Global poverty estimates based on 2011 purchasing power parity: Where should the new poverty line be drawn?

Nanak Kakwani

Hyun H. Son

Global poverty estimates based on 2011 purchasing power parity:

Where should the new poverty line be drawn?[*]

Nanak Kakwani[†]

University of New South Wales, Australia

Hyun H. Son

Asian Development Bank

Abstract

This paper calculates a new global poverty line based on 2011 PPP. It moves away from the World Bank's method of anchoring a single global poverty line on the national poverty lines of the poorest countries. To calculate a new global poverty line based on 2011 PPP, the paper proposes the use of equivalent poverty lines. Each country has a different equivalent poverty line. The paper demonstrates that there is no single poverty line in 2011 PPP that is equivalent to $1.25 in 2005 PPP. Single poverty lines vary for each region since countries have experienced different inflation rates and have different PPP conversion rates between 2005 and 2011. To calculate a single poverty line in 2011 PPP, the paper measures the weighted average of equivalent poverty lines of 66 countries in Asia and Sub-Saharan Africa with weights proportional to their populations. The corresponding poverty line is calculated at $1.78 in 2011 PPP. Using the proposed global poverty line of $1.78 in 2011 PPP, the number of poor is reduced by 58.06 million with the reduction largely occurring in Asia.

1. Introduction

How many people are considered as poor in the world? This question may seem simple, but drawing a global poverty line demands an intricate analysis of subsistence needs, relative prices and purchasing power that vary across countries and over time. The World Bank recently refined its estimates of the purchasing power parity (PPP), which is a currency conversion for comparing the size and price levels of economies, by updating the base year from 2005 to 2011. The release of the 2011 PPP has sparked debates about how a new global poverty threshold should be established. This paper deals with the determination of new global poverty thresholds based on the 2011 PPP.

The change in PPPs should not sharply shift poverty counts. However, World Bank's calculations have shown otherwise. With the modification of 1993 PPP to the 2005 PPP, the number of poor in the world increased by about 500 million. Given the same absolute poverty line and distributions, such change in PPP conversions should not substantially increase the number of poor in the world. A large increase in poverty counts of about 500 million can only happen when the real poverty line has been adjusted upward. Nonetheless, updating PPP conversions can alter the poverty profiles across countries. Since countries have different sizes of population, global poverty counts can also change. For instance, if the change in PPPs increases the percentage of poor in large countries, the total number of poor in the world can increase.

Based on its most recent estimates, the World Bank has increased the poverty line from $1.25 in 2005 PPP to $1.82 in 2011 PPP. However, the corresponding increase in the number of poor for 2011 is only moderate. The number of poor in 2011 has increased from 1.01 billion to 1.038 billion, with a modest increase of only 28 million (Jolliffe and Prydz 2015).

The poverty line of $1.25 per person per day in 2005 PPP has been widely used by the international development community as a gauge of poverty reduction efforts. The poverty counts based on this poverty line have been the key indicator for assessing progress in Millennium Development Goals (MDGs). The United Nations' more recent Sustainable Development Goals have also adopted global poverty rates as a key indicator to assess economic development in the post-MDG era. The World Bank in 2013 announced a new goal of reducing the share of the world's population living in extreme poverty to no more than 3% by 2030. Given this wide adaptation, the poverty line of $1.25 will continue to be used as a benchmark for calculating global poverty rates.

The new 2011 PPP conversion rates cover more countries and are based on superior methodology and a more detailed coverage of price data. This provides an opportunity to improve the calculations of global poverty counts. In this context, it is pertinent to inquire into what the poverty line in 2011 PPP is equivalent to in the current poverty line of $1.25 in 2005 PPP. To calculate a single international poverty line based on 2011 PPP, this paper proposes a new methodology of equivalent poverty lines. This method is different from the World Bank's approach, which establishes a single poverty line for all countries based on the national poverty lines found in the poorest countries. The poverty counts for 22 major Asian countries and for almost all 44 Sub-Saharan Africa countries are then determined based on the new methodology. The resulting

poverty counts are more accurate than the estimates based on the newly proposed World Bank's poverty line.

2. Establishing Global Poverty Lines

The first serious attempt to calculate global poverty estimates based on an international poverty threshold dates back to 1990. Using a sample of national poverty lines from 33 countries and 1985 PPP exchange rates, the World Bank derived the $1-a-day poverty line. Since then, the $1-a-day threshold has been regarded the absolute minimum standard of living, below which basic needs cannot be possibly met.

The World Bank initially attempted to derive the $1-a-day[2] poverty line by fitting a cross-country semilogarithmic function that related a country's poverty line with its mean private consumption, both expressed in 1985 PPP dollars. Instead, the World Bank eventually decided to eye-ball the scatter plot of that equation after its econometric analysis failed to produce a reasonable yardstick. Using this eye-balling method, the poverty line of $31 per month (or $1 a day) was selected because the (duly converted) national poverty lines of eight of the poorer countries in the sample were very close to $1 a day, and thus was considered to be reflective of a poverty line that was *most typical* for poor countries.

