate of increase in total quotas. Actually, this decline will further aggravate the underrepresentedness of those countries –in the upper right quadrant of the radar screen in Figure 3– that did not meet the eligibility criterion. A possible consequence is that some countries could meet the eligibility criterion after adjustment. In our simulation, seven countries (Turkmenistan, Ethiopia, Czech Republic, San Marino, Poland, Greece and Germany) find themselves outside the circle after adjustment, i.e. their new distance to the origin is greater than the radius retained to select eligible countries. Therefore, one might consider a second-round eligibility process, whereby underrepresented countries that would meet the eligibility criterion after adjustment be added to list of the eligible countries for quota increases. This will ensure that an incontestable non-eligibility of the other underrepresented countries.

Concessions

It was noted earlier that the acceptance of a new quota formula by the membership could prove difficult if it entails significant changes in the quota structure. For an adhoc quota adjustment process to be completed, individual countries will have to make some concessions. In this connection, it is worth recalling that non-eligible countries will have their quota shares reduced by $(1+x)^{-1}$, x being the size of total quota increase. The simulation considered an increase of 10.0 percent in total quota increases, which is equivalent to a decline in quota shares of 9.1 percent for non-eligible countries. This means that the final quota shares of non-eligible countries are not linked to the new formula, but to the size of the increase in total quotas. Therefore, another challenge of reaching a consensus on the reform on quota and voice is to find the size of quota increase that will balance conflicting countries' interests in that process. In particular, for non-eligible countries, there is a limit to which they could concede a decline in their quota share, while preserving their interests. To some extent, those countries will have to overlook their own interests to ensure the completion of the quota and voice reform.

Figure 4. The principal components approach to quota formulation



V. CONCLUSION

In this paper, we have explored the use of the principal components analysis in advancing the debate on quota formulation in the context of the ongoing IMF reform on quota and voice. In particular, we have established an indicator of economic size that reflects IMF member countries' relative economic weight in the world economy with a high degree of objectivity. In addition, GDP is the variable which is assigned the highest of the weights generated automatically by the PCA in all data sets proposed. Another important finding about weights is that they did not vary much between 1999 and 2004. More important is that a rebalancing of quota shares has taken place in favor of developing countries during the same period.

We have also seen that achieving a rebalancing of quota shares in favor of developing countries from the actual quota distribution depend on the measure of the GDP. Notably, no rebalancing takes place when GDP is measured at the market exchange rate. Most important, all PCA-derived quota formulas would require a significant increase—at least 27 times—in total quotas. Moreover, changing weights tends to worsen previous results. For all these reasons, we conclude that a quota formula is likely to continue guiding but not determining the quota structure of the Fund.

We have therefore used the PCA-quota formulas to simulate ad hoc quota increases using the framework of the Resolution. Interestingly, the quota formula with the set of the four traditional variables gives the best results in terms of observing the constraints set throughout the paper, consistent with the Resolution. In particular, in the case total quotas are increased by 10 percent, a tripling of total basic votes would be needed to maintain the voting power of low-income countries at their pre-Singapore level. In addition, although the adjusted quota structure shows a marginal rebalancing of quota shares, there is a much more significant rebalancing of voting power. These achievements, however, come at the cost of a less objective representation in countries' relative positions in the global economy. These findings highlight the need to carry on the discussions on quota formula and basic votes concomitantly.

The principal components approach also sheds some light on what are the challenges to specify a quota formula acceptable by the membership. In particular, the role of the G7 countries to forego any quota increase or accept significant reduction in their quota shares will be critical. Likewise, the extent to which non-eligible countries will concede a decline in their quotas shares will be determining.

Our overall assessment is that the principal components approach, as shown in Figure 4, provides an objective and transparent means to determine variable weights and countries' relative economic size. Further refinement of this approach will have nevertheless to be undertaken.

APPENDIX I

Resolution 61-5 on Quota and Voice Reform in the International Monetary Fund

WHEREAS, the Executive Board has submitted to the Board of Governors a report entitled “Quota and Voice Reform in the International Monetary Fund” (hereinafter the “Report”);

WHEREAS, the Executive Board has recommended a two-year reform program to enhance the credibility and effectiveness of the Fund, as described in the Report; and

WHEREAS, China, Korea, Mexico, and Turkey have requested increases in their quotas to better reflect their positions in the world economy and the Executive Board has recommended increases in the quotas of these members as a first step in the two-year reform program referred to above;

NOW THEREFORE, the Board of Governors hereby RESOLVES that:

1. The quotas of China, Korea, Mexico, and Turkey shall be increased to the amounts shown against their names in the Annex to this Resolution, provided that a member’s increase in quota shall not become effective unless the member in question has consented in writing to the increase and has paid to the Fund the full amount of such increase. Each member shall pay 25 percent of its increase either in special drawing rights or in the currencies of other members specified, with their concurrence, by the Fund, or in any combination of special drawing rights and such currencies. The balance of the increase shall be paid by each member in its own currency. Both the written consent and the payment of the increase shall be made not later than 30 days after the date of this Resolution; provided that the Executive Board may extend the period within which the consent and the payment may be made as it may determine.
2. The Executive Board is requested to reach agreement on a new quota formula to guide the assessment of the adequacy of members’ quotas in the Fund. Such a formula should provide a simpler and more transparent means of capturing members’ relative positions in the world economy. As a means of achieving this objective, consideration should be given to placing significantly higher weight on members’ gross domestic product, together with ensuring that other variables, in particular the openness of members’ economies, also play an important role. The Executive Board is requested to start discussions on a new quota formula that can command broad support soon after the Annual Meetings in Singapore, and to complete its work before the Annual Meetings in 2007, and not later than by the Spring 2008 meeting of the International Monetary and Financial Committee.
3. The Executive Board is requested, following the completion of its work as provided in paragraph 2 above, to recommend to the Board of Governors by the Annual Meetings in 2007 and no later than by the Annual Meetings of 2008 further increases in the quotas of those members that have requested that their quotas be increased, with a view to achieving a

significant further alignment of members' quotas with their relative positions in the world economy, based on the new quota formula; any such increases in quotas shall not become effective until the amendment of the Fund's Articles of Agreement that is requested to be proposed under paragraph 4 has entered into force.

4. As an integral part of the reform program, and together with its recommendation for increases in quotas under paragraph 3, the Executive Board is requested to propose to the Board of Governors an amendment of the Fund's Articles of Agreement that would: (a) provide for at least a doubling of the "basic" votes that each member possesses pursuant to Article XII, Section 5(a) of the Fund's Articles of Agreement, and thereby at a minimum protect the existing voting share of low income countries as a group and (b) ensure that the ratio of the sum of the "basic" votes of all members to the sum of members' total voting power remains constant following the increase under (a) above in the event of any subsequent changes in the total voting power of members. The Executive Board is requested to put forward a specific proposal by the Annual Meetings in 2007 and no later than the Annual Meetings in 2008.

5. In the context of general reviews of quotas conducted after the completion of the steps identified in paragraphs 2 and 3 above, the Board of Governors will consider distributing any increase in quotas with a view to achieving better alignment of members' quotas with their relative positions in the world economy, while ensuring that the Fund has adequate liquidity to achieve its purposes.

6. The Executive Board is requested to act expeditiously to increase the staffing resources available to those Executive Directors elected by a large number of members whose workload is particularly heavy. The Executive Board is also requested to give consideration to the merits of an amendment of the Articles that would enable each Executive Director elected by a large number of members to appoint more than one Alternate Executive Director.

7. The Managing Director is invited to work closely with the Executive Board in developing the proposals pertaining to the reform package, and to have the staff complete the necessary technical work as expeditiously as possible. The Executive Board is requested to report to the Board of Governors on progress with the reform package by the time of the 2007 Annual Meetings.

ANNEX
Proposed Quota
(In millions of SDRs)

China	8090.1
Korea	2927.3
Mexico	3152.8
Turkey	1191.3

APPENDIX II

An Example of Principal Components Analysis

We perform PCA on traditional variables in shares. As we can see in Table 1, there is not a significant difference in the variances of variables, with the highest variance being 2.40 times greater than lowest variance. Accordingly, we perform our PCA on the covariance matrix,⁹

Appendix Table 1 – Statistics of dispersion

	Mean	Std. Dev.	Minimum	Maximum
GDP	0.54	2.53	0.00	30.35
Reserves	0.54	2.25	0.00	25.27
Openness	0.54	1.62	0.00	15.80
Variability	0.54	1.73	0.00	20.37

Although the PCA is on the covariance matrix (Table 2), a look at the correlation matrix shows that three variables (GDP, Openness, Variability) out of four are highly correlated (more than 0.90) to each other while Reserves correlation with other variables is much lower at around 0.45.

Appendix Table 2 – Matrix of correlations

	GDP	Reserves	Openness	Variability
GDP	1.00			
Reserves	0.45	1.00		
Openness	0.92	0.44	1.00	
Variability	0.97	0.42	0.93	1.00

Launching the PCA, we note that the loadings of the first principal component, which are correlations between the original variables and this component, are very high – consistent with the correlation matrix – at more than 0.94 for GDP, Openness, and Variability as shown in Table 3. The loading for Reserves is however around one third lower, although it is considered as high in practice. We conclude that all variables could be retained for the purpose of the analysis.

Appendix Table 3 – Correlations between variables and principal components

	PC 1	PC 2	PC 3	PC 4
GDP	-0.97	0.22	0.11	-0.06
Reserves	-0.63	-0.77	0.00	0.00
Openness	-0.94	0.19	-0.29	-0.05
Variability	-0.96	0.24	0.01	0.16

⁹ In case the variance was much higher, one would have to perform the PCA using the correlation matrix which is a covariance matrix for standardized variables, instead of the covariance matrix, in order to avoid that the first principal component is oriented in the direction of the variable with the highest variance.

