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Governance Shares for the International Monetary Fund: Principles, Guidelines, Current Status

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Summary

During coming months, member governments will again re-negotiate quota shares and voting-rights shares – "governance shares" – for the International Monetary Fund.[1] This essay emphasizes principles and guidelines that, ideally, should influence the negotiations.

By emphasizing basic principles and introducing ideas not currently entertained, the analysis here is out of tune with the ongoing negotiations. Nonetheless, some participants and observers may find it helpful to stand back, pondering an overview of the issues. Moreover, governments will eventually find themselves pushed to allocate governance shares in the IMF with guidelines that are more defensible and that can be better sustained for the longer run. The analysis here should be, at the least, a cautionary check on the propensity to make short-run choices that exacerbate future problems.

The essay begins with relevant principles and then explains the need for a "quota formula," an objective assessment of countries' relative status in the world polity, economy, and financial system. No one formula can be judged as unambiguously preferable. But a powerful case exists for developing a satisfactory formula as an objective starting point for negotiations. An objective formula is a presumptive norm superior to alternative procedures ignoring an objective assessment of the relative status of members. The final outcome of negotiations should be an artful blend of formula calculations and constructive political bargaining.

The preferred structure for a quota formula incorporates variables expressed as the fractional shares of an IMF member in a global total. *Ratio-share* variables should be included as well as *level-share* variables. Ratio-share variables can better identify features of members'

[1] "Governance shares" is used here as shorthand for quota shares *and* voting-rights shares. An individual member's voting-rights share in the IMF depends mainly on its quota share but is also significantly influenced by its number of "basic votes."

economies and polities that are *qualitatively* distinct rather than dominantly determined by economic size.

The most comprehensive gauges of countries' relative economic status are based on gross domestic product or income – measured at market prices and exchange rates, measured at purchasing-power parities, or measured as a blend of both. GDP-based variables are the single most important class of variables for a quota formula. Other gauges, however, can be judged relevant. In principle, financial-activity variables should be incorporated (although lack of sufficient data for all IMF members will probably prevent that from happening in the near future). Shares in world population merit inclusion (notwithstanding the failure of official discussions to seriously discuss that possibility). Two ratio-share variables that deserve consideration are the ratio of gross cross-border current-account transactions to market-price GDP (an analytically more appropriate measure of current-account openness than the faulty "openness" variable currently in use) and a scaled gauge of the variability of cross-border transactions (the ratio of standard-deviation calculations of variability scaled by market-price GDP). Alternative conceptual perspectives can of course lead to different choices about the variables to be included in a quota formula.

Against the background of principles and general guidelines, the essay examines the current quota formula that was agreed at the time of the package of governance reforms concluded in April 2008. The communique of the September 2009 G-20 meeting in Pittsburgh indicated that "we [G-20 leaders] are committed to a shift in quota shares to dynamic emerging market and developing countries of at least five percent from over-represented to under-represented countries *using the current IMF quota formula as the basis to work from* (italics added). We are also committed to protecting the voting share of the poorest in the IMF." Unfortunately, there is no straightforward way – however the words are interpreted – to use the current formula as a basis for meeting that commitment. The current formula justifies a large calculated increase in quota share for China, substantial increases for countries such as Mexico, Brazil, Turkey, and moderate increases for some dozen other emerging-market countries. But it calculates *declines* in quota shares for countries such as India, Russia, Pakistan, and Peru. For the aggregate of all countries other than China, India, Brazil, Mexico, and Russia that are classified as not-advanced and not-higher-income, the formula mandates a share reduction of 3.09 % points. The G-7 countries taken together are calculated as over-represented by the meager amount of only 0.31 percentage points. For the 71 countries eligible as of late 2009 to borrow

from the IMF's Poverty Reduction and Growth Trust Facility (PRGF), the formula calculates a *decline* in aggregate share of 1.74 percentage points.

The current formula imposes an arbitrary mathematical device of a "compression factor." If this compression factor is removed from the calculations, the results from using the current formula are still more problematic. For example, the G-7 countries are calculated to be *under-represented* by 2.35 percentage points! For the 71 PRGF countries, the current formula without the compression factor points to an even larger *decline* in aggregate share of 2.16 percentage points.

The conclusion seems inescapable that the current formula is an inadequate basis from which to work if the intent really is to significantly increase the aggregate quota share of dynamic emerging-market and developing countries by at least 5 percentage points. And the current formula points in the *wrong* direction if the goal is to prevent a diminution in the quota shares of the IMF's poorest members. Semantic euphemisms aside, negotiators will have to abandon the current formula and find some better way to construct and explain their decisions.

One possibility would entail *de facto* jettisoning of all formulas and negotiating a bargaining outcome that could command consensus from the largest, most influential IMF members. Yet that course would undermine, now and for the future, development of a presumptive norm for objective assessment of countries' relative status.

To encourage thinking about possible revisions in the quota formula, the essay describes an illustrative revised formula and reports results from its use. That illustration raises the combined weight associated with GDP variables; reduces the weights on gross cross-border transactions, on unscaled variability, and on international reserves; adds a new variable for shares in world population; and introduces ratio-share variables for current-account openness and scaled variability. The illustrative formula is not so much a recommendation as a catalyst for further thinking about how to improve the ability of the quota formula to achieve systemic IMF goals.

The illustrative formula generates very different conclusions from those obtained with the current formula. For example, the G-7 countries are *over-represented* by the large amount of 4.72 % points. China is calculated with a much larger quota share; the calculated shares of India, Brazil, and Mexico are significantly larger. The 78 poorer IMF members eligible to borrow from the IMF's PRGF are *under-represented* by 5.02 % points (instead of over-represented by 2.25 % points).

The illustrative formula is an improvement in several respects. But other aspects are problematic. For many IMF members, the calculated increments in shares would be controversial. No doubt many official participants in the negotiations will perceive the illustration as going too far in shifting quota shares away from developed and toward emerging-market and developing members.

The adjustments in quota shares to be decided in the upcoming negotiations – and, in turn, the changes in voting shares derived from them -- are just part of the large subject of reforms for IMF governance. The size and composition of the IMF Executive Board, and hence the organization of members into constituencies, are at least as important. Other key issues include the size of prospective quota increases and SDR allocations, and implementation of the Council provided for as a possibility in the Articles of Agreement.

This essay has a restricted focus and does not try to cover the other dimensions of governance reform. Yet those dimensions are closely interdependent with what has been analyzed here. An improved formula and procedures for allocating quota shares is a necessary condition – necessary, but not sufficient – for satisfactory resolution of the whole range of governance issues.

The world community in the upcoming negotiations in 2010 should frankly acknowledge the inadequacy of the existing quota formula and try to reach agreement on an improved approach for the determination of governance shares.

Principles

The IMF is a universalist international organization: virtually all national governments in the world are members. The organization has a worldwide mandate to advance the goals of its members collectively. Because every member government has a stake, correspondingly each should participate – have an effective voice -- in IMF governance.

Yet the world community of nations is highly diverse. Nations range from small to large, from rich to poor, from economically influential to economically fragile. A successful international organization – one that is legitimate in terms of both representativeness and effectiveness – cannot operate with governance procedures that treat each member nation as an equivalently important decisionmaking unit. A larger, richer, or economically more influential member has, other things equal, a bigger stake and greater responsibilities in the IMF than a member that is smaller, poorer, or economically more fragile. The IMF's existing governance structure thus accords different sized quotas to each individual member, and the quotas in turn determine different-sized *weighted* votes for the members. This sound approach contrasts sharply with the one-nation/one-vote governance of the United Nations General Assembly.

The *relative* importance of individual nations can wax or wane. It follows that governance shares in the IMF over time should be adapted – "rebalanced" -- to reflect such changes in relative importance.

Governance procedures for an international organization should reflect its particular functions. Different functions may require differing governance shares for its members.

The original Bretton Woods concept of the IMF was to establish an intergovernmental lending intermediary. All nations in the world would be members and all would contribute financial resources. Each member would be able to use IMF resources in times when it had payments imbalances that needed to be financed. Payments deficits would oscillate over time, so that each nation would at times be in surplus and at other times in deficit. The lending-intermediary operations were the IMF's primary function.

In the decades that followed, however, the world changed greatly. Surveillance and crisis prevention are arguably the most important IMF functions today and for the future. All IMF members can benefit from the IMF being an *adjustment referee* and a *cooperation catalyst*. The IMF can play a critical role in collective crisis management. It can catalyze collective prudential overview of supervision and regulation of financial systems. More generally, it can facilitate oversight, monitoring, and implementation of the working norms and rules of the international financial system. Intergovernmental lending-intermediary operations that smooth the financing of payments imbalances continue as an important IMF function. But those operations are less important than in earlier decades, and are no longer the dominant function.[2]

A robust, sustainable approach for determining governance shares in the IMF should take into account all the IMF's functions, not solely its role as an intergovernmental lending intermediary. Hence a wide range of variables is relevant, not merely the ability of members to contribute resources to the IMF or the needs of members to borrow the IMF's resources. It follows that the determination of governance shares should focus on variables that are broad, comprehensive measures of members' relative status in the world polity, economy, and financial system.

The negotiation of governance shares in the IMF should not exclude political influences. Nor, realistically, could it do so. The final details in a negotiating round should be a collective political decision by member governments (discussed further below).

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[2] These issues are identified and analyzed in Bryant (2003, 2004).

Nonetheless, it will be beneficial to ground the negotiations in an objective assessment of the relative status of members. Without an objective assessment, negotiations are bound to be dominated by raw political horse-trading, which in turn ensures that the status quo of governance shares and inertia will play too large a role in negotiations. Lack of an objectively defensible assessment of relative status increases the chances of unproductive conflictual negotiations and lowers the probability that the negotiated outcome will reflect systemic values and goals.

Objective Assessment of Relative Status: The Need for a Rebalancing "Quota Formula"

Because of the IMF's multiple functions and alternative perspectives about their importance, numerous variables are potential candidates for objective assessment of members' relative status in the world polity, economy, and financial system. Alternative perspectives are summarized below.

Candidate variables include a member's gross domestic product (GDP) measured at market prices and exchange rates, its gross domestic product measured at purchasing-power-parity prices (PPP-GDP), and a broad measure of the size of its financial system (aggregate financial activity). The size of a member's population reflects its relative status in both economic and political terms. Variables emphasizing the open-economy dimensions of a member's relative status include the values of its liquid-asset international reserves, its gross flows of cross-border trade, and the gross stocks of its cross-border financial assets and liabilities.

Some candidate variables for assessment of relative status are ratios of two or more variables. Possibilities include the ratio of a member's cross-border trade in goods and services to its GDP (current-account openness), the ratio of its cross-border financial assets or liabilities to its aggregate financial activity (financial openness), and the "variability" of some measure of a member's cross-border transactions, defined for example as the ratio of the standard deviation of the cross-border transactions to its mean value (both numerator and denominator measured over some past period).

Different candidate variables imply diverse conclusions about relative status. Many variables may have a claim to be considered relevant for one or more of the IMF's multiple functions. Yet, plainly, no single variable can be an adequate yardstick.

Figure 1 illustrates the point by comparing several candidate variables for the five large nations Japan, Germany, the United Kingdom, China, and India. China has about the same share of world GDP at market prices and exchange rates as Germany, a noticeably bigger share of world PPP-GDP, a smaller share of world gross cross-border current-account transactions, and very much larger shares of world international reserves and of world population. Or consider the comparison between Japan and India. For market-price GDP Japan has a world share five times greater than India's, for PPP-GDP only 1-1/2 times greater, for gross external trade 3-5/6 times greater, and for international reserves more than 4 times greater; for population, however, Japan's world share is only 1/9 of India's. For each of the five nations, the current-account openness ratio as a fraction of the world sum of ratios for all IMF members is quite small.

The right-hand side of Figure 1 shows the current status of quota shares (proposed as of the April 2008 agreement) for the IMF quotas of the five countries. Germany's share of quotas, 6.11 percent, is 1-1/2 times larger than China's share of 4.00 percent. Japan's quota share, 6.56 percent, is 2.77 times larger than India's share of 2.44 percent.[3]

[3] The data in Figure 1 for world shares in market-price GDP, PPP-GDP, cross-border current-account transactions, and international reserves are those made available by the IMF staff in a website release of September 23, 2009 (International Monetary Fund, 2009). The data stem from averages of recent years up through 2007. The shares in world population pertain to 2007 and are calculated from the World Bank publication *World Development*

Figure 1

Because rankings of relative status differ so much across candidate variables, some objective method of combining multiple variables into a composite measure is required. A composite calibration of relative status for calculating governance shares is, for short, a ”rebalancing formula" or, more simply, a "quota formula." A quota formula of necessity assigns weights, typically different weights, to the included variables. In effect, it defines an assessment of relative status that is a weighted average of the variables.

A satisfactory formula is a broad gauge of the relative importance of individual IMF nations in the world polity, economy, and financial system. Because subsequent changes in the circumstances and relative positions of member nations will be reflected objectively in calculations made with the formula, a satisfactory formula will prove viable and sustainable over a longer run.

No one formula can be judged as unambiguously preferable, as "correct" or "the optimal gauge" of relative importance.[4] That difficulty is present whether the formula is used to capture an average of relative positions at a current point in time or whether it is used to rebalance measures of relative positions as further gradual changes occur in the world economy. Transparency and simplicity argue for a formula based on only a small number of variables. But the goals of transparency and simplicity compete with the goals of accuracy and completeness. Still another difficulty exists: what is deemed "objective" has a normative element and hence inevitably differs across analysts.

Yet such difficulties need not be insuperable obstacles to obtaining agreement on a quota formula. The essential condition for a cooperative agreement is that policymakers in good faith adopt a perspective that emphasizes suitability for the world as a whole. The appropriate way to view a well designed formula is as the starting point and foundation for informed political negotiations. Astute officials neither could nor should mechanically accept calculations from a formula as the sole basis for compromise decisions.