Moreover, the sample of national poverty lines from 33 countries was gathered from various sources within and outside the World Bank. Many of them were estimates from independent researchers and could not be considered *official*. The sample also included wealthy countries – such as Australia, Belgium, Canada, Germany, Japan, and the United States (U.S.) – where absolute poverty is of little concern. Further, some countries had more than one poverty line for urban and rural areas. In these cases, the World Bank selected the lower line, whereas the correct procedure would have been to compute the weighted average of the two lines, with weights proportional to the total population in each area.

In late 1990s, the World Bank released the 1993 PPP exchange rates, which accounted for a much broader coverage of countries than the previous PPP. However, according to critics, the change in the base year from 1985 to 1993 lowered the international poverty line in real terms. The World Bank updated the international poverty line by calculating the median of the ten lowest poverty lines in its original sample of 33 countries based on the 1993 PPP. The resulting poverty line was $1.08 a day in 1993 PPP, which replaced the previous threshold of $1 a day. The ten countries with the lowest poverty lines were not necessarily countries with low incomes. Indonesia and Thailand, as well as Tunisia – a relatively better-off country with per capita consumption of $8 in 1993 PPP – were part of the ten countries.

By 2008, the World Bank had again updated the PPP estimates. By this time, it had already produced the 2005 PPP conversion factor. However, instead of converting the previous poverty line of $1.08 to 2005 prices, it redrew the global poverty line. The World Bank found that national poverty lines do not increase with per capita consumption until they reach about $60 per month, but rise notably thereafter. As a result, the World Bank set the new international poverty line of $1.25 a day in 2005 PPP, which is now regarded as the extreme poverty line. The $1.25-a-day

---

[2] To be precise, it was actually $1.02 a day.

poverty line is based on the mean of the poverty lines among the 15 poorest countries in terms of their per capita consumption. Those poorest countries were Mali, Malawi, Ethiopia, Sierra Leone, Niger, Uganda, Gambia, Rwanda, Guinea-Bissau, Tanzania, Tajikistan, Mozambique, Chad, Nepal, and Ghana. Table 1 presents the calculations of the new poverty lines for those 15 poorest countries.

Table 1: National Poverty Lines for 15 poorest countries in 2005 PPP and 2011 PPP			
Country	Population in 2011 (million)	2005 PPP	2011 PPP
Malawi	15.46	0.86	1.34
Mali	14.42	1.38	2.15
Ethiopia	89.39	1.35	2.03
Sierra Leone	5.87	1.69	2.73
Niger	16.51	1.10	1.49
Uganda	35.15	1.27	1.77
Gambia, The	1.73	1.48	1.82
Rwanda	11.14	0.99	1.56
Guinea-Bissau	1.62	1.51	2.16
Tanzania	46.35	0.63	0.88
Tajikistan	7.81	1.93	3.18
Mozambique	1.41	0.97	1.26
Chad	1.79	0.87	1.27
Nepal	27.16	0.87	1.52
Ghana	24.82	1.83	2.13
Total	300.63	1.25	1.82
Un-weighted		1.25	1.82
Weighted		1.19	1.74

Source: Authors' calculations based on the World Bank's national poverty lines.

Critics have raised concerns with this approach of redrawing the poverty line based on new data. Regarding the $1.25-a-day threshold based in 2005 PPP, they note that the group of countries changed with a new sample of national lines, which resulted in "graduation effects" when specific countries were taken out of the reference group (Bluhm, Crombrugghe, and Szirmai 2014). For instance, if Guinea-Bissau was left out of the reference group, the global poverty line would decrease and the global poverty would thus be reduced by more than 20 times than the population of Guinea-Bissau. In contrast, both the international poverty line and the global poverty headcount increased due to India being dropped out of the average. India was originally part of the previous rounds of PPP estimation, but it was taken out of the reference group as the country's average consumption crossed the threshold of $60 (Deaton 2010).

Using the national poverty lines as presented allows the global poverty line to reflect how the world's poorest countries estimate a minimum threshold that meets basic needs. However, this is contradicted by the fact that the countries included in the reference group are not the poorest in the world. Of the 15 countries, 13 are in Sub-Saharan Africa and the remaining two, Nepal and

Tajikistan, are in Asia. Tajikistan cannot be deemed one of the poorest countries, with its percentage of poor equal to 6.04%.

A strong critique of this approach based on the 15-country reference group was laid out by Deaton (2010). It was correctly pointed out that these countries provide weak support for representing the world's poor. The national poverty lines from the 15 countries were gathered from various sources within and outside the World Bank that were built upon different methodologies. In fact, many estimates are from independent researchers and thus cannot be considered *official*. The methodology for constructing a minimum threshold for living standards is complex, and many countries often adopt such thresholds on *ad hoc* basis. Moreover, as poverty lines for some countries in the reference group were constructed more than two decades ago, they may not reflect the current level of living standards appropriately.

