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**Comparing Alternative
Measures of Poverty:**

**Assets-Based Wealth Index vs.
Expenditures-Based Poverty Score**

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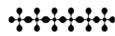
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**Comparing Alternative Measures of Poverty:**

**Assets-Based Wealth Index vs. Expenditures-Based Poverty Score**

Karen G. Fleischman Foreit[*] and Mark Schreiner[†]

# Abstract

How comparable are different measures of poverty?  In the economic literature, poverty is often measured by income or expenditures. National health surveys, such as a Demographic and Health Survey (DHS), do not routinely collect data on household expenditures but rather estimate relative wealth by analyzing household assets and housing characteristics. This paper assesses the predictive validity of using DHS data to assign expenditures-based poverty rankings to households and individuals, using countries for which there are contemporaneous expenditures surveys and a DHS.  The estimates come from a three-step method. First, potential poverty indicators are matched between the expenditures survey and the DHS. Second, a poverty scorecard is constructed based on data from the expenditures survey, using only indicators that appear in both that survey and the DHS. Third, the scorecard is applied to the DHS to produce estimates of expenditures-based poverty.

Three countries were analyzed: Bangladesh, Ethiopia, and Malawi. After matching items between DHS and expenditures surveys, the estimated proportions of people living below the poverty line of $1.25 a day purchasing power parity (PPP) were comparable between the DHS and the expenditures surveys.  When we compared individuals' assets-based wealth quintile with their expenditure-based poverty scorecard quintile, the assets-based wealth quintiles correlated positively with expenditures-based poverty scores. Marked differences between countries were also found.  Appreciable mismatch between the two poverty measures could be seen, most notably in the case of Ethiopia where more than a third of the individuals in each assets-based wealth index quintile were ranked two or more quintiles above or below that quintile on the expenditures-based poverty scorecard.

We conclude that assets-based wealth indices do not consistently track well against expenditure-based measures of poverty and should not be used to identify individuals or households living below consumption- or expenditures-based poverty thresholds.  We also recommend that future DHS country surveys harmonize the selection, wording and response categories of questions on household assets and dwelling characteristics with national expenditure surveys, and vice-versa.

# Introduction

While there is wide consensus on the need to reduce poverty-related inequalities in health, there is equally wide variation in the definition of poverty itself. This is a serious issue for analysts, policy-makers, and program planners alike. As Laderchi, Saith, and Stewart (2003) point out, "different definitions of poverty imply the use of different indicators for measurement; they may lead to the identification of different individuals and groups as poor and require different policy solutions for poverty reduction." Even within the monetary definition of poverty, there are different measurement methods. The present paper assesses the comparability of two monetary measures — one based on household ownership of durable assets and the other on correlates of household expenditures.

First pilot-tested in the late 1990's, the household assets-based wealth index is now a standard indicator in Demographic Health Surveys (DHS) and other similar national surveys.[1] The index is constructed by introducing household assets, utilities and housing construction variables into a principal components analysis (PCA) and computing a wealth index for each household. National wealth quintile cut-points are determined from the weighted frequency distribution of households and each household member assigned his/her household's quintile category (Rutstein & Johnson, 2004). This process simply finds the linear combination that maximizes the explained variation among the assets indicators without reference to any other conceptualization of poverty.

Disaggregation of survey health outcomes across wealth-index quintiles provides a quick snapshot of poverty-related inequalities in use of health services and health outcomes. Figure 1 below demonstrates trends in sub-Saharan Africa for use of a modern family planning method and for births in a health facility. In general, the lines slope upwards from the lowest wealth-index quintile to the highest, showing that poorer people are less likely to use health services. Measures of relative wealth can also be used to quantify poverty-related inequalities in health through indicators such as the concentration index.[2]

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[1] See http://www.measuredhs.com/topics/wealth/start.cfm.
[2] See PSI Research Division, 2007, available at
http://www.psi.org/sites/default/files/publication_files/Concentration-Index-Toolkit.pdf.

