INTERNATIONAL MONETARY FUND

Quota Formula Review—Data Update and Further Considerations
Supplementary Information

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June 29, 2012

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ANNEX I. FINANCIAL INTERCONNECTEDNESS

This Annex presents additional staff work on financial interconnectedness. The analysis examines a possible methodology for constructing indicators of financial interconnectedness and related data issues. In addition, it presents some illustrative simulation results.

As noted in the February paper,[1] interconnectedness is defined in terms of countries' trade and financial inter-linkages: financial interconnectedness reflects cross-border financial transactions, while similar measures of trade interconnectedness seek to reflect trade linkages between countries. This annex focuses on financial interconnectedness that takes into account the pattern and size of cross-border financial linkages and potentially provides a more comprehensive picture of a country's international financial integration.

A. Data and Methodology

Building on recent technical work by IMF staff,[2] and utilizing preliminary end-2010 data on equity and debt portfolio assets of Fund members from the Fund's Coordinated Portfolio Investment Survey (CPIS), staff has constructed a global matrix containing bilateral portfolio asset positions.[3] The CPIS data treat all countries on a residence basis and follow the definitions and classifications of Balance of Payments and International Investment Position Manual (*BPM 6*). Overall, 65 Fund members (of which 25 are advanced economies), accounting for about 98 percent of the estimated global International Investment Position (IIP), provide cross-border data on their portfolio investment holdings vis-à-vis 178 Fund members.[4] Positions between non-reporting countries and those below USD ½ million are excluded.

The measure of interconnectedness is based on a matrix of cross border holdings in financial assets. Each entry in the matrix (a_{ij}) reports the nominal value (in US Dollars) of country i's

[1] *Quota Formula Review – Initial Considerations* (2/10/12).

[2] See Čihák M., Muñoz S. and R. Scuzzarella (2011): *The Bright and the Dark Side of Cross-Border Banking Linkages*, IMF WP 186 and *Enhancing Surveillance —Interconnectedness and Clusters —Background Information* (3/16/12).

[3] While the annex uses data on portfolio assets, other types of international assets, such as cross-border banking assets (and liabilities) are equally important, but have severe data limitations. The most comprehensive data on international banking assets and liabilities are compiled by the Bank of International Settlements (BIS) locational statistics. However, these data are confidential and cannot be shared without express authorization from reporting central banks. Data on bilateral direct investment positions (FDI) are available from the Fund's Coordinated Direct Investment Survey. But it's not clear to what extent FDI should be regarded as contributing to financial interconnectedness since a primary motivation for it is the control and management of enterprises.

[4] For China, separately reported data for China's Mainland, Hong Kong SAR and Macao SAR were aggregated excluding the holdings amongst them.

assets located in country j. All diagonal elements a_{ii} are zero (i.e., a country does not have claims on itself), and off-diagonal elements are positive or zero if there is no associated link. The matrix is then expressed in portfolio shares, obtained by scaling each country's assets in other countries by its total external assets.

Based on the above matrix, a number of measures can be constructed to assess interconnectedness. In the February paper *Quota Formula Review—Initial Considerations*, staff noted that a key limitation of most simple measures is that they are predominantly qualitative. However, more complex quantitative measures can also be constructed that allow for consideration of both the number and size of bilateral linkages. One example, explored in Section B below, takes into account the fact that linkages can vary significantly in their number and magnitude or intensity. For instance, countries with a large number of bilateral financial links, but which are of limited magnitude, should be differentiated from countries with fewer bilateral linkages but relatively larger magnitudes. Such a differentiation is possible with the quantitative indicator computed in this Annex. This indicator is based on the premise that a country is highly interconnected if countries that invest in it are themselves highly interconnected. Based on the global matrix, each country's indicator is the sum of the interconnectedness indicators of countries' investing in it, weighted by their respective portfolio shares.[5]

B. Results

The calculated interconnectedness index described above ranges from 1 to 15, with the lowest value for countries with the least linkages. Figure A1.1 shows the frequency distribution of countries by this index. The United States appears to be the most interconnected with an index of almost 15. There are only five countries that have values for the index between 4 and 8 (United Kingdom, Luxembourg, Germany, France, and Netherlands) while most countries (173 members) have an index value between one and two. This dispersion can be partly explained by the shares of total portfolio assets invested in individual countries. For instance, by far the largest share (20 percent) of total global portfolio assets is invested in the United States, about ten percent is invested in the United

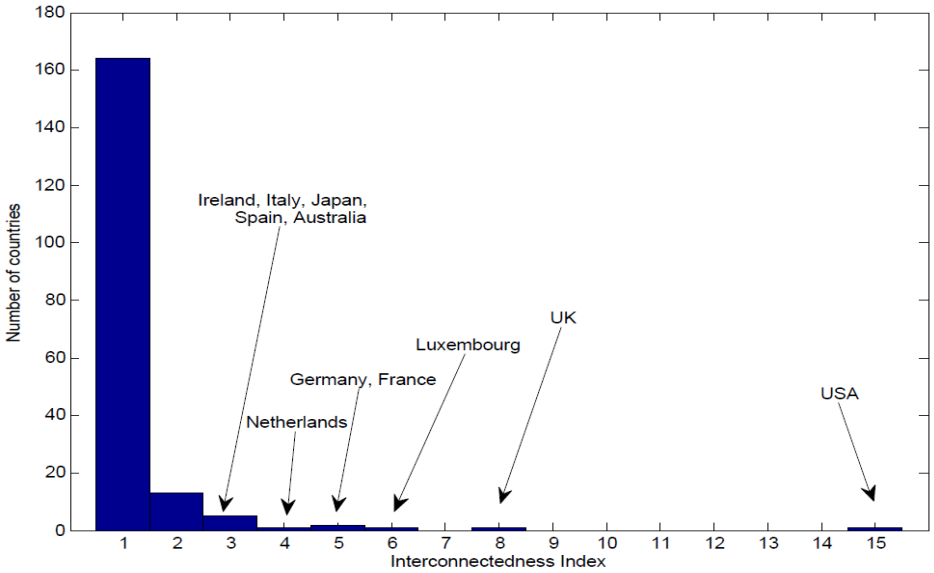
[5] For instance, if the US invests 20 percent of its total portfolio in China, then China's interconnectedness indicator will increase by the value of the US's interconnectedness, weighted by 0.2. For more details, see Bonacich P. and P. Lloyd (2001): *Eigenvector-like measures of centrality for asymmetric relations*, Social Networks, Vol. 23, pp. 191-201. For further applications in the financial sector see Von Peter (2007): *International Banking Centers: A Network Analysis*, BIS Quarterly Review, December; and Kubelec and Sá (2010): *The geographical composition of national external balance sheets: 1980-2005*, Bank of England Working Paper No. 384.