In essence, the PPP conversion factors are exchange rates used in order to maintain the real value of the poverty line (Jolliffe and Prydz 2015). Of the 15 countries, Tanzania has the lowest poverty line of $0.63 while Tajikistan has the highest at $1.93 (Table 1). This implies that the basic needs in Tajikistan are more than three times greater than those in Tanzania. If those poverty lines had appropriately reflected the cost of absolute basic needs, they should not have varied widely from one country to another. The basic needs, as reflected by the poverty lines, are different across countries. Thus, the large variation in the real poverty lines suggests that there are other country-specific factors, affecting the national poverty lines. Given this, the World Bank's assumption that the national poverty lines measure the cost of absolute basic needs may be implausible.

Aside from the PPP conversion factors, the global poverty line also depends crucially on the inflation rates between the survey year and 2011 in each of the 15 countries. To illustrate, the inflation rate in Mali will have an impact on the number of poor in China through the poverty line constructed globally. Thus, it can be said that the global poverty line has been heavily influenced by a few small countries in Sub-Saharan Africa. This is the main reason why a methodology of drawing the global poverty line can lead to peculiar results – a case in point is the increase in the number of poor in the world by 500 million, as had happened in modifying the 1993 PPP to the 2005 PPP.

3. Producing Global Poverty Estimates

In the development community, the World Bank's Povcal is widely used to calculate global poverty estimates based on any global poverty line. As commonly perceived, global poverty lines are determined using PPPs. The International Comparison Program, which was established in early 1970s, calculates PPP estimates by gathering data on prices and expenditures for a wide range of final goods and services used in the compilation of gross domestic product.

PPP estimates have undergone many rounds of revisions, with their base year being 1985, 1993, 2005, and 2011. While the 2005 round covered 146 countries, the 2011 round expanded to 177 countries. The International Comparison Program included data from 150 developing countries in its 2011 round, in comparison to 100 countries from the previous round, 2005. Given the coverage on a larger number of countries, the 2011 PPP conversion factors are better suited for estimating and comparing poverty across countries.

5

The current benchmark of $1.25 a day in 2005 PPP is the most-widely used poverty line. To use the 2005 PPP conversion rates, one would need to calculate the local currency equivalent of the $1.25 benchmark in 2005 prices, and then adjust for inflation between 2005 and the year in which the latest household survey was conducted in a particular country. Individual poverty rates can then be estimated for the years when household surveys were conducted. These poverty rates are comparable across countries because the poverty line in these calculations implies the same minimum standards of living across countries. The resulting poverty counts for individual countries can be aggregated to produce estimates for the number of poor around the globe in that particular year.

4. The Poverty Line in 2011 PPP: World Bank's Method

Global poverty counts depend on both PPP exchange rates and national consumer price indices (CPIs). Povcal calculates poverty estimates based on 2005 PPP. With the release of 2011 PPP, new global poverty estimates will be produced to account for changes in the living cost for the world's poor. Given the World Bank's new development agenda to eliminate extreme poverty by 2030, updating poverty estimates based on 2011 PPP would be crucial.

It is important to determine what the poverty line in 2011 PPP equivalent is to the current poverty line of $1.25 in 2005 PPP. Despite many criticisms, the World Bank continues to use the average of the national poverty lines from the 15 poorest countries in order to estimate the equivalent poverty line in 2011 PPP (Table 1). The mean value of these poverty lines is $1.25 in 2005 PPP and $1.82 in 2011 PPP. Given this, the World Bank has set its new global poverty line at $1.82 in 2011 PPP, which allows one to buy the same bundle of goods in 2011 as those purchased with $1.25 in 2005 PPP. This approach sounds intuitive, but the problem lies with the bundle itself, which fails to reflect the cost of absolute basic needs.

The simple mean value of poverty lines used in calculating the global poverty line is presented in Table 1. Hence, all countries are given an equal weight irrespective of their size of population. For instance, Mozambique, with its population of 1.41 million, is given exactly the same weight as Ethiopia, with its population of 89.39 million. However, the correct method would be to have calculated the weighted average of national poverty lines with weights proportional to each country's population. Based on the weighted approach, the global poverty line would be $1.19 in 2005 PPP and $1.74 in 2011 PPP, which would imply much lower global poverty counts. It is difficult to find a plausible explanation as to why the World Bank arrived at the global poverty line by taking the simple average for the national poverty lines of 15 selected countries.

To calculate a single global poverty line based on 2011 PPP, this paper proposes a new methodology of equivalent poverty lines. This approach differs from the World Bank's. The next section discusses this new method.

5.   Equivalent Poverty Lines: An Alternative Method

The World Bank's approach of drawing a single global poverty line for all countries is anchored on national poverty lines of the poorest 15 economies, of which 13 are in Sub-Saharan Africa.