**Figure 1: Poverty-related health service utilization trends in sub-Saharan Africa.**[3]
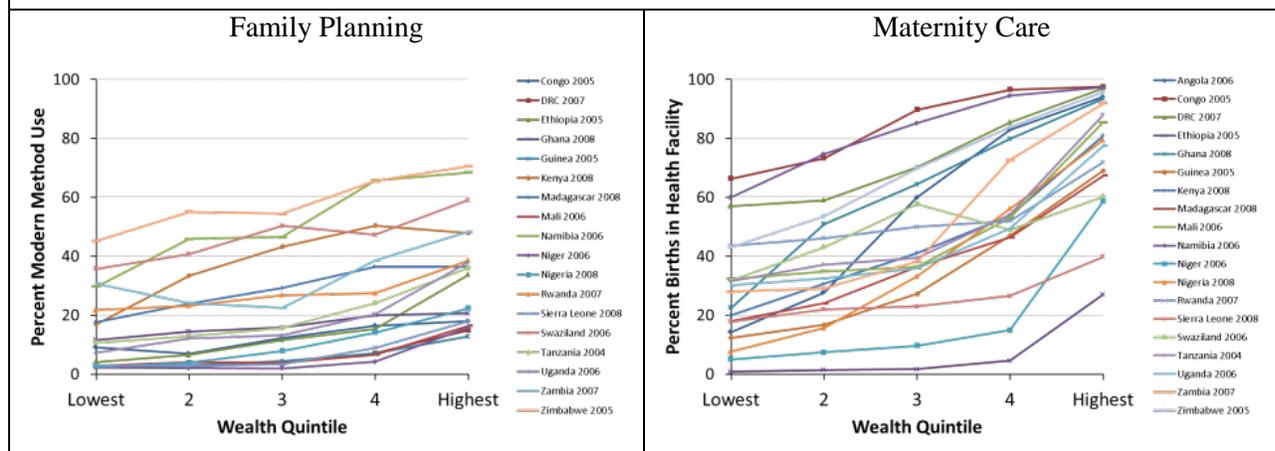


In contrast, most poverty reduction programs and development efforts focus on absolute poverty: individuals and households living below an expenditure-based poverty threshold such as $1.25 a day purchasing power parity (PPP), $2.50 a day, or the national poverty line. Rutstein and Johnson (2004) propose that the assets-based wealth index can be used to analyze absolute poverty line differences by replacing the quintile cut-points with the percentage distribution of the population living in poverty.[4]

The bulk of the evidence does suggest that both assets-based and expenditure-based measures produce similar poverty-related inequality gradients in health and welfare. Wagstaff and Watanabe (2003) compared the gradient between poverty rankings and under-five stunting and underweight for an asset index versus reported expenditure in 19 countries. They concluded, "It seems for the most part to make little difference to the measured degree of socio-economic inequalities in malnutrition among under-five children whether one measures SES by consumption or by an asset-based index." Sahn and Stifel (2003) looked at the gradient of stunting with an asset index versus both reported and predicted expenditure in 10 countries and concluded that "in the context of estimating models of nutrition, we find no compelling reason to believe that either reported or instrumented [predicted] expenditures serve as a better proxy for economic welfare than does the asset index." Filmer and Scott (2008) analyzed data from national expenditure surveys in 11 countries that covered both expenditure and health; they concluded that "inferences about inequalities in education, health care use, fertility, child mortality, and labor-market outcomes are quite robust to the specific economic status measure used." A few studies found steeper

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3   Source: Macro International Inc, 2011. MEASURE DHS STATcompiler. http://www.measuredhs.com, accessed June 14 2011.

4   "The national quintile distribution can be made compatible with a national absolute poverty line if data are available on the percentage of the population below the absolute poverty line. This same percentage can then be used in a distribution of households on a relative index basis, such as the wealth index." (Rutstein & Johnson, 2004:6).

gradients in outcomes for the asset index than for reported expenditures (Lindelow, 2006; Filmer & Pritchett, 2001; Bollen, Glanville & Stecklov, 2007).

While at the aggregate level there seems to be little systematic difference between the two poverty measures, are they interchangeable at the individual level? In other words, do individuals ranked at the bottom of the assets-based wealth index also have the lowest per-capita expenditures?

There appears to be only one national survey in the literature that includes household assets, detailed information on household expenditures and detailed health information, all in the same survey. A 2004 survey in Ecuador of maternal and child health (Centro de Estudios de Población y Desarrollo Social, 2005) included both household assets and household expenditures; while there was strong correlation between assets-based and expenditures-based quintiles, 58 percent of the households did not fall into the same quintile on both measures.[5] Filmer and Scott's (2008) meta-analysis that found comparable rankings in health and welfare outcomes between the two measures also reported that they did not yield identical household rankings. Finally, a 2009 study compared rankings for reported expenditure versus an asset index for 36 datasets from 22 countries, concluding that "the wealth index is mostly a poor proxy for consumption expenditure" (Howe, Hargreaves, Sabine & Huttly, 2009).