The first step in a sound procedure is to make calculations with a satisfactory formula and to agree that the calculations should be a presumptive norm for subsequent discussions. In effect, the calculated quota shares should be treated as presumptive targets toward which the existing actual shares will adjust. For a few individual members, special and probably temporary circumstances might exist that can be agreed to justify a significant deviation of negotiated from formula-calculated shares. But negotiators should be chary of deviating far from the presumptive norm of the calculated shares. In particular, inertia from the past by itself should not be allowed a decisive weight in the negotiations. Inertia can easily masquerade under the argument that the formula calculations yield an "imperfect" sense of "my country's true relative world position." Again, no formula can yield "perfect" results. But a satisfactory formula, applicable equally to all

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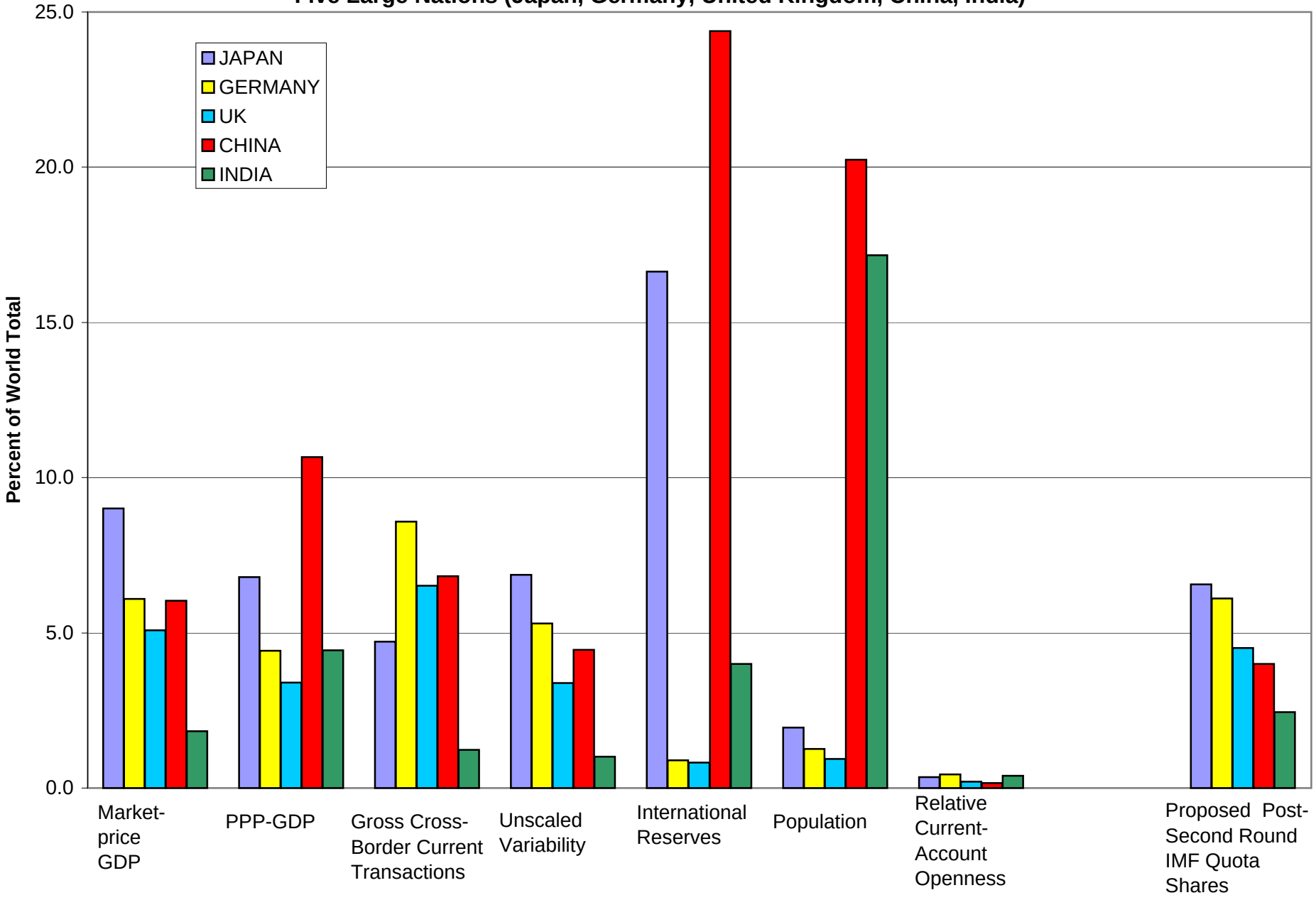
Indicators. The relative current-account openness ratios are calculated from the September 2009 IMF staff data. Data issues are discussed further below. The "post-Second-Round" quota shares shown in Figure 1 refer to the quotas and quota shares that were decided in the general package of quota and voice reforms agreed in April 2008. These proposed shares will be in force once all IMF members, as expected, have implemented the quota changes negotiated in April 2008. As of early March 2010, 65 members accounting for about 70 percent of the voting power in the Fund had accepted these proposed quotas; entry into force requires three fifths of the members (112) representing 85 percent of the total voting power.

[4] This conclusion would be even more compelling if formulas gauging relative status were to be extended still further to, for example, indicators of political power or military power.

Figure 1
World Shares of Selected Candidate Variables for
Five Large Nations (Japan, Germany, United Kingdom, China, India)



IMF members, is a much better presumptive norm than alternatives ignoring an objective assessment of the relative status of members. The final outcome of negotiations should be an artful blend of formula calculations and constructive political horsetrading.[5]

Governance shares at the outset of the IMF's history were decided on nakedly political grounds. To provide cosmetic cover, a quota formula was devised in the U.S. Treasury to produce a politically pre-determined result.[6] During the quinquennial reviews of quotas in subsequent years, minor changes were made in the original formula. The original formula or variants of it were used in IMF staff calculations for the years prior to 2007.

Throughout the IMF's history so far, however, the original formula and its variants have *not* been the principal determinants of individual members' governance shares. Historical adjustments in IMF quotas were dominated by increases granted equiproportionately to every member according to its existing quota share at the time. This equiproportionate component was on average some 70 percent of the total increase. Only a small component of any increase consisted of selective adjustments reflecting recalculated quota shares resulting from the old (inadequate) quota formulas. Instead, the negotiations downplayed the results of formula calculations. The selective adjustments that were made resulted from political horsetrading among the governments of the largest member nations and were little influenced by the formulas.

If the largest part of quota increases is allocated in proportion to existing quotas, inertia from the past of course guarantees that adjustments in the *relative* quota shares of members will be minor and that IMF members experiencing relatively rapid economic growth will have quota shares that lag far behind recent economic developments.

Basics of a Quota Formula

The preferred structure for a quota formula will use variables expressed as the fractional shares of IMF members in a global (all IMF members) total. Two classes of variables, *level-share* and *ratio-share*, are relevant.

The formula determining the quota share for each member may be algebraically written as

$$QShr_i = \alpha\left(AShare_i\right) + \beta\left(BShare_i\right) + \gamma\left(CShare_i\right) + \lambda(DRatioShr_i) + \mu(ERatioShr_i)\,.$$

In this illustration, *AShare*, *BShare*, and *CShare* are three level-share variables and *DRatioShr* and *ERatioShr* are two ratio-share variables. For an individual IMF member *i*, $AShare_i$ is defined as the value of *A* for *i* as a fraction of the corresponding global total for all members:

$$AShare_i \equiv \frac{A_i}{A_{WORLD}} \quad \text{and} \quad A_{WORLD} \equiv \sum_i A_i \quad .$$

Analogous definitions apply for $BShare_i$ and $CShare_i$. The definition for $DRatioShr_i$, and analogously for $ERatioShr_i$, is

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[5] Ideally, the IMF Executive Board could provide a helpful constraint on negotiations by adopting a new by-law. The by-law could state that a member's actual negotiated quota share at times of quinquennial quota reviews cannot differ from its formula-calculated share by more than X percent, where X is a small number. Such a provision would ensure that incremental quota adjustments over time would not deviate excessively from the quota formula's calculations.

[6] The story is well known to students of the IMF; see especially Raymond Mikesell (1994). Ariel Buira (2005) summarizes the Mikesell account; see also Murilo Portugal (2005, p. 85).

$DRatioShr_i \equiv \dfrac{DRatio_i}{DRatioSum_{WORLD}}$ where D_i and J_i are the numerator and denominator of the ratio, with

$$DRatio_i \equiv \frac{D_i}{J_i} \quad \text{and} \quad DRatioSum_{WORLD} \equiv \sum_i \frac{D_i}{J_i} \quad .$$

Appendix B at the end of the essay provides examples of the two classes of variable and discusses why the distinction between the two is helpful.

The parameter weights attached to each of the variables included in the formula, uniform across all IMF members, define the relative importance of the variables in the formula. For consistency, the parameter weights together must sum to unity; in the example above:

$$\alpha + \beta + \gamma + \lambda + \mu \quad = \quad 1.000 \quad .$$

Similarly, since the sum of each variable across members is unity, it is also true that the quota shares themselves sum to unity:

$$\sum_i QShr_i \equiv 1.000 \quad .$$

Each variable in the formula calibrates some aspect of the relativities among IMF members. Ratio-share variables are included to focus on relativities best expressed in terms of ratios.

Appendix B discusses the example of a ratio-share variable defining the current-account openness of members' economies, illustratively contrasting the differing implications for India and Costa Rica from using a genuine current-account-openness variable or a variable measuring merely a member's external transactions as a share of the world total of such transactions. Ratio-share variables may better identify features of members' economies and polities that are *qualitatively* distinct rather than dominantly determined by economic size. In particular, ratio-share variables may better reflect the relative openness of economies, giving greater weight to smaller, more open economies than to larger, less open economies.

Variables used in a quota formula will be significantly correlated with each other. This fact makes selection of the variables even more difficult. High correlations may be especially problematic for level-share variables. If several level-share variables, highly correlated, are all included in a formula and their combined weight is high, the formula results may excessively emphasize the size of member nations. Larger members may receive bigger calculated quota shares relative to smaller members than seems objectively reasonable on the grounds of size alone. In effect, large members can be "over-counted." An important advantage of including ratio-share variables in a formula—in addition to level-share variables—is that over-representation for economic size is less likely.

Alternative Perspectives about the Choice of Formula Variables

GDP-Based Variables. The most comprehensive gauges of a country's economic activity are based on measures of product or income for the national economy. Accordingly there is general agreement that the shares of IMF members in a global total for product or income are the broadest, most salient measures of countries' relative economic status. Thus agreement is also widespread that shares in world product or income are the single most relevant variables to include in a quota formula.

Little discussion has addressed the merits of nominal versus real (inflation-adjusted) measures. And most analysts focus on product rather than income concepts. The fact that most

attention has been paid to nominal and to product-side measures is probably due to the lesser availability (for some IMF members) of good data for inflation-adjusted and income-side measures.

The product variables typically appearing in quota formulas are the shares of countries in world gross domestic product (GDP) – measured at market prices and exchange rates (Mkt-GDP), measured at purchasing-power parities (PPP-GDP), or measured as a "blend" of both. PPP-GDP and Mkt-GDP can each be justified as relevant, for conceptual and practical reasons.

Many analysts regard PPP-GDP as, in principle, the preferable measure for international comparisons of aggregate economic activity across nations. It is a well established empirical generalization that the prices of non-traded goods and services relative to the prices of traded goods and services are lower in low-income countries than in high-income countries. Therefore if world-market prices and market exchange rates are used to convert national income and product accounts into a common currency unit, a comparison across countries of living standards understates the living standards of low-income developing countries relative to those of high-income countries.[7] Hence it has been proposed that world shares in GDP in a quota formula should be based on PPP-GDP rather than, or at least as a complement to, GDP at market prices and exchange rates.

Yet strong arguments can also be made for giving shares in Mkt-GDP a prominent role. For example, contributions of resources to the IMF's lending-intermediary activities and many aspects of systemic IMF surveillance are probably best analyzed in terms of market prices and exchange rates. Cross-border transactions (as measured in balance-of-payments accounts) and IMF transactions occur predominantly on the basis of market prices and exchange rates.

Data for PPP-GDP are less available and reliable than the data for Mkt-GDP, especially for smaller developing IMF members. During 2007-08, large revisions in the PPP-GDP data were made for many countries, particularly China and India. Many analysts regard the data difficulties as an argument against giving PPP-GDP a dominant weight in a blend variable for GDP.

Over a very long run, differences between many countries' Mkt-GDP and PPP-GDP can be expected to diminish. Successful growth and development narrows the difference between the two measures.

Given all the differing arguments that can be made about GDP-based variables, a straightforward approach is to permit both Mkt-GPD and PPP-GDP to play important roles in a quota formula. In effect, a formula can incorporate a blend of the two. Remaining controversy turns on the relative importance of the two in the blend. (Note that whether the formula uses a GDP-blend variable or whether the two GDP measures appear separately in the formula has no substantive consequence. The key issue is the relative weights attached to the two.)

Financial-Activity Variables. The IMF has functions that, either directly or indirectly, are *financial*. The financial dimensions of IMF activities even go well beyond its role as an intergovernmental financial intermediary. Hence a logical case exists for an IMF quota formula to include level-share and possibly also ratio-share variables that calibrate the relative importance of members' *financial* -- not merely real-sector -- activity.

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[7] Basic references include Kravis, Heston, and Summers (1982), Kravis (1984), Heston (1994), and Heston and Summers (1996). For example, as of 2005-2007 the G-7 countries together had some 58 percent of the world's GDP at market prices and exchange rates but only some 43-45 percent of the world's PPP-GDP.

Neither nominal GDP, at market prices and exchange rates or at purchasing power parities – nor still less so inflation-adjusted (real) GDP– fully captures the financial and monetary aspects of an economy. An academic literature examines the ratio of real-sector activity to financial-sector activity. Historically, the ratio varies over time. Goldsmith generalized that, as economic development proceeds, the financial superstructure of an economy tends to expand relative to its real infrastructure. Stated differently, the network of financial interrelations among agents in an economy acquires greater density at an even more rapid rate than the network of goods and services transactions (Goldsmith's "financial interrelations ratio"). Increases in the ratio of the financial superstructure to the real-sector superstructure probably cannot continue without limit as development proceeds. Eventually, one presumes, financial activity would not increase faster than real-sector activity in a very advanced economy.