In addition, the first principal component explains a large part of the variance of GDP, Reserves and Variability – which can be seen by squaring each loading in the first principal component. Only Reserves is not well captured by the first principal component with only 40% of the variance of the variable.

Table 4 shows that the first component has a large variance, accounting for 77% of the total variance in the data set, which is very good, and the second component accounts for 21% of the total variance, such that both components captures 98% of the total variance. This situation is typical for highly correlated variables. Since the eigenvalue of the first principal component is significantly high, we retain only this component for the purpose of our analysis.

Appendix Table 4 – Eigenvalues

	PC 1	PC 2	PC 3	PC 4
Eigenvalue	13.013	3.592	0.299	0.108
Variance Prop.	0.765	0.211	0.018	0.006
Cumulative Prop.	0.765	0.976	0.994	1.000

Moreover, as the first component explains 77% of the variance of the four variables, and has large correlations with all variables, this component clearly exhibits an overall size dimension among the countries; which in our case, given the nature of our variables, could be interpreted as the economic importance in the global economy. The second component in such circumstances highlights contrasts between the countries. As Reserves is highly correlated with that component, the latter therefore displays shows contrast between countries of high economic importance, USA on one side and China and Japan in the other side, with respect to the level of reserves (see Figure 1 in the main text).

A look at the coefficients of variables in Table 5 indicates that GDP has the highest weight among variables while Reserves has the lowest, with respect to the first principal component. These coefficients will be normalized, i.e. transformed such that they add up to one, and will serve as weights in a quota formula.

Appendix Table 5 - Eigenvectors

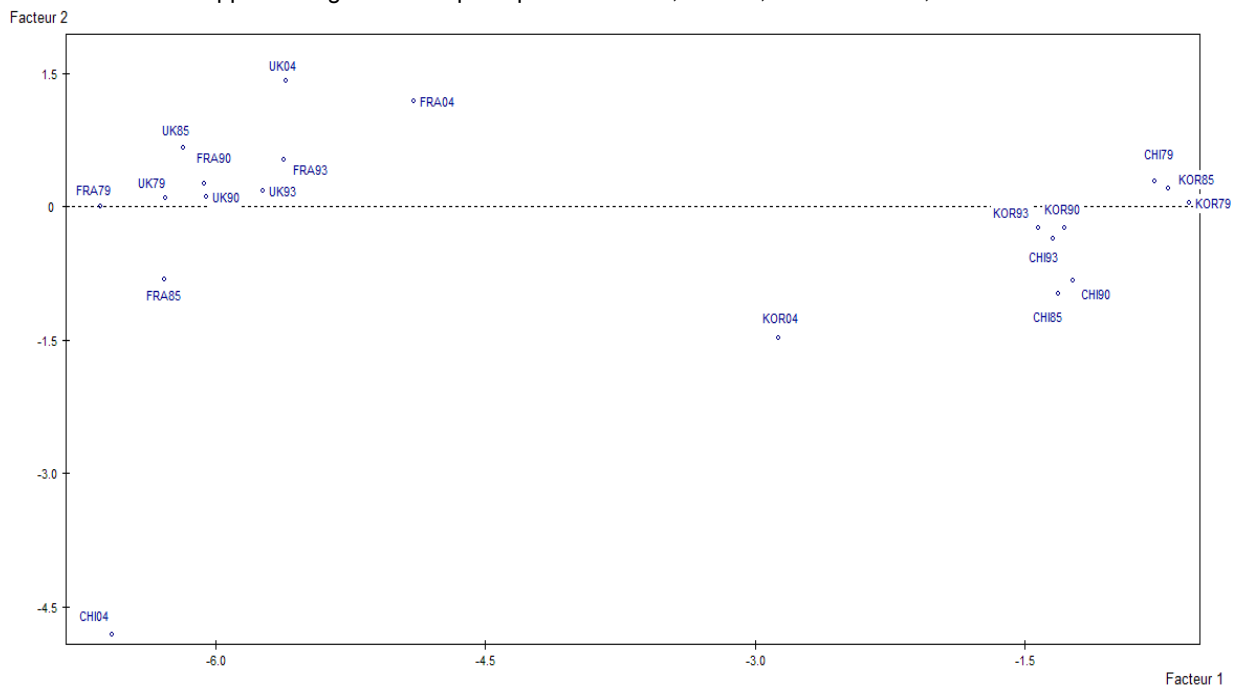
	PC 1	PC 2	PC 3	PC 4
GDP	-0.677	0.287	0.511	0.446
Reserves	-0.395	-0.918	0.012	-0.023
Openness	-0.420	0.163	-0.859	0.242
Variability	-0.458	0.219	0.023	-0.861

APPENDIX III

Temporal Paths of Countries' Economic Size

Relative economic size varies with time, reflecting the development and growth of a country in comparison with other countries. The IES shows that some countries have significantly increased their importance in the world economy over decades. An illustration of these changes is observable through the drawing of temporal paths of individual country's relative economic size using the PCA or more specifically the technique of illustrative or supplementary observations. This technique enables to know the position of some countries on the principal components determined by other countries. In our case, the technique allows observing temporal paths of any country's relative position, with respect to the actual situation. More precisely, it would be possible to display a country's relative position at different dates, given the present structure of relative economic size.¹⁰

Appendix Figure 1: Temporal paths of China, France, Korea and UK, 1979-2004



As it could not be possible to show all countries' temporal paths in one figure, we selected a few countries that would illustrate what we referred to as lost of economic importance or rising importance in the international scene. Figure 3 shows the temporal paths of China

¹⁰ Lai (2000) uses another methodology consisting in performing multiple PCAs with data at various dates. The temporal paths are assessed through the evolution of a country's scores on the first principal component. We did not use this methodology here as the membership of the Fund changed significantly over the last 30 years.

(CHI), France (FRA), Korea (KOR) and UK in the plane formed by the first two principal components, using data used for the eighth, ninth, tenth and eleventh general review of quotas as well as data used for the ad hoc quota increases in September 2006.

Going leftward meaning increasing relative importance, we can see that China's and Korea's paths go in that direction while France's and UK's temporal paths go in the opposite direction indicating a continuous decline of its relative importance. In particular, China outruns France and UK at some point between 1993 and 2004. In addition, as all three countries are among the top 20 most important countries, the downward orientation of China's and Korea's time paths indicate that international trade—which is reflected in a continuous accumulation of reserves—is playing an important role in their rising importance.

This is a good illustration of the fact that despite continued positive growth, France and UK have lost relative importance in favor of a country (China) that has been more dynamic over the time period of interest.¹¹

¹¹ We have been using the PCA with the five variables in the existing quota formulas.

APPENDIX IV

Determination of the Quota of a New Member: The Case of Montenegro

On July 18, 2006, Montenegro officially applied for Fund membership. This application has been examined by a committee set up by the Executive Board of the Fund. The committee recommended the approval of the application. The Executive Board accepted Montenegro's membership, with an initial quota share of 0.0127 percent – standing at the 159th place.

However, the existing process of determining the quotas of new members is rather complex and highly subjective, involving the use of country comparators and a lot of judgment regarding comparison factors, to ensure that the recommended quota fits well within the existing structure of quota. The principal component approach offers a simpler means to determine a new member's quota by establishing its ranking according to the IES and then using the derived quota formula to determine its quota. Applying this methodology with the traditional variables using data in Statistical Appendix I, Montenegro stands at the 155th place between Liberia and Malawi with a calculated quota share of 0.007 percent.

Appendix Table 6. Data for Quota Calculations under DS I (in percent)

GDP, 2002-2004	0.006
Openness, average for 2000-2004	0.008
Variability, 1992-2004	0.011
Reserves, 2004	0.005
Source: IMF	

APPENDIX V

Classification of Countries

WB Low-Income Countries

Afghanistan	Gambia, The	Mauritania	Somalia
Bangladesh	Ghana	Mongolia	Sudan
Benin	Guinea	Mozambique	Tajikistan
Bhutan	Guinea-Bissau	Myanmar	Tanzania
Burkina Faso	Haiti	Nepal	Timor-Leste
Burundi	India	Niger	Togo
Cambodia	Kenya	Nigeria	Uganda
C.A.R.	Korea, Dem Rep.	Pakistan	Uzbekistan
Chad	Kyrgyz Republic	Papua New Guinea	Vietnam
Comoros	Lao PDR	Rwanda	Yemen, Rep.
Congo, Dem. Rep	Liberia	Sao Tome and Principe	Zambia
Cote d'Ivoire	Madagascar	Senegal	Zimbabwe
Eritrea	Malawi	Sierra Leone	
Ethiopia	Mali	Solomon Islands	

IMF Low-Income Countries (PRGF Eligible countries)

Afghanistan	Djibouti	Madagascar	Solomon Islands
Albania	Dominica	Malawi	Somalia
Angola	Eritrea	Maldives	Sri Lanka
Armenia	Ethiopia	Mali	St. Lucia
Azerbaijan	Gambia, The	Mauritania	St. Vincent and the Grenad
Bangladesh	Georgia	Moldova	Sudan
Benin	Ghana	Mongolia	Tajikistan
Bhutan	Grenada	Mozambique	Tanzania
Bolivia	Guinea	Myanmar	Timor Leste
Burkina Faso	Guinea-Bissau	Nepal	Togo
Burundi	Guyana	Nicaragua	Tonga
Cambodia	Haiti	Niger	Uganda
Cameroon	Honduras	Nigeria	Uzbekistan
Cape Verde	India	Pakistan	Vanuatu
Central African Republic	Kenya	Papua New Guinea	Vietnam
Chad 4	Kiribati	Rwanda	Yemen, Republic of
Comoros	Kyrgyz Republic	Samoa	Zambia
Congo, D. R.	Lao, P.D.R.	Sao Tomé and Principe	Zimbabwe
Congo, Republic of	Lesotho	Senegal	
Côte d'Ivoire	Liberia	Sierra Leone	