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[5] The survey is often overlooked, probably because it is available only in Spanish and only on a nongovernmental organization's Web site, http://www.cepar.org.ec/endemain_04/nuevo05/informe/anexos/anexo1.htm.

## Methods and Data Sources

Living standards surveys that capture expenditures usually do not collect detailed health data; and a DHS, which studies health outcomes in detail, does not capture expenditures. To answer whether assets-based and expenditures-based poverty measures are interchangeable at the individual level, we developed an approach to estimate the likelihood that a DHS household has expenditures below a given poverty line. In this approach, items from a DHS are matched with items from a survey with expenditure data, and a poverty scorecard is built from the expenditure survey using the matched items. The scorecard is then applied to the DHS data set to estimate the likelihood that a given household has expenditures below a poverty line. Figure 2 illustrates the basic logic of the approach.

In this paper, we match DHS standard recode files with an expenditures survey file collected from the same country within a year of the DHS data collection. Two economic indicators are compared: an expenditure-based poverty scorecard and the standard DHS asset-based wealth index.

**Figure 2: Poverty-matching approach.**

The expenditure-based poverty scorecard was constructed as follows.

- Direct measures of absolute poverty in terms of expenditure were provided by the living standards survey. Using the expenditure data, individuals were classified as falling above or below a series of pre-defined poverty lines: $1.25/day, $2.50/day, or the national poverty line.
- Indicators are selected that are associated with poverty and were common to both the DHS and the expenditure surveys. These included household assets (ownership of durable goods), characteristics of the dwelling (building construction, electricity, etc.) and socio-demographic variables (number of household members, education, occupation, etc.).
- Scorecards were built with Logit regression on expenditure-based poverty status. The first step was to run one Logit regression for each candidate indicator. Each scorecard's accuracy was taken as Wilcoxon's signed rank statistic for predicted poverty ranks versus actual ranks.[6] One of

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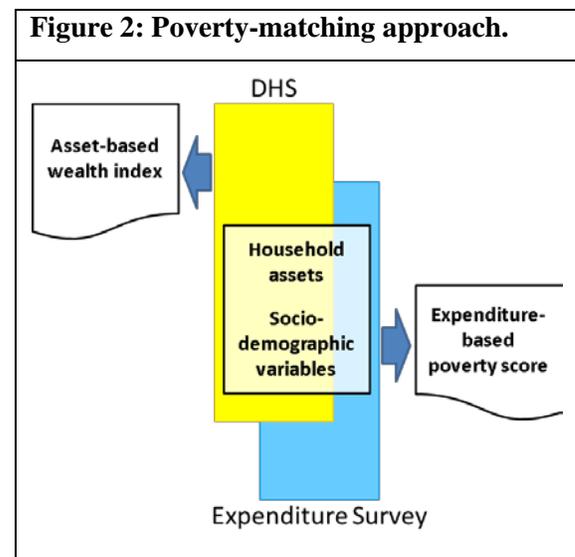
[6] This is similar to the "area under the concentration curve."

these one-indicator scorecards was then selected based on several factors, including improvement in accuracy, sensitivity to changes in poverty status, variety among indicators, and verifiability.

- A series of two-indicator scorecards were then built, each based on the one-indicator scorecard selected from the first step, with a second candidate indicator added. The best two-indicator scorecard was then selected and the steps are repeated until adding more indicators did not improve ranking materially.

- The final step transforms the Logit coefficients into non-negative integers such that an individual's total score can range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line). This linear transformation affects estimated ranks only trivially but makes the scores themselves easier to interpret. Scores can also be converted to poverty likelihoods (Schreiner, 2009).

- Finally, the poverty scorecard derived from the expenditures survey was applied to the DHS standard recode file. Expenditure-based poverty quintiles were then computed for DHS households by sorting the sample by the poverty score and dividing the ranked sample into five equal-sized groups.

While the accuracy and precision of the expenditure-based poverty scorecard can be estimated for the sample survey from which it was constructed, its applicability to another survey (such as a DHS) will depend in large degree to three factors:

- *Closeness in time*. In volatile economies, especially in developing countries, household expenditures may rise or fall markedly. Comparing two surveys that were conducted in close succession increases the likelihood that they reflect the same macroeconomic environment.

- *Comparability of sampling*. Large scale sample surveys usually draw their frame from the most recent national census. In principle, nationally representative surveys using the same census should have comparable frames.