Another finding in the literature on financial development is that financial institutions tend to become relatively more important as economic growth proceeds. In particular, the share of financial intermediaries in the issuance and ownership of financial assets tends to rise over time. This trend reflects the growing separation and institutionalization of the functions of saving and investing. In advanced industrial countries, the proportion of total financial assets accounted for by financial intermediaries has continued to increase even after the rise in the financial interrelations ratio has ceased.

A further manifestation of the complex links between financial activity and economic development is an increasing diversity in the types of financial institutions and in the types of financial instruments in which they specialize. The ratio of cross-border financial activity to "domestic" financial activity has also changed dramatically over time and with differing stages of economic development.[8]

Further research on these topics is a precondition for confident generalizations. But a strong presumption exists that neither Mkt-GDP nor PPP-GDP is so highly correlated with financial activity that there is nothing to be added to our understanding of financial interrelationships once we examine Mkt-GDP and PPP-GDP. The world shares in financial activity of IMF members may differ significantly from their world shares in GDP-based variables. Hence – in principle – a case can be made for including measures of financial-sector as well as real-sector activity in a quota formula.

Unfortunately, financial-sector data collected and reported by IMF members are even less comprehensive and reliable than real-sector data. Data-availability and definition issues are especially severe for measures of aggregate financial activity or cross-border financial assets and liabilities. Inaccuracies in underlying financial data carry through to inaccuracies in estimated world shares of financial activity and estimated relativities among financial ratio variables.[9]

Data difficulties largely explain the absence so far of financial-activity variables from a quota formula. I cannot myself provide reasonable estimates of level-share and ratio-share financial variables. But I want to underscore the importance of rectifying this omission in future iterations of a quota formula.[10]

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[8] Basic references include Goldsmith's *Financial Structure and Development* (1969) and Gurley and Shaw (1960).

[9] The IMF staff in recent years has made significant progress in collecting and publicizing some international-investment-position data for the largest countries. But for many smaller members, such data are not yet available.

[10] When the Executive Board approved the last change in the quota formula in March 2008, they genuflected before the need to bring financial activity-variables into the analysis. The official announcement stated: "the Executive Board considers that further work will be needed in the following areas: the scope for measuring openness on a value added rather than a gross basis, the appropriate treatment of intra-currency union flows, ***the appropriate way of capturing financial openness***, and how to improve the measure of variability to adequately capture members'

Cross-Border Interactions and Openness. One possible conceptual approach to the choice of variables in a quota formula would be to exclude everything except the very broadest measures of real-sector and/or financial-sector activity. Such a benchmark would entail sole reliance on GDP-based measures (perhaps supplementing them, after better data were available, with financial-sector aggregates). The contention might be that there is no need to take into account the relative status of economies' cross-border interactions with the rest of the world once the comprehensive benchmarks of Mkt-GDP and PPP-GDP are available to calibrate relative status.

The opposite extreme approach would be to place great emphasis on the relative intensity of economies' cross-border transactions. The contention in this case would be that the scale of spillovers across an economy's borders -- real-sector, financial-sector, or both – can be important determinants of the economy's welfare and hence also of its responsibilities and rights vis-à-vis the IMF. Reasoning along these lines would justify giving at least some weight in the quota formula to level-share or ratio-share variables calibrating relative status judged from cross-border transactions.

The term "openness" is a summary rough label for the degree of an economy's interactions with the rest of the world. From the perspective of judgments about an economy's welfare, spillovers from abroad into the home economy, and spillovers from the home economy abroad, are a double-edged sword.

The financial system of a nation is like a reservoir that collects the savings generated in the economy. Savers place their funds in the reservoir. Investors draw funds out of it. Saving and investment decisions can be, and are, taken independently. The level of the reservoir rises and falls in response to changes in real-sector and financial-sector conditions.

Even in a well-functioning economy, particular investments turn out to be disappointments. Conditions change. Poor judgments are made. Some financial transactions go sour. The inevitable mistakes and accidents cause waves in the reservoir. They may even generate severe storms. Storms can spread and become virulent because of herding behavior, contagion, and excessive volatility in asset prices. Financial activity not only reflects, but thus can itself cause, financial turbulence.

The inherent fragility of financial systems can be powerfully exacerbated by cross-border risks and uncertainties. When particular investments go sour in an economy open to the rest of the world, repercussions get transmitted abroad. Shocks originating in the rest of the world buffet the home economy. Mistakes and accidents can be especially problematic when investments have been financed with direct shifts of savings from one national reservoir to another. Cross-border and cross-currency liabilities amplify the consequences of distressed financial conditions. National financial reservoirs can be simultaneously afflicted by volatile cross-border capital flows, disruptive fluctuations in exchange rates, and severe balance-of-payments crises. Episodes of stormy weather can even lead to an occasional hurricane-level crisis (notably, the worldwide financial disruption of 2008-09). The potential for financial instability cannot be attributed primarily to cross-border finance. The causes are deeply rooted in the information asymmetries, the expectational and informational cascades, and the adverse-selection and moral-hazard problems that pervade all aspects of financial behavior, domestic as

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potential need for Fund resources…The Executive Board has decided to consider these issues based upon additional staff analysis before the formula is used again to guide a further realignment of quota shares" [emphasis added; see IMF, (2008)]. Because the time schedule for further changes in quota shares was subsequently advanced, envisaging a new agreement by January 2011, it may not be practical during 2010 to make changes so as to capture financial openness.

well as cross-border. Yet the cross-border features magnify the potential for instability.

Notwithstanding its hazards, financial activity is fundamentally beneficial. Financial intermediation and financial markets are underpinnings without which modern economies could not prosper. Financial activity permits individuals and enterprises to implement intertemporal patterns of spending that differ from the time profiles of their incomes. Saving and investment decisions can be taken independently. The aggregate flows of investment and saving, and hence the growth of economic activity, can be substantially greater and more efficient.

Such generalizations, true for an economy relatively closed to the rest of the world, apply with still greater force to open economies with extensive cross-border current-account and capital-account transactions. When the financial reservoirs of different nations are highly interconnected, the aggregate decisions of the ultimate savers in any single nation and the aggregate decisions of ultimate investors in that nation do not need to be closely linked. Net transfers of saving from one nation to another permit savings and investment decisions to be independent for nations as a whole. Loosening of the links between aggregate saving and aggregate investment for individual nations substantially enhances the potential for each nation's economic well-being and for prosperity for the world as a whole.

The bottom line from the preceding observations is that openness -- cross-border interdependence -- is both helpful and hazardous. Whether the positive aspects dominate the negative, or whether the home economy is on balance adversely buffeted by what occurs abroad, depends in complicated ways on the characteristics of individual nations and the circumstances at the time in the global and home economies. Regardless of the net balance between positive and negative aspects, the openness characteristics of members' economies probably merit some consideration when determining norms for the relative status of countries in IMF governance. Other things being fully taken into account, in other words, the presumption is that an IMF member with greater openness has a greater stake in the IMF's successful operations. Hence a presumption may be judged to exist for giving a bit more weight to that country in calculations of governance shares in a quota formula than would otherwise be given.

Vulnerability and Variability. An IMF member's cross-border "vulnerability" is closely related to its current-account and capital-account openness. Indeed, for many practical purposes, measures of vulnerability or the "variability" of cross-border transactions are likely to be highly correlated with measures of current-account and capital-account openness.

Analysts focusing on the potential need for IMF members to access IMF resources as a borrowing country are especially concerned with vulnerability and variability. The more variable a nation's cross-border transactions, it is argued, the greater its potential need for borrowing. (In effect, variability measures are taken as a proxy for vulnerability.) If one wishes a quota formula to pay special direct attention to the potential needs for borrowing from the IMF, the formula may need to include one or more variables measuring variability. The Secretariat for the G24 group of countries, for example, has extensively analyzed alternative definitions of variability and recommended versions of the variables they regard as superior.[11]

The presumption that openness and variability ought to be taken into account in a quota formula is, to repeat, not accepted by all analysts. When the presumption is accepted, the question arises whether the openness and variability measures should be incorporated as ratio-share or level-share variables. As already suggested above and discussed further below, ratio-share variables will usually be preferable.

[11] See G24 Secretariat (2008, 2010).

Contributions to IMF Resources. If a quota formula pays special attention to the potential needs of members to borrow from the IMF, other analysts may assert that the formula should pay special attention to the contributions of members to IMF resources.

Again it deserves mention that the roles of the IMF as an intergovernmental lending intermediary are no longer its primary functions. It follows that *neither* the potential borrowing needs of a member *nor* its contributions to IMF resources should have pride of place among candidate variables for inclusion in a quota formula. GDP-based variables (or financial-activity variables) have a stronger claim for the dominant role in a formula.

If IMF lending resources were to come entirely from quota subscriptions, furthermore, it would seem redundant to include "contributions" as a separate variable.[12] Many would argue that the IMF's lending-intermediary role would be better performed if the resources used for lending came only from quota subscriptions.

In practice, however, "extra-quota" contributions to the IMF's resources are relevant. Important examples include the New Arrangements to Borrow (NAB) and the General Arrangements to Borrow (GAB); support of the IMF's liquidity needs through bilateral loan/note purchase agreements; and resources provided for specific IMF facilities such as the Poverty Reduction and Growth Trust.

In past years when selective quota increases were negotiated for individual Fund members, special attention was paid to a member's willingness to contribute financially to IMF resources. Two notable examples occurred in 1981 when Saudi Arabia received a large increase in quota outside of a general quota review and in the 1997 9th Review of Quotas in which Japan received an ad hoc increase. Contributions to IMF resources other than quota subscriptions come in a variety of different forms and are probably not readily comparable across different categories and at different times.

If any effort were made to take special account of member's extra-quota subscriptions as "above-average" donor contributions warranting explicit incorporation in a quota formula, some method would have to be found for defining an above-average contribution. Above-average contributions would presumably be scaled by the size of member's quotas or their GDPs rather than incorporated as the absolute nominal amounts of the contributions.

Population as a Level-Share Variable. In the history of quota formulas up to the present, the formula has never included shares in world population as one of the level-share variables. Official participants in ongoing negotiations have even neglected serious analysis of this possibility. The omission of a population variable is unfortunate and shortsighted.

When individuals have wanted to kill the suggestion of including a population variable in the quota formula, they have sometimes cited the calculated quota shares that would result if population were the *sole* variable in the formula. China and India together, it is observed, have over 37 percent of the world's population. Should China and India then have 37 percent of the quota share in the IMF? Asking this rhetorical question, however, is silly. No one argues that population should be the sole variable in a quota formula. It would be inappropriate—and of course politically infeasible—even to make population the dominant variable.

To agree that population should not be the dominant variable in the formula is not to agree that a population variable should be excluded altogether. The arguments advanced for

[12] Critics of including a variability measure in the formula could symmetrically argue, of course, that the size of a member's quota should determine its access to borrowing IMF resources, and hence that it would be redundant to include a separate variability variable.

excluding population are weak and unconvincing. Appendix A contains an analysis of the arguments against and for the inclusion of a population variable in the formula.

It is sometimes asserted that population need not be considered because PPP-GDP and population are so highly correlated that the former is essentially a substitute for the latter. That assertion, however, is demonstrably false (Appendix A). Of course population and PPP-GDP have a substantial correlation. But, again, all candidate level-share variables have a substantial correlation. The correlation between population shares and PPP-GDP shares is only 0.564 and is not nearly high enough to allow the two variables to be treated as a rough substitute for one another.

Because population appears unlikely to be given serious consideration during the 2010 negotiations as one of the variables in the IMF quota formula, further discussion is left to Appendix A. For the longer run, I predict that a viable formula will eventually include such a variable. When that day comes, population shares will initially have only a modest weight. But the weight will, almost surely, gradually increase into the future until such a variable is one of several key components of a broadly acceptable formula.

Special Attention to Changes in the Recent Past? A satisfactory quota formula will accurately capture changes in the relative status of IMF members in the world polity, economy, and financial system. The formula results will have, at most, a modest lag due to inevitable delays in data updates. Provided an effort is made promptly to update the underlying data, a satisfactory formula should not need to introduce special "dynamic" features that modify level-share variables or ratio-share variables with explicit focus on changes from the recent past.

What if the currently accepted quota formula or the data used in conjunction with it do not satisfactorily capture dynamic movements of economies through time? Then – justifiably – fast-growing IMF members playing a relatively larger role in the world economy will complain that their governance relative shares are failing to increase appropriately. The logical solution to this problem is to improve the level-share and ratio-share variables in the quota formula and the data used with them. It seems a circuitous route to incorporate dynamic (rate-of-change) variables in the formula when a straightforward approach can have a comparable effect.

Current Status of the Quota Formula

The quota formula agreed in March 2008 and currently in use is a specific case of the general structure described above. It-contains five level-share variables but no ratio-share variables. Its results are also determined by a mathematical device known as a "compression factor."

The first two level-share variables in the current formula are a member's share in a world aggregated total of GDP measured at market prices and exchange rates (*GDPShare*) and its share in a world aggregate of GDP measured at purchasing-power-parity prices (*PPPGDPShare*). (Sometimes the current formula is shown with one GDP variable that is a "blend" of market-price GDP and PPP-GDP. This expositional difference does not substantively influence results calculated from the formula.) *XBTransShare* measures a member's share in a world aggregate of cross-border current-account transactions; specifically, the underlying data are a member's, and the corresponding world aggregate's, sum of current-account payments and current-account receipts (goods, services, income, and transfers). The values for the fourth variable, *UnscaledVARIABShare*, pertain to a member's share in the variability of current-account receipts and net capital flows, with variability defined as the standard deviation from a centered trend over recent years. The variable is "unscaled" in that it measures the absolute size of a member's standard deviation without any deflating by the mean or some other magnitude scaled to the

relative size of the member's economy. Finally the formula contains *Int'lRESERVEShare* , a member's share in the world total of official reserve assets (foreign exchange, SDR holdings, reserve position in the IMF, and monetary gold).