However, critics stress that anchoring the global poverty line on the lines of a group of poor countries does not provide a reliable indicator of what constitutes poverty for poor people around the world (Pogge 2010). In updating the global poverty line in 2011 PPP, there should be no need to revisit the national poverty lines of the 15 countries, given this new idea of equivalent poverty lines to be discussed in this section.

The poverty lines based on 2005 and 2011 PPP are said to be equivalent if they produce exactly the same poverty rates. The methodology of estimating equivalent poverty lines is explained in Appendix 1. The calculations can be performed if CPIs and PPP conversions rates for 2005 and 2011 are known. Tables A.1 and A.2 in Appendix 2 provide estimates for 22 Asian countries and 44 Sub-Saharan countries, respectively. These estimates show that, given the 2011 PPP, the equivalent poverty line, which supposedly corresponds to $1.25 in 2005 PPP, is not unique for all countries; each country has its own equivalent poverty line depending on the country's 2011 PPP conversion and inflation rates.

The idea of an equivalent poverty line can be illustrated as follows. The equivalent poverty line for India is calculated equal to $2.01 and the new PPP conversion rate in 2011 is 15.1 rupees (Rs) per dollar, thereby resulting in a poverty line of Rs30.32 per person per day in the local currency. After adjusting for inflation, this poverty line is estimated to be equal to Rs18.32 per person per day in 2005. The PPP exchange rate for India in 2005 was Rs 14.67 per dollar. Dividing the poverty line in the local currency in 2005 by the 2005 PPP exchange rate produces an international poverty line of $1.25 in 2005 PPP. Therefore, the poverty line of $2.01 in 2011 PPP is equivalent to the poverty line of $1.25 in 2005 PPP.

The main message from the estimates shown in Tables A.1 and A.2 is that the equivalent poverty line is not the same for all countries. The World Bank has recently announced a single poverty line of $1.82 in 2011 PPP for all countries. However, as the $1.82 poverty line in the new PPP is not equivalent to the $1.25 poverty line in 2005 PPP, the rankings of countries by their poverty estimates based on the two PPPs will change accordingly.

It has been suggested that the equivalent poverty line should be calculated based on the inflation rate of the U.S. The U.S. inflation rate averaged 15.2% during 2005–2011, which gives a single equivalent poverty line of $1.44 in 2011 PPP. However, Appendix 1 demonstrates that this method is problematic because it estimates poverty counts only if the 2011 PPP conversion rates are equal to the 2005 PPP when adjusted for the relative inflation rates of comparator countries to the U.S. Thus, a single poverty line of $1.44 cannot be adopted in 2011 PPP.

6.   The Appropriate Poverty Line and Global Poverty Counts under 2011 PPP

There is no single poverty line from the new 2011 PPP that is equivalent to $1.25 in 2005 PPP. If a single poverty line is required, then the weighted average of equivalent poverty lines for all 66 countries, with weights proportional to their population, can be used as a single global poverty line in 2011 PPP. As a result, the weighted average for all 22 Asian countries is calculated equal to $1.80 in 2011 PPP (Table A.1 in Appendix 2); similarly, the weighted average for all 44 Sub-Saharan countries is $1.67 in 2011 PPP (Table A.2 in Appendix 2). As the results show, single poverty lines in 2011 PPP are vastly different for Asia and Sub-Saharan Africa. This is because

countries in the two regions have experienced different inflation rates and also different PPP conversion rates between 2005 and 2011. If a single poverty line is required for all 66 countries, then the weighted average of the two poverty lines, with weights proportional to the population of each region, can be calculated. The resulting poverty line calculated is equal to $1.78 in 2011 PPP.

Having decided on poverty lines, the next step is to calculate poverty rates and the number of poor. The poverty rates are calculated for individual countries in Asia and Sub-Saharan Africa using the World Bank's Povcal program. The aggregate poverty rates for Asia and Sub-Saharan Africa are then obtained using weighted means with weights proportional to each country's population. This paper compares the poverty rates and number of poor based on its proposed poverty line of $1.78 and Jolliffe and Prydz's suggested poverty line of $1.82, both in 2011 PPP, with those based on $1.25 in 2005 PPP.

Many interesting results emerge from comparisons at the country level. One striking result is about the comparison of poverty incidence in India and China. Based on the poverty line of $1.25 in 2005 PPP, 24.67% of India's population lived in poverty in 2011 (with the number of poor equal to 301 million), while in China only 6.26 % were poor in the same year (with the number of poor equal to 84.14 million). When the calculations are performed using the $1.78 poverty line in 2011 PPP, India's poverty reduced to 16.98% (with the number of poor equal to about 207 million), while poverty in China increased to about 10% (with the number of poor equal to 135 million). The huge gap in poverty incidence between India and China has narrowed substantially. The change in PPP has appeared to favor India and disfavor China.

