Simple Poverty Scorecard®
Kenya

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This document and related tools are available at `SimplePovertyScorecard.com`.

Abstract
The Simple Poverty Scorecard® uses ten low-cost indicators from Kenya's 2005/6 Kenya Integrated Household Budget Survey to estimate the likelihood that a household has expenditure below a given poverty line. Field workers can collect responses in about ten minutes. The scorecard's accuracy is reported for a range of poverty lines. The scorecard is a practical way for pro-poor programs in Kenya to measure poverty rates, to track changes in poverty rates over time, and to segment clients for targeted services.

Version note
This paper uses 2005/6 data, replacing Chen, Schreiner, and Woller (2008), which uses 1997 data. The new 2005/6 scorecard here should be used from now on. Existing users of Chen, Schreiner, and Woller (2008) can still measure change over time using the food poverty line or the national poverty line with a baseline from the old 1997 scorecard and a follow-up from the new 2005/6 scorecard.

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Simple Poverty Scorecard®

			Name	Identifier
Interview ID:				
Interview date:		Participant:		
Country:	KEN	Field agent:		
Scorecard:	002	Service point:		
Sampling wgt.:		Number of household members:		

Indicator	Value	Points	Score
1. How many members does the household have?	A. Nine or more	0	
	B. Seven or eight	5	
	C. Six	8	
	D. Five	12	
	E. Four	18	
	F. Three	22	
	G. One or two	32	
2. What is the highest school grade that the female head/spouse has completed?	A. None, or pre-school	0	
	B. Primary standards 1 to 6	1	
	C. Primary standard 7	2	
	D. Primary standard 8, or secondary forms 1 to 3	6	
	E. No female head/spouse	6	
	F. Secondary form 4 or higher	11	
3. What kind of business (type of industry) is the main occupation of the male head/spouse connected with?	A. Does not work	0	
	B. No male head/spouse	3	
	C. Agriculture, hunting, forestry, fishing, mining, or quarrying	7	
	D. Any other	9	
4. How many habitable rooms does this household occupy in its main dwelling (do not count bathrooms, toilets, storerooms, or garage)?	A. One	0	
	B. Two	2	
	C. Three	5	
	D. Four or more	8	
5. The floor of the main dwelling is predominantly made of what material?	A. Wood, earth, or other	0	
	B. Cement, or tiles	3	
6. What is the main source of lighting fuel for the household?	A. Collected firewood, purchased firewood, grass, or dry cell (torch)	0	
	B. Paraffin, candles, biogas, or other	6	
	C. Electricity, solar, or gas	12	
7. Does your household own any irons (charcoal or electric)?	A. No	0	
	B. Yes	4	
8. How many mosquito nets does your household own?	A. None	0	
	B. One	2	
	C. Two or more	4	
9. How many towels does your household own?	A. None	0	
	B. One	6	
	C. Two or more	10	
10. How many frying pans does your household own?	A. None	0	
	B. One	3	
	C. Two or more	7	

Score:

Look-up table to convert scores to poverty likelihoods: National poverty lines and the line marking the poorest half of people below 100% of the national line

	Poverty likelihood (%)			
	National lines			Poorest 1/2
Score	Food	100%	150%	< 100% Natl.
0–4	95.4	95.4	100.0	95.4
5–9	72.6	95.0	100.0	79.5
10–14	57.1	85.8	96.5	61.3
15–19	47.4	82.5	95.7	51.0
20–24	37.8	77.3	93.2	48.5
25–29	32.8	67.9	89.1	40.2
30–34	23.5	63.7	83.3	30.6
35–39	12.7	46.4	75.7	17.4
40–44	9.9	36.9	64.8	12.5
45–49	4.7	30.0	64.3	5.4
50–54	1.9	17.8	49.4	1.8
55–59	0.9	13.9	41.8	1.0
60–64	0.5	6.1	32.3	0.0
65–69	0.9	4.6	20.4	0.0
70–74	0.2	3.8	11.1	0.2
75–79	0.0	0.0	4.1	0.0
80–84	0.4	0.4	6.7	0.4
85–89	0.0	0.0	4.1	0.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Look-up table to convert scores to poverty likelihoods: International 2005 and 2011 PPP poverty lines