Each share variable is measured over a period of recent years for which data are available for all IMF members. *GDPShare* and *PPPGDPShare* are averages over three recent years (2005-2007).[13] *XBTransShare* averages annual data for five recent years of current-account transactions (through 2005).[14] *UnscaledVARIABShare* measures its unscaled standard deviations from a centered three-year trend over thirteen past years. *Int'lRESERVEShare* is a twelve-month average over a single recent year.

The data described in the two preceding paragraphs are those made available by the IMF staff in a website release of September 23, 2009 (International Monetary Fund, 2009). I use these data, the most recent available to me, for all the illustrative calculations in this essay. The IMF staff is expected in the near future to publish updated data that will incorporate 2008 data into the share variables (which here only go through 2007). The newly updated data will embody significant adjustments, especially for emerging-market developing members that continued to grow more rapidly than developed members during 2008. When data updates ultimately become available incorporating 2009 data, still further adjustments in the formula variables will be made. The reader should keep these data limitations in mind when appraising the illustrations here. The qualitative inferences I emphasize here will not be substantially changed by the upcoming data updates. But the quantitative details will require amendments.

The existing quota formula assigns weights to its five variables of *GDPShare,* 30 percent; *PPPGDPShare*, 20 percent; *XBTransShare*, 30 percent; *UnscaledVARIABShare* , 15 percent; and *Int'lRESERVEShare* , 5 percent. As required, the weights sum to 100 percent (or 1.00, if written as fractional shares). Note that four fifths of the total weight (80 percent) is assigned to *GDPShare, PPPGDPShare*, and *XBTransShare*.

Expressed algebraically, the formula is:

$$QShr_i = \left[\begin{array}{l} 0.30(GDPShare_i) + 0.20(PPPGDPShare_i) + 0.30(XBTransShare_i) \\ + 0.15(UnscaledVARIABShare_i) + 0.05(Int'lRESERVEShare_i) \end{array} \right]^{\Phi} .$$

The exponent symbol Φ in the current formula is known as a "compression factor" and is set at the value 0.95. Imposing a compression factor with a value less than unity has the effect of diminishing dispersion among the shares calculated from the formula. Compression by itself does not alter the relative ranking of calculated shares; it merely reduces the dispersion across members' shares (Appendix B).

Use of the compression factor and a subsequent rescaling of shares so that they add to 100 percent reduces the size of the shares of the IMF members with the largest quotas. The formula-share reductions experienced by the largest countries are reallocated to all other IMF members. Smaller countries thereby receive a somewhat higher share than they would receive without use of the compression factor. A sizable fraction of the share increases resulting from the

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[13] For *PPPGDPShare*, the IMF staff retrieved PPP-GDP data from the IMF's World Economic Outlook database for 178 countries. For eight countries with no WEO data, they estimated the data. The PPP-GDP data reflect new purchasing-power-parity rates published by the International Comparison Program in December 2007.

[14] The IMF staff's estimates of the data underlying *XBTransShare* reflect the impact of adjustments to current receipts and payments for re-exports, international banking interest, and non-monetary gold.

diminution of large-country shares, however, also gets assigned to the shares of medium- and small-sized countries that are in the group of advanced and higher-income members (see below).

Results from Using the Current Quota Formula

Several aspects of the current quota formula are regrettable and are likely to be revised. Yet for the time being official participants in the 2010 negotiations are committed to basing discussions on the current formula.

This commitment is embodied in the language negotiated for the Pittsburgh communiqué of the G-20 leaders issued on September 24-25, 2009 (and reiterated by the IMF's IMFC):

> "we are committed to a shift in quota shares to dynamic emerging market and developing countries of at least five percent from over-represented to under-represented countries *using the current IMF quota formula as the basis to work from*. We are also committed to protecting the voting share of the poorest in the IMF." (Italics added).

If read closely, this September 2009 commitment is obscure. In particular, it is unclear whether the intent of the commitment is

a) a shift in quota shares to dynamic emerging market and developing countries of at least five percent from the current (proposed) quota shares as of early 2010;

OR

b) a shift of at least five percent from over-represented to under-represented countries using the current IMF quota formula as the basis to work from, with an effort to skew the resulting adjustments in favor of dynamic emerging market and developing countries. [15]

It is also unclear how to define "dynamic" emerging market and developing countries and which countries are to be included in the group of "poorest" IMF members.

A net aggregate shift of at least 5 percentage points from over-represented to under-represented IMF members, with the adjustments for each member proportionate to the current formula's degree of the member's over- or under-representation, is of course a completely different thing from a net aggregate shift of at least 5 percentage points of quota shares to dynamic emerging market and developing members.

Most non-official commentators subsequent to the Pittsburgh meeting have presumed that the leaders intended the first interpretation above, a straightforward net aggregate shift of at least 5 percentage points in quota shares to dynamic emerging market and developing countries. But a straightforward application of the current formula cannot produce such an outcome. This awkward fact is illustrated in Table 1.

The first column in the table shows current (proposed) IMF quota shares. The second column reports shares calculated from the current formula. The third column shows the percentage-point difference between the two (2nd column minus the first column). An IMF member or group of members that is "under-represented" has a positive value in the third column, so to speak "too small" a quota share (smaller than the share resulting from the formula). An "over-represented" member or group appear in column 3 with a minus sign, "too high" a quota share.

IMF members are classified in Table 1 (and the subsequent tables) into two broad groups. One group contains 37 members identified as "Advanced" and "Other Higher-Income." The other 149 members, emerging-market, developing, and transition countries, are shown as Not

[15] Here and elsewhere my phrase "current (proposed) quota shares" (or simply "current quota shares") means the quota shares ("post-Second-Round") that were agreed in the April 2008 package of quota and voice reforms and that will be in force once all IMF members, as expected, have implemented those quota changes.

Advanced and Not Higher-Income. Larger countries are shown separately – for example, the seven individual G7 nations in the Advanced group and China, India, Brazil, Mexico, and the Russian Federation in the Not-Advanced, Not-Higher-Income group. All Eurozone countries are in the Advanced group. A memorandum row shows the total for all 27 European Union members (a few of which are not classified as advanced and higher-income). An aggregate total is reported for the 71 countries eligible to borrow from the Poverty Reduction and Growth facility (PRGF) as of December 2009. The final memorandum row shows a figure for 23 selected not-advanced and not-higher-income members who are potential candidates for a group of "dynamic emerging-market and developing countries."[16]

Table 1

The awkward results of using the current formula are striking. The United States, Japan, and the United Kingdom are under-represented! Germany, France, Italy and Canada are each slightly over-represented. Taken together, the G-7 countries have too large a quota share by only 0.31 percentage points. The 27 countries of the European Union as a whole are collectively under-represented by 0.22 % points. (The figure for the sixteen Eurozone countries together is an under-representation of 0.06 % points.) Some European countries under-represented by a significant amount include Spain, Luxembourg, Ireland, Greece, Poland, and Hungary.[17] If all 37 of the advanced and other higher-income countries are examined together, they are over-represented by only 0.60 percentage points. The group of all 149 (=186-37) not-advanced, not-higher-income economies are under-represented by of course the corresponding 0.60 % points.

The under-represented large emerging-market members are China (by 3.48 % points), Brazil (0.19 % points), and Mexico (0.34 % points). India is over-represented (not a typo) by 0.26 % points. Russia is over-represented by 0.06 % points. Finally consider all the not-advanced, not-higher-income countries except for China, India, Brazil, Mexico, and Russia; those 144 IMF members together are over-represented by 3.09 percentage points! The quota shares for the 71 countries eligible to borrow from the IMF's Poverty Reduction and Growth Facility, a rough measure of the group of "poorest" IMF members, are over-represented by 1.74 % points.

The current formula does calculate a nearly 5 percentage-point net shift in aggregate quota share to the 23 IMF members I have labeled as dynamic emerging-market and developing. The pattern of gainers and losers, however, is problematic. India is calculated with a sizable loss in quota share; other losers are Russia, Pakistan, Peru, Panama, and Belarus. The largest gains in shares accrue to China, Brazil, Mexico, and Turkey; Poland, Kazakhstan, and Azerbaijan are gainers; Indonesia, Malaysia, Thailand, Philippines, Vietnam, Colombia, Egypt, Jordan, Angola, and Equatorial Guinea are also gainers, although in several case the gains are slight.

Plainly, the current quota formula can achieve a significant increase in quota shares of some dynamic emerging-market countries only by reducing the shares of other dynamic members. Quota-share increases for the favored dynamic members do *not* come significantly from reductions in quota shares of the advanced and higher-income members. Nor does the

[16] The 23 countries included in this "dynamic" group are China, India, Brazil, Mexico, Russian Federation, Angola, Azerbaijan, Belarus, Colombia, Egypt, Equatorial Guinea, Jordan, Indonesia, Kazakhstan, Malaysia, Pakistan, Panama, Peru, Philippines, Poland, Thailand, Turkey, and Vietnam.

[17] Luxembourg, with an existing quota share of 0.176 percent of the IMF total, is shown in the formula calculations as meriting a quota share of 0.486 percent (2.8 times its existing quota)!

Table 1
Current (Proposed) IMF Quota Shares as of Early 2010 and
Calculated Quota Shares Resulting from Current-Status Quota Formula

	Current (Proposed) Quota Share as of Early 2010 ("Post-Second Round Quotas")	Calculated Quota Share from Current-Status Quota Formula*	Calculated Quota Share from Current-Status Formula *less* Current (Proposed) Quota Share
	% of world total	% of world total	(difference in percentage points)
World Total (All IMF Members) (186)	100.000	100.000	0.000
"Advanced" & Other "Higher-Income" (37)	66.920	66.319	-0.601
G7 -- "Major Advanced" (7)	45.322	45.008	-0.314
United States (1)	17.669	17.816	0.147
Japan (1)	6.556	6.987	0.431
Canada (1)	2.672	2.423	-0.249
Germany + France + Italy + UK (4)	18.426	17.783	-0.643
Germany (1)	6.110	5.888	-0.222
France (1)	4.505	4.213	-0.292
Italy (1)	3.306	3.098	-0.208
United Kingdom (1)	4.505	4.584	0.080
Other Eurozone** (13)	9.203	9.990	0.787
Australia + New Zealand (2)	1.733	1.582	-0.151
Other Industrial & High Income*** (7)	4.543	4.269	-0.274
Korea + Singapore (2)	2.003	3.417	1.414
Saudi Arabia + 5 Other High-Income Oil Producing**** (6)	4.117	2.054	-2.063
Not "Advanced" & Not "Higher-Income" (186 - 37 = 149) (Emerging Market/Developing/Transition)	33.080	33.681	0.601
China (1)	3.996	7.474	3.479
India (1)	2.442	2.184	-0.258
Brazil (1)	1.783	1.969	0.185
Mexico (1)	1.521	1.864	0.343
Russian Federation (1)	2.494	2.434	-0.059
All Other Not Advanced & Not Higher-Income (149 - 5 = 144)	20.844	17.756	-3.088
Memo: European Union, total (27)	31.867	32.086	0.218
Memo: Eligible for IMF Poverty Reduction and Growth Facility, Dec. 2009 (71)	4.265	2.525	-1.740
Memo: Selected Not-Advanced and Not-Higher-Income Economies, potential candidates for "Dynamic Emerging-Market and Developing" ***** (23)	18.527	23.502	4.975

Source: IMF Staff and author's calculations.

* See text for description of formula variables and weights.

** Eurozone includes Germany, France, Italy and the 13 other EU members using the Euro as their currency (Belgium, Netherlands, Luxembourg, Austria, Greece, Finland, Ireland, Portugal, Spain, Slovenia, Malta, Cyprus, Slovakia). The United Kingdom does not use the Euro and is not included in the Eurozone.

*** Switzerland, Sweden, Norway, Denmark, Iceland, San Marino, and Israel.

**** Saudi Arabia plus Kuwait, United Arab Emirates, Qatar, Brunei, and Bahrain.

***** China, India, Brazil, Mexico, Russian Federation, Angola, Azerbaijan, Belarus, Colombia, Egypt, Equatorial Guinea, Jordan, Indonesia, Kazakhstan, Malaysia, Pakistan, Panama, Peru, Philippines, Poland, Thailand, Turkey, Vietnam.

current formula point in the right direction if the goal is to "protect" the quota shares of the IMF's poorest members. "Protect" presumably means to prevent a diminution.[18]

A straightforward use of the current formula seems out of the question. One way or another, semantic euphemisms aside, negotiators will be forced to find some better way to construct and explain their decisions.

The awkward results emerging from the current formula would be still more problematic if the formula did not impose its mathematical compression factor. Table 2 illustrates this point by comparing the results from the formula using the compression factor (2nd column repeated from Table 1, with $\Phi = 0.95$) and the results where the compression effect is eliminated (3rd column in Table 2, $\Phi = 1.00$). A comparison of the second and third columns shows that the compression factor mechanically reduces the quota shares of the seven IMF members with largest quotas – the United States, Japan, China, Germany, France, Italy and the United Kingdom – by an aggregate of 3.08 % points. Those 3.08 % points are distributed across all other members; some two-thirds of those points raise the shares of non-advanced IMF members other than China; but the remaining one third goes to all the other advanced and higher-income countries not in the G-7. The fourth column of Table 2 reports the difference between the calculated shares without the compression factor and current (proposed) shares.

Table 2

The calculations in Table 2 unaffected by the imposition of the compression factor indicate that all 37 advanced and higher-income countries together are *under-represented* by 1.01 % points (rather than as in Table 1 over-represented by 0.60 points). The 144 not-advanced, not-higher-income countries except for China, India, Brazil, Mexico, and Russia are *over-represented* by the large amount of 4.99 % points (rather than the lesser 3.09 %-point over-representation in Table 1). The 71 poorer countries eligible to borrow from the PRGF are calculated to be *over-represented* by 2.16 % points (2.53 % points when the compression factor is used). By itself imposition of the compression factor, as intended, favors smaller countries, and hence most developing countries.