Emerging Market Economies (Morgan Stanley)

Argentina	Egypt	Malaysia	South Africa
Brazil	Hungary	Mexico	Poland
Chile	India	Morocco	Russia
China	Indonesia	Pakistan	Thailand
Colombia	Israel	Peru	Turkey
Czech Republic	Jordan	Philippines	

STATISTICAL APPENDIX I

Variables Used for Calculations

	Quota shares before Singapore	Quota shares after Singapore	Calculated quotas (F5)	GDP		PPPGDP		Hybrid GDP 2002-2004	Reserves 2004	Current payments 2000-04	Current receipts 2000-04	Current payments plus current receipts 2000-04	Variability of current receipts and net capital inflows 1992-2004	Variability of current receipts 1992-2004	Hybrid Variability 1992-2004
				2004	2002-04	2004	2002-04								
				2004	2002-04	2004	2002-04								
United States	17.382	17.077	16.795	28.719	30.350	20.471	20.691	20.258	2.705	18.138	13.416	15.797	20.374	11.826	17.372
Japan	6.229	6.120	7.525	11.428	11.822	6.624	6.792	7.869	25.267	4.972	6.284	5.623	6.725	7.049	6.085
Germany	6.086	5.980	6.953	6.733	6.568	4.318	4.484	4.390	1.726	8.400	8.894	8.645	6.682	4.806	5.697
France	5.025	4.937	4.334	5.009	4.818	3.112	3.210	3.207	1.166	4.985	5.192	5.087	3.131	3.815	3.293
United Kingdom	5.025	4.937	5.176	5.220	5.019	3.102	3.158	3.241	1.337	6.375	6.172	6.275	2.083	3.655	3.165
China	3.301	3.244	3.442	4.107	3.943	2.879	2.992	2.929	1.047	4.084	4.071	4.077	1.882	2.182	1.884
Italy	3.269	3.211	1.063	0.613	0.596	0.573	0.566	0.555	0.740	0.738	0.980	0.858	0.877	2.384	2.057
Saudi Arabia	2.980	2.928	3.098	2.427	2.364	1.853	1.893	1.853	1.114	3.365	3.629	3.496	2.245	3.530	3.047
Canada	2.980	3.719	5.197	4.616	4.544	15.158	14.460	14.158	15.485	4.982	5.134	5.057	3.027	3.530	3.047
Russia	2.782	2.733	1.519	1.423	1.231	2.577	2.520	2.467	2.848	1.168	1.575	1.370	2.279	2.724	2.352
Netherlands	2.415	2.373	2.880	1.485	1.441	0.870	0.903	0.959	0.362	3.261	3.521	3.390	1.381	3.123	2.696
Belgium	2.155	2.117	2.088	0.875	0.837	0.555	0.569	0.557	0.346	2.287	2.432	2.359	1.189	2.218	1.914
India	1.945	1.911	1.200	1.632	1.586	0.852	0.871	0.871	5.597	3.596	0.998	1.042	1.020	0.787	0.838
Switzerland	1.618	1.590	1.530	0.878	0.873	0.406	0.421	0.581	1.633	1.531	1.896	1.712	1.485	1.518	1.310
Australia	1.514	1.488	1.182	1.556	1.429	1.064	1.080	1.080	1.049	1.259	1.063	1.162	1.054	1.336	1.153
Mexico	1.427	1.402	2.250	2.545	2.369	1.820	1.852	1.813	0.454	2.761	2.567	2.664	1.908	1.574	1.627
Spain	1.421	1.396	0.998	1.478	1.432	2.635	2.670	2.614	1.586	0.938	0.869	0.903	1.878	0.874	1.602
Brazil	1.244	1.222	0.415	0.267	0.261	0.262	0.253	0.247	0.573	0.250	0.348	0.299	0.685	1.032	0.890
Korea	1.210	1.449	1.928	1.656	1.800	1.797	1.823	1.785	1.932	2.123	2.022	2.073	2.128	2.032	1.815
Venezuela	1.121	1.101	1.229	0.857	0.817	0.455	0.463	0.544	0.651	1.298	1.474	1.385	0.945	1.360	1.174
Sweden	0.991	0.973	0.396	0.374	0.350	0.387	0.425	0.408	0.523	0.373	0.395	0.384	1.040	0.605	0.887
Argentina	0.973	0.956	0.767	0.631	0.635	1.594	1.591	1.557	1.086	0.688	0.770	0.729	1.110	1.184	1.022
Indonesia	0.876	0.861	1.142	0.720	0.690	0.466	0.479	0.469	0.264	1.411	1.415	1.413	0.760	0.762	0.658
Austria	0.874	0.859	0.436	0.525	0.445	0.943	0.956	0.936	0.311	0.469	0.461	0.465	0.502	0.490	0.428
South Africa	0.820	0.806	0.309	0.158	0.152	0.289	0.282	0.276	0.369	0.178	0.246	0.211	0.498	0.783	0.676
Nigeria	0.782	0.769	0.868	0.621	0.608	0.327	0.336	0.404	1.261	0.704	1.001	0.851	1.180	1.293	1.116
Norway	0.789	0.755	1.078	0.597	0.573	0.317	0.327	0.381	1.138	0.990	1.055	1.023	1.177	1.577	1.362
Denmark	0.765	1.346	2.508	1.663	1.675	1.653	1.664	1.629	5.376	2.250	2.407	2.328	2.498	3.046	2.629
Iran	0.700	0.688	0.404	0.383	0.375	0.906	0.896	0.877	0.927	0.303	0.370	0.336	0.296	0.750	0.647
Malaysia	0.696	0.684	1.399	0.290	0.290	0.475	0.468	0.458	1.721	1.106	1.228	1.166	1.187	1.561	1.348
Kuwait	0.646	0.635	0.351	0.136	0.127	0.078	0.076	0.085	0.231	0.174	0.307	0.240	0.414	0.939	0.811
Ukraine	0.642	0.631	0.277	0.158	0.141	0.554	0.522	0.511	0.294	0.255	0.290	0.272	0.314	0.379	0.327
Poland	0.641	0.629	0.739	0.617	0.608	0.831	0.830	0.813	1.107	0.785	0.728	0.757	0.971	0.786	0.828