- *Similarities/differences in questionnaire wording and response categories*. Sometimes even the most basic indicators are worded differently. For example, regarding school attendance among children ages 6 to 14, the 2004 Malawi DHS asks: "Is <name> currently attending school" while the 2004/5 IHS asks: "Is <name> currently attending school, or, if school is not now in session, did <name> attend school in the session just completed *and* plan to attend next session?"

Surveys from three countries were analyzed: Bangladesh (the 2004 DHS [National Institute of Population Research and Training, Mitra and Associates & ORC Macro, 2005]; 2005 Household Income and Expenditure Survey-HIES[Bangladesh Bureau of Statistics, 2005]); Ethiopia (the 2005 Ethiopia DHS

[Central Statistical Agency and ORC Macro, 2006], 2004/5 Household Income, Consumption and Expenditure Survey-HICES [Central Statistical Agency of Ethiopia, 2006]); and Malawi (the 2004 DHS [National Statistical Office and ORC Macro, 2005] and 2004/5, Integrated Household Survey-IHA [National Statistics Office, 2005]). We compared individuals' asset-based wealth quintile with their expenditure-based poverty scorecard quintile.

## Results

*Survey timing*. While none of the DHS and expenditure surveys in the three countries coincided in time exactly, they all came close (table 1). All were in the field for a year or less, and fieldwork overlapped for the two surveys in Bangladesh and in Malawi, with a two-month gap between surveys in Ethiopia. This closeness in time makes it more likely that the surveys represent the same population and that the relationships between indicators and poverty are the same in the DHS as in the expenditure survey.

*Sampling and indicators*. All the surveys were designed to be nationally representative. We cannot compare primary sampling units, which are unavailable in the data sets. Without a direct way to test the similarity between sampling frames, we compare the distribution of responses for close-to-identical items in both surveys. Indicators are well-matched across surveys when questions appear in the same context, have the same wording, offer the same response options, and elicit the same distribution of responses. For poverty mapping, Zhao and Lanjouw (2009: 6) say that, "only [indicators] with the same definition and distribution are allowed to be used." Poverty maps generally allow indicators if the null of "no difference" in the distribution of responses is not rejected at the 5 percent level.

The Zhao and Lanjouw standards are rarely met in the data here: almost all indicators have differences in the question and/or response distributions that differ at $p < 0.05$. The worst mismatches in terms of response distribution were discarded, but we allowed more tolerance than what Zhao and Lanjouw suggest.[7] We count indicators as "matched" if logical regroupings of responses give percentage differences that are less than about 10 percent of the incidence of an item's most common response.

To illustrate, table 2 compares distributions of three indicators between the Bangladesh 2004 DHS and the 2005 HIES. The definition of *household* differs, but we count the indicator *household size* as matched: the most common response is two members (28 percent); the largest percentage difference in any response

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[7] Most poverty maps are based on expenditure surveys with sample sizes similar to those here and applied to census data. Even if both surveys use the exact same questions and responses, the census' massive sample size should make it difficult to find indicators whose distribution does not differ at $p < 0.05$.

category is 1.9 percentage points, which is less than 10 percent of the incidence of the most common response. The same logic applies to the electricity indicator: the most common response is no electricity (55 percent); the largest difference for a response category is 4.1 percentage points, which is less than 10 percent of the incidence of most common response. The education indicator is well-matched by the standard used here, but the DHS households are less likely to have a female head/spouse and less likely to have a female head/spouse with more than 4 years of education. Taken together, these differences raise the possibility that the DHS may have covered worse-off households than the HIES.

Quality of matching in Ethiopia and Malawi (analyses not shown) were not much better than Bangladesh. In general, the low quality of matches is a potentially critical weakness of the poverty-mapping approach. Weak matches mean potentially low correspondence between measured accuracy in the national expenditure survey and extrapolated accuracy in the DHS.

Appendices 1-3 present the matched scorecards for Bangladesh, Ethiopia, and Malawi.

_Correspondence between assets-based wealth index and expenditure-based poverty scorecard._ Despite problems in matching items between DHS and expenditures surveys, *the estimated proportions of people living below the poverty line of $1.25/day per person PPP were virtually the same between the DHS and the expenditures surveys*: for Bangladesh the proportions were 52 percent and 50 percent (DHS and expenditure survey, respectively); for Ethiopia 36 percent and 35 percent; and for Malawi 72 percent and 74 percent.[8] This finding supports the validity of the analyses presented below. In other words, whatever the differences in the distribution of responses to the specific indicators, the estimated poverty rate in the DHS sample is close to the estimate rate in the expenditure survey, supporting both the possibility that the expenditure-based tool accurately estimates expenditure-based poverty for DHS households and that both surveys represent the same population.