The compression factor in the current formula, by reducing the shares of the largest IMF members relative to what they would otherwise be, mitigates somewhat the awkward implications of the formula. One can appreciate why some analysts have favored the device. Yet the rationale for the compression factor merits closer inspection. Why should one wish to penalize the IMF governance shares of the largest countries merely because those members have large relative positions in the world economy and financial system? A better balanced formula could incorporate better indicators of relative positions. Negotiations based on such formula calculations could then broadly implement the formula results without further doctoring. A satisfactory underlying formula could remove the rationale for applying a compression factor. Alternatively stated, arguments for a compression factor implicitly admit that the underlying formula is inappropriate. The most worrisome aspect of the compression-factor device is that it may undermine straightforward efforts to design a balanced formula viable for the longer-run future.[19]

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[18] At first blush, one might think that the quota shares of the poorest IMF members could be "protected" merely by freezing the aggregate share of the 71 PRGF members. But according to any reasonable formula, some of the individual PRGF members would merit a share increase. Freezing the PRGF aggregate share would thus require that any such individual share increases come at the expense of reducing other PRGF members' shares.

[19] Only if a satisfactory formula cannot be agreed that strikes an appropriate balance between large and small IMF members can one envisage a strong case in favor of using the arbitrary device of a compression factor.

Table 2
Effects on Calculated Quota Shares of Imposing a Compression Factor of 0.95
in the Current-Status Quota Formula

	(Proposed) Quota Share as of Early 2010 ("Post-Second Round Quotas")	Calculated Quota Share from Current-Status Quota Formula (Compression Factor =	Calculated Quota Share from Current-Status Ouota	Calculated Share from Current Formula Without Compression Factor *less* Current (difference in percentage points)
	% of world total	% of world total	% of world total	
World Total (All IMF Members) (186)	100.000	100.000	100.000	0.000
"Advanced" & Other "Higher-Income" (37)	66.920	66.319	67.930	1.010
G7 -- "Major Advanced" (7)	45.322	45.008	47.668	2.346
United States (1)	17.669	17.816	19.658	1.989
Japan (1)	6.556	6.987	7.339	0.783
Canada (1)	2.672	2.423	2.407	-0.265
Germany + France + Italy + UK (4)	18.426	17.783	18.264	-0.161
Germany (1)	6.110	5.888	6.129	0.019
France (1)	4.505	4.213	4.309	-0.196
Italy (1)	3.306	3.098	3.117	-0.189
United Kingdom (1)	4.505	4.584	4.709	0.205
Other Eurozone (13)**	9.203	9.990	9.536	0.333
Australia + New Zealand (2)	1.733	1.582	1.502	-0.231
Other Industrial & High Income* (7)**	4.543	4.269	4.012	-0.532
Korea + Singapore (2)	2.003	3.417	3.339	1.337
Saudi Arabia + 5 Other High-Income Oil Producing** (6)**	4.117	2.054	1.873	-2.243
Not "Advanced" & Not "Higher-Income" (186 - 37 = 149)	33.080	33.681	32.070	-1.010
(Emerging Market/Developing/Transition)				
China (1)	3.996	7.474	7.879	3.883
India (1)	2.442	2.184	2.158	-0.285
Brazil (1)	1.783	1.969	1.934	0.151
Mexico (1)	1.521	1.864	1.826	0.305
Russian Federation (1)	2.494	2.434	2.419	-0.075
All Other Not Advanced & Not Higher-Income (149 - 5 = 144)	20.844	17.756	15.854	-4.990
Memo: European Union, total (27)	31.867	32.086	31.780	-0.088
Memo: Eligible for IMF Poverty Reduction and Growth Facility, Dec. 2009 (71)	4.265	2.525	2.102	-2.163
Memo: Selected Not-Advanced and Not-Higher-Income Economies, potential candidates for "Dynamic Emerging-Market and Developing" *** (23)**	18.527	23.502	23.200	4.673

Source: IMF Staff and author's calculations.

* See text for description of formula variables and weights.

** Eurozone includes Germany, France, Italy and the 13 other EU members using the Euro as their currency (Belgium, Netherlands, Luxembourg, Austria, Greece, Finland, Ireland, Portugal, Spain, Slovenia, Malta, Cyprus, Slovakia). The United Kingdom does not use the Euro and is not included in the Eurozone.

*** Switzerland, Sweden, Norway, Denmark, Iceland, San Marino, and Israel.

**** Saudi Arabia plus Kuwait, United Arab Emirates, Qatar, Brunei, and Bahrain.

***** China, India, Brazil, Mexico, Russian Federation, Angola, Azerbaijan, Belarus, Colombia, Egypt, Equatorial Guinea, Jordan, Indonesia, Kazakhstan, Malaysia, Pakistan, Panama, Peru, Philippines, Poland, Thailand, Turkey, Vietnam.

The unfortunate results of the current quota formula can be traced in part to the weights associated with its variables. In particular, the assignment of four-fifths of the total weight to the three variables *GDPShare, PPPGDPShare*, and *XBTransShare* illustrates the difficulty, identified earlier, of high correlations among level-share variables. The correlation coefficient between *GDPShare* and *XBTransShare* is the very high value of 0.911. The correlation between *PPPGDPShare* shares and *XBTransShare* shares is 0.895.[20] Given these correlations, the current formula greatly emphasizes the relative absolute sizes of economies and, in effect, is biased in favor of the largest economies. Yes, the compression factor mitigates the bias to a limited extent. This mitigation, however, comes at a significant cost.

Other unfortunate results of the current formula stem from problems with the definitions of the *XBTransShare* and *UnscaledVARIABShare* variables.

In IMF documents, *XBTransShare* is misleadingly labeled as "openness." It suffers from two deficiencies. The first is that the definition of cross-border transactions inappropriately includes intra-currency-union cross-border transactions as though they are fully comparable to cross-border transactions across the boundaries of a currency union. The major instance of this definition problem occurs with goods and services flows among the members of the Eurozone in the European Union. For the purposes of judging relative positions of Eurozone members in the world economy, it is implausible to treat intra-Eurozone cross-border transactions between two Eurozone countries as conceptually equivalent to cross-border transactions between a Eurozone country and a country outside the Eurozone. If an adjustment were made to exclude intra-currency-union transactions, calculations of quota shares with the formula would be significantly altered.[21]

The other deficiency is that gross flows of cross-border transactions, and world shares in the total of those gross flows, is an inappropriate measure of the current-account openness of economies. Current-account "openness" – if it is to be represented in the formula at all -- should not be measured as the gross amount of cross-border current-account transactions but rather a variable expressed as a ratio (e.g., the ratio of cross-border transactions to GDP at market prices and exchange rates). An individual nation's share in the world aggregate of cross-border transactions is dominantly influenced by the relative size of its economy (and hence, again, is highly correlated with its GDP). The ratio of a nation's current-account transactions to its GDP measures its openness in a qualitatively distinct manner not as dependent on the absolute size of its economy. Indeed, there is an inverse correlation: the smaller the absolute size of an economy, the more likely it is to be open in the ratio sense.

A comparable problem exists with an unscaled definition of the variability of cross-border transactions (regardless of whether the transactions are goods trade, goods and services trade, or both current-account and capital-account transactions). A measure of variability should preferably be constructed as a ratio-share variable. Unlike in the present treatment, measures of the absolute standard deviation of external transactions for an economy should be scaled by some measure of the size of the economy. The unscaled measures are very highly correlated with the

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[20] The correlation between the two measures of gross domestic product, *GDPShare* and *PPPGDPShare*, is 0.965.

[21] Note 9 in the Annex to the Report of the Quota Formula Review Group chaired by Richard Cooper (IMF, 2000) examines intra-European trade data. That note, written by the IMF Staff, showed that the calculated quota shares of European Union members would be substantially reduced if intra-trade flows within the Eurozone were excluded from their cross-border trade. Ted Truman and Richard Cooper have emphasized the problems that arise when using measures of gross cross-border transactions as a measure of "openness" and the need for distinguishing gross versus value-added measures; see Cooper and Truman (2007).

level of the external transactions themselves and do not capture the idea of a volatility not dominated by the absolute size of the economy.[22]

These points can be illustrated with a single example of the relative positions of India and Costa Rica. India is much the larger of the two economies in absolute size regardless of which indicators are examined. India's world shares in market-price GDP and PPP-GDP are, respectively, some 1.84 percent and 4.44 percent; the comparable figures for Costa Rica's world shares in the GDP measures are only 0.05 percent and 0.07 percent. India's share of world gross cross-border current transactions is 1.23 percent, 13 times larger than Costa Rica's 0.07 percent. India's world share in the unscaled measure of variability now in use by the IMF staff is 1.01 percent, some 12 times the comparable unscaled measure for Costa Rica of 0.08 percent. But now consider the associated *ratios* for current-account openness (current-account transactions to market-price GDP) and variability (standard deviation of external transactions scaled by market-price GDP). For both ratios Costa Rica has much higher values than India. India's cross-border transactions are less than two-fifths of its GDP (the openness ratio is only 0.43). Costa Rica's current-account transactions are slightly greater than its GDP; it has a current-account openness ratio of 1.04, a multiple of India's by a factor of 2-1/2. The scaled ratio of Costa Rica's variability of external transactions (with capital flows included) is 3.3 times larger than India's scaled ratio.

An Illustrative Revised Formula

The preceding discussion shows that, one way or another, the results from the current quota formula will have to be substantially modified. The modifications could take many forms. Some modifications might entail jettisoning the current formula, imposing non-formula devices such as "filters," "boosters," and "foregoing" adjustments. That approach was in essence the procedure followed in March-April 2008.

A preferable approach would be to revise the formula in ways that would directly produce more acceptable results. A well-considered revised formula would lay a sounder basis for future reviews of IMF quotas.

To suggest possibilities for revisions in the formula, I include here a single illustration. Most or all of the conceivable revisions, including those suggested here, may be thought too radical for consideration in the 2010 negotiations. I offer the illustration here not as a recommendation but rather as a catalyst for further thinking about how to improve the ability of the quota formula to achieve systemic IMF goals.

The first revision in the illustration below raises the combined weight assigned to the *GDPShare* and *PPPGDPShare* variables together and gives the two equal emphasis in the combined blend. The current formula gives the blend of the two GDP variables a weight of only 50 percent and within that blend market-price GDP has a weight half again as large as that for PPP-GDP.

A further set of revisions alters significantly the treatment of cross-border current-account transactions and the current-account openness of members' economies. The illustration does not abandon the *XBTransShare* variable entirely, but it does reduce the weight assigned to it by a factor of six (so the weight is 0.05 rather than 0.30). As an analytically more appropriate measure of current-account openness, the illustration introduces the ratio of gross cross-border current-account transactions to market-price GDP, *XBTransOPENRatioShare* ; this ratio-share variable is assigned a weight of 0.05.

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[22] See again the analytical work on this topic done by the G24 Secretariat (2008, 2010).

The illustration retains the variable *UnscaledVARIABShare* from the current formula but again significantly reduces its weight to two-thirds of the existing value (to 0.10 from 0.15). The motive for that reduction is partially to substitute a ratio-share measure of variability for the existing unscaled measure. Hence the illustrative revision introduces *ScaledVARIABRatioShare*, obtained by dividing the same standard-deviation data used in *UnscaledVARIABShare* but scaling that standard deviation by a member's market-price GDP. The new ratio-share variable in the formula is assigned a small weight of 0.03.

The adjusted formula retains the *Int'lRESERVEShare* variable but reduces its weight from 0.05 to 0.03.

Finally, the illustrative revision introduces a variable, $POPShare_i$, calibrating the size of a member's population as a fraction of the aggregate population of all IMF members. The underlying data for $POPShare_i$ pertain to 2007 and are taken from the World Bank's publication *World Development Indicators*. This additional variable is given the modest weight of 0.12.

Here is an algebraic version of the illustrative adjusted formula:

$$QShr_i = \left[\begin{array}{l} 0.31(GDPShare_i) + 0.31(PPPGDPShare_i) \\ \quad + 0.05(XBTransShare_i) \\ \quad + 0.10(UnscaledVARIABShare_i) \\ \quad + 0.03(Int'lRESERVEShare_i) \\ \quad + 0.12(POPShare_i) \\ \quad + 0.05(XBTransOPENRatioShare_i) \\ \quad + 0.03(ScaledVARIABRatioShare_i) \end{array} \right]^{1.0}$$

As required for consistency, the sum of weights in the formula adds to 1.00. The revised formula assumes that a compression factor is not allowed to influence the calculations. (Setting the exponent compression factor Φ to unity is equivalent to eliminating its effects.)

Table 3 reports calculated quota shares resulting from the revised formula for selected IMF members and groups. As with the preceding tables, the first column shows current (proposed) shares, the second column shows the calculated quota shares, and the final column indicates the difference in percentage points between the two initial columns.

Table 3

The revised formula generates dramatically different conclusions about "over-representation" and "under-representation" from those obtained with the current formula. The United States and Japan are still under-represented, the former by a sizable 0.66 % points. But Canada and the four European Union G-7 countries much more than offset that under-representation. Taken together, the G-7 countries are over-represented by the large amount of 4.72 % points (the corresponding figure in Table 1 is only 0.31 % points). The 27 countries of the European Union as a whole are collectively over-represented by 7.66 % points. When all 37 of the advanced and other higher-income countries are grouped together, they are over-represented – and the 149 (=186-37) "non-advanced" economies under-represented – by nearly 11 percentage points (compared with 0.60 % points in Table 1).