Finland	0.591	0.581	0.546	0.455	0.438	0.277	0.281	0.291	0.350	0.590	0.693	0.641	0.641	0.532	0.546
Algeria	0.587	0.577	0.325	0.202	0.186	0.391	0.388	0.380	1.154	0.158	0.250	0.204	0.478	0.705	0.609
Turkey	0.556	0.546	0.246	0.063	0.052	0.063	0.052	0.055	0.115	0.166	0.162	0.164	0.348	0.598	0.516
Iraq	0.526	0.517	0.228	0.078	0.069	0.111	0.110	0.108	0.695	0.111	0.151	0.131	0.345	0.503	0.434
Libya	0.506	0.497	0.909	0.396	0.394	0.909	0.895	0.877	1.360	0.871	0.962	0.916	1.133	1.026	0.966
Thailand	0.486	0.477	0.468	0.246	0.227	0.284	0.286	0.280	0.419	0.548	0.503	0.526	0.481	0.359	0.410
Hungary	0.484	0.475	0.191	0.252	0.245	0.650	0.639	0.626	0.344	0.173	0.197	0.185	0.250	0.193	0.213
Pakistan	0.482	0.473	0.207	0.179	0.160	0.314	0.306	0.300	0.328	0.232	0.209	0.221	0.271	0.175	0.231
Romania	0.451	0.548	0.741	0.739	0.658	0.936	0.909	0.890	1.078	0.747	0.698	0.723	1.677	1.011	1.430
Egypt	0.442	0.434	0.248	0.187	0.222	0.503	0.508	0.497	0.424	0.231	0.248	0.240	0.356	0.317	0.304
Israel	0.434	0.427	0.579	0.286	0.303	0.262	0.266	0.260	0.830	0.550	0.559	0.555	0.586	0.713	0.616
New Zealand	0.419	0.411	0.229	0.239	0.215	0.171	0.172	0.168	0.139	0.268	0.245	0.256	0.240	0.225	0.205
Philippines	0.412	0.405	0.504	0.211	0.222	0.684	0.679	0.665	0.422	0.461	0.501	0.481	0.580	0.741	0.640
Portugal	0.406	0.399	0.528	0.410	0.398	0.349	0.365	0.358	0.186	0.630	0.549	0.590	0.628	0.607	0.536
Singapore	0.404	0.397	1.922	0.261	0.263	0.205	0.203	0.198	3.212	1.888	1.402	1.294	2.105	2.107	1.819
Chile	0.401	0.393	0.298	0.230	0.214	0.315	0.314	0.307	0.498	0.294	0.294	0.294	0.383	0.351	0.327
Ireland	0.392	0.385	1.677	0.451	0.422	0.276	0.277	0.281	0.088	1.579	1.604	1.591	3.065	2.757	2.613
Greece	0.385	0.378	0.456	0.508	0.468	0.416	0.417	0.409	0.088	0.544	0.463	0.504	0.928	0.537	0.791
Czech Republic	0.383	0.376	0.538	0.264	0.247	0.311	0.313	0.307	0.638	0.590	0.555	0.573	0.595	0.368	0.507
Colombia	0.362	0.356	0.208	0.241	0.237	0.560	0.563	0.552	0.389	0.207	0.203	0.205	0.285	0.209	0.243
Bulgaria	0.299	0.294	0.113	0.050	0.054	0.117	0.116	0.114	0.218	0.117	0.106	0.112	0.129	0.109	0.110
Peru	0.299	0.293	0.139	0.168	0.170	0.274	0.274	0.269	0.337	0.131	0.122	0.127	0.286	0.120	0.244
United Arab Emirates	0.286	0.281	0.461	0.255	0.244	0.214	0.205	0.201	0.554	0.347	0.439	0.393	0.585	0.858	0.741
Morocco	0.275	0.270	0.165	0.122	0.118	0.232	0.232	0.228	0.452	0.167	0.175	0.168	0.131	0.106	0.112
Bangladesh	0.249	0.245	0.103	0.136	0.143	0.499	0.494	0.484	0.089	0.110	0.114	0.112	0.069	0.076	0.066
Congo, Dem. Republic of	0.249	0.245	0.025	0.016	0.016	0.075	0.074	0.073	0.007	0.021	0.023	0.022	0.575	0.052	0.490
Zambia	0.229	0.225	0.022	0.014	0.013	0.018	0.018	0.017	0.008	0.019	0.018	0.019	0.051	0.043	0.043
Serbia / Montenegro	0.219	0.215	0.111	0.059	0.055	0.074	0.073	0.072	0.129	0.080	0.062	0.071	0.162	0.287	0.248
Sri Lanka	0.193	0.190	0.074	0.049	0.050	0.141	0.140	0.137	0.064	0.084	0.082	0.083	0.066	0.074	0.064
Belarus	0.181	0.177	0.118	0.056	0.050	0.121	0.116	0.113	0.021	0.114	0.111	0.113	0.112	0.197	0.170
Ghana	0.173	0.170	0.043	0.023	0.021	0.090	0.089	0.087	0.043	0.041	0.043	0.042	0.066	0.057	0.056
Kazakhstan	0.171	0.168	0.164	0.100	0.086	0.091	0.092	0.187	0.190	0.151	0.148	0.150	0.235	0.257	0.222
Croatia	0.171	0.168	0.144	0.084	0.078	0.199	0.191	0.090	0.250	0.156	0.146	0.151	0.179	0.130	0.152
Slovak Republic	0.168	0.165	0.231	0.101	0.089	0.143	0.142	0.139	0.396	0.228	0.220	0.224	0.183	0.261	0.225
Zimbabwe	0.165	0.162	0.026	0.014	0.040	0.057	0.064	0.063	0.009	0.027	0.023	0.025	0.014	0.041	0.035
Trinidad and Tobago	0.157	0.154	0.062	0.028	0.028	0.030	0.029	0.028	0.086	0.050	0.058	0.054	0.068	0.102	0.088
Vietnam	0.154	0.151	0.214	0.123	0.117	0.404	0.394	0.385	0.205	0.242	0.241	0.241	0.114	0.190	0.164
Cote d'Ivoire	0.152	0.149	0.061	0.039	0.038	0.047	0.049	0.048	0.047	0.059	0.062	0.060	0.050	0.089	0.076
Sudan	0.147	0.145	0.040	0.054	0.047	0.135	0.134	0.131	0.037	0.043	0.035	0.039	0.041	0.036	0.035
Uruguay	0.144	0.141	0.047	0.032	0.034	0.056	0.054	0.053	0.071	0.042	0.040	0.041	0.168	0.078	0.143