We now compare quintile rankings by the assets-based wealth index with rankings by the expenditure-based poverty scorecard. The five-by-five matrix has 25 cells. If the asset-based quintiles match perfectly with the expenditure-based quintiles, all cases would fall on the diagonal. The null-hypothesis — no relationship between asset-based and expenditure-based quintiles — would distribute 4 percent of the sample in each cell and the sum of the diagonals (perfect matches) would be 20 percent.

Table 3 presents the distributions of expenditure-based by asset-based quintile rankings for all three countries. The shaded cells on the diagonal represent perfect matches: percentages of individuals ranked

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[8] Value of $1.25/day PPP was 31.86 BDT (Bangladesh); 3.21 ETB (Ethiopia); and 64.14 MWK (Malawi).

in the lowest asset-based quintile who were also ranked in the lowest expenditure-based quintile, those ranked in the second quintile on both assets and expenditures, and so on. Actual correspondence in the three test countries is better than random,[9] and the two indices have positive rank correlation. Bangladesh has the strongest correspondence with 44 percent of people falling in the same quintile under both approaches. Malawi is next at 40 percent, and Ethiopia is the weakest at 28 percent. In each country, the correspondence is strongest for the lowest and highest quintiles and weakest in the middle.

We also relaxed the criteria for matching to include adjacent quintiles. Figure 3 presents the proportions of each assets-based wealth index quintile who were ranked within plus or minus one quintile of that rank on the expenditure-based poverty scorecard. For comparison purposes, we include comparable results from the 2004 survey in Ecuador (Centro de Estudios de Población y Desarrollo Social, 2005). We continue to find some appreciable mismatch between the two poverty measures, most notably in the case of Ethiopia where more than a third of the individuals in each assets-based wealth index quintile were ranked two or more quintiles above or below that quintile on the expenditures-based poverty scorecard. It is also striking to note that the match between poverty measures in Ecuador, which were derived from direct measures of expenditures in the same survey (and for which there is therefore no issue of matching indicators across two surveys), was no better than that observed in Bangladesh, which applied proxy measures of consumption from an expenditure survey to the DHS.

**Figure 3:** **Proportions of individuals ranked by assets-based wealth index classified within plus or minus one quintile of that rank on the expenditure-based poverty scorecard**.
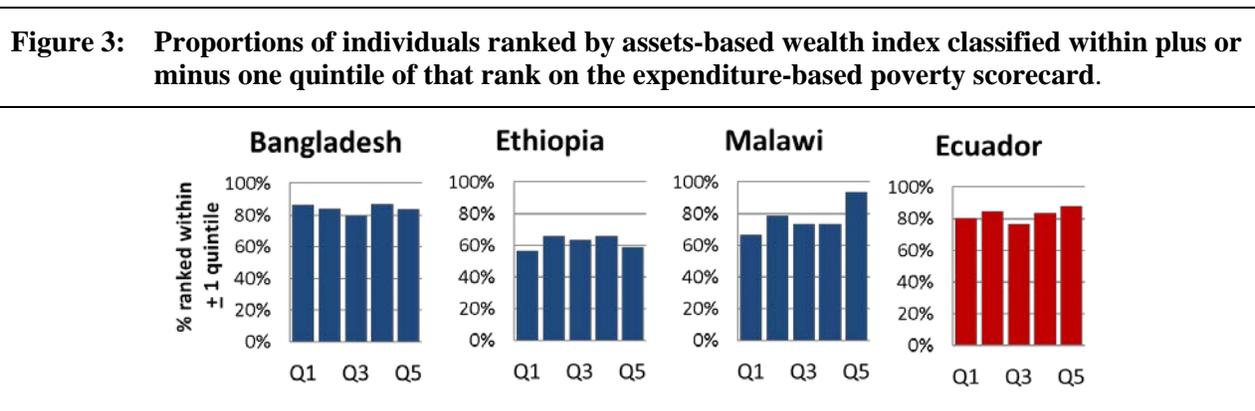


## Discussion

The present study was designed to test the one-to-one equivalence between the assets-based wealth index derived from principal components analysis of household assets and dwelling characteristics versus poverty rankings based on a scorecard's prediction of household expenditures. We linked indicators

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[9] p < 0.01 for a Chi-square test for no association.

collected by DHS country surveys to similar indicators collected by expenditure surveys from the same countries to create an estimate of expenditures-based poverty for the DHS, and we then ranked respondents on both measures.