Kingdom, and investments located in Luxembourg, Germany, and France account each for around seven percent of total portfolio assets.

The interconnectedness index provides country rankings that are broadly similar to the rankings according to IIP shares (Table A1.1), [6] with the correlation between the two of 0.71. To the extent that there are differences in rankings, they reflect both the quite differing methodologies and differences in the underlying data. With respect to the methodology, interconnectedness provides additional information on the pattern of bilateral linkages not captured in IIP, so that a country with a high IIP share, but with a small number of inter-linkages, may not be highly interconnected based on the measure presented here.

While the interconnectedness indicator captures important features beyond those of IIP, there are significant challenges if consideration were to be given to include it in the quota formula. Among others, the indicator does not capture well all size-related dimensions, which is an important part of the other quota variables. In particular, the largest country based on this measure (the United States) is only 15 times larger than the smallest member. Moreover, the index provides almost no differentiation for the vast majority of countries (where it is between 1 and 2), as noted above. In addition, the question of how to treat countries that are major international financial centers would need to be addressed, as discussed in more detail in the main text.

Figure A1.1. Histogram of Interconnectedness Index



Source: Finance Department

[6] The corresponding table in the February paper (p. 21) showed significant deviations between countries' rankings based on IIP shares in 2008 and interconnectedness implied by network measures that take into account only information on whether or not a link exists between banking sectors.

Table A1.1: Countries' Rankings according to Financial Openness and Interconnectedness 1/

	IIP	Inter-connectedness 2/
United States	1	1
United Kingdom	2	2
Germany	3	4
France	4	5
Luxembourg	5	3
China 3/	6	14
Japan	7	9
Netherlands	8	6
Ireland	9	7
Switzerland	10	15
Italy	11	8
Spain	12	10
Belgium	13	21
Australia	14	11
Canada	15	12
Singapore	16	23
Sweden	17	18
Russia	18	28
Austria	19	17
Brazil	20	13
Norway	21	25
Korea	22	16
Denmark	23	24
Finland	24	26
Portugal	25	29
India	26	19
Mexico	27	30
Greece	28	20
Saudi Arabia	29	27
Turkey	30	22

Source: Finance Department

1/ Table shows the top 30 countries ranked according to their gap-filled IIP shares in 2010 and the corresponding rankings in interconnectedness.
2/ Calculated using bilateral portfolio investment data from CPIS.
3/ Including China, P.R., Hong Kong SAR, and Macao SAR.

ANNEX II. SELECTED APPROACHES TO MODIFYING THE MEASURE OF VARIABILITY

This Annex presents additional staff work on variability, responding to suggestions by several Directors at the March 2012 Board discussion. It considers first a variety of measures based on current receipts and net capital flows (i.e., the variables that also underpin the current measure of variability in the formula), and then examines an alternative approach for assessing vulnerability based on determinants of the use of Fund resources.

A. Selected Alternative Variability Measures based on Current Receipts and Net Capital Flows

In *Quota Formula Review–Initial Considerations*, staff noted several shortcomings of the current variability measure in the quota formula, which is intended to reflect members' potential need for Fund resources. First, staff's analysis suggested that the current measure is uncorrelated with an indicator for approval of a Fund arrangement. Second, it showed that the current measure adds significant instability to the calculated quota shares for a wide range of members, as it fluctuates considerably from year to year.

To address the instability issue, one option would be to change the statistical measure of dispersion while retaining current receipts and net capital flows as the relevant variables capturing members' external vulnerability. A number of variability indicators based on current receipts and net capital flows have been explored already in earlier staff work.[7] Several other measures are examined below:

- **Average absolute deviation from a three-year centered moving average calculated over a recent 13-year period (13Y AAD).** This measure is conceptually close to the existing one—the only difference is how the deviations from the trend are calculated. The current measure of variability is a root mean squared deviation from a three-year moving average, calculated over a recent 13-year period. Compared to the current measure, the 13Y AAD measure uses the average absolute deviation, which reduces the impact of extreme observations on variability that in some cases can be very large.

- **Statistical measures of dispersion based on a recent 5-year period.** Unlike the existing variability measure which is based on deviations from a trend, these measures are calculated relative to the sample mean and median. The choice of a 5-year period aims to strike a balance between capturing the structural aspect of variability and reducing the influence of trends which would dominate the measure when longer periods are considered. Possible measures include:

[7] *Quota and Voice Reform —Stocktaking and Further Considerations* (7/11/07). Among others, earlier work also reviewed proposals by the G-24 Secretariat, which are briefly discussed again in the main paper.

