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**A Primer on the IMF's Information Notice System**

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**Abstract**

This paper describes the methodology and the data used to compute nominal and real effective exchange rate indices in the International Monetary Fund's Information Notice System (INS). In particular, it highlights improvements to the INS implemented over 1994-96, including modifications to the computational methodology, use of updated data, and extension of the INS to recent Fund members.

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## A Primer on the IMF's Information Notice System

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## SUMMARY

The International Monetary Fund's Information Notice System (INS) came into existence in 1983 to facilitate surveillance over the exchange rate policy of Fund members, as dictated in the IMF's Articles of Agreement. Under the INS, real and nominal effective exchange rate series are computed for almost all Fund members.

Following revisions to the INS in 1986 and 1994-96, real effective exchange rates based on unit labor costs are computed for 21 industrial countries, while nominal effective exchange rates and real effective exchange rates based on consumer price indices are computed for almost all Fund members.

To derive real effective exchange rates based on unit labor costs, partner country weights are computed from 1989-91 data on trade in manufactured goods, taking into account competition between imports and locally produced import-substituting goods, competition between own exports and locally produced foreign goods, and competition between own exports and exports of other countries in third markets. In addition, unit labor cost series are filtered to remove fluctuations at business cycle frequency.

For most Fund members, computation of real effective exchange rates based on consumer price indices relies on a weighting scheme that takes into account trade in manufactured goods, primary commodities, and, where significant, tourism services over the period 1988-90. As in the computation of real effective exchange rates based on unit labor costs, the weights reflect both direct and third-market competition.

For a group of recent members to the Fund and a very limited number of other countries, available data do not permit the use of this methodology. For these countries, a simple weighting scheme is used to compute effective exchange rates based on bilateral import and export shares.

A large number of the nominal and real effective exchange rate series computed under the INS are published in the Fund's *International Financial Statistics*.

## I. INTRODUCTION

This paper describes the methodology and the data used in the International Monetary Fund's Information Notice System (INS) to calculate effective exchange rate indicators. It is principally intended to help users of the INS and other interested parties gain a better understanding of the nature of the system's effective exchange rate indicators and thus help them form a judgment of their diagnostic power in specific circumstances. A secondary objective of the paper is to present information on the system's update carried over 1994-96. This update was only the second such exercise conducted since the introduction of the INS, the first one having taken place in 1986.

The paper is very much focused on describing the derivation and computation of effective exchange rate indicators in the INS. It touches only very briefly on the general properties and interpretation of different kinds of exchange rate indices. To compensate for the brevity of treatment of these issues, the reader will in appropriate places be referred to a number of articles on these questions.

The paper is organized as follows. Following this introduction, a brief history of the INS, a description of its main features, and the reasons behind the 1994-96 revision are presented in Section II. Section III discusses the computation of unit labor cost (ULC)-based indicators for a group of 21 industrialized countries. Section IV considers the computation of consumer price index (CPI)-based nominal and real effective exchange rates indicators for a majority of Fund members. Section V considers again the computation of CPI-based nominal and real effective exchange rate indicators, but this time for a limited set of recent Fund members. Section VI concludes the paper with an agenda for future work.

## II. A BRIEF HISTORY OF THE INFORMATION NOTICE SYSTEM

Article IV of the Fund's Articles of Agreement, which took its present form following the Second Amendment to the Articles adopted in 1978, stipulates that "*the Fund shall exercise firm surveillance over the exchange rate policies of members.*" The Information Notice System came into operation in 1983 to help fulfil this mandate.

At the inception of the system, Fund members were divided in three categories, according to data availability and characteristics of trade flows. Category I was composed of 14 industrial countries for which normalized unit labor cost (ULC) indices were available. For these countries, ULC-based effective exchange rate indices (REER) were computed. Category II was composed of all industrial countries except Luxembourg (including the fourteen included in category I) and of developing countries classified as major exporters of manufactures. For the 36 countries in this category, CPI-based real effective exchange rate indices were computed using, for each country, trade weights reflecting the relative importance of bilateral trade with the other 35 countries as well as competition in third markets. Category III was constituted of 107 countries generally regarded as being

predominantly producers and exporters of primary commodities. For 73 of these 107 countries, CPI-based real effective exchange rate indices were computed using weights that reflected bilateral trade flows with the countries included in category II. For 34 of these countries, only nominal effective exchange rates were computed owing to a lack of adequate price data.

Significant improvements to the INS were introduced in 1986. The most important changes then made were as follows:

- The set of countries for which ULC-based REER indices are computed (category I) was enlarged to 17 industrial countries;
- For these countries, the computation of ULC-based REER indices was refined by modifying the weighting scheme to take into account competition between domestic production and imports in the home market, by using more detailed estimates of production and consumption flows, by employing a more disaggregated set of markets, and by utilizing more up-to-date trade data.
- For all countries previously put in categories II and III, a new method of computing trade weights used in the calculation of CPI-based effective exchange rate indices was adopted. The revised weighting scheme took into account bilateral trade in manufactures and primary commodities as well as third market competition for trade in manufactures. It relied on the use of disaggregated trade data for the years 1980-1982.

These modifications resulted in an expansion of the coverage and an improvement of the INS.

In the early 1990s, a second major revision of the INS was initiated. The primary motivation behind this exercise was the desire to enhance the accuracy of effective exchange rate indicators by incorporating in their computations a weighting scheme that reflected current trade patterns. This involved updating the trade data used in the calculations of trade weights. A secondary motivation was to incorporate in the INS the large number of recent Fund members. In addition, there was an inclination to take advantage of this revision to introduce various technical modifications and improvements. In the end, these efforts resulted in the following main changes:

- The weights used in the computation of effective exchange rates were updated by using more recent trade data. For ULC-based REER indices, data for the years 1989-91 were used instead of 1980 data. For CPI-based REER indices, data for the years 1988-90 were used in replacement of 1980-82 data;
- The set of industrial countries for ULC-based REER indices are computed was enlarged to 21;

- Effective exchange rate indices were computed for 30 recent members, mostly economies in transition, that had never been part of the INS until then;
- The set of countries for which weights are adjusted to recognize the importance of exports of tourism services was expanded from 8 to 46;
- Less disaggregated trade data was selected to compute the revised trade weights so as to facilitate subsequent periodic revisions and extensions of country coverage.

Following this revision, the INS now covers nearly all Fund members.<sup>2</sup>

### III. ULC-BASED REAL EFFECTIVE EXCHANGE RATE INDICES FOR 21 INDUSTRIAL COUNTRIES

This section begins with a very brief discussion of properties of unit labor cost-based real effective exchange rate indices. It then proceeds to describe the methodology used in the INS to compute ULC-based REER indicators for a set of 21 industrial countries.

#### A. Properties of ULC-Based REER Indicators

Real effective exchange rate indices based on unit labor costs in the manufacturing sector have been found by many authors to be useful indicators of international competitiveness for a variety of reasons (see, for instance, Artus and Knight (1984), Marsh and Tokarick (1994), Turner and Van't dack (1983)). They capture cost developments in an important sector exposed to international competition. They offer a reliable gauge of the relative profitability of traded goods. They are convenient from a statistical viewpoint, since fairly comparable data on the manufacturing sector exist for a number of countries. And, finally, by construction, they bring into focus the largest component of nontraded costs and of value added, thus proxying for significant developments in total variable costs.<sup>3</sup>

Given these characteristics, ULC-based REER indicators are often judged preferable to alternative, economy-wide measures, such as REER indicators based on consumer price indices or value added deflators. This does not mean, of course, that ULC-based REER indices are a uniformly superior indicator of competitiveness. In fact, as argued in a number of articles on exchange rate indices, no single available measure can claim such a status because the informational content of each indicator is necessarily limited (see, for instance, Lipschitz

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<sup>2</sup>The complete list of countries for which nominal and real effective exchange rates series are computed under the INS is presented in Appendix II.