	Quota shares before	Quota shares after	Calculated quotas (F5)	GDP		PPPGDP		Hybrid GDP	Reserves	Current payments	Current receipts	Current payments plus current receipts	Variability of current receipts and net capital inflows	Variability of current receipts	Hybrid Variability	
	Singapore	Singapore		2004	2002-04	2004	2002-04	2002-2004		2004	2000-04	2000-04	2000-04	1992-2004		1992-2004
Cameroon	0.087	0.086	0.033	0.045	0.040	0.073	0.073	0.072	0.021	0.034	0.032	0.033	0.056	0.041	0.048	
Uganda	0.085	0.083	0.025	0.017	0.018	0.071	0.070	0.069	0.036	0.021	0.017	0.019	0.039	0.047	0.041	
Bolivia	0.080	0.079	0.023	0.021	0.023	0.043	0.043	0.042	0.022	0.025	0.024	0.025	0.031	0.025	0.026	
El Salvador	0.080	0.079	0.053	0.039	0.041	0.053	0.054	0.053	0.054	0.055	0.053	0.054	0.056	0.066	0.057	
Jordan	0.080	0.079	0.082	0.028	0.028	0.046	0.045	0.044	0.159	0.077	0.082	0.079	0.087	0.047	0.075	
Bosnia-Herzegovina	0.079	0.078	0.066	0.020	0.019	0.039	0.039	0.038	0.063	0.055	0.048	0.052	0.093	0.119	0.103	
Costa Rica	0.077	0.075	0.084	0.045	0.048	0.075	0.075	0.074	0.054	0.092	0.085	0.088	0.087	0.109	0.094	
Afghanistan, Islamic Republik	0.076	0.074	0.042	0.014	0.014	0.048	0.046	0.045	0.035	0.025	0.024	0.024	0.120	0.119	0.102	
Senegal	0.076	0.074	0.024	0.019	0.018	0.033	0.033	0.032	0.037	0.026	0.024	0.025	0.019	0.021	0.018	
Azerbaijan	0.075	0.074	0.036	0.021	0.020	0.056	0.053	0.052	0.027	0.042	0.032	0.037	0.050	0.045	0.042	
Gabon	0.072	0.071	0.047	0.020	0.018	0.016	0.017	0.016	0.009	0.028	0.036	0.032	0.077	0.132	0.114	
Georgia	0.070	0.069	0.017	0.011	0.011	0.025	0.024	0.024	0.009	0.018	0.015	0.017	0.023	0.023	0.020	
Lithuania	0.067	0.066	0.096	0.055	0.050	0.078	0.076	0.075	0.106	0.095	0.087	0.091	0.085	0.132	0.114	
Cyprus	0.066	0.064	0.061	0.038	0.035	0.029	0.030	0.029	0.107	0.068	0.064	0.066	0.098	0.042	0.084	
Namibia	0.064	0.063	0.024	0.013	0.011	0.025	0.025	0.025	0.010	0.021	0.025	0.023	0.019	0.044	0.038	
Bahrain	0.063	0.062	0.144	0.027	0.027	0.026	0.025	0.025	0.058	0.105	0.111	0.108	0.237	0.308	0.265	
Ethiopia	0.063	0.062	0.076	0.023	0.021	0.097	0.096	0.094	0.037	0.025	0.026	0.025	0.284	0.312	0.269	
Papua New Guinea	0.062	0.061	0.028	0.011	0.010	0.024	0.025	0.024	0.017	0.022	0.025	0.024	0.040	0.052	0.045	
Bahamas, The	0.061	0.060	0.029	0.014	0.015	0.011	0.011	0.011	0.020	0.033	0.028	0.030	0.025	0.039	0.033	
Nicaragua	0.061	0.060	0.021	0.013	0.012	0.036	0.036	0.035	0.019	0.026	0.021	0.023	0.029	0.015	0.025	
Honduras	0.061	0.060	0.037	0.018	0.019	0.035	0.035	0.034	0.051	0.040	0.038	0.039	0.032	0.035	0.030	
Liberia	0.060	0.059	0.005	0.001	0.001	0.001	0.001	0.001	0.000	0.005	0.004	0.004	0.017	0.010	0.015	
Latvia	0.059	0.058	0.053	0.034	0.031	0.047	0.045	0.044	0.051	0.061	0.054	0.057	0.049	0.057	0.049	
Moldova	0.058	0.057	0.018	0.006	0.006	0.014	0.014	0.013	0.011	0.016	0.015	0.016	0.025	0.033	0.029	
Madagascar	0.057	0.056	0.022	0.011	0.013	0.026	0.026	0.025	0.014	0.017	0.015	0.016	0.037	0.053	0.045	
Iceland	0.055	0.054	0.035	0.030	0.028	0.017	0.017	0.019	0.029	0.044	0.040	0.042	0.050	0.016	0.043	
Mozambique	0.053	0.052	0.025	0.015	0.014	0.043	0.042	0.041	0.030	0.024	0.020	0.022	0.025	0.038	0.033	
Guinea	0.050	0.049	0.010	0.010	0.010	0.032	0.032	0.032	0.004	0.011	0.010	0.010	0.016	0.017	0.015	
Sierra Leone	0.049	0.048	0.004	0.003	0.003	0.008	0.008	0.008	0.002	0.004	0.003	0.003	0.011	0.009	0.010	
Malta	0.048	0.047	0.058	0.013	0.013	0.013	0.014	0.014	0.084	0.050	0.046	0.049	0.047	0.055	0.048	
Mauritius	0.048	0.047	0.032	0.016	0.015	0.027	0.027	0.026	0.049	0.032	0.033	0.033	0.029	0.033	0.028	
Paraguay	0.047	0.046	0.039	0.018	0.017	0.047	0.048	0.047	0.034	0.032	0.033	0.032	0.068	0.076	0.066	
Mali	0.044	0.043	0.015	0.012	0.011	0.023	0.024	0.023	0.027	0.015	0.014	0.014	0.010	0.017	0.014	
Suriname	0.043	0.042	0.009	0.003	0.003	0.023	0.021	0.021	0.003	0.007	0.006	0.007	0.020	0.018	0.017	
Armenia	0.043	0.042	0.012	0.009	0.008	0.006	0.006	0.005	0.016	0.013	0.012	0.013	0.011	0.013	0.011	
Guyana	0.043	0.042	0.015	0.002	0.002	0.005	0.005	0.006	0.008	0.009	0.009	0.009	0.029	0.035	0.031	
Kyrgyz Republic	0.042	0.041	0.010	0.005	0.005	0.018	0.017	0.017	0.014	0.009	0.008	0.009	0.018	0.017	0.016	
Cambodia	0.041	0.040	0.055	0.012	0.012	0.056	0.055	0.054	0.028	0.036	0.033	0.034	0.117	0.134	0.116	
Tajikistan	0.041	0.040	0.012	0.005	0.004	0.014	0.013	0.013	0.005	0.012	0.012	0.012	0.018	0.018	0.016	
Congo, Republic of	0.040	0.039	0.029	0.010	0.010	0.007	0.007	0.007	0.001	0.021	0.026	0.023	0.060	0.065	0.056	
Haiti	0.038	0.038	0.014	0.009	0.009	0.025	0.027	0.027	0.002	0.014	0.013	0.014	0.025	0.022	0.021	
Somalia	0.038	0.038	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.002	0.002	0.002	0.002	
Rwanda	0.037	0.037	0.007	0.004	0.005	0.020	0.021	0.020	0.007	0.005	0.005	0.005	0.017	0.020	0.017	
Burundi	0.036	0.035	0.003	0.002	0.002	0.009	0.009	0.009	0.002	0.002	0.002	0.002	0.007	0.009	0.008	
Turkmenistan	0.035	0.034	0.046	0.040	0.034	0.064	0.058	0.056	0.085	0.034	0.038	0.036	0.061	0.099	0.085	
Togo	0.034	0.034	0.009	0.005	0.005	0.016	0.016	0.016	0.009	0.009	0.008	0.008	0.014	0.012	0.012	
Nepal	0.033	0.033	0.021	0.016	0.017	0.009	0.009	0.009	0.065	0.045	0.020	0.020	0.029	0.025	0.024	
Fiji	0.033	0.032	0.011	0.008	0.007	0.066	0.067	0.069	0.013	0.010	0.011	0.011	0.008	0.017	0.015	
Malawi	0.032	0.032	0.007	0.005	0.005	0.008	0.008	0.008	0.026	0.004	0.008	0.007	0.009	0.008	0.007	
Macedonia, FYR	0.032	0.032	0.028	0.013	0.013	0.026	0.027	0.013	0.027	0.027	0.025	0.026	0.039	0.043	0.037	
Barbados	0.032	0.031	0.015	0.008	0.008	0.013	0.013	0.008	0.021	0.017	0.016	0.017	0.016	0.011	0.014	
Niger	0.031	0.030	0.007	0.007	0.007	0.036	0.035	0.018	0.008	0.006	0.006	0.006	0.014	0.011	0.012	
Estonia	0.030	0.030	0.067	0.027	0.025	0.018	0.019	0.024	0.045	0.074	0.067	0.071	0.053	0.075	0.064	
Mauritania	0.030	0.029	0.008	0.003	0.003	0.012	0.012	0.011	0.003	0.007	0.008	0.007	0.014	0.013	0.012	
Botswana	0.029	0.029	0.054	0.019	0.016	0.015	0.015	0.029	0.169	0.037	0.043	0.040	0.066	0.076	0.065	
Benin	0.029	0.029	0.009	0.010	0.009	0.030	0.030	0.014	0.020	0.010	0.008	0.009	0.007	0.006	0.006	
Burkina Faso	0.028	0.028	0.010	0.013	0.011	0.028	0.028	0.027	0.021	0.009	0.006	0.007	0.017	0.022	0.019	
Chad	0.028	0.026	0.016	0.011	0.008	0.008	0.008	0.008	0.006	0.016	0.011	0.013	0.032	0.035	0.030	
Central African Republic	0.026	0.026	0.004	0.003	0.003	0.022	0.019	0.019	0.004	0.004	0.003	0.003	0.008	0.004	0.007	
Lao, People's Dem. Republic	0.025	0.024	0.006	0.007	0.007	0.020	0.020	0.020	0.007	0.007	0.006	0.006	0.015	0.008	0.013	
Mongolia	0.024	0.023	0.010	0.003	0.003	0.009	0.009	0.009	0.007	0.011	0.009	0.010	0.014	0.011	0.012	
Swaziland	0.024	0.023	0.021	0.006	0.005	0.010	0.010	0.010	0.009	0.019	0.020	0.020	0.025	0.034	0.029	
Albania	0.023	0.023	0.026	0.021	0.018	0.028	0.027	0.027	0.036	0.023	0.021	0.022	0.028	0.048	0.041	
Lesotho	0.016	0.016	0.012	0.003	0.003	0.009	0.009	0.009	0.015	0.010	0.009	0.010	0.011	0.019	0.016	
Equatorial Guinea	0.015	0.015	0.039	0.013	0.009	0.032	0.027	0.026	0.016	0.039	0.032	0.035	0.050	0.068	0.058	
Gambia, The	0.015	0.014	0.003	0.001	0.001	0.005	0.005	0.005	0.002	0.003	0.003	0.003	0.005	0.004	0.004	
Belize	0.009	0.009	0.006	0.003	0.003	0.004	0.003	0.003	0.003	0.007	0.005	0.006	0.007	0.005	0.006	
San Marino	0.008	0.008	0.024	0.003	0.003	0.003	0.003	0.002	0.003	0.018	0.018	0.018	0.022	0.029	0.025	
Vanuatu	0.008	0.008	0.003	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.005	0.006	0.005	
Djibouti	0.007	0.007	0.003	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.003	
Eritrea	0.007	0.007	0.008	0.002	0.002	0.007	0.007	0.007	0.001	0.005	0.005	0.005	0.017	0.018	0.016	
St. Lucia	0.007	0.007	0.004	0.002	0.002	0.002	0.002	0.002	0.004	0.005	0.004	0.005	0.004	0.004	0.004	
Guinea-Bissau	0.007	0.006	0.004	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.002	0.001	0.012	0.015	0.013	
Antigua and																