- *Standard deviation (5Y SD)*
- *Average absolute deviation (5Y AAD)*
- *Median absolute deviation (5Y MAD)*
- *Maximum deviation from the mean (5Y MAXD)*

These four measures have differing statistical properties. For example, the median absolute deviation is a robust statistic which tends to be less affected by extreme observations, whereas the maximum deviation is essentially driven by the outliers.

- **Instability index (10Y II).** The original idea behind the current variability measure was to account for deviations from a trend which was proxied by a moving average. There are different ways to estimate trends, some of which can be quite complex (e.g., various kinds of filters or smoothing splines). A simple alternative to the moving average is the linear trend. An example of a variability measure based on a linear trend is the instability index calculated as:

$$II = \frac{\sum_{t=2}^{n} |x_t - x_{t-1} - b|}{n-1},$$

where b is the slope of the linear regression $x_t = a + bt$ estimated by OLS.[8] For illustrative purposes, the instability index is calculated over a 10-year period.

Figure A2.1, shows the cross-sectional standard deviation of the year-on-year changes in variability shares for the alternative measures based on the last two updates of the quota database. The stability properties of the alternative variability measures depend substantially on the period considered. The 13-year average absolute deviation and the instability index yield the smallest variation in shares in 2009-10. For 2008-09, the measure based on 5-year standard deviation relative to the sample mean fares better. Looking at a longer time span, the 13-year absolute deviation produces the smallest variation in shares on average.[9] However, there are periods (e.g., 2004-2007) where the existing variability measure yields more stable results than the alternatives.[10] Overall, none of the alternative measures consistently outperforms the current one in terms of stability properties.

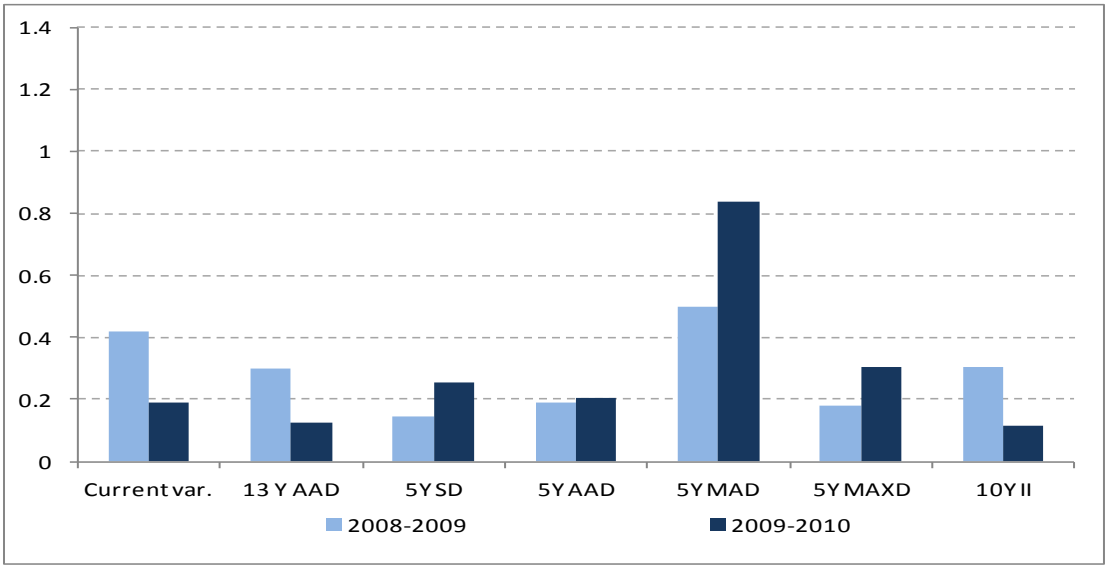
[8] This is a modified version of the instability index suggested by Glezakos in a study of the effects of export instability on growth (see Glezakos, C. *Export Instability and Economic Growth: A Statistical Verification*, Economic Development and Cultural Change, Vol. 21, No. 4, part I (Jul. 1973), pp. 670-678) .

[9] Analysis covers the period 1990-2010 and is based on the latest quota data update for current receipts and net capital flows since 1998, and previous quota data and WEO estimates for earlier years. The series also takes into account past data revisions.

[10] In some cases volatility in shares can be driven by large deviations in a particular year that may be reversed in the following year. To account for the possibility for "return to normal", in addition to the standard deviations it may be useful to also look at the number of countries that underwent changes with different signs in two

(continued)

Figure A2.1. Standard Deviation of Changes in Variability Shares (In percentage points)



Source: Finance Department

In addition to stability of outcomes, a variability indicator should be assessed by how closely it is associated with members' potential financing needs—the primary rationale for including this variable in the quota formula. Staff's analysis in the February paper suggested that even after accounting for economic size, variability was uncorrelated with a binary variable for approval of a Fund arrangement. The same analysis has been carried out using the alternative definitions of variability introduced above and the results are similar—correlations are not significantly different from zero. These results are consistent with previous findings about variability measures constructed from current receipts and net capital flows.[11] As it turns out, all these measures are highly correlated among themselves even when an adjustment is made for economic size (by subtracting the country's share in GDP from its variability share). For individual members, however, the outcomes can differ significantly (Table A2.1).

B. Macroeconomic Variables Signaling Vulnerability

This section explores whether variables other than current receipts and net capital flows can provide a better proxy for economic vulnerabilities. To improve on the current variability

consecutive years. Based on that, the 13-year AAD yields the smallest number of reversals for 2008-2010, whereas over the longer horizon, the current measure and the 5-year AAD perform better.