<sup>3</sup>Since capital goods are traded internationally and financial market integration tends to equalize real long-term interest rates, the emphasis on labor costs to assess international competitiveness seems warranted.

and McDonald (1981), Marsh and Tokarick (1994), and Durand and Giorno (1987)). It has often been noted that the interpretation of ULC-based REER indices, as that of other indices, is not necessarily straightforward. For instance, it may be complicated by the following factors: the use of intermediate inputs in the production of manufactured goods whose prices can differ across countries; the possibility of different intensities of capital use across countries; and cyclical movements in labor productivity, even though remedies can be used to attempt to filter out volatility at business-cycle frequencies (see subsection III.B.).<sup>4</sup> In addition, the incomplete coverage of the tradable sector in ULC-based REER indices can be a serious restriction in countries where trade in raw materials, semi-finished products and services is a large proportion of total trade.

In practice, the choice of the preferred real effective exchange rate index is also in part dictated by data constraints. For many countries, a lack of data make it impossible to compute ULC-based REER indicators and may limit the choice of indicators to CPI-based ones. This last factor largely explains why, in the INS, ULC-based REER indices are computed only for a subset of industrialized countries, where generally comparable information on unit labor costs and necessary data on production and trade of manufactured goods are available.

### B. Methodology of Computation of ULC-Based REER Indicators

ULC-based REER indicators measure international competitiveness as an index of unit labor costs in a country's manufacturing sector relative to a weighted average of the unit labor costs in competing countries expressed in a common currency. Specifically, the ULC-based REER indicator of country  $i$  is given by

$$E_i = \prod_{j \neq i} \left[ \frac{C_i R_i}{C_j R_j} \right]^{W_{ij}}$$

where  $j$  is an index that runs over country  $i$ 's trade partners,  $W_{ij}$  is the competitiveness weight attached by country  $i$  to country  $j$ ,  $C_i$  and  $C_j$  are normalized unit labor cost measures in countries  $i$  and  $j$  expressed in local currencies, and  $R_i$  and  $R_j$  represent the nominal exchange rates of countries  $i$  and  $j$ 's currencies in US dollars.

Three basic methodological issues arise in this computation: (i) the determination of a meaningful competitiveness weight structure; (ii) the selection of a filter for unit labor costs

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<sup>4</sup>These factors can distort the interpretation of ULC-based REER indices in the following way: differential increases in nonlabor costs will affect the relative competitive position of a country but will not be recorded in the index; a higher capital-labor ratio, which entails higher capital costs and lower unit labor costs, lead to a ULC-based indicator that overestimates competitiveness; the procyclical changes in productivity add statistical noise to the indices.

series so as to limit the influence of cyclical swings in productivity on the REER index; and (iii) the choice of a level of disaggregation in the definition of products and markets.

### Derivation of competitiveness weights

The weighting scheme is all important because it determines how developments in exchange rates and unit costs in different foreign countries have an impact on the measured competitive position of the home country. The present methodology derives total competitiveness weights as a convex combination of bilateral import weights and double export weights, using data on trade and consumption of manufactured goods.

The theoretical underpinnings for these weights are described in Armington (1969) and in McGuirk (1987). Heuristically, the appeal of this structure is that, under certain (demanding) conditions on the elasticity of substitution between goods supplied by different producers to the same market, the set of total competitiveness weights for one country turns out to be proportional to the set of elasticities of demand for that country's goods with respect to the relative price of goods produced by its trading partners. Hence, these weights represent a reasonable way of linking changes in costs at home and abroad to changes in a country's ability to compete internationally.

Formally, assume that there are  $k$  markets in which the producers of country  $i$  and country  $j$  compete. Let  $T_l^k$  represent the sales of country  $l$  in market  $k$ . Let  $s_j^k$  be country  $j$ 's market share in market  $k$  and  $w_i^k$  be the share of country  $i$ 's output sold in market  $k$ , which is to say

$$s_j^k = \frac{T_j^k}{\sum_l T_l^k}$$
$$w_i^k = \frac{T_i^k}{\sum_n T_i^n}$$

Then, the weight attached to country  $j$  by country  $i$  is

$$W_{ij} = \frac{\sum_k w_i^k s_j^k}{\sum_k w_i^k (1 - s_i^k)}$$

This weight can be interpreted as the sum over all markets of a gauge of the degree of competition between producers of countries  $i$  and  $j$  divided by the sum over all markets of a gauge of the degree of competition between producers of country  $i$  and all other producers. Under this interpretation, the gauge of the degree of competition between producers of countries  $i$  and  $j$  in market  $k$  is the product of market  $k$ 's importance for country  $i$  (measured by the share of country  $i$ 's output sold in market  $k$ ) times the strength of country  $j$ 's



competitive position in market  $k$  (measured by country  $j$ 's market share there); and the gauge of the degree of competition between producers of country  $i$  and all other producers in market  $k$  is the product of market  $k$ 's importance for country  $i$  times the combined market share of all these other producers in market  $k$ .

The decomposition of the total competitiveness weight,  $W_{ij}$ , in a convex combination of a bilateral import weight and a double export weight is as follows:<sup>5</sup>

$$W_{ij} = \lambda_i^M MW_{ij} + \lambda_i^X XW_{ij}$$

where

$$MW_{ij} = \frac{s_j^i}{\sum_{l \neq i} s_l^i}$$

$$XW_{ij} = \frac{\sum_{k \neq i} w_i^k s_j^k}{\sum_{k \neq i} w_i^k (1 - s_i^k)}$$

and

$$\lambda_i^M = \frac{w_i^i (1 - s_i^i)}{\sum_k w_i^k (1 - s_i^k)}$$

$$\lambda_i^X = \frac{\sum_{k \neq i} w_i^k (1 - s_i^k)}{\sum_k w_i^k (1 - s_i^k)}$$

The import weight,  $MW_{ij}$ , is simply equal to country  $j$ 's share of country  $i$ 's imports. The export weight,  $XW_{ij}$ , can be interpreted as the ratio of a measure of the intensity of competition between producers of countries  $i$  and  $j$  in all of country  $i$ 's export markets (including country  $j$ ) divided by the intensity of competition between country  $i$ 's producers and all other producers in these same markets. The coefficient on the import weight,  $\lambda_i^M$ , measures the relative importance of competition in the domestic market between producers of country  $i$  and all other producers. It can indeed be seen to be equal to the ratio of the gauge of competition in country  $i$  between producers of country  $i$  and all other producers to the sum over all markets of the gauge of competition between these same producers. Conversely, the

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<sup>5</sup>See Appendix I for a derivation of this decomposition and details on the interpretation of its various elements.

coefficient on the export weight,  $\lambda_i^X$ , measures the relative importance of competition in all export markets of country  $i$  between producers of that country and all other producers.