The finding that at the aggregate level, the estimated proportions of people living below the poverty line of $1.25/day per person PPP did not differ widely between the DHS and the expenditures surveys gives us confidence in our approach. At the individual level, while exact quintile matches were reliably higher than chance, there were appreciable differences between the rankings produced by the two poverty measures. The proportions of individuals ranked two or more quintiles apart ranged from 16 percent in Bangladesh, the best case, to 38 percent in Ethiopia, with Malawi in between at 23 percent. The findings thus caution against using the two poverty measures interchangeably, especially in light of similar findings from direct comparisons of expenditures and asset-based wealth rankings in Ecuador. Moreover, the comparability between the Bangladesh findings (based on cross-survey comparisons) and the Ecuador findings (a within-survey comparison) suggests that the poverty scoring approach can be as accurate as the direct-measurement approach.

If the two measures of poverty produce similar rankings of health and welfare outcomes but do not correspond precisely to one another, what would be the advantage of using one over the other and in what circumstances? To demonstrate poverty-related inequalities in health at the aggregate level, for example, either measure appears to be appropriate.[10] Either expenditures-based or assets-based poverty indices from national surveys can help governments and/or donors decide whether or not to design and implement targeted health interventions to the poor or other socially-disadvantaged groups. However, most poverty-reduction and equity strategies continue to use income- or expenditures-based definitions of poverty.[11] In these cases, assets-based measures are inadequate to track the proportion of program services or subsidies that are captured by the poor. In other words, whenever programs use poverty lines that are established on the basis of income or expenditures, monitoring program success in serving the poor requires poverty measures that also are based on household expenditures.

Finally, the results of the present analyses demonstrate the feasibility of linking independent nationally-representative surveys to derive an expenditure-based poverty scorecard for surveys that themselves do not include a detailed expenditure module. Between-survey linking would be improved if the country DHS and expenditure surveys included the same questions and response categories for household assets

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[10] Foreit (2008) argues for using residence-specific wealth quintiles for strategic planning.

[11] For example, the first target under Goal 1 of the United Nation's Millennium Development Goals is to "Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day." http://www.un.org/millenniumgoals/poverty.shtml

and dwelling characteristics.  Not only would this facilitate inter-survey comparisons within countries, but it would do no violence to cross-country comparisons within the DHS.  Many household asset and dwelling characteristics questions are already country-specific and vary among DHS countries.  Second, the factor loadings derived from PCA analysis for the same items already vary among countries and between surveys in a given country.  Third, the quintile cut points vary between countries, and individuals classified as belonging to a given quintile in one country may be worse or better off than individuals belonging to the same quintile in a different country.  Most important, harmonization of asset questions would not affect cross-country comparability of health and welfare indicators — mortality, fertility, use of critical health services, etc.

## Conclusions and Recommendations

We conclude that assets-based wealth indices do not consistently track well against expenditure-based measures of poverty.  Moreover and on a more technical note, we recommend that future DHS country surveys *harmonize the selection, wording and response categories of questions on household assets and dwelling characteristics with national expenditure surveys* and vice-versa.

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**Table 1:** **Expenditure Collection, Start, and End Dates of Fieldwork, and Sample Size for DHS and National Expenditure Surveys in Bangladesh, Ethiopia, and Malawi**

| | Bangladesh | | Ethiopia | | Malawi | |
|---|---|---|---|---|---|---|
| | DHS | HIES | DHS | HICES* | DHS | HIS |
| Start date | 1/04 | 1/04 | 4/05 | 7/05 | 10/04 | 3/04 |
| End date | 5/04 | 12/04 | 8/05 | 2/05 | 1/05 | 3/05 |
| Households surveyed | 10,500 | 10,080 | 13,721 | 21,297 | 13,664 | 11,280 |