[11] See *Quota Formula Review—Initial Considerations*(2/10/12), for analysis of variability based on deviations from a 5-year moving average, scaled variability, downside variability, extreme variability and variability of current receipts plus variability of net capital flows. In this paper staff also considered volatility of GDP growth, a measure which has been recently discussed by the G-24.

measure in capturing balance of payments need, as a starting point it is useful to explore how countries with programs differ in terms of macroeconomic fundamentals from countries without programs.[12] For this purpose, staff compared the characteristics of the two groups in the year of approval of the Fund arrangement as well as the two preceding years.

Variables that explain potential use of Fund resources

The existing literature on the factors determining the use of Fund resources (UFR) can serve as a guide in selecting the relevant variables. To narrow down the set of potential candidates, staff focused on the main variables identified in the previous literature on UFR. Staff focused on eight variables, of which the reserve cover ratio and the current account (typically expressed as percent of GDP) stand out as the most widely used vulnerability indicators. Other variables that have been identified as important include per capita GDP, real GDP growth, inflation, external debt service, government balance and the stock of external debt.

Staff examined the properties of these variables for countries with and without IMF programs and ran formal statistical tests to establish whether the two samples come from the same or from different distributions.[13] For the eight variables individually, the main findings are as follows:

- The average *current account deficit* as percent of GDP is about twice as high for program countries compared to non-program countries. This result is valid both for the contemporaneous and the lagged values of the indicator.

- Countries with programs tend to have lower *reserve cover ratios* (reserves to imports) compared to countries without Fund arrangements. The difference in the year preceding the arrangement approval is about 8 percentage points.

[12] In Appendix II of *Quota Formula Review—Initial Considerations*, the probability of approval of a Fund arrangement was modeled as a function of a number of macroeconomic indicators.

[13] In addition to the standard t-test for the means, two non-parametric tests were applied—the Mann-Whitney test and the Smirnov test. The Mann-Whitney test is a non-parametric counterpart of the two sample t-test, i.e., it is a test for differences in location. The Smirnov test is robust to all types of differences that may exist between the two distribution functions. Results are available from staff.

- The results for the *GDP per capita* suggest that countries with lower per capita income are more likely to have Fund arrangements.
- Countries with programs have recorded lower *GDP growth* on average. This result is robust with respect to the use of lags.
- *Inflation* is typically higher in countries with IMF programs.
- *Budget deficits* are higher by 0.9-1.4 percent of GDP on average in countries with programs than in countries without programs. Again, like with other variables, the peak difference is in the year preceding the approval of the arrangement.
- The stock of *external debt* as percent of GDP also differs between the two groups of members. The average for the countries with programs in the year of approval is 77 percent compared to 68 percent for countries without programs.
- The differences in the stock of external debt are reflected in the different proportion of exports that countries allocate to *external debt service payments* with program countries using a greater share of their export earnings to repay their creditors.

Constructing a Composite Indicator

The above analysis suggests a number of potential candidates for inclusion in the quota formula as a measure of variability. To decide which variable best reflects the differences between program and non-program countries, one option would be to calculate correlations and check the results for robustness over different subsamples. However, given the changing nature of balance of payments crises, no single variable has proven to be a robust indicator of vulnerability. A more promising approach appears to be to combine several indicators into a composite variable which would capture different types of vulnerabilities. The advantage of using a composite indicator is that it will generally have higher explanatory/predictive power compared to its individual components.

The use of a composite indicator to assess vulnerabilities is not uncommon—several papers on use of Fund resources have included such variables in the list of regressors. The IMF vulnerability exercises for emerging markets, advanced countries and LICs also use a similar concept.

When constructing a composite indicator the question of weights is key. For illustrative purposes, weights are determined based on the inverse of the standard deviation of each component (as in Jaramillo and Sancak (2009)[14] and Bal Gunduz (2009),[15] for example). The

[14] Jaramillo, L., Sancak, C., *Why Has the Grass Been Greener on One Side of Hispaniola? A Comparative Growth Analysis of the Dominican Republic and Haiti*, IMF Staff Papers, Vol. 56, 2009.

[15] Bal Gündüz, Yasemin, *Estimating Demand for IMF Financing by Low-Income Countries in Response to Shocks* IMF Working Paper No. 09/263, November 2009.

(continued)

standardization ensures that the index is not driven by only one of its components. Estimates suggest that in terms of correlation with the binary variable for a Fund arrangement, a composite indicator based on this approach does not significantly underperform an indicator based on a logit model estimated over the entire sample. However, the method using inverse standard deviations as weights has the advantage of being simpler.

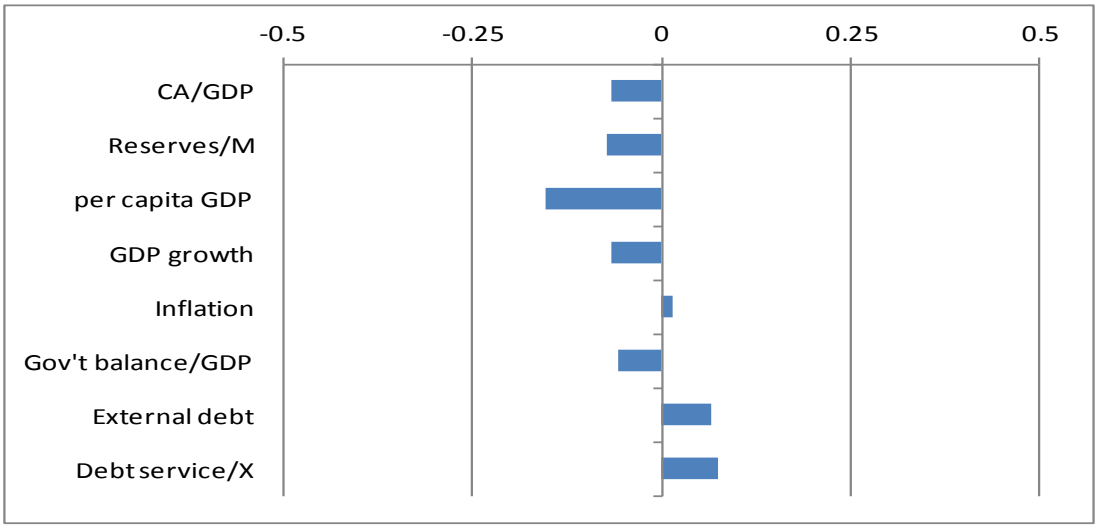
Several variants of the composite indicator are considered: (i) **Comp1** is a linear combination of all variables except for inflation which, as Figure A2.2 suggests, shows little correlation with the likelihood of a Fund arrangement; (ii) **Comp2** also excludes external debt and external debt service and (iii) **Comp3** in addition excludes the fiscal balance.[16]