The normalized export weight can, in turn, be decomposed into a convex combination of a normalized bilateral export weight,  $BXW_{ij}$ , which accounts for competition in country  $j$ , and a normalized third-market export weight,  $TXW_{ij}$ , which accounts for competition in all markets but countries  $i$  and  $j$ . This second decomposition is as follows:

$$XW_{ij} = \mu_i^{BX} BXW_{ij} + \mu_i^{TX} TXW_{ij}$$

where

$$BXW_{ij} = \frac{w_i^j s_j^j}{\sum_{k \neq i} w_i^k s_k^k}$$

$$TXW_{ij} = \frac{\sum_{k \neq i, j} w_i^k s_j^k}{\sum_{k \neq i} w_i^k (1 - s_i^k - s_k^k)}$$

and

$$\mu_i^{BX} = \frac{\sum_{k \neq i} w_i^k s_k^k}{\sum_{k \neq i} w_i^k (1 - s_i^k)}$$

$$\mu_i^{TX} = \frac{\sum_{k \neq i} w_i^k (1 - s_i^k - s_k^k)}{\sum_{k \neq i} w_i^k (1 - s_i^k)}$$

The bilateral export weight,  $BXW_{ij}$  is akin to country  $i$ 's export share in country  $j$ . It would turn out to be exactly equal to that export share if the share of sales done by domestic producers were identical in each market. The third-market export weight,  $TXW_{ij}$ , can be interpreted as the ratio of a measure of the intensity of competition between producers of countries  $i$  and  $j$  in all third markets (i.e., excluding countries  $i$  and  $j$ ) divided by the intensity of competition between country  $i$ 's producers and all other non-domestic producers in these same markets. The coefficient on the bilateral export weight,  $\mu_i^{BX}$ , measures the relative importance of competition in country  $i$ 's export markets between producers of country  $i$  and domestic producers. Conversely, the coefficient on the third-market export weight,  $\mu_i^{TX}$ , measures the relative importance of competition in country  $i$ 's export markets between producers of country  $i$  and all other non-domestic producers.

As shown in McQuirk (1987), many alternative weighting schemes turn out to be special cases of these total competitiveness weights.

### **Estimation of productivity trends**

Unit labor costs are calculated as the ratio of hourly compensation in manufacturing to measured labor productivity in that sector. The latter is obtained by dividing sectoral gross value added by the product of employment and average hours worked per person. Because of labor hoarding, measured productivity varies over the business cycle, inducing fluctuations in unit labor costs that are unrelated to fundamental changes in competitiveness. In order to eliminate this spurious volatility at business cycle frequencies, the output per person series is filtered before computing the normalized ULC-based REER indices.

To filter the output series, a productivity trend estimate is obtained by applying a Hodrick-Prescott filter to average product in manufacturing. The filtered series represents a compromise between a series that is close to the raw data (in a goodness-of-the-fit sense) and a linear trend.<sup>6</sup> However, given that this method is backward looking and thus may fail to capture any changes in the true trend at the end of the sample, it is not applied after the last cyclical peak in the sample period. From this peak on, WEO projections for productivity growth are used to derive the estimated productivity trend.

### **Definition of markets and products**

The world is divided into 22 markets, the first 21 markets being the countries for which ULC-based REER indices were being computed and the last a catch-all “Rest-of-the-World” market. Previously, the Rest-of-the-World had been divided into seven regions, and the total competitiveness weights had been computed on the basis of competition in the 17 countries then included in the exercise and these seven markets. Disaggregation of the Rest-of-the-World was abandoned for the sake of simplicity, as it was found not to have a noticeable impact on the computed competitiveness weights.

Manufactured goods are treated as a unique composite good in the derivation of the competitiveness weights. Previously, manufactures were disaggregated into 143 products and the weights were computed on the basis of production and trade data for these 143 goods.<sup>7</sup> As for the disaggregation of the Rest-of-the-World, disaggregation by product was abandoned

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<sup>6</sup>Econometrically, this involves choosing estimates of trend productivity in such a way as to minimized the squared deviations between the actual and the filtered series as well as the squared differences of consecutive changes in the estimated trend.

<sup>7</sup> The use of disaggregated data meant that, in addition to the derivation shown in this subsection, the computation of competitiveness weights involved a weighted summation over all 143 products, with weights reflecting the relative importance of each of these products.

after extensive experiments showed that the loss of precision resulting from this choice was minimal. In addition, derivation of total competitiveness weights on the basis of aggregate manufacture trade flows and production levels was seen to facilitate more frequent weight updates as well as later extension of the computation of ULC-based REER indices to additional countries.

### **C. Computation of ULC-Based REER Indices**

Equipped with the methodology described in the above subsection, ULC-based REER indices were updated for 17 industrial countries and computed for the first time for four other industrial countries, Australia, Greece, New Zealand and Portugal. Altogether, these 21 countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

#### **Data**

As can be seen in the formulas presented in the above subsection, computation of the trade weights require data on trade and production (or consumption) of manufactures.

Data on aggregate trade flows for manufactures (one-digit SITC numbers 5-8 except two-digit SITC number 68) were obtained from the Trade Analysis Reporting System (TARS) of the World Bank, which accesses the COMTRADE database of United Nations Statistical Office, for the period 1989-91. Previously, data for the year 1980 had been used. For each of the 21 countries involved in this exercise, bilateral trade with the Rest-of-the-World was derived by subtracting from total exports, as reported in the TARS database, exports to the 20 partner countries.

As regards production, all the data that is needed can be summarized in the set of domestic producers' shares of home market sales, also known as internal trade shares. For the 17 countries for which ULC-based REER indices were previously computed, these shares were left unchanged. These numbers were previously derived from input-output tables obtained from national statistical authorities. For the countries for which ULC-based indices were computed from the first time, internal trade shares were estimated using the value of total manufacturing output found in national statistics, converting this value in US dollars, subtracting the value of exports, and then expressing the result as a percentage of total domestic sales of manufactured goods inclusive of imports.

Data on hourly compensation and labor productivity in manufacturing were obtained from national sources and were seasonally adjusted. If annual data were provided, quarterly series were generated using national income aggregates as benchmarks. In turn, monthly series were generated by simple interpolation of the quarterly series.

#### **Results**

The updated competitiveness weights are shown in Table 1, together with the previous sets of weights. Most ULC-based REER series derived from these weights and bilateral exchange rate and unit labor cost series are published monthly in *International Financial Statistics*.

The updating exercise offers interesting lessons regarding the robustness of the ULC-based REER indices. The new weights turn out to be remarkably close to the old ones despite the differences in the degree of disaggregation at the commodity and country level and the use of more recent trade data. Thus, the new and original indices come across as broadly consistent. This, in turn, reinforces the sense that ULC-based REER indices can be reliable indicators of changes in competitiveness over the medium term (with the caveats mentioned in subsection III.A.).

#### **IV. CPI-BASED REAL EFFECTIVE EXCHANGE RATE INDICES FOR “OLD” FUND MEMBERS**

This section begins with a very brief discussion of properties of consumer price index (CPI)-based real effective exchange rate (REER) indices. It then proceeds to describe the methodology used by the Fund to compute CPI-based REER indices for a very large section of its membership, which for reasons that will become clear in Section V may be referred to as “old” Fund members.

##### **A. Properties of CPI-Based REER Indicators**

CPI-based real effective exchange rate indicators are a frequently used indicator of competitiveness. Under the assumption that all traded goods are homogeneous and consequently that their prices are equalized across countries by international trade, such indicators provide information on the relative evolution of prices of nontraded goods in the home country and in foreign countries. These indicators can then be interpreted as a measure of the relative pull on factors of production between tradable and nontradable goods sectors in the home and foreign countries.