Table 2 provides an aggregate summary of poverty rates and the number of poor for Asia and Sub-Saharan Africa.[3] Based on the poverty line of $1.25 in 2005 PPP, the total number of poor in Asia and Sub-Saharan Africa is 931 million, while the total number of poor in the world is 1.011 billion. Almost 92% of the world's poor are concentrated in the two regions, with total populations amounting 4.358 billion. The incidence of extreme poverty outside these two regions is almost negligible.

The proposed global poverty line of $1.78 in 2011 PPP has led to a reduction in the number of poor by 58.06 million. The reduction has largely occurred in Asia where the number of poor is reduced by 85 million, but at the same time the number of poor in Sub-Saharan Africa has increased by about 27 million. The percentage of poor Asia is reduced to 12.95%. In contrast, Sub-Saharan Africa saw an increase in poverty rate from 46.94% to 50.2% mainly because of the change in PPP conversion rates in 2011.

The World Bank's poverty line of $1.82 in 2011 PPP has been largely driven by the national poverty lines in Sub-Sahara Africa. When this line is applied to Sub-Saharan Africa, the number of poor has increased by 38.5 million when compared with the number of poor based on the poverty line of $1.25 in 2005 PPP. Such widening gap suggests that the World Bank's new poverty line of $1.82 in 2011 PPP may have been an overestimation.

Another way of assessing the precision of the poverty lines is by calculating the absolute mean deviation of poverty rates based on poverty lines in 2005 and 2011 PPP. When the World Bank's

---

[3] See also Tables A.3 and A.4 in Appendix 2.

poverty line of $1.82 in 2011 PPP is applied to Sub-Saharan Africa, the value of absolute mean deviation is estimated at 6.71 percentage points. In contrast, the poverty line of $1.78 in 2011 PPP derived in this paper has yielded the value of absolute mean deviation equal to 5.91 percentage points.

Table 2: Poverty estimates in Asia and Sub-Saharan Africa in 2011			
	Asia	Sub-Saharan Africa	Total
Population (million)	3,530.63	827.66	4,358.29
	Poverty line: $1.25 in 2005 PPP		
% of poor	15.36	46.94	21.36
Number of poor (million)	542.34	388.52	930.86
Poverty line	Poverty line: $1.82 in 2011 PPP		
% of poor	13.76	51.59	20.95
Number of poor (million)	485.97	427.02	913.00
Change in % of poor	-1.60	4.65	-0.41
Change in number of poor	-56.37	38.50	-17.87
Absolute Mean Deviation	5.07	6.71	5.38
	Poverty line: $1.78 in 2011 PPP		
% of poor	12.95	50.20	20.03
Number of poor (million)	457.32	415.48	872.80
Change in % of poor	-2.41	3.26	-1.33
Change in number of poor	-85.02	26.96	-58.06
Absolute Mean Deviation	5.46	5.91	5.55

Source: Authors' calculations.

7.   Conclusion

The release of 2011 PPP exchange rates should give a better picture of the extent of global poverty by accounting for changes in the poor's cost of living. The refined estimates of the PPP provide a window of opportunity to update the global poverty line.

This paper provides an alternative to the World Bank's method of anchoring a single global poverty line on the national poverty lines of the poorest countries. The World Bank's method assumes that national poverty lines measure the cost of absolute basic needs, while the basic needs as reflected by the national poverty lines are different for each country. Other country-specific factors that determine national poverty lines cause variation in real poverty lines.

To calculate a new global poverty line based on 2011 PPP, this paper proposes the use of equivalent poverty lines. This paper finds that there is no single poverty line in 2011 PPP that is equivalent to $1.25 in 2005 PPP. Single poverty lines vary for each region since countries have experienced different inflation rates and have different PPP conversion rates between 2005 and 2011. Thus, in this paper, the weighted average of equivalent poverty lines of 66 countries in Asia and Sub-Saharan Africa were calculated with weights proportional to their populations. It was estimated that the corresponding poverty line is at $1.78 in 2011 PPP.

Using the proposed global poverty line of $1.78 in 2011 PPP, the number of poor was drastically reduced by 58.06 million with the reduction largely occurring in Asia. In contrast, the number of poor increased in Sub-Saharan Africa primarily due to the change in the PPP conversion rates in 2011.

The incidence of poverty and the number of poor vary across countries when the base changes from 2005 to 2011, as estimated in this study. The gap in poverty between India and China narrowed substantially when the 2011 PPP was used. With lower poverty in India than China, the change in PPP appeared to have favored India over China. These findings rebuff the arguments presented by Jolliffe and Prydz (2015), which erroneously reject the idea of equivalent poverty lines in determining the global poverty line based on 2011 PPP. It was wrongly asserted that the new methodology of equivalent poverty line produces exactly the same poverty rates and number of poor for each country irrespective of the 2005 or 2011 PPP.

More importantly, it was shown in this paper that the change in PPP conversions should not drastically alter world poverty estimates given the same absolute poverty line and the same income distributions. Had the World Bank used equivalent poverty lines, the dramatic increase in world poverty count by 500 million upon the change in the PPP base year from 1993 to 2005 would not have occurred.