The signs in the linear combinations are chosen such that the respective term contributes positively to the index if a higher value of the underlying variable increases vulnerability. For example, the sign on the reserve cover ratio is negative because more vulnerable countries tend to have less reserves. For illustrative purposes, all variables are taken as three-year averages but other approaches could be considered as well, e.g., using only the latest data point or averaging over a different period.

Figure A2.3 shows the correlations of the composite vulnerability indicators with the binary variable for approval of a Fund arrangement. All correlations are statistically significant, albeit not particularly high, largely reflecting the diversity of membership and the different kinds of vulnerabilities prevailing in different periods. In this regard, it is interesting to note that correlations are higher when the subgroup of emerging markets and advanced economies is considered. Thus, for instance, for *Comp3* where the correlation for the full sample is 0.19, dropping LICs increases the correlation to 0.24. For LICs only the correlations are generally much weaker – between 0.05-0.07. The results are quite robust with respect to subsamples – the correlation coefficients remain highly significant when calculated over 5-year intervals since 1990.

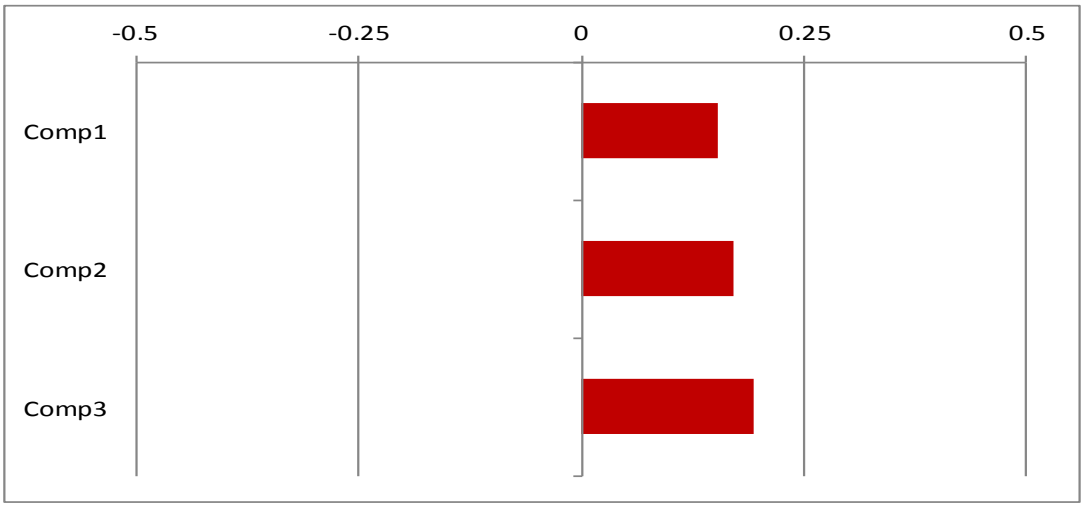
[16] For a number of members fiscal data and data on external debt and debt service are not readily available. Thus, Comp3 is calculated for the largest number of countries.

Figure A2.2 Correlations of Individual Variables with Potential Need



Source: Finance Department

Figure A2.3 Correlations of the Composite Indicators with Potential Need



Source: Finance Department

Linking the composite indicator to the quota formula

To convert a composite vulnerability indicator to a variable that could be included in the quota formula is not straightforward. The composite indicator can take a range of values, including negative ones and is not related to economic size. On the other hand, all other variables in the quota formula have a significant size component. Since all other variables in the current formula are expressed as shares of global totals, it seems preferable to transform the vulnerability scores obtained from the composite indicator into a variable which contains the economic size dimension. One possibility is to multiply the vulnerability scores by members' shares in GDP. Pursuing this approach directly, however, is problematic because

of the relatively wide variation in scores and the occurrence of negative values which could make the normalization (calculation of shares) infeasible. Therefore, an intermediate step is required whereby the composite indicator is transformed such that it takes only non-negative values. The following mapping is one example:

$$\hat{x}_i = 1 + \frac{x_i}{1+|x_i|}, \qquad (1)$$

where x_i is the vulnerability score for country *i*. This transformation will stack all individual scores in the (0,2) interval. To illustrate how this method works, again *Comp3* is used as it provides broad enough coverage (it is calculated for 175 members).[17] Table A2.2 compares the outcomes for some major countries and country groups.