The revised illustrative formula assigns incrementally much greater quota shares to the largest emerging-market members – for example, increases to China of 5.15 % points, to India of

Table 3
Calculated Quota Shares from an Illustrative Revised Quota Formula

	Current (Proposed) Quota Share as of Early 2010 ("Post-Second Round Quotas")	Calculated Quota Share from Illustrative Revised Formula*	Calculated Illustrative Quota Share from preceding column *less* Current (Proposed) Quota Share
	% of world total	% of world total	(difference in percentage points)
World Total (All IMF Members) (186)	**100.000**	**100.000**	**0.000**
"Advanced" & Other "Higher-Income" (37)	**66.920**	**56.040**	**-10.880**
G7 -- "Major Advanced" (7)	**45.322**	**40.605**	**-4.717**
United States (1)	**17.669**	**18.332**	**0.663**
Japan (1)	**6.556**	**6.566**	**0.010**
Canada (1)	**2.672**	**1.882**	**-0.790**
Germany + France + Italy + UK (4)	**18.426**	**13.825**	**-4.600**
Germany (1)	**6.110**	**4.426**	**-1.684**
France (1)	**4.505**	**3.374**	**-1.130**
Italy (1)	**3.306**	**2.572**	**-0.735**
United Kingdom (1)	**4.505**	**3.454**	**-1.051**
Other Eurozone (13)**	**9.203**	**7.045**	**-2.158**
Australia + New Zealand (2)	**1.733**	**1.314**	**-0.419**
Other Industrial & High Income* (7)**	**4.543**	**2.915**	**-1.629**
Korea + Singapore (2)	**2.003**	**2.465**	**0.462**
Saudi Arabia + 5 Other High-Income Oil Producing** (6)**	**4.117**	**1.697**	**-2.420**
Not "Advanced" & Not "Higher-Income" (186 - 37 = 149) (Emerging Market/Developing/Transition)	**33.080**	**43.960**	**10.880**
China (1)	**3.996**	**9.145**	**5.149**
India (1)	**2.442**	**4.301**	**1.858**
Brazil (1)	**1.783**	**2.254**	**0.471**
Mexico (1)	**1.521**	**1.792**	**0.271**
Russian Federation (1)	**2.494**	**2.394**	**-0.099**
All Other Not Advanced & Not Higher-Income (149 - 5 = 144)	**20.844**	**24.073**	**3.229**
Memo: European Union, total (27)	**31.867**	**24.214**	**-7.653**
Memo: Eligible for IMF Poverty Reduction and Growth Facility, Dec. 2009 (71)	**4.265**	**7.297**	**3.032**
Memo: Selected Not-Advanced and Not-Higher-Income Economies, potential candidates for "Dynamic Emerging-Market and Developing" *** (23)**	**18.527**	**28.107**	**9.579**

Source: IMF Staff and author's calculations.

* See text for description of formula variables and weights.

** Eurozone includes Germany, France, Italy and the 13 other EU members using the Euro as their currency (Belgium, Netherlands, Luxembourg, Austria, Greece, Finland, Ireland, Portugal, Spain, Slovenia, Malta, Cyprus, Slovakia). The United Kingdom does not use the Euro and is not included in the Eurozone.

*** Switzerland, Sweden, Norway, Denmark, Iceland, San Marino, and Israel.

**** Saudi Arabia plus Kuwait, United Arab Emirates, Qatar, Brunei, and Bahrain.

***** China, India, Brazil, Mexico, Russian Federation, Angola, Azerbaijan, Belarus, Colombia, Egypt, Equatorial Guinea, Jordan, Indonesia, Kazakhstan, Malaysia, Pakistan, Panama, Peru, Philippines, Poland, Thailand, Turkey, Vietnam.

1.86 % points, to Brazil of 0.47 % points, and to Mexico of 0.27 % points. The 144 not-advanced, not-higher-income members other than China, India, Brazil, Mexico, and Russia are under-represented by 3.23 % points (instead of over-represented by 3.09 % points in Table 1). The 71 poorer IMF members eligible to borrow from the PRGF are under-represented by 3.03 % points (instead of over-represented by 1.74 % points). The 23 selected dynamic emerging-market and developing economies are calculated with a large net aggregate share increase of 9.58 % points (the calculated increase with the current formula is a 4.98 % point increase).

Self-evidently, the results from the revised formula are consistent with significantly increasing the quota shares of dynamic emerging-market and developing countries by well over 5 percentage points. And they more than "protect" – they substantially increase – the quota shares of the IMF's poorest members.

Although the results from the revised illustrative formula can be viewed as an improvement in several respects, other aspects are problematic. The increased quota share for China is very large, raising its share from 4.00 to 9.15 percent; the increase for China with the current formula is also large, but only raises its share to 7.47 percent. Any increase for the United States, especially as large as 0.66 % points, may be deemed inappropriate. European members, large and small, will doubtless regard the reductions in their shares as excessive. The sizable reductions in shares for Germany (1.68 % points), France (1.13 % points), the United Kingdom (1.05 % points) and Italy (0.74 % points) would be especially contentious. For many IMF members not shown separately in the tables, the incremental share changes might also prove controversial. Many official participants in the negotiations would surely argue that the results in Table 3 go too far in shifting quota shares away from advanced, higher-income and toward emerging-market and developing IMF members.

For reasons already discussed, I am unenthusiastic about applying a compression factor of less than unity to the results of quota-formula calculations. Nonetheless, if only to anticipate a likely reaction and suggestion, I have also calculated results from the revised formula using a compression factor. Thus the results in Table 4 stem from identical variables, weights, and assumptions as those underlying Table 3; the only difference is that Table 4 imposes a compression factor of 0.95 whereas the Table 3 results have the compression exponent set exactly to 1.00 (eliminating all compression results).[23]

[Table 4]

The imposition of a 0.95 compression factor in the revised formula leads of course to a reduction in the dispersion in quota shares across IMF members and to a diminution in the shares of the largest countries. In Table 4, the number of large countries experiencing a reduced quota share from compression is increased; the list in Table 4 includes not only the United States, Japan, China, Germany, France, Italy and the United Kingdom (as in Table 2) but also three other countries, India, Russia, and even Brazil. The United States quota share falls to 16.43 percent (instead of rising to 18.33 percent as in Table 3). China's share rises to only 8.49 instead of 9.15 percent. The compression effects work to reduce even further the shares of Germany, France, Italy, and the United Kingdom from the values calculated without compression. Similarly, compression somewhat reduces the increases in quota shares calculated for India and Brazil and slightly enlarges the share decline for Russia. The effects of compression of course strongly favor developing and smaller countries. The 144 not-advanced, not-higher-income members other than China, India, Brazil, Mexico, and Russia together experience a share

[23] Table 4 bears the same relation to Table 3 that Table 2 bears to Table 1.

Table 4
Calculated Quota Shares from an Illustrative Revised Quota Formula with Imposition of a Compression Factor of 0.95

	Current (Proposed) Quota Share as of Early 2010 ("Post-Second Round Quotas")	Calculated Quota Share from Illustrative Revised Formula with imposition of Compression Factor = 0.95*	Calculated Illustrative Quota Share from preceding column *less* Current (Proposed) Quota Share
	% of world total	% of world total	(difference in percentage points)
World Total (All IMF Members) (186)	100.000	100.000	0.000
"Advanced" & Other "Higher-Income" (37)	66.920	54.253	-12.667
G7 -- "Major Advanced" (7)	45.322	37.970	-7.352
United States (1)	17.669	16.429	-1.240
Japan (1)	6.556	6.194	-0.362
Canada (1)	2.672	1.890	-0.782
Germany + France + Italy + UK (4)	18.426	13.457	-4.969
Germany (1)	6.110	4.258	-1.852
France (1)	4.505	3.291	-1.214
Italy (1)	3.306	2.543	-0.764
United Kingdom (1)	4.505	3.365	-1.140
Other Eurozone** (13)	9.203	7.411	-1.792
Australia + New Zealand (2)	1.733	1.373	-0.360
Other Industrial & High Income*** (7)	4.543	3.126	-1.417
Korea + Singapore (2)	2.003	2.519	0.516
Saudi Arabia + 5 Other High-Income Oil Producing**** (6)	4.117	1.854	-2.263
Not "Advanced" & Not "Higher-Income" (186 - 37 = 149) (Emerging Market/Developing/Transition)	33.080	45.747	12.667
China (1)	3.996	8.486	4.490
India (1)	2.442	4.144	1.702
Brazil (1)	1.783	2.243	0.460
Mexico (1)	1.521	1.804	0.283
Russian Federation (1)	2.494	2.376	-0.118
All Other Not Advanced & Not Higher-Income (149 - 5 = 144)	20.844	26.693	5.849
Memo: European Union, total (27)	31.867	24.487	-7.381
Memo: Eligible for IMF Poverty Reduction and Growth Facility, Dec. 2009 (71)	4.265	8.367	4.102
Memo: Selected Not-Advanced and Not-Higher-Income Economies, potential candidates for "Dynamic Emerging-Market and Developing" ***** (23)	18.527	27.805	9.277

Source: IMF Staff and author's calculations.

* See text for description of formula variables and weights.

** Eurozone includes Germany, France, Italy and the 13 other EU members using the Euro as their currency (Belgium, Netherlands, Luxembourg, Austria, Greece, Finland, Ireland, Portugal, Spain, Slovenia, Malta, Cyprus, Slovakia). The United Kingdom does not use the Euro and is not included in the Eurozone.

*** Switzerland, Sweden, Norway, Denmark, Iceland, San Marino, and Israel.

**** Saudi Arabia plus Kuwait, United Arab Emirates, Qatar, Brunei, and Bahrain.

***** China, India, Brazil, Mexico, Russian Federation, Angola, Azerbaijan, Belarus, Colombia, Egypt, Equatorial Guinea, Jordan, Indonesia, Kazakhstan, Malaysia, Pakistan, Panama, Peru, Philippines, Poland, Thailand, Turkey, Vietnam.

increase of 5.85 % points with compression instead of only 3.23 % points without it. The 71 poorer IMF members eligible to borrow from the IMF's PRGF collectively have their quota share increase by 4.10 % points rather than only 3.03 % points without compression. Because of the effects on China, India, Brazil, and Russia, the 23 selected "dynamic" IMF members experience a share increase of 9.28 % points (somewhat smaller than the 9.58 % points without compression).

Voting Shares

Votes for IMF decisions are divided into two components. A small fraction of the total is "basic" votes; each member is allocated an equal number of such votes. The remaining votes, much the largest fraction, are proportional to members' quotas. The practices used to fix individual quotas and quota shares thus are the most important determinant of a member's voting share. A member's voting share is the primary factor determining its relative political influence in IMF decisions. (Executive Board decisions are often taken by consensus rather than with explicit voting. Notwithstanding that procedure, voting shares are a central feature, "behind the curtain," influencing decisions.)

When the IMF was established in 1944, it had only 44 member nations and basic votes were significant in the voting power of members. Basic votes as a fraction of the total votes were at the level of 11.3 percent in 1944. With many new members joining and with total quotas increasing only moderately, the proportion of basic votes actually rose, to as high as 15.6 percent in 1958. The fraction of basic votes was still high at roughly 14 percent in 1963-65. Because the number of basic votes per member was not changed and aggregate quotas were periodically increased, however, the basic-votes proportion thereafter declined sharply over time. It fell to 5-1/2 percent by 1980-82 and declined further all the way to only 2.1 percent in 2007.

The waning significance of basic votes reduced the voting power of smaller IMF members and hence their ability to influence IMF decisionmaking. By the time of the Annual Meeting of the IMF in Singapore in September 2006, a consensus had emerged for a modest increase in basic votes. A reform along those lines was then agreed in the April 2008 compromise. The number of basic votes to be allotted to each IMF member was tripled (from the then current 250 to 750). That raised the proportion of total votes accounted for by basic votes to about 5-1/2 percent. From the perspective of history, a basic-vote fraction of 5-1/2 percent was not generous. Nonetheless, the 2008 change definitely moved in the right direction. A further helpful change agreed in April 2008 was to propose an amendment to the IMF Articles of Agreement preventing the basic-vote fraction from falling again in future years when aggregate quotas are increased further. That amendment is in essence an indexation provision that maintains basic votes at the then-current percentage of total voting power in upcoming quinquennial reviews of quotas.

Because quota-proportional votes are by far the largest fraction of total votes, the basic-vote component of voting power has to be determined simultaneously and in an integrated way with the formula for determining quota shares. The final part of Appendix B summarizes the straightforward procedure for making the integrated calculations.

Other Governance Reforms

This essay focuses on governance shares. But of course many other aspects of IMF governance are salient. A partial list includes the size and composition of the IMF's Executive Board (and hence the number and definitions of member constituencies); ways of enhancing the effectiveness of the Board; possible implementation of the Council provided for as a possibility in the IMF's Articles of Agreement; the size of prospective IMF quota increases and SDR

allocations; selection procedures for the top level of the IMF's management; and procedures for improving the accountability of management to the Executive Board and national governments.

These issues are of equal importance as quota shares and voting shares. The size and composition of the Executive Board, and the definition of constituencies, are probably even more important.

It is not practical to discuss all the other governance issues in this essay. But, self-evidently, the other issues are closely interlinked with how governance shares are determined. Only after the world community has been able to settle on an improved formula and procedures for allocating quota shares will it be possible to hope for genuine progress on the whole range of governance reforms.

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Appendix A

Population as a Variable in a Quota Formula

Official participants in ongoing negotiations about IMF governance reform have thus far rejected the use of shares in world population as one of the level-share variables in an IMF quota formula. This rejection of a population variable is unfortunate and shortsighted. Eventually, a formula viable for the longer run is almost sure to include such a variable, albeit at first with only a modest weight.

How High a Correlation between PPP-GDP and Population?

The first argument to consider is the assertion that member nations' shares in PPP-GDP and members' shares in population are so highly correlated that PPP-GDP is essentially a substitute for population. That assertion is flatly wrong. Population shares and PPP-GDP shares do of course have a substantial correlation. But *every pair* of candidate level-share variables exhibits a substantial correlation. Large countries tend to have large values and small countries tend to have smaller values because each level-share variable reflects some aspect of relative world positions. The correlation between population and PPP-GDP, however, is not high enough to justify treating the two variables as a substitute for one another. For all 186 IMF members, the correlation coefficient between the two is only 0.564. (For comparison, the correlation coefficients are much higher between cross-border current transactions and market-price GDP (0.911) and between PPP-GDP and market-price GDP (0.965).)[24] The verdict on this question is unambiguous: a quota formula *cannot* get similar results merely be excluding population shares as a variable, including PPP-GDP shares, and assigning PPP-GDP shares a higher weight than might otherwise be considered.[25]

Is Population an Economic Variable?