One significant advantage of CPI-based REER indices is that they can be computed for a large range of countries, given the wide availability of consumer price indices.

However, as was the case for ULC-based REER indices, it is not necessarily straightforward to derive conclusions on international competitiveness from the sole observation of CPI-based REER indices. First, since all traded goods are not homogeneous, the interpretation of these indices given above is to be treated with caution. In addition, these indices may be affected by price controls and other distortions. CPI-based REER indices may also poorly reflect competitiveness in trade of intermediate goods, which for many countries

makes a large share of international trade (see Turner and Van't Dack (1993), Wickham (1993), and Marsh and Tokarick (1994) for further discussions of these issues).

## B. Methodology of Computation of CPI-Based REER Indicators

Like ULC-based REER indices, CPI-based REER indicators are computed as a weighted geometric average of the level of consumer prices in the home country relative to that in its trade partners. Specifically, the CPI-based REER indicator of country  $i$  is given by

$$E_i = \prod_{j \neq i} \left[ \frac{P_i R_i}{P_j R_j} \right]^{W_{ij}}$$

where  $j$  is an index that runs over country  $i$ 's trade partners,  $W_{ij}$  is the competitiveness weight put by country  $i$  on country  $j$ ,  $P_i$  and  $P_j$  are consumer price indices in countries  $i$  and  $j$ , and  $R_i$  and  $R_j$  represent the nominal exchange rates of countries  $i$  and  $j$ 's currencies in US dollars.

### Derivation of competitiveness weights

The weighting scheme used in the computation of the CPI-based REER indices is based on trade in manufactures, non-oil primary commodities, and, for a set of 46 countries and regions, tourism services. For each of these categories of goods, separate weights are computed. These weights are then aggregated to derive the overall weight attached by country  $i$  to country  $j$ ,  $W_{ij}$ . Specifically,

$$W_{ij} = \alpha_i(M) W_{ij}(M) + \alpha_i(P) W_{ij}(P) + \alpha_i(T) W_{ij}(T)$$

where  $W_{ij}(M)$ ,  $W_{ij}(P)$ , and  $W_{ij}(T)$  are weights based on trade in manufactures, primary commodities, and tourism services. For countries in which tourism services accounted for more than 20 percent of all exports in 1989-90—46 countries and regions happened to meet this condition—the factors  $\alpha_i(M)$ ,  $\alpha_i(P)$ , and  $\alpha_i(T)$  are the shares of trade in manufactures, primary commodities, and tourism services in country  $i$ 's external trade, with external trade computed as the sum of trade in manufactures, primary commodities, and tourism services.<sup>8 9</sup>

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<sup>8</sup> These 46 countries and regions are Antigua and Barbuda, Austria, The Bahamas, Barbados, Belize, Costa Rica, Cyprus, Dominica, Dominican Republic, Egypt, El Salvador, Fiji, France, Germany, Greece, Grenada, Italy, Jamaica, Japan, Jordan, Kenya, Kiribati, Maldives, Mali, Malta, Mauritius, Morocco, Nepal, Netherlands Antilles, Portugal, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Seychelles, Spain, Syrian Arab Republic, Thailand, Togo, Tonga, Tunisia, Turkey, United Kingdom, United States, Vanuatu, Western Samoa and Republic of Yemen.

<sup>9</sup> The 20 percent cutoff was chosen on practical grounds. With this threshold, trade in tourism services is incorporated in the computation of competitiveness weights for all countries where tourism is recognized to be an important source of foreign exchange; and, at the same time,

(continued...)

For other countries, for the sake of simplicity  $\alpha_i(T)$  was set equal to zero; and  $\alpha_i(M)$  and  $\alpha_i(P)$  are the shares of trade in manufactures and primary commodities in total trade, with total trade being computed as the sum of trade in these two categories.

***Weights based on trade in manufactures***

The weights based on trade in manufactures are computed in a manner analogous to the weights presented in section III. The main reason behind this similarity is that trade in manufactured goods is implicitly modeled in an identical way in the computation of ULC-based and CPI-based REER indices. In both cases, manufactured goods are assumed to be differentiated by their country of origin, and consequently trade is modeled as trade in differentiated goods (see Wickham (1987) for additional information on this issue).

Thus, for each pair of countries  $(i, j)$ , the weight  $W_{ij}(M)$  is the sum of two components, one reflecting competition in the home market (i.e., country  $i$ ) and the other competition in all foreign markets; and in turn, the export component is itself the sum of two sub-components, one accounting for competition in country  $j$  itself and the other for competition in third markets.

The formulas are as follows. Let  $X_l^k(M)$  represent country  $l$ 's exports of manufactures to market  $k$ . Let  $s_j^k(M)$  be country  $j$ 's share of all manufactures exports to market  $k$  and let  $w_i^k(M)$  be the share of country  $i$ 's manufactures exports shipped to market  $k$ , which is to say

$$s_j^k(M) = \frac{X_j^k(M)}{\sum_{l \neq k} X_l^k(M)}$$

$$w_i^k(M) = \frac{X_i^k(M)}{\sum_{n \neq i} X_i^n(M)}$$

Let  $\beta_i^M(M)$  and  $\beta_i^X(M)$  be the share of imports and exports in country  $i$ 's trade of manufactures, which is to say

$$\beta_i^M(M) = \frac{\sum_{l \neq i} X_l^i(M)}{\sum_{l \neq i} X_l^i(M) + \sum_{n \neq i} X_i^n(M)}$$

$$\beta_i^X(M) = \frac{\sum_{n \neq i} X_i^n(M)}{\sum_{l \neq i} X_l^i(M) + \sum_{n \neq i} X_i^n(M)}$$

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<sup>9</sup>(...continued)

extraction and manipulation of the data on tourism needed to compute the weights remain manageable.

Then

$$W_{ij}(M) = \beta_i^M(M) MW_{ij}(M) + \beta_i^X(M) XW_{ij}(M)$$

where

$$MW_{ij}(M) = s_j^i(M)$$

and

$$\begin{aligned} XW_{ij}(M) &= \frac{1}{2} BXW_{ij}(M) + \frac{1}{2} TXW_{ij}(M) \\ &= \frac{1}{2} w_i^j(M) + \frac{1}{2} \frac{\sum_{k \neq i, j} w_i^k(M) s_j^k(M)}{\sum_{k \neq i} w_i^k(M) (1 - s_i^k(M))} \end{aligned}$$

The import weight,  $MW_{ij}(M)$ , simply is the share of country  $i$ 's imports of manufactures coming from country  $j$ . The bilateral export weight,  $BXW_{ij}(M)$ , is just as simply the share of country  $i$ 's exports of manufactures going to country  $j$ . The third-market export weight,  $TXW_{ij}(M)$  is similar to the third-market weight derived in Section III. It is equal to a weighted average over all third-country markets of country  $j$ 's import share divided by a weighted average of the combined import share of all of country  $i$ 's competitors, with the weights being the shares of country  $i$ 's exports to the various markets. The bilateral and third-market export weights are arbitrarily given equal importance in the computation of the overall export weight,  $XW_{ij}(M)$ .

### *Weights based on trade in tourism services*

The weights based on trade in tourism services are computed in exactly the same fashion as the weights based on trade in manufactured goods. This is because, like manufactured goods, tourism services are implicitly assumed to be differentiated products. Consequently, trade in tourism services is implicitly modeled as trade in differentiated products, just like trade in manufactured goods.