The table suggests that the new variability shares based on the composite indicator are to a large extent driven by the shares in GDP reflecting the scaling up of the vulnerability score. Yet, there are exceptions. China is one of the cases where its share in variability is much lower than its share in GDP. Italy and Spain, on the other hand, have significantly higher variability shares compared to their GDP shares. This is even more pronounced in the cases of Greece and Portugal (not shown in the table) where the composite variability shares based on 2010 data are more than twice their GDP shares. Relative to the existing variability measure, the largest individual gainer is the United States. In addition to the size effect, the result for US is largely driven by its reserve cover ratio, which is among the lowest in the sample as well as by its growth performance in the recent years. Clearly, for the US the reserve cover ratio is not a relevant vulnerability indicator given the reserve currency status of the US dollar and this again demonstrates the difficulties encountered in designing a single variability measure for the entire membership.

The above analysis shows that even drawing on the extensive literature to find variables which help to explain potential BoP need, translating this information into a suitable measure that could be used in the formula poses major challenges. Composite indicators raise a number of issues, including about the choice of variables, weights, and transformations into a variable that is consistent with other variables in the quota formula. Since they combine macroeconomic variables that have tended to predict past use of Fund resources, it is not clear how robust they would be in predicting the future use of Fund resources. Furthermore, it is not clear how a composite variability measure fits in the objectives of simplicity and transparency and there are important data availability issues. These issues are discussed in more detail in the main paper.

[17] The main problem with transformation (1), as with any other non-linear mapping, is that it may reduce the correlation with the arrangement indicator. In the case of Comp3, the correlation goes down from 0.19 to 0.16 after applying (1) and further down to 0.09 after multiplying the transformed score by the GDP shares, rescaling and then subtracting the GDP share to adjust for the size effect.

Table A2.1 Shares in Variability under Different Measures
(In percent)

	Current Var.	13Y AAD	5Y SD	5Y AAD	5Y MAD	5Y MAXD	10Y II
Advanced economies	57.9	59.0	52.0	54.7	58.2	50.2	57.6
Major advanced economies	38.7	40.6	31.7	33.6	37.2	30.6	37.4
United States	15.5	16.5	11.4	12.0	12.4	11.8	13.4
Japan	5.2	6.1	2.8	2.7	4.5	3.0	5.3
Germany	6.1	5.7	4.9	5.0	8.7	4.8	4.9
France	2.3	2.7	2.2	2.5	0.7	2.0	3.0
United Kingdom	4.5	4.8	6.6	7.3	6.6	5.6	6.3
Italy	3.0	2.6	2.3	2.5	3.3	2.0	2.4
Canada	2.1	2.1	1.4	1.5	1.0	1.5	2.2
Other advanced economies	19.2	18.4	20.3	21.1	21.0	19.6	20.1
Spain	2.1	2.0	2.4	2.7	1.4	2.1	2.6
Netherlands	2.9	2.6	2.4	2.7	3.6	1.9	2.6
Australia	1.5	1.4	1.5	1.6	2.1	1.3	1.2
Belgium	1.8	1.7	1.6	1.7	1.8	1.8	1.8
Switzerland	0.9	1.1	2.8	2.7	2.9	2.6	1.2
Sweden	1.5	1.3	1.6	1.7	1.3	1.8	1.6
Austria	0.9	0.8	0.8	0.8	1.1	0.6	0.8
Norway	1.3	1.4	1.1	1.1	1.3	1.2	1.4
Ireland	1.5	1.6	1.3	1.4	1.4	1.1	1.4
Denmark	0.7	0.8	0.8	0.7	0.5	0.8	1.0
Emerging Market and Developing Countries 1/	42.1	41.0	48.0	45.3	41.8	49.8	42.4
Africa	3.6	3.5	3.2	3.1	3.1	3.3	3.4
South Africa	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Nigeria	0.5	0.6	0.3	0.3	0.4	0.3	0.5
Asia	14.9	14.3	23.0	20.9	15.2	24.2	15.5
China 2/	5.6	5.2	12.1	10.7	7.8	12.3	6.0
India	1.6	1.5	2.5	2.1	1.1	2.5	2.0
Korea	1.3	1.5	1.7	1.5	0.1	2.0	1.2
Indonesia	0.8	0.8	1.1	1.0	0.7	1.3	0.7
Singapore	2.2	2.1	2.0	2.1	2.0	2.1	2.0
Malaysia	0.9	1.0	0.8	0.8	0.9	0.9	1.0
Thailand	1.2	1.0	1.3	1.3	0.9	1.4	1.1
Middle East, Malta & Turkey	7.5	7.6	6.9	6.7	6.8	7.5	7.0
Saudi Arabia	2.8	2.5	1.9	1.7	1.6	2.3	2.1
Turkey	1.3	1.4	0.9	1.0	1.1	0.8	1.0
Iran, Islamic Republic of	0.3	0.3	0.3	0.3	0.4	0.3	0.4
Western Hemisphere	6.5	7.0	5.8	5.6	6.1	5.7	6.7
Brazil	1.6	1.8	1.9	1.7	1.3	1.9	1.8
Mexico	1.6	1.6	1.3	1.3	2.0	1.1	1.6
Venezuela, República Bolivariana de	0.6	0.7	0.4	0.4	0.3	0.5	0.6
Argentina	0.5	0.6	0.4	0.4	0.4	0.4	0.6
Transition economies	9.6	8.7	9.0	9.0	10.7	9.1	9.8
Russian Federation	2.9	2.4	2.5	2.5	3.5	2.5	3.6
Poland	1.0	1.0	1.3	1.2	1.4	1.4	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Including Czech Republic, Estonia, Korea, Malta, Singapore, Slovak Republic, and Slovenia.
2/ Including China, P.R., Hong Kong SAR, and Macao SAR.