	Poverty likelihood (%)					
	2005 PPP				2011 PPP	
Score	**$1.25**	**$2.00**	**$2.50**	**$4.00**	**$1.90**	**$3.10**
0–4	100.0	100.0	100.0	100.0	100.0	100.0
5–9	97.2	100.0	100.0	100.0	93.3	100.0
10–14	83.7	98.6	99.3	100.0	79.3	96.8
15–19	87.6	96.6	99.1	99.5	79.5	96.4
20–24	81.1	94.8	99.2	99.7	67.6	92.5
25–29	70.7	91.8	96.2	99.3	63.2	87.9
30–34	63.1	90.0	95.4	98.2	52.4	85.7
35–39	48.4	79.0	91.0	98.5	39.4	73.0
40–44	35.1	69.7	82.7	95.1	27.5	62.6
45–49	25.4	63.1	75.5	94.4	14.4	54.6
50–54	8.7	41.6	61.1	88.5	5.9	30.2
55–59	7.8	29.1	44.0	75.1	4.2	22.5
60–64	1.0	16.3	29.0	63.7	0.9	10.2
65–69	1.1	11.4	20.0	47.4	0.4	7.0
70–74	0.2	2.5	9.4	30.3	0.2	1.7
75–79	0.0	4.4	6.0	23.5	0.0	2.3
80–84	0.4	0.4	2.2	9.7	0.4	0.4
85–89	0.0	4.1	4.1	7.3	0.0	0.0
90–94	0.0	0.0	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0	0.0	0.0

Simple Poverty Scorecard®
Kenya

1. Introduction

This paper presents the Simple Poverty Scorecard®, an easy-to-use tool that pro-poor programs in Kenya can use to estimate the likelihood that a household has expenditure below a given poverty line, to estimate groups' poverty rates at a point in time, to track changes in groups' poverty rates over time, and to target services to households.

The direct approach to poverty measurement via surveys is difficult and costly, asking households about a lengthy list of expenditure items. As a case in point, the 2005/6 Kenya Integrated Household Budget Survey (KIHBS) runs 60 pages. The expenditure module covers almost 600 items, and "each household was visited at least 10 times" (Kenya National Bureau of Statistics, 2007, p. 14). An example set of questions for an expenditure item are "Over the past one week (7 days), did your household acquire/purchase/consume any maize grain (loose)? If yes, how much was purchased and in what units? How many shillings did you pay? How much of the purchased maize grain (loose) was consumed? How much maize grain (loose) was consumed from own-production? How much was consumed from own stock? How much was consumed from gifts and other sources? How much in total did your household

consume in the past week? Now then, over the past one week (7 days), did your household acquire/purchase/consume any green maize? . . .".

In contrast, the indirect approach via poverty scoring is simple, quick, and inexpensive. It uses ten verifiable indicators (such as "Does your household own any irons (charcoal or electric)?" or "What is the highest school grade that the female head/spouse has completed?") to get a score that is highly correlated with poverty status as measured by the exhaustive survey.

The scorecard here differs from "proxy means tests" (Coady, Grosh, and Hoddinott, 2002) in that it is tailored to the capabilities and purposes not of national governments but rather of local, pro-poor organizations. The feasible poverty-measurement options for these organizations are typically subjective and relative (such as participatory wealth ranking by skilled field workers) or blunt (such as rules based on land-ownership or housing quality). Measurements from these approaches are not comparable across organizations, they may be costly, and their accuracy and precision are unknown.

Pro-poor organizations can use the scorecard to measure the share of their participants below a given poverty line, such as the Millennium Development Goals' \$1.25/day at 2005 purchase-power parity. USAID microenterprise partners can use it to report how many of its participants are among the poorest half of people below the national poverty line. The scorecard can also be used to measure movement across a poverty line. In all these cases, the scorecard provides an expenditure-based, objective

tool with known accuracy. While expenditure surveys are costly even for governments, some small, local organizations may be able to implement an inexpensive scorecard that can serve for monitoring and targeting.