No one has seriously argued that population shares should be the sole variable in a quota formula. Everyone agrees that it would be inappropriate, and politically infeasible, even to make population shares the most important variable.

In arguing for the complete exclusion of population shares, some have asserted that population is "not an economic variable" and hence is "not relevant for a financial institution."

Beyond doubt, population is a variable that bears directly on nations' evolutions in the world economy and financial system. Labor supply and employment are critical components of economic performance. Demographic trends, such as fertility declines and population aging, are widely acknowledged as key determinants of health-care supplies and economic performance more broadly. The assertion that population is not an economic variable is either a silly remark or relies on a definition of "economic" far outside common usage.

The motivations are murky that underlie the remark that population is not relevant for a financial institution such as the IMF. Suppose the remark is interpreted as charitably as possible.

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[24] The correlation between population and market-price GDP is only 0.351, still lower than the 0.564 between PPP-GDP and population.

[25] The point can be visually grasped by considering scatter diagrams that plot member nations' shares in world PPP-GDP on the vertical axis and their shares in world population on the horizontal axis (both axes scaled to the same range). The differences between the values of the two variables across the entire range of individual members are so significant that one can see merely from visual inspection that neither one of the two variables could appropriately substitute for the other in formula calculations. To save space here, I have omitted the scatter diagrams.

Then proponents of this view may be hypothesized as believing that the IMF's lending and borrowing operations are the IMF's primary if not exclusive function. That belief in turn could lead to an exclusive emphasis on member nations' potential ability to contribute financial resources to the Fund's lending operations and members' potential needs to borrow those funds, which in turn could lead to an assertion that only those two criteria should be considered in selecting variables to appear in a quota formula.[26]

The text of this essay argues that variable selection for a quota formula should *not* focus narrowly on member nations' "contributions" and "needs" in the IMF's intergovernmental lending-intermediary operations. Rather the formula should emphasize variables that bear on relative status in the world economy broadly conceived, in keeping with the shifts in the IMF's primary functions away from lending operations toward such newly important activities as multilateral surveillance and monitoring. If that view of the IMF's mission is accepted, population has just as much claim in principle to be considered an economic variable included in the formula as such variables as GDP, cross-border transactions, and international reserves. A sufficiently broad view of the IMF's functions today and in the future invalidates the contention that use of population as a variable is not compatible with the IMF's functions as a financial institution.

Population is not merely an economic variable. To consider population for inclusion in a quota formula opens the door explicitly to a still wider range of political considerations. But debate about all candidate variables for a quota formula is in any event political.

Relative Productivities

Some analytic preliminaries can help. Consider the relationship between a nation's population and the gross output it produces. Gross output as typically measured depends *both* on the number of people in the nation (strictly, the number engaged in measured economic activity) *and* on the "productivity" of those people. A nation's productivity can be roughly measured as the ratio of its gross output to its population, in other words output per capita.[27]

The following algebraic identities summarize these definitions for an individual nation and for the world, where Y_i is the individual nation's output (GDP), N_i its population, $prody_i$ its per capita output; Y_W and N_W are aggregated output and population for the world as a whole; and $YShare_i$ and $NShare_i$ are the respective shares for nation i :

$$prody_i \equiv \frac{Y_i}{N_i};\ \ Y_i \equiv N_i(prody_i);\ \ Y_W \equiv \sum_i Y_i\ ;\ \ N_W \equiv \sum_i N_i;\ \ YShare_i \equiv \frac{Y_i}{Y_W};\ \ NShare_i \equiv \frac{N_i}{N_W}\ .$$

Given these definitions, the identity for a nation's share in world output can also be written as:

$$YShare_i \equiv \frac{N_i(prody_i)}{Y_W} \equiv (\frac{N_i}{N_W})(\frac{prody_i}{Y_W})N_W \equiv NShare_i\left[\frac{prody_i}{\frac{Y_W}{N_W}}\right]\ .$$

In words, the share of a nation in world GDP is the product of its share in world population and the ratio of the nation's productivity (measured by national GDP per capita) to *average* world productivity (world GDP per capita).

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[26] The Quota Formula Review Group working in the years 1999-2000 (IMF, 2000) adopted, in essence, a sophisticated variant of this view.

[27] For more precise analysis of productivity trends, measures of productivity should be expressed as another ratio, for example, the output produced by resident workers divided by the number of hours worked.

A highly productive, rich nation will have higher-than-world-average productivity; its ratio $\left[\frac{prody_i}{\frac{Y_W}{N_W}}\right]$ will be substantially greater than unity. Conversely, that ratio will be low, significantly less than unity, for a relatively unproductive, poor country. If every nation in the world had productivity equal to world average productivity, the ratio $\left[\frac{prody_i}{\frac{Y_W}{N_W}}\right]$ for every nation would be unity; then the only difference between nations' share in world GDP would be attributable to different size populations. In that hypothetical world, it could make no difference whether member nations are weighted relative to each other by their GDP shares or by their population shares. In practice, of course, relative productivities across nations differ enormously. Therefore it makes a great difference when relative positions have to be judged—for example, in an IMF quota formula—whether one weights by GDP shares, by population shares, or some mixture between the two.

To weight voting shares in the IMF exclusively by population shares would completely ignore national differences in productivity and the resulting cross-national differences in output and wealth. Yet those differences determine the capacities of member nations to contribute resources to the IMF and, still more important, determine their capacities and willingness to support the activities of the IMF more generally.

But now consider the other extreme choice, choosing voting shares only on the basis of GDP shares, giving a zero weight to population shares. That choice would be tantamount to saying that output and wealth are alone the relevant criterion. Yes, a sole use of GDP shares as weights would implicitly accord a limited role to population. Everything else being the same, a member nation with a larger rather than a smaller population would receive a higher voting share. But, in effect, the implicit principle would be to count each individual in the world, not as an entire person, but rather weighting each person by the relative productivity of the nation in which they reside (alternatively stated, by how much output per capita is produced in their nation relative to the average output produced by all individuals in all nations). Nations with lower than average productivity (GDP per capita) would have their residents discounted, treated as a fraction — $\left[prody_i/(Y_W/N_W)\right] < 1$ — of a person with average world productivity. Nations with higher than average productivity would have their individuals enhanced, counted as a multiple — $\left[prody_i/(Y_W/N_W)\right] > 1$—, perhaps a large multiple, of a single person.

Governance within Nations versus Governance for the IMF: Which Relativities?

For purposes of governance, should political jurisdictions be weighted by how much output and wealth they produce, or by how many individuals are resident within the jurisdictions? Significantly, *within* democratic nations the second method is unambiguously preferred for government institutions. There is no serious advocacy for counting each individual person not as an entire individual but rather weighting persons in a jurisdiction by how much average output the jurisdiction produces relative to the average output produced by all individuals in all jurisdictions.

Consider two states within the United States, New Jersey and West Virginia. The population of New Jersey is a bit less than 5 times that of West Virginia. Representation in the U.S. House of Representatives is based on population. New Jersey thus has 15 Congressman and West Virginia has 3. If one examines measures of state economic product, however, New

Jersey's is more than 8 times that of West Virginia's. One does not encounter the argument that New Jersey should have 24 Congressmen—8 times as many as West Virginia's 3. Nor is there discussion of giving partial weight to state products and partial weight to populations, for example allocating New Jersey 7 or 6 times as many Congressmen as West Virginia instead of just 5 times.

By invoking this example, I am not suggesting that the relative influence of political jurisdictions within the United States is, even today, without controversy. And determination of today's relativities, after all, was the outcome of a difficult, chequered history. A key feature of the 1789 constitution in the United States was the so-called sectional compromise among slavery and anti-slavery states that each slave would be counted as *three-fifths* of a person for the computation of populations governing the allocation among states of seats in the House of Representatives. The United States fought a bloody civil war before slavery was eradicated. It had to endure decades of political struggle over gender equality and civil rights before one-adult-person-one-vote became a reality instead of a legal promise!

Determining relativities among political jurisdictions even within nations is thus not at all straightforward. Not for the United States. Not within individual European countries. Not in Canada. Not in Japan. Probably not within *any* nation giving prominence to some procedural form of democratic decisionmaking. Nevertheless, within those nations as of today, there exists widespread acceptance of the principle that domestic jurisdictions' relative voting power in national political institutions should depend on the numbers of people resident in the jurisdictions.[28]

Determining quota shares and voting shares for the IMF is a very different matter from determining relativities among political jurisdictions within a nation. The presumptions should be and are different. It *is* relevant that the IMF is an international institution with specialized economic and financial functions.

But just how different should IMF governance be? Should IMF governance shares be determined in a process that assigns world shares in population a weight of *exactly zero* after world shares in output and wealth are taken into account?

Consider again an example comparing two political jurisdictions. But now let the jurisdictions be IMF member nations, the United States and Brazil. The United States has a population roughly 1.6 times that of Brazil (world population shares are, respectively, 4.60 percent and 2.90 percent). U.S. productivity measured by market-price GDP per capita is some 5.8 times greater than the world average. Brazil's productivity measured comparably is only 3/4 of the world average. Given those facts about relative populations and relative productivity, U.S. output at market prices is some 12 times the output of Brazil. The U.S. current share of total quotas in the IMF is 17.67 percent, about 10 times the Brazilian share of 1.78 percent.

The comparison between the United States and Brazil is between two nation states in a heterogeneous and imperfectly integrated world economy. When judging the current relativities between the two, one inevitably asks whether it seems appropriate that the United States should have a quota share in the IMF 10 times greater than Brazil's when the United States has output 12 times greater and output per capita 7-1/2 times greater but population only 1-1/2 times greater. Even given that one wishes to make substantial allowance for the greater output and wealth of the United States as a proxy for its greater ability and (it is hoped) greater willingness to support the activities of the IMF, how large a difference in governance shares and population shares is appropriate? Yes, the shares should be different. But just how different?

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[28] And for intermediate "federal" entities, the issues are still more complex. Think of that most difficult case of the political relativities of the now 27 nations within the European Union as a whole. Voting shares and decisionmaking procedures for the European Union are still, at best, a work in progress—and "progress" sometimes seems too extravagant a word for what is actually happening.

If one tries to reason from first principles about the general issue highlighted by this example, no conclusion could be reached that would command a full consensus. But it is surely an extreme position, most unlikely to command thoughtful agreement in the world community as a whole, that governance shares should be determined by according population shares a weight of exactly zero once shares in world output are taken into account.

Broader Justifications for Inclusion of Population as a Variable

The reasoning in this appendix so far is rooted in economics as much as politics. It supports the inclusion of population shares in a quota formula, but only as one of several variables and only if the population-shares variable has a modest weight relative to other variables. But one should also stand back from today's political perspectives and take a longer view.

The history of suffrage expansion within domestic political organizations in democratic nations suggests some salutary lessons for thinking about the future. The notion that democratic societies should adopt governance procedures emphasizing one-adult-person-one-vote was never written in tablets of stone. Very much the contrary. Those societies that now emphasize such procedures evolved, painfully and slowly, to their current position.

Before the nineteenth century in Britain and Continental Europe, the original idea about voting in governance institutions was that only those owning a minimum amount of property should have the vote. The arguments—made notably by property owners—included the contentions that property owners had a much bigger stake in how the society functioned, that property owners contributed more to the functioning and the stability of the political institutions, and that only property owners would prudently exercise the responsibility of voting.

Decades elapsed before the original idea was modified. But eventually voting rights were extended to men regardless of the property they owned.

In nations describing themselves as democratic, originally women were not allowed to vote either. It was for long argued by many—notably the men—that men had a larger stake in how the society functioned, that men contributed more to the functioning and stability of the political institutions, and that only men would prudently exercise the responsibility of voting.

After decades of heated discussion and controversy, such arguments also failed to be sustained. Eventually voting rights were extended to adult individuals regardless of gender.

If we look ahead fifty or one hundred years, should we presume that voting rights in international institutions—including specifically international *financial* institutions such as the IMF—will still depend primarily on the relative wealths of nations, giving no or little weight to the numbers of people living in the nations independently of national wealths? To put the question more provocatively, which seems justified if one holds the view that democratic ideas should actually be implemented in societies that claim allegiance to them, can we imagine the persistence for 50 or 100 years of a world in which rich nations always enjoy large vote shares proportional to their wealths, regardless of their populations, while poor nations, again regardless of their populations, experience small vote shares simply because they are poorer, have fewer resources, and have not yet unlocked the secret of successful development?

The longer view just sketched points toward permitting population shares to be used in a revised formula for IMF quota and voting shares. Economic reasoning, detailed examination of the alternatives for a quota formula, and a longer view of political history all point toward letting the camel's nose a little bit into the tent today.

According a modest weight to population shares in the formula would marginally help in the short run to increase governance shares for many individual developing nations and for developing nations in the aggregate. Over a much longer run, the modest weight on population shares in a quota formula could gradually increase further. Pressures to adjust the governance of international institutions to reflect more fully the widely professed democratic principle of one

person, one vote will eventually push the IMF and its shareholder governments in that direction. The world in the first decades of the twenty-first century is certainly not ready for governance of international institutions giving prominence to that principle. But if the experiences of democracies around the world are a guide—in western Europe, North America, Japan, India and elsewhere in Asia, in South America, in Africa—then global decisionmaking over the long run will need to accord gradually increasing weight to individual persons regardless of their geographical jurisdiction and regardless of their incomes and wealths.

Appendix B

The Structure of Formulas for IMF Governance Shares

This appendix summarizes a robust specification for a formula for IMF quota shares and its use in the calculation of voting shares. The distinction between level-share and ratio-share variables and the incorporation of ratio-share variables in the formula is a departure from current practice.