REFERENCES

Bluhm R., D. Crombrugghe, and A. Szirmai. 2014. Poor trends – The pace of poverty reduction after the Millennium Development Agenda. MERIT Working Papers 006, United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology.

Jolliffe, D. and E. Prydz. 2015. "Global Poverty Goals and Prices: How Purchasing Poverty Matters" *WPS 7256 Policy Research Working Paper 7256*. Washington D.C.: World Bank

Deaton, A. 2010. Price indexes, inequality, and the measurement of world poverty. *American Economic Review* 100 (1), pp. 1–34.

Pogge, T. 2010. *Politics as Usual: What Lies Behind Pro-Poor Rhetoric*. Cambridge: Polity Press.

APPENDIX 1

The equivalent poverty lines based on 2005 and 2011 PPP are derived in this section. If the extreme poverty line in 2005 at 2005 PPP was $1.25 per person per day, then what would be the equivalent poverty line in 2011 at 2011 PPP? The following definitions are presented below:

- PPP (2005): Purchasing power parity in 2005
- PPP (2011): Purchasing power parity in 2011
- PLLOCAL (2005): Poverty line in local currency in 2005
- PLLOCAL (2011): Poverty line in local currency in 2011
- CPI (2005): Consumer price index in 2005
- CPI (2011): Consumer price index in 2011
- PLUSA (2005, 2005 PPP): Poverty line in U.S. dollars in 2005 PPP
- PLUSA (2011, 2011 PPP): Poverty line in U.S. dollars in 2011 PPP

The following relations will hold:

$$PLLOCAL\ (2005) = PLUSA\ (2005, 2005\ PPP) \times PPP(2005) \tag{1}$$

$$PLLOCAL(2011) = PLUSA(2011, 2011\ PPP) \times PPP(2011) \tag{2}$$

Adjusting the poverty lines in local currency for inflation in the country gives:

$$PLLOCAL(2011) = PLLOCAL(2005) \times CPI(2011)/CPI(2005) \tag{3}$$

Substituting (1) and (2) into (3) gives:

$$PLUSA(2011, 2011\ PPP) = PLUSA(2005, 2005\ PPP) \times \left[\frac{PPP(2005)}{PPP(2011)}\right] \times \left[\frac{CPI(2011)}{CPI(2005)}\right]$$

This equation gives the two poverty lines: PLUSA (2005, 2005 PPP) and PLUSA (2011, 2011 PPP), which are equivalent because they imply the same real poverty lines in local currency in 2005 and 2011. If PLUSA (2005, 2005 PPP) is set equal to $1.25, then the equivalent poverty line in 2011 in 2011 PPP will be given by

$$PL(2011) = 1.25 \times \left[\frac{PPP(2005)}{PPP(2011)}\right] \times \left[\frac{CPI(2011)}{CPI(2005)}\right] \tag{4}$$

PL (2011) is the international poverty line in 2011, which provides the same poverty rates as $1.25 a day in 2005. It is noted from (4) that PL (2011) is not unique for all countries, and varies with inflation rates in the country between 2005 and 2011, as well as PPP rates in 2005 and 2011. A country with a high inflation rate will give a higher poverty line in 2011. Similarly, if the PPP exchange rate for the country appreciates in 2011 relative to that in 2005, the poverty line will also be higher. Therefore, there exists no single equivalent poverty line in 2011 PPP as is generally implied.

PPP (2011) is the PPP exchange rate in 2011, which has recently been estimated by the International Comparison Program. If PPP (2011) were not available, then one could still calculate the exchange rates using the 2005 PPP as

$$EX(2011, 2005\ PPP) = PPP(2005) \times \left[\frac{CPI(2011)CPI_R(2005)}{CPI(2005)CPI_R(2011)} \right] \qquad (5)$$

where $CPI_R(2005)$ and $CPI_R(2011)$ are the consumer price index for the reference country (U.S.) in 2005 and 2011, respectively. The exchange rate in 2011 in a country is determined by the relative inflation rates in the country to that of U.S. Equating this exchange rate to PPP (2011), equations (4) and (5) yield

$$PL(2011) = 1.25 \times \left[\frac{CPI_R(2011)}{CPI_R(2005)} \right]$$

which shows that the poverty line in 2011 equivalent to the poverty line of $1.25 depends on the inflation rate in the U.S.: the larger the inflation rate, the larger the poverty line in 2011. It has therefore been suggested that the equivalent poverty line should be calculated based on the rate of inflation in the U.S. But this method is problematic because it estimates poverty counts only under the highly restricted assumption that the 2011 PPP conversion rates are equal to the 2005 PPP rates when adjusted for the relative inflation rates of comparator countries to the U.S.