The statistical approach here aims to be understood by non-specialists. After all, if managers are to adopt poverty scoring on their own and apply it to inform their decisions, they must first trust that it works. Transparency and simplicity build trust. Getting "buy-in" matters; proxy means tests and regressions on the "determinants of poverty" have been around for three decades, but they are rarely used to inform decisions at the local level, not because they do not work, but because they are presented (when they are presented at all) as tables of regression coefficients incomprehensible to non-specialists (with cryptic indicator names such as "`LGHHSZ_2`", negative values, and many decimal places). Thanks to the predictive-modeling phenomenon known as the "flat maximum", simple scorecards are usually about as accurate as complex ones.

The technical approach here is innovative in how it associates scores with poverty likelihoods, in the extent of its accuracy tests, and in how it derives formulas for standard errors. Although these accuracy tests are simple and commonplace in statistical practice and in the for-profit field of credit-risk scoring, they have rarely been applied to poverty-assessment tools.

The scorecard (Figure 1) is based on the 2005/6 KIHBS conducted by the Kenya National Bureau of Statistics (KNBS). Indicators are selected to be:

- Inexpensive to collect, easy to answer quickly, and simple to verify
- Associated with poverty
- Liable to change over time as poverty status changes

All points in the scorecard are non-negative integers, and total scores range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line). Non-specialists can collect data and tally scores on paper in the field in five to ten minutes.

Poverty scoring can be used to estimate three basic quantities. First, it can estimate a particular household's "poverty likelihood", that is, the probability that the household has per-adult-equivalent or per-capita expenditure below a given poverty line.

Second, poverty scoring can estimate the poverty rate of a group of households at a point in time. This is defined as the average poverty likelihood among the households in the group.

Third, poverty scoring can estimate changes in the poverty rate for a group of households (or for two independent samples of households that are representative of the same population) between two points in time. This estimate is the change in the average poverty likelihood of the group(s) of households over time.

Poverty scoring can also be used for targeting. To help managers choose an appropriate targeting cut-off for their purposes, this paper reports several measures of targeting accuracy for a range of possible cut-offs.

This paper presents a single scorecard whose indicators and points are derived from household expenditure data and Kenya's national (absolute) poverty line. Scores from this one scorecard are calibrated to poverty likelihoods for six poverty lines.

The scorecard is constructed and calibrated using half of the data from the 2005/6 KIHBS, and its accuracy is validated on the other half of the data.

While all three scoring estimators are *unbiased* (that is, they match the true value on average in repeated samples when applied to the same population from which the scorecard was built), they are—like all predictive models—biased to some extent when applied to a different population.[1]

Thus, while the indirect scoring approach is less costly than the direct survey approach, it is also biased. (The survey approach is unbiased by assumption.) There is bias because scoring must assume that the future relationship between indicators and poverty will be the same as in the data used to build the scorecard. Of course, this assumption—inevitable in predictive modeling—holds only partly.

When applied to the validation sample with bootstrap samples of $n = 16{,}384$, the difference between scorecard estimates of groups' poverty rates and the true rates at a point in time is +0.4 or +0.3 percentage points for the three national poverty lines, +0.1 percentage points for the USAID "extreme" line, and +1.0 and +2.1 percentage

[1] Important examples include nationally representative samples at a different point in time or non-nationally representative sub-groups (Tarozzi and Deaton, 2009).

points for the $1.25/day and $2.50/day 2005 PPP lines.[2] These differences are due to sampling variation and not bias; the average of each difference would be zero if the whole 2005/6 KIHBS were to be repeatedly redrawn and divided into sub-samples before repeating the entire process of constructing and calibrating scorecards.

The 90-percent confidence intervals for these estimates are ±0.6 percentage points or less. For $n = 1{,}024$, 90-percent intervals are ±2.7 percentage points or less.

Section 2 below describes data and poverty lines. Sections 3 and 4 describe scorecard construction and offer guidelines for use in practice. Sections 5 and 6 detail the estimation of households' poverty likelihoods and of groups' poverty rates at a point in time. Section 7 discusses estimating changes in poverty rates through time, and Section 8 covers targeting. Section 9 places the new scorecard here in the context of existing exercises for Kenya, and Section 10 is a summary.