 * Fieldwork conducted 7-8 2004 and 2-3 2005

**Table 2.    Indicator Matching, Bangladesh**

| Questionnaire wording | Response categories | DHS | HIES | Diff. |
|---|---|---|---|---|
| DHS: How many people usually live with the household?<br>HIES: How many people live with the household (live together and take food from the same kitchen) six months out of the year? | None | 11% | 10% | 1.5% |
| | One | 17% | 16% | 1.5% |
| | Two | 28% | 28% | 0.1% |
| | Three | 25% | 27% | -1.9% |
| | Four or more | 18% | 20% | -1.2% |
| DHS: Does the household have electricity?<br>HIES: Does the household have an electricity connection? | No | 59% | 55% | 4.1% |
| | Yes | 41% | 45% | -4.1% |
| DHS: What is the level of schooling that <name> has attended? What is the highest class that <name> has completed in that schooling?<br>HIES: What is the highest grade <name> has completed? | None or <Yr 4 primary | 69% | 64% | 4.8% |
| | No female head/spouse | 4% | 3% | 1.0% |
| | Yr 4 primary or Yr 1 secondary | 14% | 14% | -0.3% |
| | Yr 2 secondary | 3% | 3% | -0.1% |
| | Yr 3 secondary | 3% | 5% | -1.6% |
| | Yr 4 secondary | 3% | 4% | -0.6% |
| | Yr 5 secondary | 2% | 4% | -3.0% |
| | Post-secondary | 3% | 3% | -0.2% |

**Table 3.** Correspondence among Quintile Ranks, Expenditure-Based Poverty Scorecard vs. Asset-Based Wealth Index

**Bangladesh**

| Expenditure-based poverty scorecard | Asset-based wealth index | | | | |
|---|---|---|---|---|---|
| Q | 1 | 2 | 3 | 4 | 5 |
| 1 | 12.2 | 5.4 | 1.9 | 0.4 | 0.1 |
| 2 | 5.0 | 6.8 | 5.3 | 2.2 | 0.7 |
| 3 | 2.2 | 4.7 | 5.6 | 5.1 | 2.5 |
| 4 | 0.5 | 2.7 | 5.1 | 7.0 | 4.8 |
| 5 | 0.0 | 0.5 | 2.2 | 5.3 | 12.0 |

**Ethiopia**

| Expenditure-based poverty scorecard | Asset-based wealth index | | | | |
|---|---|---|---|---|---|
| Q | 1 | 2 | 3 | 4 | 5 |
| 1 | 6.7 | 4.9 | 3.8 | 2.9 | 1.8 |
| 2 | 4.6 | 4.3 | 4.3 | 4.0 | 2.8 |
| 3 | 3.5 | 4.0 | 4.5 | 4.4 | 3.7 |
| 4 | 3.1 | 3.7 | 3.9 | 4.9 | 4.4 |
| 5 | 2.2 | 3.2 | 3.6 | 3.8 | 7.3 |

**Malawi**

| Expenditure-based poverty scorecard | Asset-based wealth index | | | | |
|---|---|---|---|---|---|
| Q | 1 | 2 | 3 | 4 | 5 |
| 1 | 8.3 | 6.0 | 4.2 | 1.5 | 0.1 |
| 2 | 5.0 | 5.4 | 5.7 | 3.9 | 0.1 |
| 3 | 3.3 | 4.5 | 5.1 | 6.0 | 1.1 |
| 4 | 2.6 | 3.2 | 3.8 | 5.8 | 4.6 |
| 5 | 0.8 | 1.1 | 1.2 | 3.0 | 14.0 |

## Appendix 1.   Matched DHS-Expenditure Survey Poverty Scorecard, Bangladesh

| Indicator | Response categories | Pts |
|---|---|---|
| 1. How many household members are 11 years-old or younger? | A. Four or more | 0 |
| | B. Three | 3 |
| | C. Two | 7 |
| | D. One | 12 |
| | E. None | 23 |
| 2. Do all household members ages 6 to 11 currently attend school? | A. No | 0 |
| | B. No children ages 6 to 11 | 1 |
| | C. Yes | 4 |
| 3. What is the highest grade that the female head/spouse has completed? | A. None, or Year 4 of primary or less | 0 |
| | B. No female head/spouse | 0 |
| | C. Year 5 of primary or Year 1 of secondary | 3 |
| | D. Year 2 of secondary | 5 |
| | E. Year 3 of secondary | 7 |
| | F. Year 4 of secondary | 8 |
| | G. Year 5 of secondary | 14 |
| | H. Year 1 or more of post-secondary | 19 |
| 4. What is the main material of the walls of the residence? | A. Other | 0 |
| | B. Finished (brick/cement or tin) | 3 |
| 5. What is the main material of the roof of the residence? | A. Natural (katcha, bamboo/thatch) or other | 0 |
| | B. Rudimentary (tin) | 6 |
| | C. Finished (pukka, cement/concrete/tiled) | 18 |
| 6. Does the household have electricity? | A. No | 0 |
| | B. Yes | 8 |
| 7. Where is cooking usually done? | A. Outdoors, in a room used for living or sleeping, or other | 0 |
| | B. In a separate room (same building or separate building) | 2 |
| 8. How much land does the household own (other than the homestead land)? | A. None | 0 |
| | B. 1 to 50 decimals | 2 |
| | C. 51 to 200 decimals | 6 |
| | D. 201 decimales or more | 14 |
| 9. Does the household (or any of its members) have a sewing machine? | A. No | 0 |
| | B. Yes | 3 |
| 10. Does the household (or any of its members) have a watch or clock? | A. No | 0 |
| | B. Yes | 6 |

