Methodology

To capture the evolving nature of international trade patterns, this exchange rate indexes allow changes in the component exchange rates and their weights. The currency weights in the birr indexes are based on annual trade data, vary by year, and have been updated annually since 1998.

CHOICE OF INDEX FORMULA

Exchange rate indexes are geometrically weighted averages of bilateral exchange rates. Following this tradition, *The Broad Real Effective Exchange Rate Index* at time t, I_t is obtained by the formula;

$$I_t = I_{t-1} \times \prod_{j=1}^{N(t)} \left(\left(e_{j,t} \times \frac{p_t}{p_{j,t}}\right) \Big/ \left(e_{j,t-1} \times \frac{p_{t-1}}{p_{j,t-1}}\right) \right)^{w_{j,t}}$$

The index formula is derived as follows:

The real exchange rate index at time t, I_t, is calculated as a weighted average of bilateral exchange rates that have been adjusted for relative price levels. Hence, $I_t = e_{j,t} \times \frac{p_t}{p_{j,t}}$ where $e_{j,t}$ is the price of the birr in terms of foreign currency j at time t (the nominal bilateral rate expressed as the number of foreign currency units per unit of birr), and p_t is the price level of Ethiopia (CPI), and $p_{j,t}$ is the price level (WPI or PPI used where available, if not the CPI) in country j at time t.[1]

Although the arithmetic average is probably more familiar and accessible, there are strong theoretical and mathematical reasons to prefer the geometric averaging procedure. As a result, Geometric rather than simple arithmetic averaging is used and calculated as

$$\prod_{j=1}^{N(t)} e_{j,t}^{w_{j,t}}$$

Where $w_{j,t}$ is the weight of currency *j* in the index at time *t*, *N*(*t*) is the number of foreign currencies in the index at time *t,* and $\sum_j w_{j,t} = 1$.

WEIGHT

The index formula is derived to incorporate changes in the pattern of trade by enabling the weights on the exchange rates to vary overtime. Thus, since the weights are based on annual data on international trade, they are constant within a calendar year. If weights are allowed to vary, however, the index must be adjusted at every period that the weights are changed. Otherwise, movements in the index will be misleading.

This problem is handled through an adjustment of the index. Assume that at time t, weights change from their previous values $w(j, t-1)$, which had been set at time $(t-1)$, to new values $w(j,t)$. Then,

$I_t = \prod_j \left(e_{j,t} \times \frac{p_t}{p_{j,t}}\right)^{w_{j,t}} \times Q_t$; where I_t is the index, $\left(e_{j,t} \times \frac{p_t}{p_{j,t}}\right)$ is the bilateral real exchange rate with currency j at time t, and $w(j,t)$ is the weight of currency *j* in the index at time *t.* Q_t is the adjustment of the index and is obtained as

$$Q_t = \frac{I_{t-1}}{\left(\prod_j e_{j,t-1} \times \frac{p_{t-1}}{p_{j,t-1}}\right)^{w_{j,t}}}$$

This approach can be characterized as an adjusted or "spliced" Laspeyres index (Ellis, 2001). Rearranging the equation shows that the real exchange rate is the product of the real exchange rate's level prior to the introduction of new weights and a Paasche index of bilateral real exchange rates in that base period and in the current period. These are weighted according to the weights that apply in the *current* period and yield the formula for the *Broad Real Effective Exchange Rate Index*.

BASE YEAR

The base-period value of the index, I_0, is assumed to take an arbitrary value—typically equal to 100—at an arbitrary time. Replacing the real exchange rates, $e_{j,t} \times \frac{p_t}{p_{j,t}}$, with their nominal counterparts, $e_{j,t}$, where $e_{j,t}$ is the price of the birr in terms of foreign currency j at time t, yields the formula for the *Major Currency Nominal Exchange Rate Index*. Therefore, both indexes are constructed so that an appreciation of the birr corresponds to higher index values.

To construct *Major Currency Nominal Exchange Rate Index*, the currencies in the basket are identified not only on the basis of the direction of trade involving Ethiopia's trade, i.e., the currencies mainly used by Ethiopia and its trading partners and competitors, but also on the basis that the currencies are traded in deep and relatively liquid financial markets. Because the basket includes only major currencies that generally trade in liquid financial markets and excludes currencies of trading partners with a history of high inflation relative to Ethiopia, the index is important to gauge financial market pressures on the birr; analysis of short-term developments in exchange rate markets, the effect of foreign economic and financial developments on the domestic price level, and the demand for domestic and foreign currency assets.

SELECTION OF BILATERAL CURRENCIES

The Broad Real Effective Exchange Rate Index

Since it measures the effects of the birr's appreciation and depreciation against foreign currencies on the competitiveness selecting bilateral currencies, the channels and sources of competition must be identified and used as important selection criteria.

A basket of 47 currencies representing more than 60 economies are compiled for the "Broad Index" from the three sources of imports, exports, and third-country competitors in important export markets. Trade with the economies represented in the "Broad Index" account for well over 90 percent of Ethiopia's imports and exports since 1997 selected as potential competitors to Ethiopia (table 2).

The Major Currency Nominal Exchange Rate Index

Three major currencies - the U.S. Dollar, the Euro, and the British Pound Sterling - are selected to makeup the *Major Currency Nominal Exchange Rate Index* basket. One of the major selection criteria is that nearly all of Ethiopia's trade (both merchandize and services) must be denominated in the currencies moreover the currencies are also selected on the basis that they represent economies with a history of low inflation and therefore, have not experienced persistent depreciation at least in the past 20 years As noted earlier, the "Major Index" is primarily constructed to aid the active management of a credible exchange rate regime. Based on this objective, several factors are considered in the selection process.