[2] The scorecard is constructed using the per-adult-equivalent national line, and this may explain why differences are greater for the per-capita 2005 PPP lines.

2. Data and poverty lines

This section discusses the data used to construct and test the scorecard. It also presents the poverty lines to which scores are calibrated.

2.1 Data

The scorecard is based on data from the 12,644 households in the 2005/6 KIHBS surveyed by the KNBS from May 2005 to May 2006 who completed all the major survey modules used here. Because Kenya's official poverty statistics use the 13,158 households with complete expenditure data, the poverty figures in this paper differ slightly from the official ones.

For the purposes of poverty scoring, the households in the 2005/6 KIHBS are randomly divided into two sub-samples (Figure 2):

- *Construction and calibration* for selecting indicators and points and for associating scores with poverty likelihoods
- *Validation* for measuring accuracy with data not used in construction or calibration

2.2 Poverty rates and poverty lines

2.2.1 Rates

As a general definition, the *poverty rate* is the share of people in a group who live in households whose total household expenditure (divided by the number of household members or the number of adult equivalents) is below a given poverty line.

Beyond this general definition, there two special cases, *household-level poverty rates* and *person-level poverty rates*. With household-level rates, each household is counted as if it had only one person, regardless of true household size, so all households are counted equally. With person-level rates (the "head-count index"), each household is weighted by the number of people in it or by the number of adult equivalents in it, so larger households count more.

For example, consider a group of two households, the first with one member and the second with two members. Suppose further that the first household has per-capita expenditure (or per-adult-equivalent expenditure) above a poverty line (it is "non-poor") and that the second household has per-capita expenditure (or per-adult-equivalent expenditure) below a poverty line (it is "poor"). The household-level rate counts both households as if they had only one person and so gives a poverty rate of $1 \div (1 + 1) =$ 50 percent. In contrast, the person-level rate weighs each household by (say) the number of people in it and so gives a poverty rate of $2 \div (1 + 2) = 67$ percent.

Whether the household-level rate or the person-level rate is more relevant depends on the situation. If an organization's "participants" include all the people in a household, then the person-level rate is relevant. Governments, for example, are concerned with the well-being of people, regardless of how those people are arranged in households, so governments typically report person-level poverty rates.

If an organization has only one "participant" per household, however, then the household-level rate may be relevant. For example, if a microlender has only one borrower in a household, then it might prefer to report household-level poverty rates.

Figure 2 reports poverty lines and poverty rates for Kenya at both the household- and person-level for the country as a whole and for the construction/calibration and validation sub-samples used for scoring. Figure 3 reports poverty lines and poverty rates (household-level and person-level) for Kenya as a whole and for its eight provinces (Nairobi, Central, Coast (Mombasa), Eastern, North Eastern, Nyanza (Kisumu), Rift Valley (Nakuru) and Western), both for each province as a whole and by urban/rural within each province.

The scorecard is constructed using the 2005/6 KIHBS and household-level lines, scores are calibrated to household-level poverty likelihoods, and accuracy is measured for household-level rates. Person-level poverty rates can be estimated by taking a household-size-weighted average of the household-level poverty likelihoods. It is also possible to construct a scorecard based on person-level lines, person-level likelihoods, and person-level rates, but it is not done here.

2.2.2 Poverty lines

Kenya's food poverty line is defined as the cost of 2,250 kilocalories from a food basket consistent with rural and urban consumption recorded in the KIHBS (KNBS, 2007). This cost is found iteratively (Pradhan *et al.*, 2001) for a reference group that starts with households in the middle quintile of food expenditure. After adjusting for

household-level differences in cost-of-living and for inflation over the course of the KIHBS fieldwork (KNBS, 2007), the average food lines are KES49.97 per adult equivalent per day (urban) and KES32.94 (rural, Figure 3). These lines imply household-level poverty rates of 5.1 percent (urban) and 17.9 percent (rural) and person-level poverty rates of 7.7 percent (urban) and 22.2 percent (rural).[3]