**Appendix 2.  Matched DHS-Expenditure Survey Poverty Scorecard, Ethiopia**

| Indicator | Response categories | Pts |
|---|---|---|
| 1. How many people usually live with the household? | A. Nine or more | 0 |
| | B. Eight | 2 |
| | C. Seven | 6 |
| | D. Six | 9 |
| | E. Five | 14 |
| | F. Four | 21 |
| | G. Three | 27 |
| | H. One or two | 42 |
| 2. What is the highest grade the female head/spouse has completed? | A. Four or less | 0 |
| | B. No female head/spouse | 0 |
| | C. Five or six | 4 |
| | D. Seven to nine | 10 |
| | E. Ten or higher | 13 |
| 3. What is the main material of the walls of the residence? | A. Stone with mud, stone with lime/cement, or cane/trunks/bamboo/reed | 0 |
| | | 5 |
| | B. Bamboo/wood, uncovered adobe, plywood, carton, no walls, or other | 11 |
| | C. Cement, bricks, cement blocks, covered adobe, or wood planks/shingles | |
| 4. What type of toilet facility do members of your household usually use? | A. Non-flush or none | 0 |
| | B. Flush | 5 |
| 5. What type of fuel does your household mainly use for cooking? | A. Wood or straw/shrubs/grass, or animal dung | 0 |
| | B. All others | 5 |
| 6. Does the household have a bed? | A. No | 0 |
| | B. Yes | 5 |
| 7. Does the household have a radio? | A. No | 0 |
| | B. Yes | 8 |
| 8. Does any member of this household own any land that can be used for agriculture? | A. No | 0 |
| | B. Yes | 6 |
| 9. Does the household own any cattle, sheep or goats? | A. No | 0 |
| | B. Yes | 5 |

**Appendix 3.   Matched DHS-Expenditure Survey Poverty Scorecard, Malawi**

| Indicator | Response categories | Pts |
|---|---|---|
| 1. How many household members are 14 years-old or younger? | A. Five or more<br>B.  Four<br>C. Three<br>D. Two<br>E. One<br>F. None | 0<br>5<br>7<br>11<br>18<br>28 |
| 2. Do all household members ages 6 to 14 currently attend school? | A. No<br>B. Yes<br>C. No members ages 6 to 14 | 0<br>4<br>8 |
| 3. How many years of education has the female head/spouse completed? | A. None, or nursery/pre-school<br>B. Primary standard 1 or 2<br>C. Primary standard 3, 4, or 5<br>D. Primary standard 6 or 7<br>E. Primary standard 8 or secondary form 1<br>F. Secondary form 2 or 3<br>G. No female head/spouse<br>H. Secondary form 4 or higher | 0<br>2<br>5<br>6<br>8<br>10<br>11<br>17 |
| 4. What is the main material of the floor? | A. Earth/sand, dung, palm/bamboo, or broken bricks<br>B. Wood planks, parquet or polished wood, vinyl or asphalt strips, ceramic tiles, cement, carpet, other, or no data | 0<br>8 |
| 5. What is the main source of drinking water for members of the household? | A. Community standpipe, river/stream, spring, pond/lake, dam, rainwater, or other<br>B. Protected public well, tanker truck/bowser, open well in yard/plot, open public well, or protected well in yard/plot<br>C. Bottled or piped inside or outside dwelling | 0<br>3<br><br>7 |
| 6. What type of fuel does your household mainly use for cooking? | A. Firewood, straw, or dung<br>B. Charcoal, electricity, LPG/natural gas paraffin/kerosene, biogas, coal/lignite, other, or no data | 0<br>6 |
| 7. Does your household have a bed with a mattress? | A. No<br>B. Yes | 0<br>8 |
| 8. Does your household have any mosquito nets that can be used while sleeping? | A. No<br>B. Yes | 0<br>4 |
| 9. Does the household have a sofa set? | A. No<br>B. Yes | 0<br>7 |
| 10. Does any member of the household own a bicycle, motorcycle, motor scooter, car, or truck? | A. No<br>B. Yes | 0<br>7 |