Two Classes of Variable

Variables in a quota formula can be divided into two classes, *level-share* variables and *ratio-share* variables.

A level-share variable contains values for each individual IMF member expressed as the member's *fractional share in a global level total*. Definition of such variables in terms of members' *shares* in global totals is simpler and more transparent than specifying variables in actual level amounts (either nominal or inflation-adjusted).[29] A ratio-share variable contains values for each individual member expressed as a *ratio* of two or more variables for that member.

Examples of level-share variables are members' fractional shares in global totals for:

- GDP at market prices and exchange rates.
- GDP at purchasing power parity prices (PPP-GDP).
- aggregate financial activity measured from the asset side of balance sheets.
- aggregate financial activity measured from the liability side of balance sheets.
- exports of goods and services, or all current-account receipts.
- imports of goods and services, or all current-account payments.
- cross-border financial assets.
- cross-border financial liabilities.
- international reserves.
- population.

A level-share variable may indicate something about the ability of a member nation to contribute financial resources to the lending-intermediary operations of the IMF. A level-share variable may indicate something about the size of a member's potential need to use (borrow) the IMF's financial resources. But because lending and borrowing of Fund resources to finance

[29] The five variants of the original Bretton Woods formula predominantly used variables in nominal-levels form rather than as shares in global totals. An emphasis on using shares rather than levels began during the 2007-2008 negotiations about governance shares.

payments imbalances are no longer the primary function of the IMF and because functions such as surveillance, crisis prevention, and monitoring of the norms and rules of the world financial system are even more important IMF functions, it follows that level-share variables capturing still other dimensions of members' positions may be equally if not more relevant.

Level-share variables could be combined in several ways. For example, rather than using GDP-PPP and GDP at market prices and exchange rates as separate variables, one could use a "blend" of the two (e.g., 50 % of each or 67% GDP at market rates and 33% PPP-GDP). Exports and imports could be combined into a cross-border trade variable that is the average of exports and imports, or the sum of the two. Whether two variables are combined into a blend variable or whether they appear separately in the formula is solely an expositional matter so long as the effective weights on the two variables are comparable for both methods.

Examples of ratios that for ratio-share variables include:

- a measure of the "trade openness" of an economy (e.g., the ratio of a member's cross-border trade to its market-price GDP).
- a measure of the "financial openness" of an economy (e.g., the ratio of a member's cross-border financial assets or cross-border liabilities to a measure of the total assets of its national financial system).
- a scaled measure of the "variability" of the member's cross-border transactions (e.g., some measure of the standard deviation of its cross-border transactions scaled by the mean of those transactions—such as one standard deviation from a centered five-year average calculated over a recent 13-year period scaled by the mean of those transactions or scaled by some other variable, all averaged over the same period).
- other scaled measures of the "vulnerability" of the member's cross-border transactions to exogenous shocks.
- the ratio of a member's GDP to its population (per capita GDP).

To be included in a quota formula, a level-share variable should capture some significant dimension of individual members' relative positions in the world economy and financial system. Preferably, a particular level-share variable should reflect characteristics identifiably different from other level-share variables. Because such variables measure *relative* position, they all tend to capture the size, somehow measured, of member's economies or polities. Every pair of level-share variables, viewed from a statistical perspective, will have a fairly high correlation coefficient.

Ratio-share variables, like level-share variables, should capture something significant about individual members' relative positions in the world economy and financial system. Yet there is a subtle difference. Ratio-share variables focus on a different type of relativities among nations. The value of the ratio for an individual member is calibrated, in effect, against the

corresponding world-average value of the ratio. Because the numerator and denominator of a ratio variable are both typically a function of members' economic sizes, the ratio variable can depict relativities that are not dominated by economic size alone.

The text provides an illustration by contrasting the relative positions of Costa Rica and India. Because India is a much larger country by any measure, India's share of world cross-border transactions is more than 13 times larger than Costa Rica's (1.23 versus 0.07 percent for recent data). But the transactions-openness *ratio*—cross-border transactions divided by GDP—is almost 2-1/2 times higher for Costa Rica than for India (1.04 versus 0.43). An unscaled measure of the variability of cross-border trade and capital-flow transactions is 12 times higher for India than for Costa Rica, but the *ratio* of that variability to GDP is 3.3 times larger in Costa Rica than the corresponding ratio value for India.

The preceding illustration reflects the general point that ratio-share variables often can better identify some features of members' economies and polities that are *qualitatively* distinct rather than dominantly determined by economic size. For example, ratio-share variables can better reflect the relative openness of economies, giving greater weight to smaller, more open economies than to larger, less open economies.[30]

Problems Arising from the Correlation among Formula Variables

High correlations may exist among ratio-share as well as level-share variables. For example, the broader concept of member nations' "vulnerability" to shocks originating outside their borders can depend both on ratios of trade and financial openness and on ratios of the variability of cross-border transactions, with all those ratios exhibiting a sizable correlation with each other.

When considering candidate variables for inclusion in a quota formula, however, high correlations are most problematic for level-share variables.[31] If a variety of level-share variables, all highly correlated, are included in a formula, the formula can excessively emphasize the sizes of member nations. Larger members may receive bigger calculated quota shares

[30] During negotiations about quota shares in recent years, formula variables pertaining to the "openness" and "variability" of economies have been confusingly labeled. Economically sensible definitions of openness should be expressed as ratios of cross-border transactions to total transactions (domestic and cross-border combined). (This confusion is in addition to the practice in IMF staff analyses that defines cross-border trade measures as including intra-currency zone trade -- notably, intra-Euro-zone trade.) Indicators of variability in cross-border transactions should be defined as a ratio, for example a standard-deviation measure scaled by the mean size of transactions. Ideally, if openness and vulnerability variables are to be included in a quota formula, they should be included as ratio-share rather than level-share variables.

[31] Recall the example emphasized in the text of the paper: the correlation coefficient between member nations' shares in world cross-border trade and shares in world market-price GDP is the high value 0.91.

relative to smaller members than seems objectively reasonable on the grounds of size alone. In effect, large members can be "over-counted." An important advantage of including ratio-share variables in a formula—in addition to level-share variables—is that over-representation for economic size is less likely.

Formula Structure

Suppose that, say, three different variables have been agreed for use as level-share variables, *AShare*, *BShare*, and *CShare*. For a particular member *i*, the *Ashare* variable is defined as its value of the nominal or inflation-adjusted magnitude of *A* as a fraction of the corresponding global total for *A*. The global total is the sum across all members of *A* values:

$$AShare_i \equiv \frac{A_i}{A_{WORLD}} \quad \text{and} \quad A_{WORLD} \equiv \sum_i A_i \quad .$$

Analogously,

$$BShare_i \equiv \frac{B_i}{B_{WORLD}}; B_{WORLD} \equiv \sum_i B_i \quad \text{and} \quad CShare_i \equiv \frac{C_i}{C_{WORLD}}; C_{WORLD} \equiv \sum_i C_i \quad .$$

By construction, the sum of each share variable across members is unity (or 100 if the shares are expressed in percent):

$$\sum_i AShare_i \equiv \sum_i BShare_i \equiv \sum_i CShare_i \equiv 1.000$$

For an individual member, the level-share part of the overall quota formula is then given by:

$$\alpha\left(AShare_i\right) + \beta\left(BShare_i\right) + \gamma\left(CShare_i\right),$$

where α, β, and γ are positive parameter values assigned as the weights associated with the variables. Each parameter has a value bounded by zero and unity.[32] These features of the structure of a formula are now widely accepted. (If the formula is to include a different number of level-share variables than three, the number and values of the parameter weights obviously have to be changed accordingly.)

Suppose two ratio-share variables are also to be included in the formula. For a particular member *i*, suppose the ratios are

$$DRatio_i \equiv \frac{D_i}{J_i} \quad \text{and} \quad ERatio_i \equiv \frac{E_i}{K_i} \ ,$$

[32] To exclude a variable altogether from a particular calculation with the formula, its parameter weight can be set exactly equal to zero.

where D_i and E_i are the identifying numerator variables for the ratios and J_i and K_i are the associated scalar (denominator) variables.[33] To obtain *relative* ratios for member nations, define the world sums of members' ratios as

$$DRatioSum_{WORLD} \equiv \sum_i \frac{D_i}{J_i} \quad \text{and} \quad ERatioSum_{WORLD} \equiv \sum_i \frac{E_i}{K_i}$$

and then define the ratio-share relatives themselves as

$$DRatioShr_i \equiv \frac{DRatio_i}{DRatioSum_{WORLD}} \quad \text{and} \quad ERatioShr_i \equiv \frac{ERatio_i}{ERatioSum_{WORLD}} \ .$$

Again by construction it will be true that

$$\sum_i DRatioShr_i \equiv \sum_i ERatioShr_i \equiv 1.000 \ .$$

For an individual member, the part of the overall formula comprising ratio-share variables is then given by:

$$\lambda\left(DRatioShr_i\right) + \mu\left(ERatioShr_i\right),$$

where as before λ and μ are positive parameter weights with values bounded by zero and unity. (Use of just one ratio-share variable, or more than two, require the obvious adjustments in the algebra.)

When both types of variables are entered into the formula together, the entire formula determining the quota share for each member is

$$QShr_i = \alpha\left(AShare_i\right) + \beta\left(BShare_i\right) + \gamma\left(CShare_i\right) + \lambda(DRatioShr_i) + \mu(ERatioShr_i) \ .$$

The parameter weights on each of the included variables, uniform across all member nations, determine the relative importance of the variables in the formula. For consistency, the parameter weights together must sum to unity:

$$\alpha + \beta + \gamma + \lambda + \mu \quad = \quad 1.000 \quad .$$

Similarly, since the sum of each variable across members is unity, it is also true that

$$\sum_i QShr_i \equiv 1.000 \quad .$$

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[33] J_i and K_i could of course be the same variable, for example an indicator of total economic activity such as GDP, rather than two different variables..

A Compression Factor?

Use of a "compression factor" for a formula is, as emphasized in section III above, unnecessary if the formula itself is adequate. If used, the compression factor is motivated by a desire to mitigate unpalatable implications of an inadequate formula.

The algebra underlying the idea is straightforward. Suppose that, as in the proposals on the table at the time of this writing, a formula uses four level-share variables, labeled for simplicity here as *AShare*, *BShare*, *CShare*, and *FShare.* The underlying formula, yielding quota shares for individual nations, is then:

$$QShr_i = \alpha\left(AShare_i\right) + \beta\left(BShare_i\right) + \gamma\left(CShare_i\right) + \varphi(FShare_i)\,.$$

When the four weights on the variables sum to unity $(\alpha + \beta + \gamma + \varphi \equiv 1.00)$, then also $\sum_i QShr_i \equiv 1.000$. The imposition of a compression factor changes the formula to:

$$QShr_i = \left[\alpha\left(AShare_i\right) + \beta\left(BShare_i\right) + \gamma\left(CShare_i\right) + \varphi(FShare_i)\right]^{\Phi}$$

where Φ is an exponent with a value less than one. When the compression-altered formula is used for all members, the resulting $QShr_i$ do not, as required, sum to unity. A further scaling-up adjustment must then be applied to each $QShr_i$ to produce shares that do sum for all members to unity.

Simultaneous Calculation of Quota Shares and Voting Shares

A quota formula and the procedure for determining voting shares should be determined together in an integral fashion. That in turn means that "basic votes" must be determined simultaneously with votes proportional to quota shares. As part of the April 2008 agreement on IMF reform, the number of basic votes per member was tripled and an amendment of the IMF Articles of Agreement was agreed that sets the aggregate of basic votes at a constant agreed fraction of the total voting power (not, as formerly, an absolute number of votes).[34]

Given an aggregate value for total quotas, which must be agreed at each quinquennial review, an individual member's quota is given by

$$Quota_i = QShr_i\left(AggregateQuotas\right).$$

[34] The original IMF Articles of Agreement specified that each country will have 250 basic votes. During the spring 2008 negotiations, an agreement was reached to amend the Articles to increase the number of basic votes to 750. The indexation provision agreed in 2008 will maintain basic votes at the current percent of total voting power in future quinquennial reviews of quotas (and even when selective changes in quotas occur, as for example when a new member joins the IMF)..

The Articles of Agreement provide that each member, in addition to its basic votes, will have one additional vote for each part of its quota equivalent to 100,000 special drawing rights. Thus its quota-related number of votes is determined by

$$QuotaDrivenVote_i = \frac{Quota_i}{100,000}.$$

For the IMF as a whole,

$$AggregateTotalVotes = BasicVotes + QuotaDrivenVotes$$

and, similarly, for the individual member country,

$$TotalVotes_i = BasicVote_i + QuotaDrivenVotes_i .$$

The aggregate number of basic votes, if calculated as a fraction of total votes and with an indexation provision in force, would be

$$BasicVotes = \Theta\left(AggregateTotalVotes\right), \qquad 0 < \Theta < 1$$

where Θ is the fraction of total votes reserved for basic votes.

For the individual member country:

$$BasicVotes_i = \frac{1}{n}\left(BasicVotes\right),$$

where *n* is the number of IMF member nations. As of March 2010, the number *n* is 186. Therefore for the individual member,

$$\begin{aligned} TotalVotes_i &= \frac{1}{n}\left(BasicVotes\right) + \frac{Quota_i}{100,000} \\ &= \frac{\Theta}{n}\left(AggregateTotalVotes\right) + \frac{1}{100,000}\left(QShr_i\left(AggregateQuotas\right)\right) . \end{aligned}$$

Thus the share in voting power of an individual member, with an indexation provision keeping Θ unchanged over time, will be

$$VoteShr_i = \frac{TotalVotes_i}{AggregateTotalVotes} = \frac{\Theta}{n} + \left(\frac{QShr_i}{100,000}\right)\left(\frac{AggregateQuotas}{AggregateTotalVotes}\right) .$$

This last relationship makes it transparent that the values of $QShr_i$ and of *Aggregate Quotas* (and of Θ, if Θ were also to be changed) must be simultaneously chosen at the time of a review of quotas and voting shares.