The national ("absolute") poverty line (sometimes called here "100% of the national line") is defined as total expenditure (food plus non-food) for households whose food expenditure is close to the food poverty line. In particular, "The starting point was to compute the mean value of total non-food expenditures consumed by households whose food expenditures fall within a one-percentage-point interval around the food poverty line. This process was repeated ten times and at each stage the interval was increased by additional percentage points. The average of the mean total non-food expenditures from each stage provides a weighted non-parametric estimate of the value of the non-food component which was added to the food poverty line to compute the overall poverty line" (KNBS, 2007, p. 27). For urban areas, the national line is KES98.73 per adult equivalent per day, giving a household-level poverty rate of 26.0 percent and a person-level rate of 33.1 percent (Figure 3). For rural areas, the national line is KES52.08, with a household-level rate of 41.8 percent and a person-level rate of 49.6 percent.

[3] These rates are less than the official food-poverty rates because the official rates compare food expenditure with the food line, but international practice (used here) is to compare total expenditure (food plus non-food) with the food line (Ravaillon, 1998).

Because local pro-poor organizations may want to use different or various poverty lines, this paper calibrates scores from its single scorecard to poverty likelihoods for six lines:

- Food
- National
- 150% of national
- USAID "extreme"
- $1.25/day 2005 PPP
- $2.50/day 2005 PPP

The USAID "extreme" line is defined as the median expenditure of people (not adult equivalents nor households) below the national line (U.S. Congress, 2004). This median line is found for urban and rural areas in each of Kenya's eight provinces.

The $1.25/day 2005 PPP line is derived from:

- 2005 PPP exchange rate for "individual consumption expenditure by households" (World Bank, 2008): KES32.68 per $1.00
- Average all-Kenya consumer price index for 2005 of 180.6183[4]
- Average all-Kenya CPI for May 2005 to May 2006 of 192.1085

Given this, the $1.25/day 2005 PPP line for Kenya as a whole during the 2005/6 KIHBS is (Sillers, 2006):

$$(\text{2005 PPP exchange rate}) \cdot \$1.25 \cdot \left(\frac{\text{CPI}_{\text{Ave. May '05 to May '06}}}{\text{CPI}_{\text{2005 average}}} \right) =$$

$$\left(\frac{\text{KES32.68}}{\$1.00} \right) \cdot \$1.25 \cdot \left(\frac{192.1085}{180.6183} \right) = \text{KES43.45}.$$

[4] `http://www.centralbank.go.ke/downloads/publications/statistics/bulletin/dec06.pdf`, retrieved 6 February 2011.

This line is then adjusted for each household-specific price deflator. Re-aggregating the results back up to the national level gives an average $1.25/day line (Figures 2 and 3) of KES44.20. This is slightly different from KES43.45 due to the dropping of households that did not complete all survey modules used here.

The $2.50/day 2005 PPP line is twice the $1.25/day line.

A previous scorecard for Kenya (Chen, Schreiner, and Woller, 2008) is based on the 1997 Welfare Monitoring Survey and its associated poverty lines. Poverty likelihoods and poverty rates derived from this earlier scorecard and its poverty lines are not comparable with poverty likelihoods and rates derived from the new scorecard here (based on the 2005/6 KIHBS) and its poverty lines. The expenditure modules are different (the WMS asks about 235 items, versus 600 in the KIHBS), and the poverty lines are derived differently. Any combination or comparison of estimates from the two scorecards should note this. There is no good or general way to improve comparability, nor to estimate how much the differences might matter.

3. Scorecard construction

For Kenya, about 115 potential indicators are initially prepared in the areas of:

- Family composition (such as household size)
- Education (such as the highest grade completed by the female head/spouse)
- Employment (such as sector of work of the male head/spouse)
- Housing (such as floor material)
- Ownership of durable goods (such as irons or towels)
- Agriculture (such as ownership of cattle)

Figure 4 lists the candidate indicators, ordered by their entropy-based "uncertainty coefficient" (Goodman and Kruskal, 1979) that measures how well the indicator predicts poverty on its own.

The scorecard also aims to measure *changes* in poverty through time. This means that, when selecting indicators and holding other considerations constant, preference is given to more sensitive indicators. For example, ownership of an iron is probably more likely to change in response to changes in poverty than is the age of the male head/spouse.