STATISTICAL APPENDIX II

Indicator of Economic Size - The Ranking

Country	Actual	DS I	DS II	DS III	DS IV	DS V	DS VI	Country	Actual	DS I	DS II	DS III	DS IV	DS V	DS VI
United States	1	1	1	1	1	1	1	Cameroon	93	105	106	106	105	104	106
Japan	2	2	2	2	2	2	2	Uganda	94	113	114	116	108	103	108
Germany	3	4	4	4	4	4	4	Bolivia	95	116	121	118	116	119	119
France	4	6	6	6	6	6	6	El Salvador	96	93	90	92	98	95	96
United Kingdom	4	5	5	5	5	5	5	Jordan	96	77	77	79	77	78	80
China	6	3	3	3	3	3	3	Bosnia-Herzegovina	98	90	87	89	92	88	92
Italy	7	7	7	7	9	9	9	Costa Rica	99	83	79	81	85	82	84
Saudi Arabia	8	30	22	22	29	23	25	Afghanistan, Islamic Repub	100	97	100	104	97	98	101
Canada	9	9	9	9	11	11	11	Senegal	100	120	117	120	119	118	120
Russia	10	12	12	13	10	10	10	Azerbaijan	102	111	110	111	109	109	110
Netherlands	11	14	10	10	16	13	14	Gabon	103	110	101	103	114	111	112
Belgium	12	20	17	18	24	18	18	Georgia	104	130	133	134	131	131	131
India	13	13	14	14	7	8	8	Lithuania	105	78	74	76	80	76	78
Switzerland	14	17	16	17	17	17	17	Cyprus	106	82	85	82	87	89	86
Australia	15	19	18	19	22	21	21	Namibia	107	128	126	127	128	125	125
Mexico	16	10	11	11	12	12	12	Bahrain	108	73	72	74	75	72	74
Spain	17	11	13	12	14	16	16	Ethiopia	109	76	76	78	73	73	76
Brazil	18	16	19	16	13	15	13	Papua New Guinea	110	125	122	123	122	120	121
Korea	19	8	8	8	8	7	7	Bahamas, The	111	123	120	121	127	126	126
Venezuela	20	40	34	37	40	38	38	Nicaragua	111	126	128	128	121	124	122
Sweden	21	23	23	23	28	28	27	Honduras	111	109	107	110	111	108	111
Argentina	22	31	38	33	30	33	32	Liberia	114	155	164	157	158	169	161
Indonesia	23	27	26	28	19	20	20	Latvia	115	98	92	97	101	97	100
Austria	24	29	30	30	31	31	31	Moldova	116	135	132	133	134	132	132
South Africa	25	39	40	41	33	36	35	Madagascar	117	127	124	124	124	123	124
Nigeria	26	47	45	45	50	45	46	Iceland	118	106	111	107	113	121	117
Norway	27	24	25	26	26	27	28	Mozambique	119	124	119	122	117	115	115
Denmark	28	25	24	24	27	25	26	Guinea	120	142	144	144	133	134	135
Iran	29	36	31	31	32	30	30	Sierra Leone	121	156	160	160	156	158	157
Malaysia	30	22	20	21	20	19	19	Malta	122	101	93	98	104	100	102
Kuwait	31	52	46	46	57	52	52	Mauritius	122	112	109	112	112	113	113
Ukraine	32	51	51	52	49	46	48	Paraguay	124	107	105	108	107	102	107
Poland	33	28	29	29	25	29	29	Mali	125	129	129	129	129	127	128
Finland	34	34	35	35	39	40	40	Suriname	126	151	151	151	139	144	143
Algeria	35	37	33	36	35	32	33	Armenia	126	137	136	136	149	147	150
Turkey	36	21	28	25	21	26	23	Guyana	128	138	140	139	142	141	141
Iraq	37	60	58	59	64	61	62	Kyrgyz Republic	129	141	143	142	137	137	137
Libya	38	48	48	48	51	50	51	Cambodia	130	99	95	99	95	94	95
Thailand	39	26	27	27	23	22	22	Tajikistan	131	144	145	145	147	148	149
Hungary	40	44	44	44	43	43	43	Congo, Republic of	132	121	125	125	126	130	130
Pakistan	41	50	52	51	47	48	47	Haiti	133	136	141	137	132	135	133
Romania	42	53	54	53	52	53	53	Somalia	133	180	179	180	181	181	181
Egypt	43	46	49	49	45	44	45	Rwanda	135	149	146	147	141	140	140
Israel	44	32	32	32	36	34	34	Burundi	136	168	166	168	159	157	158
New Zealand	45	55	55	56	60	62	60	Turkmenistan	137	92	86	88	91	84	89
Philippines	46	43	41	42	37	35	36	Togo	138	147	147	146	145	146	147
Portugal	47	38	39	40	41	41	42	Nepal	139	115	116	117	110	105	109
Singapore	48	15	15	15	15	14	15	Fiji	140	143	138	141	151	143	145
Chile	49	45	47	47	46	47	49	Malawi	141	153	153	153	144	145	144
Ireland	50	18	21	20	18	24	24	Macedonia, FYR	141	118	118	119	123	122	123
Greece	51	35	43	38	38	49	41	Barbados	143	131	134	132	135	136	136
Czech Republic	52	33	36	34	34	37	37	Niger	144	148	148	149	146	149	148
Colombia	53	49	50	50	48	51	50	Estonia	145	96	91	95	102	96	98
Bulgaria	54	69	70	72	66	66	66	Mauritania	146	152	152	152	154	154	154
Peru	55	54	59	55	53	57	56	Botswana	147	84	80	84	84	79	83
United Arab Emirates	56	41	37	39	42	39	39	Benin	148	139	139	140	140	139	139
Morocco	57	57	56	57	54	55	55	Burkina Faso	149	133	130	131	130	128	129
Bangladesh	58	71	71	73	59	59	58	Chad	150	132	135	135	138	138	138
Congo, Dem. Republic of	58	63	123	69	63	112	69	Central African Republic	150	158	163	159	153	153	153
Zambia	60	122	127	126	125	129	127	Lao, People's Dem. Republ	152	146	150	148	143	151	146
Serbia / Montenegro	61	74	69	71	74	69	70	Mongolia	153	150	149	150	152	152	152
Sri Lanka	62	85	82	86	78	77	79	Swaziland	153	134	131	130	136	133	134
Belarus	63	81	75	77	79	74	75	Albania	155	117	113	114	120	117	118
Ghana	64	104	104	105	90	92	93	Lesotho	156	145	142	143	148	142	142
Kazakhstan	65	61	62	62	61	60	61	Equatorial Guinea	157	114	115	115	115	116	116
Croatia	66	62	64	63	62	64	64	Gambia, The	158	171	171	171	165	165	167
Slovak Republic	67	56	53	54	56	56	57	Belize	159	160	159	161	161	162	162
Zimbabwe	68	119	112	113	118	114	114	San Marino	160	140	137	138	150	150	151
Trinidad and Tobago	69	89	84	87	94	87	91	Vanuatu	160	172	172	172	174	172	174
Vietnam	70	59	60	60	55	54	54	Djibouti	162	169	168	169	170	168	171
Cote d'Ivoire	71	95	88	90	100	93	94	Eritrea	162	154	154	154	155	155	155
Sudan	72	102	97	101	89	86	90	St. Lucia	164	165	165	167	168	167	169
Uruguay	73	80	89	83	82	91	85	Guinea-Bissau	165	163	161	164	162	163	164
Ecuador	74	67	81	70	68	83	71	Antigua and Barbuda	165	167	156	156	169	160	160
Syrian Arab Republic	75	65	63	64	76	75	77	Grenada	167	170	170	170	172	171	172
Tunisia	76	75	73	75	70	71	72	Samoa	167	178	177	177	176	176	176
Angola	77	64	61	61	65	63	63	Solomon Islands	169	174	173	173	171	166	168
Luxembourg	78	42	42	43	44	42	44	Cape Verde	169	161	167	163	164	170	166
Uzbekistan	79	88	94	91	86	90	87	Comoros	171	179	178	179	179	177	178
Jamaica	80	94	103	96	103	110	105	St. Kitts and Nevis	171	176	174	175	177	175	175
Kenya	81	100	102	100	96	99	97	Seychelles	171	162	169	165	167	174	170
Qatar	82	70	68	68	72	70	73	St. Vincent and the Grenadi	174	173	176	174	175	179	177
Myanmar	83	108	108	109	88	85	88	Dominica	174	177	180	178	173	173	173
Yemen, Republic of	84	68	67	67	69	67	68	Maldives	174	164	158	162	166	164	165
Slovenia	85	66	65	65	67	65	65	Timor-Leste	174	157	155	155	160	159	159
Dominican Republic	86	86	83	85	83	81	82	Sao Tome and Principe	178	184	184	184	184	184	184
Brunei Darussalam	87	87	99	93	93	106	99	Tonga	178	181	181	181	180	180	180
Guatemala	88	79	78	80	81	80	81	Bhutan	180	159	157	158	157	156	156
Panama	89	91	98	94	99	107	103	Kiribati	180	166	162	166	163	161	163
Lebanon	90	58	57	58	58	58	59	Micronesia, Fed. States of	182	175	175	176	178	178	179
Tanzania	91	103	96	102	106	101	104	Marshall Islands	183	183	183	183	183	183	183
Oman	92	72	66	66	71	68	67	Palau, Republic of	184	182	182	182	182	182	182