Using a notation similar to the one above, the weights are

$$\begin{aligned} W_{ij}(T) &= \beta_i^M(T) MW_{ij}(T) + \beta_i^X(T) XW_{ij}(T) \\ &= \beta_i^M(T) s_j^i(T) + \beta_i^X(T) \left( \frac{1}{2} w_i^j(T) + \frac{1}{2} \frac{\sum_{k \neq i, j} w_i^k(T) s_j^k(T)}{\sum_{k \neq i} w_i^k(T) (1 - s_i^k(T))} \right) \end{aligned}$$



where the coefficients  $\beta_i^M(T)$  and  $\beta_i^X(T)$  are the share of imports and exports in country  $i$ 's trade in tourism services,  $s_j^k(T)$  is country  $j$ 's share of all expenditure on foreign tourism by residents of country  $k$  (i.e. country  $j$ 's share of all imports of tourism services by country  $k$ ), and  $w_i^k(M)$  is country  $k$ 's share of all tourism services received by foreign residents in country  $i$  (i.e., the share of country  $i$ 's exports of tourism services sold in country  $k$ ).

As for the weights based on trade in manufactures, the weights based on trade in tourism are a weighted sum of a weight reflecting competition in the domestic market (i.e., for  $W_{ij}(T)$ , competition for tourists from country  $i$  between sellers of tourism services in countries  $i$  and  $j$ ), a weight reflecting competition abroad against domestic producers (i.e., for  $W_{ij}(T)$ , competition for tourists from country  $j$  between sellers of tourism services in countries  $i$  and  $j$ ), and a weight reflecting competition abroad against other exporters (i.e., for  $W_{ij}(T)$ , competition for tourists from all countries but countries  $i$  and  $j$  between sellers of tourism services in countries  $i$  and  $j$ ).

### *Weights based on trade in primary commodities*

The weights based on trade in primary commodities are computed in a very different way from the two previous sets of weights. Contrary to manufactured goods and tourism services, primary commodities are assumed to be homogeneous goods. Thus, for each primary commodity, there only is one world market and one world price. With this implicit model in mind, for each commodity, the weight attached to country  $j$  by any country should reflect the importance of country  $j$  as either a seller or a buyer in the world market. Overall, for country  $i$ , the weight attached to country  $j$ ,  $W_{ij}(P)$ , should be a (normalized) sum over all commodity markets of the product of the individual weight of country  $j$  in each market  $h$  times the importance of market  $h$  for country  $i$  (see Wickham (1987) for further discussion of this issue).

Formally, let  $X_j^h(P)$  be country  $j$ 's exports of commodity  $h$  and let  $M_i^h(P)$  be country  $i$ 's imports of commodity  $h$ . Let  $s_j^h(P)$  be country  $j$ 's share of worldwide trade in commodity  $h$  and let  $w_i^h(P)$  be commodity  $h$ 's share of country  $i$ 's trade in all commodities, which is to say

$$s_j^h(P) = \frac{M_j^h(P) + X_j^h(P)}{\sum_n M_n^h(P) + \sum_n X_n^h(P)}$$

$$w_i^h(P) = \frac{M_i^h(P) + X_i^h(P)}{\sum_h M_i^h(P) + \sum_h X_i^h(P)}$$

Then, the weight attached by country  $i$  to country  $j$  for trade in primary commodities, is

$$W_{ij}(P) = \frac{\sum_h w_i^h(P) s_j^h(P)}{\sum_h w_i^h(P) (1 - s_i^h(P))}$$

In the above formula, the denominator's purpose is to normalize the sum of  $W_{ij}(P)$  over all trade partners of country  $i$  to 1. Logically, this denominator is the sum over all markets of the product of the share of country  $i$ 's commodity trade in each given commodity times the combined share of trade in that commodity done by all partners of country  $i$ .

### Adjustment to CPI series

To remove the impact of seasonal variation of prices on the computed REER indices, CPI series are seasonally adjusted in all but a few countries using the X-11 variant of the U.S. Census Bureau's Method II seasonal adjustment routine. The few countries where the CPI series are not adjusted are countries where inflation is so high and variable at some time during the sample period that the seasonal adjustment routine yields implausible results.

### Definition of products and markets

Manufactured goods are treated as a single composite good, as in the computation of ULC-based REER indices.

Primary commodities are disaggregated into 25 groups, which correspond to two-digit SITC numbers 00-09, 11-12, 21-29, 41-43, and 68. Previously, primary commodities had been divided into 100 groups. Again, it was found through experimentation that use of a lower level of disaggregation did not have a noticeable impact on computed trade weights.

As done since the first revision to the INS, trade in petroleum and energy products is excluded from the computation of competitiveness weights. Two reasons lie behind this choice. First, in the short to medium term, trade in petroleum and energy products may be considered relatively insensitive to changes in exchange rates and domestic costs and prices, as the oil and gas industry generally faces prices which are high relative to average variable costs and marginal costs are typically flat until (slow-adjusting) extraction capacity is reached and as short- to medium-run demand elasticities are low. It is thus unlikely that production decisions be affected by changes in variable extraction costs and, in turn, by changes in the exchange rate. Second, in many oil-producing countries, the energy sector can be considered as segmented from the rest of the economy, except for the impact of energy revenues on the state budget. In that case, the exchange rate simply acts as an accounting unit (translating foreign exchange receipts from energy exports into domestic currency) and it is the government's spending decisions—rather than exchange rate movements *per se*—that affect other sectors of the economy.

There is no distinction here between markets and countries: each country is a market and each market is a country. Put differently, contrary to the approach used in the computation of ULC-based REER indices, there is no need here to introduce an aggregate Rest-of-the-World market. This means that for each given country  $i$  bilateral competitiveness weights are computed with every other country. Theoretically, this could make the monthly computation of the REER indices themselves for all countries in the INS quite cumbersome. To avoid this difficulty and given that a large number of the bilateral competitiveness weights for any country  $i$  are very small, it was decided to truncate each country's set of competitiveness weights at a threshold of one percent.<sup>10</sup>

### C. Computation of CPI-Based REER Indices

On the basis of the formulas described above, trade weights and CPI-based real effective exchange rate index series were updated for 131 countries and regions. Trade weights and nominal effective exchange rate series were computed for another 16 countries for which consumer price index series are not available.<sup>11 12</sup>

#### Data

As can be seen above, computation of the trade weights require data on trade of manufactured goods, primary commodities and tourism services.

Data on trade of manufactured goods were obtained from the Trade Analysis Reporting System (TARS) of the World Bank. These data covered trade flows for all commodities classified under the one-digit SITC numbers 5 to 8, with the exception of the two-digit SITC number 68. Data were averaged over 1988-1990. Previously, data for the period 1980-82 had been used. The choice of the 1988-1990 period was a compromise between use of up-to-date information, on the one hand, and comprehensive information, on the other hand. It reflected the long reporting delays in the U.N. statistical system.

Reported export and import data do not necessarily match. To ensure consistency, the following procedure was used: for trade between two countries that are included in a set of "preferred reporters", the average of the reported bilateral exports and imports was

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<sup>10</sup>After this truncation, for obvious reasons, the set of remaining bilateral weights, i.e., all the weights originally above 1 percent, are scaled so that they add up to 1.

<sup>11</sup>The list of these countries and regions is provided in Appendix II.

<sup>12</sup>To be precise, updated series were computed with the methodology and data described in this paper from January 1990 on. The former series were then spliced with the updated series at January 1990.

recorded;<sup>13</sup> for trade between a preferred reporter and a non-preferred reporter, trade data from the preferred reporter was recorded; for trade between two non-preferred reporters, the average of reported bilateral exports and imports was recorded. In addition, in a few cases, some adjustment to trade figures were made based on specific information provided by country economists (e.g., estimates of unrecorded border trade).