The scorecard itself is built using the national poverty line and Logit regression on the construction sub-sample. Indicator selection uses both judgment and statistics. The first step is to use Logit to build one scorecard for each candidate indicator. Each scorecard's accuracy is taken as "c", a measure of ability to rank by poverty status (SAS Institute Inc., 2004).

One of these one-indicator scorecards is then selected based on several factors (Schreiner *et al.*, 2004; Zeller, 2004), including improvement in accuracy, likelihood of

acceptance by users (determined by simplicity, cost of collection, and "face validity" in terms of experience, theory, and common sense), sensitivity to changes in poverty status, variety among indicators, and verifiability.

A series of two-indicator scorecards are 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 is then selected, again based on "c" and judgment. These steps are repeated until the scorecard has 10 indicators.

The final step is to transform the Logit coefficients into non-negative integers such that total scores range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line).

This algorithm is the Logit analogue to the common R^2-based stepwise least-squares regression. It differs from naïve stepwise in that the criteria for selecting indicators include not only statistical accuracy but also judgment and non-statistical factors. The use of non-statistical criteria can improve robustness through time and helps ensure that indicators are simple and make sense to users.

The single scorecard here applies to all of Kenya. Evidence from India and Mexico (Schreiner, 2006 and 2005a), Sri Lanka (Narayan and Yoshida, 2005), and Jamaica (Grosh and Baker, 1995) suggests that segmenting scorecards by urban/rural does not improve targeting accuracy much, although it may improve the accuracy of estimates of poverty rates (Tarozzi and Deaton, 2009).

4. Practical guidelines for scorecard use

The main challenge of scorecard design is not to maximize statistical accuracy but rather to improve the chances that scoring is actually used in practice (Schreiner, 2005b). When scoring projects fail, the reason is not usually statistical inaccuracy but rather the failure of an organization to decide to do what is needed to integrate scoring in its processes and to learn to use it properly (Schreiner, 2002). After all, most reasonable scorecards have similar targeting accuracy, thanks to the empirical phenomenon known as the "flat maximum" (Falkenstein, 2008; Hand, 2006; Baesens *et al.*, 2003; Lovie and Lovie, 1986; Kolesar and Showers, 1985; Stillwell, Barron, and Edwards, 1983; Dawes, 1979; Wainer, 1976; Myers and Forgy, 1963). The bottleneck is less technical and more human, not statistics but organizational-change management. Accuracy is easier to achieve than adoption.

The scorecard here is designed to encourage understanding and trust so that users will adopt it and use it properly. Of course, accuracy matters, but it is balanced against simplicity, ease-of-use, and "face validity". Programs are more likely to collect data, compute scores, and pay attention to the results if, in their view, scoring does not make a lot of "extra" work and if the whole process generally seems to make sense.

To this end, the scorecard here fits on one page. The construction process, indicators, and points are simple and transparent. "Extra" work is minimized; non-specialists can compute scores by hand in the field because the scorecard has:

- Only 10 indicators
- Only categorical indicators
- Simple weights (non-negative integers, and no arithmetic beyond addition)

A field agent using the paper scorecard would:

- Record participant identifiers and household size
- Read each question from the scorecard
- Circle the response and its point value
- Write the point value in the far-right column
- Add up the points to get the total score
- Implement targeting policy (if any)
- Deliver the paper scorecard to a central office for filing or data entry

Of course, field agents must be trained. The quality of outputs depends on the quality of inputs. If organizations or field agents gather their own data and believe that they have an incentive to exaggerate poverty rates (for example, if funders reward them for higher poverty rates), then it is wise to do on-going quality control via data review and audits (Matul and Kline, 2003).[5] IRIS Center (2007a) and Toohig (2008) are useful nuts-and-bolts guides for budgeting, training field workers and supervisors, logistics, sampling, interviewing, piloting, recording data, and controlling quality.