Source: IMF

Source: IMF

STATISTICAL APPENDIX III

Quotas, Adjusted Quotas and Voting Power 1/

	Actual shares before		Actual shares after		DS I			DS II			DS III			DS IV			DS V			DS VI		
	Quotas	Voting	Quotas	Voting	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power
United States	17.382	17.027	17.077	16.735	19.273	17.077	16.176	17.251	15.525	14.708	18.490	17.077	16.176	14.792	15.525	14.708	12.570	15.525	14.708	13.903	15.525	14.708
Japan	6.229	6.109	6.120	6.004	12.010	6.120	5.816	12.675	6.120	5.816	12.092	6.120	5.816	11.582	6.120	5.816	12.303	6.120	5.816	11.701	6.120	5.816
Germany	6.086	5.969	5.980	5.867	6.062	5.436	5.169	5.590	5.436	5.169	5.811	5.436	5.169	5.174	5.436	5.169	4.640	5.436	5.169	4.894	5.436	5.169
France	5.025	4.930	4.937	4.846	3.740	4.488	4.273	3.847	4.488	4.273	3.776	4.488	4.273	3.077	4.488	4.273	3.143	4.488	4.273	3.092	4.488	4.273
United Kingdom	5.025	4.930	4.937	4.846	3.855	4.488	4.273	4.198	4.488	4.273	4.116	4.488	4.273	3.178	4.488	4.273	3.470	4.488	4.273	3.414	4.488	4.273
Italy	3.301	3.243	3.244	3.188	2.902	2.949	2.818	2.979	2.949	2.818	2.918	2.949	2.818	2.453	2.949	2.818	2.498	2.949	2.818	2.456	2.949	2.818
Saudi Arabia	3.269	3.211	3.211	3.156	0.747	2.919	2.790	1.015	2.919	2.790	0.995	2.919	2.790	0.744	2.919	2.790	1.014	2.919	2.790	0.989	2.919	2.790
Canada	2.980	2.929	2.928	2.878	2.327	2.662	2.546	2.542	2.662	2.546	2.493	2.662	2.546	2.116	2.662	2.546	2.314	2.662	2.546	2.271	2.662	2.546
China	2.980	2.929	3.719	3.653	6.513	5.584	5.310	7.019	6.391	6.072	6.667	5.725	5.442	9.903	6.781	6.441	10.547	7.181	6.819	10.145	7.168	6.807
Russia	2.782	2.734	2.733	2.688	1.834	2.484	2.379	1.911	2.484	2.379	1.844	2.484	2.379	2.280	2.484	2.379	2.380	2.484	2.379	2.301	2.484	2.379
Netherlands	2.415	2.376	2.373	2.335	1.628	2.157	2.069	1.938	2.157	2.069	1.909	2.157	2.069	1.438	2.157	2.069	1.728	2.157	2.069	1.706	2.157	2.069
Belgium	2.155	2.121	2.117	2.084	1.148	1.924	1.849	1.319	1.924	1.849	1.298	1.924	1.849	1.046	1.924	1.849	1.205	1.924	1.849	1.188	1.924	1.849
India	1.945	1.916	1.911	1.883	1.683	1.738	1.673	1.788	1.738	1.673	1.705	1.738	1.673	1.280	2.428	2.325	3.108	2.518	2.411	3.007	2.499	2.393
Switzerland	1.618	1.596	1.590	1.568	1.352	1.446	1.396	1.357	1.446	1.396	1.313	1.446	1.396	1.311	1.446	1.396	1.315	1.446	1.396	1.272	1.446	1.396
Australia	1.514	1.494	1.488	1.468	1.206	1.352	1.308	1.263	1.352	1.308	1.230	1.352	1.308	1.077	1.352	1.308	1.130	1.352	1.308	1.099	1.352	1.308
Spain	1.427	1.408	1.402	1.384	1.937	1.759	1.692	1.845	1.761	1.695	1.869	1.719	1.655	1.673	1.274	1.234	1.562	1.274	1.234	1.596	1.274	1.234
Brazil	1.421	1.402	1.396	1.378	1.454	1.269	1.229	1.246	1.269	1.229	1.384	1.269	1.229	1.802	1.597	1.540	1.609	1.269	1.229	1.741	1.269	1.229
Venezuela	1.244	1.229	1.222	1.208	0.432	1.111	1.080	0.483	1.111	1.080	0.470	1.111	1.080	0.444	1.111	1.080	0.499	1.111	1.080	0.482	1.111	1.080
Mexico	1.210	1.196	1.449	1.431	1.962	1.792	1.724	1.935	1.842	1.772	1.891	1.750	1.684	1.966	1.705	1.642	1.938	1.697	1.634	1.895	1.689	1.626
Sweden	1.121	1.109	1.101	1.090	0.936	1.001	0.976	1.006	1.001	0.976	0.983	1.001	0.976	0.850	1.001	0.976	0.914	1.001	0.976	0.893	1.001	0.976
Argentina	0.991	0.981	0.973	0.964	0.554	0.885	0.866	0.444	0.885	0.866	0.508	0.885	0.866	0.696	0.885	0.866	0.592	0.885	0.866	0.653	0.885	0.866
Indonesia	0.973	0.964	0.956	0.947	0.858	0.869	0.851	0.861	0.869	0.851	0.834	0.869	0.851	1.150	0.869	0.851	1.165	0.869	0.851	1.132	0.869	0.851
Austria	0.876	0.869	0.861	0.854	0.776	0.782	0.769	0.768	0.782	0.769	0.752	0.782	0.769	0.692	0.782	0.769	0.675	0.782	0.769	0.664	0.782	0.769
South Africa	0.874	0.868	0.859	0.853	0.435	0.781	0.768	0.427	0.781	0.768	0.417	0.781	0.768	0.571	0.781	0.768	0.566	0.781	0.768	0.555	0.781	0.768
Nigeria	0.820	0.814	0.806	0.800	0.290	0.733	0.722	0.331	0.733	0.722	0.323	0.733	0.722	0.337	0.733	0.722	0.382	0.733	0.722	0.371	0.733	0.722
Norway	0.782	0.777	0.769	0.764	0.927	0.699	0.690	0.939	0.699	0.690	0.908	0.699	0.690	0.904	0.699	0.690	0.919	0.699	0.690	0.886	0.699	0.690
Denmark	0.769	0.764	0.755	0.751	0.926	0.687	0.679	0.989	0.687	0.679	0.960	0.687	0.679	0.902	0.687	0.679	0.967	0.687	0.679	0.936	0.687	0.679
Korea	0.765	0.760	1.346	1.329	2.758	2.289	2.194	2.933	2.631	2.518	2.810	2.342	2.244	2.949	2.139	2.052	3.143	2.257	2.164	3.010	2.239	2.147
Iran	0.700	0.697	0.688	0.685	0.460	0.626	0.621	0.653	0.626	0.621	0.621	0.626	0.621	0.635	0.626	0.621	0.747	0.626	0.621	0.721	0.626	0.621
Malaysia	0.696	0.693	0.684	0.681	0.979	0.881	0.863	1.053	0.983	0.959	1.013	0.908	0.888	1.109	0.894	0.875	1.190	0.940	0.919	1.145	0.931	0.910
Kuwait	0.646	0.644	0.635	0.633	0.240	0.577	0.575	0.325	0.577	0.575	0.320	0.577	0.575	0.233	0.577	0.575	0.320	0.577	0.575	0.312	0.577	0.575
Ukraine	0.642	0.640	0.631	0.629	0.241	0.573	0.572	0.250	0.573	0.572	0.242	0.573	0.572	0.357	0.573	0.572	0.370	0.573	0.572	0.360	0.573	0.572
Poland	0.641	0.638	0.629	0.628	0.826	0.572	0.571	0.790	0.572	0.571	0.794	0.572	0.571	0.913	0.770	0.757	0.881	0.572	0.571	0.883	0.572	0.571
Finland	0.591	0.590	0.581	0.580	0.511	0.528	0.529	0.480	0.528	0.529	0.487	0.528	0.529	0.465	0.528	0.529	0.431	0.528	0.529	0.439	0.528	0.529
Algeria	0.587	0.586	0.577	0.576	0.454	0.524	0.526	0.510	0.524	0.526	0.486	0.524	0.526	0.563	0.524	0.526	0.627	0.524	0.526	0.598	0.524	0.526
Iraq	0.556	0.556	0.546	0.546	0.159	0.496	0.499	0.192	0.496	0.499	0.189	0.496	0.499	0.157	0.496	0.499	0.191	0.496	0.499	0.187	0.496	0.499
Libya	0.526	0.526	0.517	0.517	0.274	0.470	0.474	0.308	0.470	0.474	0.294	0.470	0.474	0.319	0.470	0.474	0.358	0.470	0.474	0.341	0.470	0.474
Thailand	0.506	0.507	0.497	0.498	0.875	0.750	0.739	0.852	0.785	0.771	0.836	0.728	0.718	1.069	0.781	0.768	1.055	0.780	0.767	1.035	0.786	0.773
Hungary	0.486	0.487	0.477	0.479	0.390	0.434	0.440	0.363	0.434	0.440	0.373	0.434	0.440	0.417	0.434	0.440	0.390	0.434	0.440	0.400	0.434	0.440
Pakistan	0.484	0.485	0.475	0.477	0.253	0.432	0.438	0.245	0.432	0.438	0.246	0.432	0.438	0.369	0.432	0.438	0.365	0.432	0.438	0.364	0.432	0.438
Romania	0.482	0.483	0.473	0.475	0.233	0.430	0.437	0.216	0.430	0.437	0.224	0.430	0.437	0.283	0.430	0.437	0.268	0.430	0.437	0.276	0.430	0.437
Turkey	0.451	0.453	0.548	0.548	0.997	0.847	0.831	0.835	0.780	0.767	0.926	0.805	0.791	1.085	0.814	0.799	0.930	0.741	0.731	1.017	0.800	0.786
Egypt	0.442	0.444	0.434	0.436	0.298	0.395	0.403	0.290	0.395	0.403	0.286	0.395	0.403	0.389	0.395	0.403	0.385	0.395	0.403	0.379	0.395	0.403
Israel	0.434	0.437	0.427	0.429	0.530	0.388	0.396	0.557	0.388	0.396	0.537	0.388	0.396	0.547	0.388	0.396	0.576	0.388	0.396	0.555	0.388	0.396
New Zealand	0.419	0.421	0.411	0.414	0.214	0.374	0.383	0.208	0.374	0.383	0.206	0.374	0.383	0.197	0.374	0.383	0.190	0.374	0.383	0.188	0.374	0.383
Philippines	0.412	0.415	0.405	0.407	0.402	0.368	0.377	0.422	0.368	0.377	0.411	0.368	0.377	0.542	0.368	0.377	0.567	0.368	0.377	0.553	0.368	0.377
Portugal	0.406	0.409	0.399	0.402	0.450	0.362	0.372	0.430	0.362	0.372	0.424	0.362	0.372	0.428	0.362	0.372	0.406	0.362	0.372	0.401	0.362	0.372
Singapore	0.404	0.407	0.397	0.400	1.515	1.143	1.111	1.518	1.305	1.263	1.449	1.113	1.082	1.659	1.022	0.996	1.677	1.046	1.019	1.600	1.043	1.015
Chile	0.401	0.404	0.393	0.397	0.329	0.358	0.368	0.323	0.358	0.368	0.316	0.358	0.368	0.371	0.358	0.368	0.368	0.358	0.368	0.360	0.358	0.368
Ireland	0.392	0.395	0.385	0.389	1.227	0.947	0.925	1.029	0.907	0.887	1.076	0.855	0.838	1.168	0.773	0.761	0.969	0.681	0.674	1.012	0.722	0.712
Greece	0.385	0.388	0.378	0.382	0.507	0.344	0.355	0.400	0.344	0.355	0.464	0.344	0.355	0.								