Data on trade of primary commodities were also obtained from the Trade Analysis Reporting System. These data covered trade in non-oil primary commodities. Data were averaged over 1988-1990. Consistency between import and export data was achieved by applying to these data the method described in the previous paragraph.

Data on sales and consumption of tourism services were derived from the 1994 *Yearbook of Tourism Statistics*, Volumes I and II, published by The World Tourism Organization. This publication provides information on: (i) tourism receipts by country in the years 1988-90; and (ii) the number of arrivals in each country according to the country of residence of the visitors. From these data, figures for exports and imports of trade services between pairs of countries were computed by allocating aggregate tourism receipts of a tourism "exporter" to "importing" countries in proportion of the share of arrivals from the said importing country to the said exporting country.<sup>14</sup> In other words, in the absence of detailed and consistent information, it was assumed that average expenditure per tourist at a given destination is independent of the tourist's country of origin.

## Results

The computed trade weights for the relevant set of 146 countries and regions are available from the authors upon request. They have not been reproduced in this working paper for lack of space. For many Fund members, the CPI-based REER series derived from these weights and from bilateral exchange rate and CPI series are published monthly in *International Financial Statistics*.

## V. CPI-BASED REAL EFFECTIVE EXCHANGE RATE INDICES FOR

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<sup>13</sup>The group of countries or regions referred to as "Preferred Reporters" is made of Australia, Austria, Belgium/Luxembourg, Canada, Denmark, Finland, France, Federal Republic of Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States, Iceland, Israel, Turkey, South Africa, China, Hong Kong, India, Korea, Singapore, and Taiwan, Province of China.

<sup>14</sup> In the case of three tourism exporters (Dominica, El Salvador and Kenya) a breakdown of arrivals does not exist for the three years 1988-90, and the available information for 1991 has been used.

### “NEW” FUND MEMBERS

In recent years, a large number of countries, primarily in Eastern Europe and the former Soviet Union, have joined the Fund. Logically, it was seen desirable to incorporate these recent members in the INS. However, data deficiencies as well as unstable trade patterns precluded the application of the methodology described in the previous section to these cases. In addition, data deficiencies for a limited number of older Fund members also precluded application of the said methodology. Altogether, these recent and less recent members form the following group of 35 countries: Albania, Angola, Armenia, Azerbaijan, Belarus, Bhutan, Botswana, Brunei Darussalam, Bulgaria, Cambodia, Croatia, Czech Republic, Eritrea, Estonia, Georgia, Kazakstan, Kyrgyz Republic, Latvia, Lesotho, Lithuania, FYR Macedonia, Marshall Islands, Micronesia, Moldova, Mongolia, Namibia, Russia, Slovak Republic, Slovenia, Swaziland, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Vietnam.

With these data restrictions in mind and with a view to full integration of these Fund members in the INS at a later date, it was decided to compute competitiveness weights and to create REER index series on the basis of bilateral trade flows.

For these countries, the competitiveness weight attached to country  $j$  by country  $i$ ,  $W_{ij}$ , is then, simply, given by the following formula:

$$W_{ij} = \frac{M_i}{M_i + X_i} s_j^i + \frac{X_i}{M_i + X_i} w_i^j$$

where  $M_i$  and  $X_i$  represent country  $i$ 's imports and exports,  $s_j^i$  is the share of country  $i$ 's imports originating from country  $j$ , and  $w_i^j$  is the share of country  $i$ 's exports sold in country  $j$ . Then, just as described in Section IV, the CPI-based REER indicator of country  $i$  is given by

$$E_i = \prod_{j \neq i} \left[ \frac{P_i R_i}{P_j R_j} \right]^{W_{ij}}$$

where  $j$  is an index that runs over country  $i$ 's trade partners,  $P_i$  and  $P_j$  are consumer price indices in countries  $i$  and  $j$ , and  $R_i$  and  $R_j$  represent the nominal exchange rates of countries  $i$  and  $j$ 's currencies in US dollars.

As for “old” Fund members, when the necessary data is available, trade in oil and gas is excluded from total trade data to compute competitiveness weights.

For these computations, data on bilateral trade flows were obtained from the IMF's DOT database or, directly, through communications with national statistical authorities. The period covered by these data varied among countries according to data availability and reliability.

## VI. AGENDA FOR FUTURE WORK

Three directions for future work naturally come to mind. The first is extension of the computation of ULC-based REER index series to a larger number of countries. In particular, it would appear very useful to derive such series for a number of Asian and Latin American countries that have become major exporters and importers of manufactured goods. Improvements in the availability, reliability and timeliness of national statistics should make this possible over time. The second is computation of CPI-based REER index series for "new" Fund members according to the methodology used for other countries. Again, the passage of time and improvements in national statistics should allow this to happen in due course. The third is further comparative analysis of different methods for computing trade weights with a particular eye on the performance of methods requiring limited data. Such work might eventually lead to simplifications in the computations of competitiveness weights and effective exchange rate series at little or no cost to the series' accuracy. It would thus permit, for instance, faster extension of the set of countries for which ULC-based REER indices are computed.

Table 1. Total Competitiveness Weights: New and Old

	Australia		Austria		Belgium-Luxembourg		Canada		Denmark		Finland		France	
	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights
Australia	0	n.a.	0.09	n.a.	0.11	n.a.	0.15	n.a.	0.13	n.a.	0.23	n.a.	0.13	n.a.
Austria	0.49	n.a.	0	0	1.44	1.13	0.21	0.33	1.66	1.85	1.69	3.11	1.31	1.33
Belgium-Luxembourg	1.16	n.a.	3.02	2.78	0	0	0.46	0.99	3.19	3.27	3.05	2.66	8.38	9.31
Canada	1.82	n.a.	0.49	0.67	0.51	0.82	0	0	0.53	0.69	0.95	2.06	0.76	1.01
Denmark	0.34	n.a.	0.86	1.06	0.79	0.77	0.12	0.20	0	0	3.54	3.74	0.78	0.74
Finland	0.61	n.a.	0.85	1.65	0.73	0.58	0.21	0.54	3.42	3.45	0	0	0.78	0.70
France	3.08	n.a.	6.21	7.28	18.95	20.72	1.57	2.73	7.12	7.07	7.33	7.18	0	0
Germany	7.94	n.a.	49.93	43.42	29.13	27.55	2.81	4.05	27.28	24.66	22.12	19.83	28.56	27.42
Greece	0.07	n.a.	0.31	n.a.	0.27	n.a.	0.03	n.a.	0.32	n.a.	0.28	n.a.	0.35	n.a.
Ireland	0.36	n.a.	0.35	0.26	0.62	0.38	0.15	0.23	0.71	0.56	0.63	0.36	0.81	0.41
Italy	3.21	n.a.	10.18	10.90	7.86	7.28	1.21	1.63	5.03	5.24	5.60	4.81	14.38	14.70
Japan	31.44	n.a.	4.15	5.08	3.85	4.42	5.95	7.43	4.24	5.10	5.22	5.49	4.20	6.45
Netherlands	1.28	n.a.	2.93	3.09	9.22	9.47	0.66	0.92	5.01	4.49	3.82	3.87	4.88	5.01
New Zealand	8.17	n.a.	0.04	n.a.	0.04	n.a.	0.07	n.a.	0.07	n.a.	0.09	n.a.	0.04	n.a.
Norway	0.27	n.a.	0.48	0.85	0.51	0.66	0.14	0.33	4.71	4.88	3.04	3.98	0.50	0.58
Portugal	0.12	n.a.	0.40	n.a.	0.47	n.a.	0.06	n.a.	0.83	n.a.	0.85	n.a.	1.00	n.a.
Spain	0.46	n.a.	2.07	1.10	2.90	1.52	0.32	0.58	2.11	1.15	2.43	1.59	7.00	3.86
Sweden	1.67	n.a.	2.09	2.96	2.07	1.90	0.61	0.98	13.14	13.63	16.24	17.88	1.85	2.18
Switzerland	1.40	n.a.	6.45	7.24	2.32	3.51	0.43	0.64	2.85	3.09	2.48	2.45	4.07	4.00
United Kingdom	10.15	n.a.	4.87	5.82	10.53	10.07	2.45	4.42	10.83	11.81	11.48	12.83	10.87	10.12
United States	25.97	n.a.	4.22	5.84	7.67	9.24	82.39	74.00	6.84	9.06	8.93	8.18	9.34	12.17
<b>Total</b>	<b>100.0</b>	<b>n.a.</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>