Source: Finance Department

Table A2.2 Shares in GDP, Existing and Composite Variability 1/ (In percent)

	GDP		Existing variability (1)		Composite variability (2)		Difference (2)-(1)	
	2009	2010	2009	2010	2009	2010	2009	2010
Advanced economies	66.4	64.2	58.6	57.9	69.6	67.9	11.0	10.0
Major advanced economies	53.8	51.9	37.6	38.7	56.8	54.4	19.2	15.8
United States	24.5	23.5	14.1	15.5	27.1	25.4	13.0	9.9
Japan	8.2	8.5	5.5	5.2	5.6	5.4	0.1	0.2
Germany	5.9	5.6	5.8	6.1	6.2	5.9	0.3	-0.2
France	4.7	4.4	2.8	2.3	5.0	5.0	2.2	2.6
United Kingdom	4.4	3.9	4.2	4.5	5.1	5.1	0.9	0.6
Italy	3.7	3.6	3.5	3.0	5.4	5.2	1.8	2.3
Canada	2.4	2.4	1.7	2.1	2.5	2.5	0.8	0.3
Other advanced economies	12.6	12.3	20.9	19.2	12.8	13.5	-8.2	-5.7
Spain	2.6	2.4	2.3	2.1	3.5	3.9	1.2	1.7
Netherlands	1.4	1.3	2.9	2.9	1.2	1.3	-1.7	-1.6
Australia	1.7	1.8	1.6	1.5	1.4	1.4	-0.2	0.0
Belgium	0.8	0.8	2.1	1.8	0.8	0.8	-1.3	-1.0
Switzerland	0.8	0.8	1.0	0.9	0.5	0.5	-0.4	-0.4
Sweden	0.8	0.7	1.8	1.5	0.7	0.6	-1.1	-0.9
Austria	0.7	0.6	0.8	0.9	0.6	0.6	-0.2	-0.3
Norway	0.7	0.7	1.0	1.3	0.4	0.4	-0.7	-1.0
Ireland	0.4	0.4	2.0	1.5	0.4	0.5	-1.6	-1.0
Denmark	0.6	0.5	1.0	0.7	0.5	0.4	-0.5	-0.3
Emerging Market and Developing Countries 2/	33.6	35.8	41.4	42.1	30.4	32.1	-11.0	-10.0
Africa	2.1	2.2	3.8	3.6	2.3	2.5	-1.5	-1.0
South Africa	0.5	0.5	0.3	0.3	0.7	0.8	0.4	0.4
Nigeria	0.3	0.3	0.6	0.5	0.2	0.2	-0.4	-0.3
Asia	14.7	16.0	12.6	14.9	9.8	10.5	-2.8	-4.4
China 3/	7.9	8.9	4.5	5.6	3.6	4.0	-0.9	-1.6
India	2.1	2.3	1.3	1.6	1.6	1.8	0.3	0.2
Korea	1.6	1.5	1.4	1.3	1.5	1.4	0.1	0.1
Indonesia	0.9	1.0	0.6	0.8	0.8	0.9	0.2	0.1
Singapore	0.3	0.3	1.8	2.2	0.2	0.2	-1.6	-2.0
Malaysia	0.3	0.4	0.8	0.9	0.3	0.3	-0.5	-0.6
Thailand	0.5	0.5	1.0	1.2	0.5	0.5	-0.4	-0.7
Middle East, Malta & Turkey	4.4	4.7	8.6	7.5	4.1	4.1	-4.5	-3.4
Saudi Arabia	0.7	0.7	3.0	2.8	0.3	0.3	-2.7	-2.5
Turkey	1.1	1.1	1.1	1.3	1.9	1.6	0.8	0.3
Iran, Islamic Republic of	0.6	0.6	0.2	0.3	0.4	0.6	0.2	0.3
Western Hemisphere	6.9	7.3	6.4	6.5	8.0	8.0	1.5	1.5
Brazil	2.6	3.0	1.9	1.6	2.1	2.2	0.2	0.6
Mexico	1.7	1.7	1.2	1.6	3.2	2.7	2.0	1.1
Venezuela, República Bolivariana de	0.5	0.6	0.7	0.6	0.5	0.7	-0.2	0.1
Argentina	0.5	0.6	0.5	0.5	0.4	0.4	-0.1	-0.1
Transition economies	5.6	5.5	10.0	9.6	6.2	7.0	-3.8	-2.6
Russian Federation	2.4	2.4	3.0	2.9	1.7	1.9	-1.4	-1.1
Poland	0.8	0.8	1.1	1.0	0.8	0.9	-0.2	-0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0

1/ Based on the transformed Comp3 indicator (see text above).
2/ Including Czech Republic, Estonia, Korea, Malta, Singapore, Slovak Republic, and Slovenia.
3/ Including China, P.R., Hong Kong SAR, and Macao SAR.

Source: Finance Department

ANNEX III. FINANCIAL CONTRIBUTIONS

This Annex provides additional background information on the financial contributions covered in the main text of the paper (see Table 8). These include the pre-NAB commitments, NAB and new pledges, PRGT loans and subsidies as well as contributions to technical assistance and those made in the context of the Financial Transactions Plan (FTP).

Pre-NAB Commitments

The data cover loan commitments by members under the 1974 and 1975 Oil Facilities, the Supplementary Financing Facility (SFF), the Enlarged Access Facility (EAF), and the expanded General Agreements to Borrow (GAB) as well as bilateral borrowing agreements with Italy (1966), Switzerland (1977), and Japan (1986).[18]

NAB

The data cover the commitments by members under NAB credit arrangements and reflecting the rollback agreed by the Executive Board.[19] Commitments by those members that have not yet adhered to the NAB decision are not included. For those members that have bilateral borrowing arrangements with the Fund that are being folded into the NAB, only the NAB commitment is included. Bilateral loan commitments from members that are not participants in the NAB (Czech Republic, Malta, Slovak Republic, and Slovenia) have been included.

