Estimating subregional and regional growth for developing Asia

In estimating subregional (e.g., East Asia) and regional (i.e., developing Asia) gross domestic product (GDP) growth, it is necessary to use weights to properly account for the contribution of countries to overall regional performance. In this aggregation, country income measured in domestic currency must be converted to common units. A choice has to be made whether to use market exchange rates; some kind of adjusted exchange rate, e.g., the World Bank Atlas method; or purchasing power parity (PPP) rates.

In its early publications, *Asian Development Outlook* derived its subregional and regional averages using current US dollar exchange rates. But after the financial crisis in 1997–98 as devaluations of currencies continued, *ADO* shifted to the Atlas method to smoothen the abrupt changes associated with the rapid movement of Asian currencies.

This technical note explains the two most frequently used weighting systems in cross-country comparisons of economic size and growth—the World Bank Atlas method and the PPP approach—and illustrates how their use can influence the calculation of averages. These measures are usually applied to the gross national income (GNI) of economies, so that the rankings or the relative economic size of economies reflect all facets of income earned domestically and abroad.

World Bank Atlas method

While using current market exchange rates is straightforward, it is an unsatisfactory solution for international comparisons because of possible volatility of market exchange rates and cross-country inflation rates. For instance, their use will depress estimates of those economies experiencing large depreciations even though domestic purchasing power may change by much less. The Atlas method reduces these fluctuations and modulates impacts on estimates of economic size and growth. The World Bank's official estimates of countries' relative economic sizes are based on GNI, which is converted to US dollars, using the Atlas method.

The Atlas conversion factor (ACF) is the average of a country's exchange rate for a given year and its exchange rates for the 2 preceding years, adjusted for the difference between the rate of inflation in the country and the G5 economies.[1] A country's inflation rate is measured by the change in its GDP deflator, while that for the G5, also called "international" inflation, is measured by the change in their special drawing rights (SDR) deflators.

The SDR deflator is calculated as the weighted average of the G5 economies' GDP deflators in SDR units. Country deflators are first expressed in SDR units with each country's SDR weight used for

aggregation. The SDR deflator is then converted to US dollars using the $/SDR Atlas conversion factor (the simple average of the actual $/SDR exchange rate for year *t*, and the inflation-adjusted $/SDR exchange rates for years *t-1* and *t-2*).

The ACF is then applied to a country's GNI to get the GNI in US dollars. The ACF, e^*, for year *t* is calculated as follows:

$$e_t^* = \frac{1}{3}\left[e_{t-2}\left(\frac{p_t}{p_{t-2}} / \frac{p_t^{S\$}}{p_{t-2}^{S\$}} \right) + e_{t-1}\left(\frac{p_t}{p_{t-1}} / \frac{p_t^{S\$}}{p_{t-1}^{S\$}} \right) + e_t \right]$$

where, e_t = annual exchange rate or domestic currency per dollar, p_t = the GDP deflator, and $p_t^{S\$}$ = the SDR deflator in dollars.

This formula implies that if domestic and international price deflators move in perfect synchronization, the Atlas deflator is just the unweighted average of the current and past 2 years' exchange rates. However, if domestic inflation is faster than international inflation over comparable periods, the weighted average of the historical market exchange rates is raised to reflect the fact that there has been an erosion of domestic purchasing power relative to the international benchmark. A higher ACF reduces a country's GNI in US dollars; a lower ACF, reflecting higher international inflation or an appreciation of the domestic currency relative to the dollar, increases it.

Taking the ratio of a country's GNI in US dollars to total regional GNI gives the country's weight, w_i. The weighted GDP growth for the region or subregion is then computed using the following formula:

$$g_j = \sum_{i \in j} g_i \left[\frac{w_i}{\sum_{k \in j} w_k} \right]$$

where, g_i = growth rate of country *i*, *k* = subregion, and *j* = region.
The World Bank publishes Atlas-based GNI data on a regular basis. For most countries, the GNI data can be downloaded from the *World Development Indicators* online database.

Purchasing power parity method

An alternative approach in converting income from national currencies into a common currency is the PPP method. This is useful for aggregating real expenditures into regional and subregional totals because it eliminates the relative price distortions between traded and nontraded goods inherent in conversions using market exchange rates.
PPP is defined as the number of units of a country's currency that is required to buy the same amount of goods and services in another country. PPPs are expressed in terms of a "numeraire" currency, usually US dollars and presented either in terms of values expressed in the common currency or as an index with the common currency equal to 100. The choice of a numeraire currency does not affect the relative parities of volume and prices across economies.

PPP numbers are not available on a yearly basis, because special

and benchmark International Comparison Program price surveys are only conducted at about 3- to 5-year intervals, depending on the region. PPP estimates for nonbenchmark years are therefore extrapolated or estimated, based on the latest benchmark year.

As with Atlas-based GNI data, the World Bank publishes PPP-based GNI estimates through the *World Development Indicators* online database.

Comparing economic size and regional growth estimates

Atlas- and PPP-converted GNIs provide better estimates of economic size and computations of growth than do market exchange rates because of the volatility inherent in exchange rates and the changes in the relative price levels between countries. The Atlas method damps variability caused by fluctuations in exchange rates, while the PPP method eliminates the effects of differences and changes in relative price levels. Though better conversion factors than simple market exchange rates, they are not perfect.

For the Atlas method, results may still be distorted if exchange rates change rapidly. The PPP method, on the other hand, is based on surveys, hence subject to sampling errors and estimation problems, particularly on services that may have a large nonmarket component. PPP estimates for nonbenchmark years use the nearest sample period, and so may not be reflective of the actual PPP for the year. For countries not covered in PPP surveys, estimates are imputed using statistical models, and as such are prone to error.