Table 1 (concluded). Total Competitiveness Weights: New and Old

	Norway		Portugal		Spain		Sweden		Switzerland		United Kingdom		United States	
	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights	New weights	Old weights
Australia	0.14	n.a.	0.08	n.a.	0.06	n.a.	0.27	n.a.	0.17	n.a.	0.48	n.a.	0.67	n.a.
Austria	1.24	1.78	1.32	n.a.	1.34	1.11	1.71	2.07	4.04	3.84	1.19	1.24	0.56	0.73
Belgium-Luxembourg	2.75	3.38	3.22	n.a.	3.93	3.75	3.55	3.25	3.04	4.57	5.39	5.25	2.12	2.83
Canada	0.81	1.41	0.48	n.a.	0.48	1.18	1.16	1.39	0.62	0.69	1.38	1.90	25.09	18.73
Denmark	6.31	5.90	1.42	n.a.	0.71	0.67	5.60	5.47	0.93	0.94	1.38	1.45	0.47	0.65
Finland	3.93	4.45	1.41	n.a.	0.79	0.85	6.69	6.63	0.78	0.69	1.41	1.45	0.59	0.54
France	6.09	6.66	15.57	n.a.	21.46	21.26	7.15	8.29	12.07	11.59	12.59	11.75	5.84	8.31
Germany	19.20	15.93	23.07	n.a.	23.99	19.23	22.28	22.26	33.58	28.74	22.49	20.01	11.50	14.50
Greece	0.28	n.a.	0.22	n.a.	0.26	n.a.	0.27	n.a.	0.28	n.a.	0.31	n.a.	0.13	n.a.
Ireland	0.60	0.34	0.52	n.a.	0.62	0.38	0.77	0.36	0.52	0.27	3.08	2.42	0.70	0.49
Italy	4.85	3.77	7.64	n.a.	14.02	12.56	6.05	5.46	11.37	9.57	8.27	7.66	4.56	5.60
Japan	5.14	7.47	2.49	n.a.	3.88	8.39	5.20	7.07	6.45	6.62	7.00	8.83	30.29	25.86
Netherlands	4.89	4.81	3.71	n.a.	3.49	3.51	4.24	3.87	2.80	3.04	5.71	5.00	2.23	2.75
New Zealand	0.08	n.a.	0.04	n.a.	0.02	n.a.	0.14	n.a.	0.08	n.a.	0.21	n.a.	0.25	n.a.
Norway	0	0	1.12	n.a.	0.44	0.64	5.58	5.86	0.46	0.58	1.19	1.31	0.47	0.58
Portugal	0.88	n.a.	0	n.a.	2.82	n.a.	0.93	n.a.	0.49	n.a.	0.84	n.a.	0.23	n.a.
Spain	1.73	1.33	14.32	n.a.	0	0	2.48	1.30	2.23	1.32	3.85	2.02	1.47	1.55
Sweden	17.54	17.65	3.74	n.a.	1.96	1.88	0	0	2.10	2.13	3.45	3.79	1.88	2.06
Switzerland	1.89	2.32	2.58	n.a.	2.30	2.51	2.74	2.80	0	0	3.27	5.48	2.03	2.76
United Kingdom	12.50	13.00	11.26	n.a.	10.20	9.58	11.56	12.43	8.37	13.68	0	0	8.91	12.02
United States	9.14	9.81	5.82	n.a.	7.21	12.51	11.63	11.48	9.64	11.73	16.49	20.44	0	0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>n.a.</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**DECOMPOSITIONS OF TOTAL COMPETITIVENESS WEIGHTS**

Following McQuirk (1987), the gross total competitiveness weight attached to country  $j$  by country  $i$  is

$$GW_{ij} = \sum_k \left\{ \frac{T_i^k}{\sum_k T_i^k} \frac{T_j^k}{\sum_l T_l^k} \right\}$$

where  $T_i^k$  represents the sales of country  $i$  in market  $k$ . Let  $s_j^k$  be country  $j$ 's market share in market  $k$  and let  $w_i^k$  be the share of country  $i$ 's output sold in market  $k$ , which is to say let

$$s_j^k = \frac{T_j^k}{\sum_l T_l^k}$$

$$w_i^k = \frac{T_i^k}{\sum_k T_i^k}$$

Then,  $GW_{ij}$  can be rewritten as follows:

$$GW_{ij} = \sum_k \left\{ w_i^k s_j^k \right\}$$

In words, the weight attached to country  $j$  by country  $i$  is the sum over all markets of the product of the importance of a particular market for country  $i$  (measured by the percentage of country  $i$ 's sales made there) times the strength of country  $j$ 's competitive position in that market (measured by the percentage of sales in that market made by country  $j$ ).

To normalize these weights, they have to be divided by their sum over all partner countries of country  $i$ .<sup>15</sup> This normalization yields the following formula for the weight attached by country  $i$  to country  $j$ :

$$W_{ij} = \frac{\sum_k w_i^k s_j^k}{\sum_k w_i^k (1-s_i^k)}$$

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<sup>15</sup> The sum of  $GW_{ij}$  over all partner countries of country  $i$  is not equal to 1, i.e.,

$$\sum_{j \neq i} GW_{ij} \neq 1. \text{ In fact, } \sum_j GW_{ij} = 1$$

The normalized weight,  $W_{ij}$ , can be decomposed into a convex combination of a normalized import weight,  $MW_{ij}$ , which accounts for competition in country  $i$  itself, and a normalized export weight,  $XW_{ij}$ , which accounts for competition in all export markets. Under this decomposition,  $W_{ij}$  can be written as follows:

$$W_{ij} = \lambda_i^M MW_{ij} + \lambda_i^X XW_{ij}$$

where

$$MW_{ij} = \frac{s_j^i}{\sum_{l \neq i} s_l^i}$$

$$XW_{ij} = \frac{\sum_{k \neq i} w_i^k s_j^k}{\sum_{k \neq i} w_i^k (1 - s_i^k)}$$

and

$$\lambda_i^M = \frac{w_i^i (1 - s_i^i)}{\sum_k w_i^k (1 - s_i^k)}$$

$$\lambda_i^X = \frac{\sum_{k \neq i} w_i^k (1 - s_i^k)}{\sum_k w_i^k (1 - s_i^k)}$$

The import weight,  $MW_{ij}$ , is simply equal to country  $j$ 's bilateral share of country  $i$ 's imports. The export weight,  $XW_{ij}$ , can be interpreted as the ratio of a measure of the intensity of competition between producers of countries  $i$  and  $j$  in all of country  $i$ 's export markets (including country  $j$ ) divided by the intensity of competition between country  $i$ 's producers and all other producers in these same markets. Under this interpretation, the gauge of the intensity of competition between producers of countries  $i$  and  $j$  in each market  $k$  is the product of the importance of that market for country  $i$  (measured by the percentage of country  $i$ 's sales made in market  $k$ ) times the strength of country  $j$ 's competitive position there (measured by country  $j$ 's market share in market  $k$ ); and the gauge of the intensity of competition between producers of country  $i$  and all other producers in market  $k$  is the product of the importance of that market for country  $i$  times the combined market share of all these other producers in market  $k$ .