NAB + New Pledges

In addition to the NAB amounts described above, these data reflect the bilateral pledges under the current fund raising exercise, including the announcements made at the G-20 Leaders' Summit in Los Cabos.[20]

PRGT Loans

This reflects all loan commitments to the PRGT Trust as of December 31, 2011.[21] In addition, Saudi Arabia's pledge of SDR 11 million as communicated to the Fund in a letter received by the Fund on June 5, 2012 is included.

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[18] See *Fourteenth General Review of Quotas—Realigning Quota Shares—Initial Considerations—Supplement* (3/5/10).

[19] See *IMF Executive Board Approves Major Overhaul of Quotas and Governance* (IMF Press Release No. 10/418, 11/05/ 2010).

[20] See *IMF Managing Director Christine Lagarde Welcomes Additional Pledges to Increase IMF Resources, Bringing Total Commitments to US$ 456 Billion* (IMF Press Release No. 12/231, 6/19/ 2012).

PRGT Subsidies

This includes total bilateral resources provided since 1987 for subsidizing concessional lending, HIPC and MDRI debt relief as of December 31, 2011 plus all pledges made under current fundraising as of December 31, 2011.[22]

Technical Assistance

This reflects actual cash disbursements to the Fund for technical assistance and training excluding in kind contributions over the period FY1999-FY2012.[23]

FTP Participation

Two metrics have been developed to account for FTP participation. The first one is duration-based and is derived from the number of quarters out of the 80 quarters covering 1992–2011 that a member was included in the Financial Transactions Plan (FTP). The share of a member is calculated by taking the total number of quarters a member has participated in the FTP over the 20-year period January 1992–December 2011 (i.e., 80 quarters) as a share of total participant quarters that reflects the number of participants in the FTP in each quarter aggregated over the 80 quarters (these sum to 3,197). The maximum share for a member that participated in all 80 quarters is 2.5 = (80/3197)*100.[24] Figure A3.1 below shows participation in the FTP during the period in question. The second metric is resources-based and is obtained by weighting each member's participation in the FTP with its nominal quota. A member's share in the resources-based FTP participation metric is thus a proxy for the share of resources a member has made available over time in the FTP.

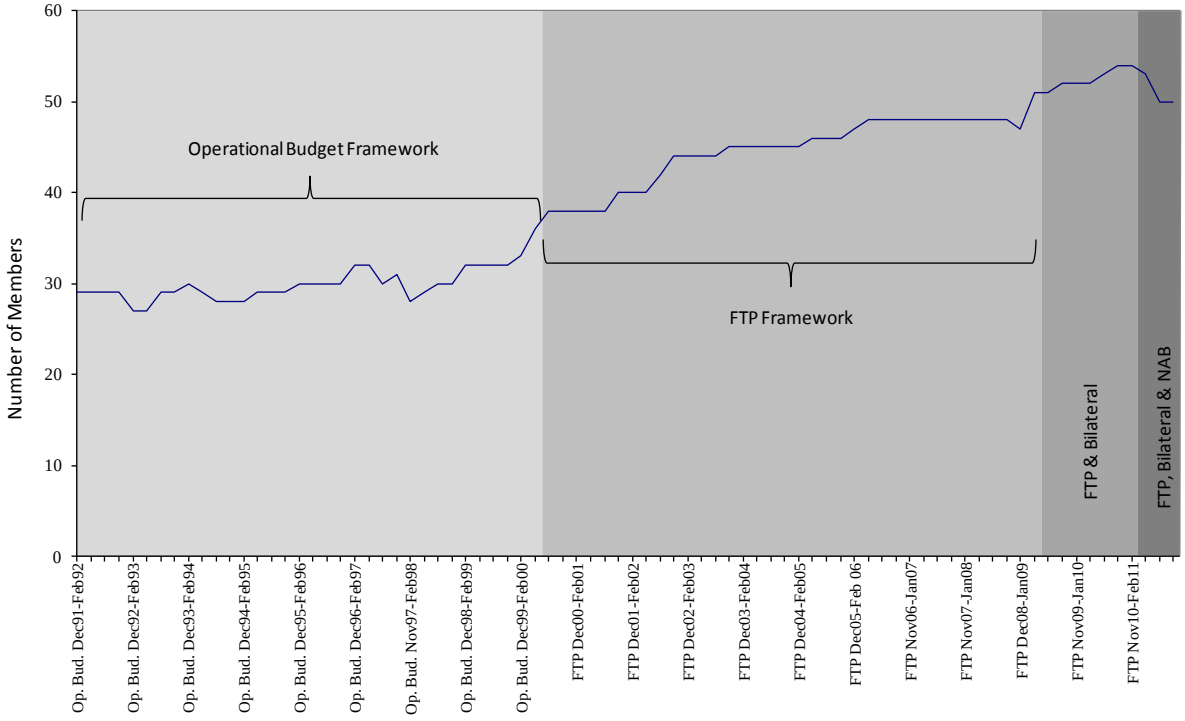
[21] See *Update on the Financing of the Fund's Concessional Assistance and Debt Relief to Low-Income Member Countries* (4/18/12).

[22] Ibid, Appendix Table 1.

[23] These data do not include pledges.

[24] The period 1992-2011 includes the move from the Operational Budget to the FTP framework in mid-2000 as well as the period of expanding membership in the early 1990 which was reflected in FTP participation.

Figure A3.1. Participation in the FTP, December 1991–December 2011 1/



1/ For quarters prior to June-August, 2000, the Operational Budget participation is shown.

Source: Finance Department