APPENDIX 2

Table A.1: Equivalent Poverty Lines in 2011 PPP for Asia corresponding to $1.25 in 2005 PPP						
Country	Population in 2011	2005 CPI	2011 CPI	2005 PPP	2011 PPP	Equivalent Poverty line
Bangladesh	152.86	69.2	110.7	22.64	23.15	1.96
Bhutan	0.73	74.8	108.8	15.74	16.86	1.70
India	1,221.16	65.8	108.9	14.67	15.11	2.01
Maldives	0.33	72.3	112.8	8.13	8.53	1.86
Nepal	27.16	66.3	109.3	22.65	24.63	1.90
Pakistan	176.17	55.3	111.9	19.10	24.35	1.98
Sri Lanka	20.87	58.3	106.7	35.17	38.65	2.08
Cambodia	14.61	67.8	105.5	1278.55	1347.11	1.85
China	1,344.13	86.6	105.4	3.45	3.51	1.50
Fiji	0.87	79.0	108.7	1.43	1.04	2.36
Indonesia	243.8	68.7	105.4	3934.26	3606.57	2.09
Lao PDR	6.52	78.5	107.6	2988.38	2467.75	2.07
Malaysia	28.76	87.7	103.2	1.73	1.46	1.75
Philippines	95.05	78.7	104.6	21.75	17.85	2.03
Thailand	66.58	86.6	103.8	15.93	12.37	1.93
Timor-Leste	1.18	74.4	113.5	0.47	0.52	1.73
Vietnam	87.84	59.9	118.7	4712.69	6709.19	1.74
Armenia	2.96	76.4	107.7	178.58	187.10	1.68
Azerbaijan	9.17	61.1	107.9	0.33	0.36	2.03
Kazakhstan	16.56	61.7	108.3	57.61	80.17	1.58
Kyrgyz Republic	5.51	59.8	116.5	11.35	17.76	1.56
Tajikistan	7.81	58.9	112.4	0.74	1.74	1.02
Total	3531					1.80

CPI = consumer price index; PPP = purchasing power parity.
Source: Authors' calculations.

Table A.2: Equivalent Poverty Lines in 2011 PPP for Sub-Saharan Africa corresponding to $1.25 in 2005 PPP						
Country	Population in 2011	2005 CPI	2011 CPI	2005 PPP	2011 PPP	Equivalent Poverty line
Benin	9.78	84.3	102.7	219.58	214.03	1.56
Botswana	1.99	64.3	108.5	2.42	3.76	1.36
Burkina Faso	16	86.9	102.8	200.23	213.66	1.38
Burundi	9.54	61.3	109.7	342.96	425.77	1.80
Cabo Verde	0.49	82.6	104.5	69.36	48.59	2.26
Cameroon	21.16	85.7	102.9	251.02	227.21	1.66
CFR	4.44	80.9	101.3	263.74	255.86	1.61
Chad	12.08	85.6	96.3	208.00	250.44	1.17

Country						
Comoros	0.7	84.4	101.8	226.19	207.58	1.64
Congo DR	63.93	58.6	115.3	214.27	521.87	1.01
Congo Republic of	4.23	77.0	101.3	268.76	289.30	1.53
Cote d'Ivoire	19.39	87.7	104.9	287.49	228.23	1.88
Ethiopia	89.39	44.8	133.2	2.25	4.92	1.70
Gabon	1.59	88.7	101.3	256.23	318.16	1.15
Gambia, The	1.73	81.1	104.8	7.56	9.94	1.23
Ghana	24.82	52.9	108.7	0.37	0.70	1.37
Guinea	11.16	42.2	121.4	1219.35	2518.39	1.74
Guinea-Bissau	1.62	84.2	105.0	217.30	220.08	1.54
Kenya	42.03	55.5	114.0	29.52	34.30	2.21
Lesotho	2.03	70.9	105.0	3.49	3.92	1.65
Liberia	4.08	61.8	108.5	28.12	37.35	1.65
Madagascar	21.68	63.0	109.5	649.57	673.73	2.10
Malawi	15.46	64.2	107.6	39.46	76.26	1.08
Mali	14.42	85.9	102.9	240.09	210.19	1.71
Mauritania	3.7	75.2	105.6	98.84	115.85	1.50
Mauritius	1.29	72.9	106.5	14.68	15.94	1.68
Mozambique	24.58	63.6	110.4	10.91	16.03	1.48
Namibia	2.22	71.4	105	4.26	4.66	1.68
Niger	16.51	88.5	102.9	226.66	221.09	1.49
Nigeria	164.19	61.9	110.8	60.23	74.38	1.81
Rwanda	11.14	67.0	105.7	186.18	260.75	1.41
Sao Tome	0.18	38.5	111.9	5558.09	8527.16	2.37
Senegal	13.33	87.3	103.4	251.67	236.29	1.58
Seychelles	0.09	54.1	102.6	3.39	6.69	1.20
Sierra Leone	5.87	58.5	116.2	1074.12	1553.14	1.72
South Africa	51.58	71.6	110.9	3.87	4.77	1.57
Sudan	36.43	60.0	122.1	1.08	1.22	2.25
Swaziland	1.21	69.5	106.1	3.29	3.90	1.61
Tanzania	46.35	66.3	112.7	395.63	522.48	1.61
Togo	6.47	84.7	106.3	240.38	215.06	1.75
Uganda	35.15	66.7	118.7	619.64	833.54	1.65
Zambia	13.63	59.9	106.4	2.41	2.38	2.25
Total	827.66					1.67

CPI = consumer price index; PPP = purchasing power parity.
Source: Authors' calculations.