The GNI of developing countries measured in PPP terms will generally exceed their GNI measured using the Atlas method, reflecting productivity differentials between high- and low-income countries. In a high-productivity country, high wages lead to high prices of services and other nontraded goods, whereas in a low-productivity country, low wages produce low prices. The low prices of nontraded goods in developing countries boost GNI in PPP terms, but not using the Atlas conversion factors.

4.2.1 Top 10 economies based on GNI shares (% of total regional GNI), 2006

PPP method		Atlas method	
China, People's Rep. of	50.6	China, People's Rep. of	43.6
India	21.4	India	15.3
Korea, Rep. of	6.1	Korea, Rep. of	14.7
Indonesia	4.7	Indonesia	5.4
Thailand	3.1	Hong Kong, China	3.7
Philippines	2.6	Thailand	3.4
Pakistan	2.1	Malaysia	2.4
Bangladesh	1.8	Singapore	2.3
Malaysia	1.5	Philippines	2.1
Viet Nam	1.4	Pakistan	2.1
Total	95.3	Total	95.0

Note: PPP estimates exclude Afghanistan; Bhutan; Cook Islands; Maldives; Marshall Islands; Palau; Taipei,China; Timor-Leste; and Tuvalu. Atlas estimates here exclude Taipei,China.

Sources: World Bank, *World Development Indicators* online database; *Asian Development Outlook* database.

Economic size

Comparing GNI data based on the Atlas and PPP methods confirms the difference in rankings. Table 4.2.1 shows the top 10 economies in terms of size (excluding Taipei,China), for each method. The People's Republic of China (PRC), India, Republic of Korea (Korea), and Indonesia are in the top four spots for both approaches, but rankings for Hong Kong, China; Philippines; and Thailand are more sensitive. Other country differences are also apparent.

Subregional and regional growth

These variations in weights result in different estimates of GDP growth for regional and subregional aggregates (Table 4.2.2). Growth estimates are higher under PPP because the PRC and India have higher PPP shares than Atlas shares and their growth rates are among the fastest in the region (Figure 4.2.1). Estimated regional growth in 2006, excluding Taipei,China, was 9.4% in PPP terms compared with only 8.5% using the Atlas method. (This difference is not sensitive to the inclusion of Taipei,China in the Atlas calculations.)

At the subregional level, the most significant differences are for East Asia. This is because of the larger weight given to rapidly growing PRC and a reduction in the weight for Korea, where growth is moderate.

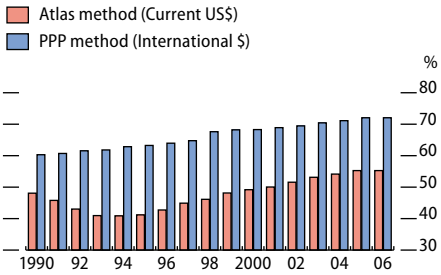
4.2.2 Subregional and regional GDP growth (%)

	2002	2003	2004	2005	2006
Atlas method (current $)					
Central Asia	8.7	9.4	9.8	11.1	12.4
East Asia	7.5	7.3	8.4	8.3	9.0
South Asia	3.7	7.8	7.4	8.7	8.8
Southeast Asia	4.8	5.3	6.4	5.6	6.0
The Pacific	0.4	1.8	3.6	2.6	2.6
Developing Asia	6.4	7.1	7.9	8.0	8.5
PPP method (current international $)					
Central Asia	8.6	9.1	9.6	11.3	12.7
East Asia	8.6	9.0	9.5	9.7	10.4
South Asia	3.7	7.9	7.4	8.7	8.9
Southeast Asia	4.9	5.6	6.3	5.6	5.9
The Pacific	0.7	0.7	3.2	2.7	2.2
Developing Asia	6.7	8.2	8.4	8.9	9.4

Note: PPP estimates exclude Afghanistan; Bhutan; Cook Islands; Maldives; Marshall Islands; Palau; Taipei,China; Timor-Leste; and Tuvalu. Atlas estimates here include Taipei,China.

Sources: World Bank, *World Development Indicators* online database; *Asian Development Outlook* database.

4.2.1 Shares of PRC and India to total GNI



Source: World Bank, *World Development Indicators* online database.

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Conclusions

The differences between the Atlas and PPP methods influence estimates of economic size and calculations of subregional and regional growth. The Atlas method smoothens fluctuations in income caused by changes in exchange rates, while the PPP method eliminates the effects of differences and changes in the relative price levels of goods and services.

In these growth computations, *ADO* uses Atlas-based GNI weights because the factors used in the calculation of country GNIs are more

timely, continuous, and less subject to statistical problems in aggregation procedures. With the PRC and India dominating overall GNI shares in PPP terms, the estimated growth for the region would be higher with the PPP than Atlas method.

Endnote

1 Since 2001, the G5 economies have comprised the euro zone (superseding two previous members, France and Germany), Japan, United Kingdom, and United States.

References

Asian Development Bank. 2007. "Purchasing Power Parity Preliminary Report." Economics and Research Department. A report prepared for the 2005 International Comparison Program in Asia and the Pacific. Available: http://www.adb.org/Documents/Reports/ICP-Purchasing-Power-Parity/Main-Report.pdf.

Asian Development Bank (various years). *Asian Development Outlook*. Manila.

World Bank. International Comparisons of Income website. Available http://go.worldbank.org/W51XUJ1QX0.

———International Comparison Program. Available: http://go.worldbank.org/MW520NNFK0