The coefficient on the import weight,  $\lambda_i^M$ , measures the relative importance of competition in the domestic market between producers of country  $i$  and all other producers. It can be indeed be seen to be equal to the ratio of the gauge of competition in country  $i$

between producers of country  $i$  and all other producers to the sum over all markets of the gauge of competition between these same producers. Conversely, the coefficient on the export weight,  $\lambda_i^X$ , measures the relative importance of competition in all export markets of country  $i$  between producers of that country and all other producers.

The normalized export weight can, in turn, be decomposed into a convex combination of a normalized bilateral export weight,  $BXW_{ij}$ , which accounts for competition in country  $j$ , and a normalized third-market export weight,  $TXW_{ij}$ , which accounts for competition in all markets but countries  $i$  and  $j$ . Thus,  $XW_{ij}$  can be written as follows:

$$XW_{ij} = \mu_i^{BX} BXW_{ij} + \mu_i^{TX} TXW_{ij}$$

where

$$BXW_{ij} = \frac{w_i^j s_j^j}{\sum_{k \neq i} w_i^k s_k^k}$$

$$TXW_{ij} = \frac{\sum_{k \neq i, j} w_i^k s_j^k}{\sum_{k \neq i} w_i^k (1 - s_i^k - s_k^k)}$$

and

$$\mu_i^{BX} = \frac{\sum_{k \neq i} w_i^k s_k^k}{\sum_{k \neq i} w_i^k (1 - s_i^k)}$$

$$\mu_i^{TX} = \frac{\sum_{k \neq i} w_i^k (1 - s_i^k - s_k^k)}{\sum_{k \neq i} w_i^k (1 - s_i^k)}$$

The bilateral export weight,  $BXW_{ij}$ , equals a measure of the intensity of competition between producers of countries  $i$  and  $j$  in country  $j$  divided by a sum over all export markets of country  $i$  of the intensity of competition between producers of country  $i$  and domestic producers. This weight is akin to a bilateral export weight, i.e. the share of country  $i$ 's exports sold in country  $j$ , and turns out to be exactly equal to that bilateral export weight when the share of sales done by domestic producers is identical in each market. The third-market export weight,  $TXW_{ij}$ , can be interpreted as the ratio of a measure of the intensity of competition between producers of countries  $i$  and  $j$  in all third markets (i.e., excluding countries  $i$  and  $j$ ) divided by the intensity of competition between country  $i$ 's producers and all other non-domestic producers in these same markets.

The coefficient on the bilateral export weight,  $\mu_i^{BX}$ , measures the relative importance of competition in country  $i$ 's export markets between producers of country  $i$  and domestic producers. It is equal to the ratio of the sum over all country  $i$ 's export markets of the gauge of competition between producers of country  $i$  and domestic producers to the sum over the same markets of the gauge of competition between producers of country  $i$  and all other producers. Conversely, the coefficient on the third-market export weight,  $\mu_i^{TX}$ , measures the relative importance of competition in country  $i$ 's export markets between producers of country  $i$  and all other non-domestic producers.

The previous decompositions obviously can be combined. This yields the following:

$$W_{ij} = \lambda_i^M MW_{ij} + \lambda_i^{BX} BXW_{ij} + \lambda_i^{TX} TXW_{ij}$$

where

$$MW_{ij} = \frac{s_j^i}{\sum_{l \neq i} s_l^i}$$

$$BXW_{ij} = \frac{w_i^j s_j^j}{\sum_{k \neq i} w_i^k s_k^k}$$

$$TXW_{ij} = \frac{\sum_{k \neq i, j} w_i^k s_j^k}{\sum_{k \neq i} w_i^k (1 - s_i^k - s_k^k)}$$

and

$$\lambda_i^M = \frac{w_i^i (1 - s_i^i)}{\sum_k w_i^k (1 - s_i^k)}$$

$$\lambda_i^{BX} = \frac{\sum_{k \neq i} w_i^k s_k^k}{\sum_k w_i^k (1 - s_i^k)}$$

$$\lambda_i^{TX} = \frac{\sum_{k \neq i} w_i^k (1 - s_i^k - s_k^k)}{\sum_k w_i^k (1 - s_i^k)}$$

In this decomposition, the import, bilateral export, and third-market export weights are as before; and  $\lambda_i^M$ ,  $\lambda_i^{BX}$ , and  $\lambda_i^{TX}$  represent the relative importance for the computation of

the total competitiveness weight of competition in the home market, of competition in foreign markets with domestic producers, and of competition in foreign markets with other exporters.

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**LIST OF COUNTRIES FOR WHICH ULC- AND CPI-BASED REER INDICES ARE COMPUTED**

**A. Countries for which ULC-Based REER Indices are Computed  
Using the Methodology Described in Section III**

Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

**B. Countries and Regions for which CPI-Based REER Indices are Computed  
Using the Methodology Described in Section IV**

Algeria, Antigua and Barbuda, Argentina, Australia, Austria, The Bahamas, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Brazil, Burkina Faso, Burundi, Cameroon, Canada, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Congo, Costa Rica, Côte d'Ivoire, Cyprus, Denmark, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Ethiopia, Fiji, Finland, France, Gabon, The Gambia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Islamic Republic of Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kiribati, Korea, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Morocco, Mozambique, Myanmar, Nepal, Netherlands, Netherlands Antilles, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Rwanda, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Solomon Islands, South Africa, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Syrian Arab Republic, Taiwan, Province of China, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, United States, Uruguay, Vanuatu, Venezuela, Western Samoa, Zaire, Zambia, Zimbabwe.

**C. Countries for which only NEER Indices are Computed  
Using the Methodology Described in Section IV**

Islamic State of Afghanistan, Comoros, Djibouti, Iraq, Kuwait, Lao P.D.R., Lebanon, Liberia, Libya, Maldives, Oman, Qatar, São Tomé and Príncipe, Somalia, United Arab Emirates, Republic of Yemen.

**D. Countries for which REER Indices are Computed  
Using the Methodology Described in Section V**

Albania, Angola, Armenia, Azerbaijan, Belarus, Bhutan, Botswana, Brunei Darussalam, Bulgaria, Cambodia, Croatia, Czech Republic, Eritrea, Estonia, Georgia, Kazakstan, Kyrgyz Republic, Latvia, Lesotho, Lithuania, FYR Macedonia, Marshall Islands, Federated States of Micronesia, Moldova, Mongolia, Namibia, Russia, Slovak Republic, Slovenia, Swaziland, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Vietnam.

**E. Fund Members not Presently Covered Under the INS**

Bosnia and Herzegovina, San Marino.



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