Table A.3: Poverty estimates for different poverty lines for Asia in 2011				
Country	$1.25 in 2005 PPP	$1.78 in 2011 PPP	$1.80 in 2011 PPP	$1.82 in 2011 PPP
Bangladesh	39.56	32.59	33.24	33.88

Bhutan	3.01	3.82	4.12	4.27
India	24.67	16.98	17.51	18.05
Maldives	0.02	0.02	0.01	0.02
Nepal	25.41	21.57	22.54	23.03
Pakistan	12.74	7.25	7.62	8.39
Sri Lanka	2.84	1.18	1.24	1.31
Cambodia	10.05	8.22	8.94	9.3
China	6.26	10.08	10.25	10.58
Fiji	3.26	0.91	0.95	1
Indonesia	16.2	9.11	9.88	10.27
Lao PDR	31.15	21.74	22.27	23.32
Malaysia	0	0	0	0
Philippines	18.6	13.33	13.69	14.05
Thailand	0.29	0.14	0.19	0.2
Timor-Leste	33.16	35.54	36.14	36.73
Vietnam	4.96	5.5	5.68	6.06
Armenia	2.45	3.14	3.21	3.32
Azerbaijan	0.31	0.23	0.23	0.23
Kazakhstan	0.03	0.09	0.09	0.1
Kyrgyz Republic	5.11	7.93	8.25	8.51
Tajikistan	6.04	29.99	30.66	31.22
Total	15.36	12.95	13.33	13.76
Number of poor	542.34	457.32	470.63	485.97

PPP = purchasing power parity.
Source: Authors' calculations.

Table A.4: Poverty estimates for different poverty lines for Sub-Saharan Africa in 2011			
Country	$1.25 in 2005 PPP	$1.67 in 2011 PPP	$1.78 in 2011 PPP	$1.82 in 2011 PPP
Benin	51.61	55.34	58.37	59.8
Botswana	10.02	15.92	17.65	18.27
Burkina Faso	40.8	52.44	56.37	57.48
Burundi	79.79	76.44	79.1	80.12
Cabo Verde	11.87	4.2	5.6	6.02
Cameroon	24.94	25.32	28.36	29.48
CFR	56.68	58.05	60.96	61.87
Chad	36.53	54.67	58.1	59.19
Comoros	48.18	48.83	51.33	52.53
Congo DR	84.01	93.92	94.63	94.87
Congo Republic of	32.82	37.13	40.25	41.27
Cote d'Ivoire	37.31	31.82	34.59	35.76
Ethiopia	36.79	35.65	40.22	44.72

Gabon	5.39	15.83	18.22	19.02
Gambia, The	34.02	48.45	51.5	52.56
Ghana	18.02	25.45	28.1	29.16
Guinea	41.28	38.68	42.81	44.31
Guinea-Bissau	48.66	54.22	57.95	59.73
Kenya	38.03	25.31	28.31	29.15
Lesotho	45.7	46.21	48.61	49.45
Liberia	70.91	71.16	74.57	75.71
Madagascar	87.83	81.41	83.29	84.01
Malawi	71.56	86.94	88.39	88.92
Mali	50.83	49.17	53.5	55.05
Mauritania	23.54	28.46	31.91	32.92
Mauritius	0.39	0.38	0.45	0.48
Mozambique	55.77	62.48	66.15	67.18
Namibia	21.98	21.65	24.24	25.17
Niger	40.81	49.88	54.81	56.88
Nigeria	60.08	55.73	59.25	60.49
Rwanda	63.02	70.95	73.71	74.72
Sao Tome	42.19	22.24	25.53	26.62
Senegal	34.06	36.9	40.45	41.61
Seychelles	0.2	0.69	0.9	1
Sierra Leone	56.63	54.97	59.28	60.29
South Africa	9.42	11.59	13.89	14.63
Sudan	17.21	8.01	9.58	10.13
Swaziland	39.84	41.15	44	44.91
Tanzania	43.48	46.11	50.14	51.59
Togo	52.46	50.18	53.2	54.27
Uganda	36.95	37.38	41.18	42.4
Zambia	73.19	62.61	64.99	65.73
Total	46.94	47.08	50.20	51.59
Number of poor	388.52	389.64	415.48	427.02

PPP = purchasing power parity.
Source: Authors' calculations.