	Actual shares before		Actual shares after		DS I			DS II			DS III			DS IV			DS V			DS VI		
	Quotas	Voting	Quotas	Voting	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power	Quota shares before	After adjustment Quota shares	Voting power
Serbia / Montenegro	0.219	0.226	0.215	0.222	0.099	0.196	0.215	0.118	0.196	0.215	0.115	0.196	0.215	0.107	0.196	0.215	0.128	0.196	0.215	0.124	0.196	0.215
Sri Lanka	0.193	0.201	0.190	0.197	0.064	0.173	0.193	0.065	0.173	0.193	0.063	0.173	0.193	0.090	0.173	0.193	0.092	0.173	0.193	0.090	0.173	0.193
Belarus	0.181	0.188	0.177	0.185	0.072	0.161	0.182	0.084	0.161	0.182	0.083	0.161	0.182	0.089	0.161	0.182	0.102	0.161	0.182	0.100	0.161	0.182
Ghana	0.173	0.180	0.170	0.177	0.041	0.154	0.175	0.038	0.154	0.175	0.038	0.154	0.175	0.061	0.154	0.175	0.059	0.154	0.175	0.059	0.154	0.175
Kazakhstan	0.171	0.179	0.168	0.176	0.156	0.153	0.174	0.156	0.153	0.174	0.151	0.153	0.174	0.191	0.153	0.174	0.193	0.153	0.174	0.187	0.153	0.174
Croatia	0.171	0.179	0.168	0.176	0.152	0.153	0.174	0.144	0.153	0.174	0.147	0.153	0.174	0.165	0.153	0.174	0.158	0.153	0.174	0.160	0.153	0.174
Slovak Republic	0.168	0.175	0.165	0.172	0.202	0.150	0.171	0.222	0.150	0.171	0.213	0.150	0.171	0.234	0.150	0.171	0.256	0.211	0.229	0.246	0.208	0.226
Zimbabwe	0.165	0.173	0.162	0.170	0.024	0.148	0.169	0.029	0.148	0.169	0.029	0.148	0.169	0.029	0.148	0.169	0.034	0.148	0.169	0.034	0.148	0.169
Trinidad and Tobago	0.157	0.165	0.154	0.163	0.055	0.140	0.162	0.061	0.140	0.162	0.059	0.140	0.162	0.058	0.140	0.162	0.064	0.140	0.162	0.062	0.140	0.162
Vietnam	0.154	0.162	0.151	0.159	0.161	0.137	0.160	0.179	0.137	0.160	0.173	0.137	0.160	0.244	0.197	0.216	0.265	0.209	0.227	0.258	0.209	0.227
Cote d'Ivoire	0.152	0.160	0.149	0.158	0.047	0.136	0.158	0.054	0.136	0.158	0.053	0.136	0.158	0.054	0.136	0.158	0.058	0.136	0.158	0.056	0.136	0.158
Sudan	0.147	0.156	0.145	0.153	0.042	0.132	0.154	0.041	0.132	0.154	0.041	0.132	0.154	0.066	0.132	0.154	0.066	0.132	0.154	0.065	0.132	0.154
Uruguay	0.144	0.152	0.141	0.149	0.074	0.128	0.151	0.052	0.128	0.151	0.067	0.128	0.151	0.082	0.128	0.151	0.060	0.128	0.151	0.074	0.128	0.151
Ecuador	0.141	0.150	0.139	0.147	0.134	0.126	0.149	0.067	0.126	0.149	0.115	0.126	0.149	0.139	0.126	0.149	0.073	0.126	0.149	0.121	0.126	0.149
Syrian Arab Republic	0.138	0.146	0.135	0.144	0.138	0.123	0.146	0.144	0.123	0.146	0.142	0.123	0.146	0.096	0.123	0.146	0.100	0.123	0.146	0.099	0.123	0.146
Tunisia	0.134	0.143	0.132	0.140	0.094	0.120	0.143	0.089	0.120	0.143	0.091	0.120	0.143	0.116	0.120	0.143	0.111	0.120	0.143	0.113	0.120	0.143
Angola	0.134	0.142	0.131	0.140	0.145	0.120	0.143	0.159	0.120	0.143	0.159	0.120	0.143	0.150	0.120	0.143	0.166	0.120	0.143	0.163	0.120	0.143
Luxembourg	0.131	0.139	0.128	0.137	0.405	0.313	0.326	0.406	0.353	0.363	0.402	0.315	0.327	0.397	0.261	0.277	0.396	0.264	0.279	0.392	0.270	0.285
Uzbekistan	0.129	0.138	0.127	0.136	0.056	0.115	0.139	0.044	0.115	0.139	0.051	0.115	0.139	0.073	0.115	0.139	0.062	0.115	0.139	0.069	0.115	0.139
Jamaica	0.128	0.137	0.126	0.135	0.048	0.115	0.138	0.038	0.115	0.138	0.045	0.115	0.138	0.049	0.115	0.138	0.039	0.115	0.138	0.046	0.115	0.138
Kenya	0.127	0.136	0.125	0.133	0.045	0.113	0.137	0.039	0.113	0.137	0.042	0.113	0.137	0.056	0.113	0.137	0.051	0.113	0.137	0.054	0.113	0.137
Qatar	0.124	0.132	0.121	0.130	0.114	0.110	0.134	0.119	0.110	0.134	0.117	0.110	0.134	0.109	0.110	0.134	0.115	0.110	0.134	0.112	0.110	0.134
Myanmar	0.121	0.130	0.119	0.127	0.034	0.108	0.132	0.034	0.108	0.132	0.033	0.108	0.132	0.067	0.108	0.132	0.067	0.108	0.132	0.066	0.108	0.132
Yemen, Republic of	0.114	0.123	0.112	0.121	0.126	0.102	0.126	0.128	0.102	0.126	0.125	0.102	0.126	0.133	0.102	0.126	0.137	0.102	0.126	0.132	0.102	0.126
Slovenia	0.109	0.118	0.107	0.116	0.134	0.097	0.121	0.140	0.097	0.121	0.134	0.097	0.121	0.143	0.097	0.121	0.150	0.097	0.121	0.144	0.097	0.121
Dominican Republic	0.102	0.112	0.101	0.110	0.062	0.092	0.116	0.065	0.092	0.116	0.064	0.092	0.116	0.077	0.092	0.116	0.080	0.092	0.116	0.079	0.092	0.116
Brunei Darussalam	0.101	0.110	0.099	0.108	0.058	0.090	0.115	0.040	0.090	0.115	0.050	0.090	0.115	0.059	0.090	0.115	0.041	0.090	0.115	0.050	0.090	0.115
Guatemala	0.098	0.108	0.097	0.106	0.075	0.088	0.113	0.070	0.088	0.113	0.073	0.088	0.113	0.084	0.088	0.113	0.080	0.088	0.113	0.082	0.088	0.113
Panama	0.097	0.106	0.095	0.104	0.052	0.087	0.111	0.041	0.087	0.111	0.048	0.087	0.111	0.052	0.087	0.111	0.041	0.087	0.111	0.048	0.087	0.111
Lebanon	0.095	0.104	0.093	0.103	0.192	0.159	0.180	0.198	0.178	0.198	0.189	0.159	0.180	0.207	0.149	0.171	0.215	0.155	0.176	0.205	0.153	0.174
Tanzania	0.093	0.103	0.091	0.101	0.041	0.083	0.108	0.041	0.083	0.108	0.040	0.083	0.108	0.047	0.083	0.108	0.048	0.083	0.108	0.046	0.083	0.108
Oman	0.091	0.100	0.089	0.099	0.107	0.081	0.106	0.131	0.081	0.106	0.128	0.081	0.106	0.111	0.081	0.106	0.136	0.113	0.137	0.133	0.081	0.106
Cameroon	0.087	0.097	0.086	0.095	0.038	0.078	0.103	0.034	0.078	0.103	0.036	0.078	0.103	0.047	0.078	0.103	0.043	0.078	0.103	0.044	0.078	0.103
Uganda	0.085	0.094	0.083	0.093	0.027	0.076	0.101	0.028	0.076	0.101	0.027	0.076	0.101	0.043	0.076	0.101	0.044	0.076	0.101	0.043	0.076	0.101
Bolivia	0.080	0.090	0.079	0.089	0.025	0.072	0.098	0.023	0.072	0.098	0.024	0.072	0.098	0.031	0.072	0.098	0.029	0.072	0.098	0.030	0.072	0.098
El Salvador	0.080	0.090	0.079	0.088	0.050	0.071	0.097	0.051	0.071	0.097	0.050	0.071	0.097	0.054	0.071	0.097	0.056	0.071	0.097	0.054	0.071	0.097
Jordan	0.080	0.090	0.079	0.088	0.080	0.071	0.097	0.074	0.071	0.097	0.077	0.071	0.097	0.092	0.071	0.097	0.086	0.071	0.097	0.090	0.071	0.097
Bosnia-Herzegovina	0.079	0.089	0.078	0.087	0.052	0.071	0.096	0.055	0.071	0.096	0.054	0.071	0.096	0.060	0.071	0.096	0.063	0.071	0.096	0.062	0.071	0.096
Costa Rica	0.077	0.087	0.075	0.085	0.067	0.069	0.094	0.070	0.069	0.094	0.068	0.069	0.094	0.075	0.069	0.094	0.078	0.069	0.094	0.076	0.069	0.094
Afghanistan, Islamic Republic of	0.076	0.086	0.074	0.084	0.045	0.068	0.094	0.040	0.068	0.094	0.039	0.068	0.094	0.055	0.068	0.094	0.051	0.068	0.094	0.050	0.068	0.094
Senegal	0.076	0.086	0.074	0.084	0.024	0.068	0.094	0.025	0.068	0.094	0.024	0.068	0.094	0.029	0.068	0.094	0.030	0.068	0.094	0.029	0.068	0.094
Azerbaijan	0.075	0.085	0.074	0.084	0.032	0.067	0.093	0.030	0.067	0.093	0.030	0.067	0.093	0.042	0.067	0.093	0.040	0.067	0.093	0.040	0.067	0.093
Gabon	0.072	0.082	0.071	0.081	0.033	0.064	0.090	0.040	0.064	0.090	0.039	0.064	0.090	0.032	0.064	0.090	0.039	0.064	0.090	0.038	0.064	0.090
Georgia	0.070	0.080	0.069	0.079	0.015	0.063	0.089	0.014	0.063	0.089	0.014	0.063	0.089	0.018	0.063	0.089	0.018	0.063	0.089	0.017	0.063	0.089
Lithuania	0.067	0.077	0.066	0.076	0.078	0.060	0.087	0.087	0.060	0.087	0.085	0.060	0.087	0.089	0.060	0.087	0.098	0.060	0.087	0.095	0.060	0.087
Cyprus	0.066	0.076	0.064	0.074	0.071	0.059	0.085	0.060	0.059	0.085	0.068	0.059	0.085	0.073	0.059	0.085	0.063	0.059	0.085	0.070	0.059	0.085
Namibia	0.064	0.074	0.063	0.073	0.015	0.057	0.084	0.019	0.057	0.084	0.019	0.057	0.084	0.019	0.057	0.084	0.023	0.057	0.084	0.023	0.057	0.084
Bahrain	0.063	0.073	0.062	0.072	0.100	0.087	0.112	0.104	0.096	0.120	0.102	0.089	0.114	0.101	0.081	0.107	0.105	0.084	0.109	0.103	0.084	0.109
Ethiopia	0.063	0.073	0.062	0.072	0.087	0.056	0.083	0.079	0.056	0.083	0.078	0.056	0.083	0.108	0.085	0.110	0.102	0.082	0.107	0.100	0.082	0.107
Papua New Guinea	0.062	0.072	0.061	0.071	0.021	0.055	0.082	0.022	0.055	0.082	0.022	0.055	0.082	0.026	0.055	0.082	0.027	0.055	0.082	0.026	0.055	0.082
Bahamas, The	0.061	0.071	0.060	0.070	0.022	0.054	0.081	0.024	0.054	0.081	0.023	0.054	0.081	0.021	0.054	0.081	0.023	0.054	0.081	0.		

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