In particular, while collecting scorecard indicators is relatively easier than alternatives, it is still absolutely difficult. Training and explicit definitions of terms and

[5] If an organization does not want field agents to know the points associated with indicators, then they can use the version of the scorecard without points and apply the points later in a spreadsheet or database at the central office.

concepts in the scorecard is essential (Appendix). For the example of Nigeria, Onwujekwe, Hanson, and Fox-Rushby (2006) found distressingly low inter-rater and test-retest correlations for indicators as seemingly simple and obvious as whether the household owns an automobile. At the same time, Grosh and Baker (1995) find that gross underreporting of assets does not affect targeting. For the first stage of targeting in a conditional cash-transfer program in Mexico, Martinelli and Parker (2007) find that "underreporting [of asset ownership] is widespread but not overwhelming, except for a few goods . . . [and] overreporting is common for a few goods, which implies that self-reporting may lead to the exclusion of deserving households" (pp. 24–25). Still, as is done in Mexico in the second stage of its targeting process, most false self-reports can be corrected by field agents who verify responses with a home visit, and this is the suggested procedure for poverty scoring in Kenya.

In terms of sampling design, an organization must make choices about:

- Who will do the scoring
- How scores will be recorded
- What participants will be scored
- How many participants will be scored
- How frequently participants will be scored
- Whether scoring will be applied at more than one point in time
- Whether the same participants will be scored at more than one point in time

In general, the sampling design should follow from the organization's goals for the exercise and the business questions that it seeks to inform.

The non-specialists who apply the scorecard with participants in the field can be:

- Employees of the organization
- Third-party contractors

Responses, scores, and poverty likelihoods can be recorded:

- On paper in the field and then filed at an office
- On paper in the field and then keyed into a database or spreadsheet at an office
- On portable electronic devices in the field and then downloaded to a database

Given a group of interest for a given question, the subjects to be scored can be:

- All participants
- A representative sample of all participants
- All participants in a representative sample of branches
- A representative sample of all participants in a representative sample of branches

If not determined by other factors, the number of participants to be scored can be derived from sample-size formulas (presented later) for a desired level of confidence and a desired confidence interval.

Frequency of application can be:

- At in-take of new clients only (precluding measuring change in poverty rates)
- As a once-off project for current participants (precluding measuring change)
- Once a year (or at some other fixed time interval, allowing measuring change)
- Each time a field agent visits a participant at home (allowing measuring change)

When the scorecard is applied more than once in order to measure change in poverty rates, it can be applied:

- With a different set of participants
- With the same set of participants

An example set of choices is illustrated by BRAC and ASA, two microlenders in Bangladesh who each have more than 7 million participants and who are applying the Simple Poverty Scorecard® (Chen and Schreiner, 2009b). Their design is that loan officers in a random sample of branches score all participants each time they visit a

homestead (about once a year) as part of their standard due diligence prior to loan disbursement. Responses are recorded on paper in the field before being sent to a central office to be entered into a database. ASA's and BRAC's sampling plans cover 50,000–100,000 participants each.

5. Estimates of household poverty likelihoods

The sum of scorecard points for a household is called the *score*. For Kenya, scores range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line). While higher scores indicate less likelihood of being below a line, the scores themselves have only relative units. For example, doubling the score increases the likelihood of being above a given poverty line, but it does not double the likelihood.

To get absolute units, scores must be converted to *poverty likelihoods*, that is, probabilities of being below a poverty line. This is done via simple look-up tables. For the example of the national line, scores of 35–39 have a poverty likelihood of 46.4 percent, and scores of 40–44 have a poverty likelihood of 36.9 percent (Figure 5).

The poverty likelihood associated with a score varies by poverty line. For example, scores of 35–39 are associated with a poverty likelihood of 46.4 percent for the national line but 12.7 percent for the food line.[6]

5.1 Calibrating scores with poverty likelihoods

A given score is associated ("calibrated") with a poverty likelihood by defining the poverty likelihood as the share of households in the calibration sub-sample who have the score and who are below a given poverty line.

[6] Starting with Figure 5, many figures have six versions, one for each of the six poverty lines. To keep them straight, they are grouped by poverty line. Single tables pertaining to all poverty lines are placed with the tables for the national line.

For the example of the national line (Figure 6), there are 10,523 (normalized) households in the calibration sub-sample with a score of 35–39, of whom 4,886 (normalized) are below the poverty line. The estimated poverty likelihood associated with a score of 35–39 is then 46.4 percent, because 4,886 ÷ 10,523 = 46.4 percent.

To illustrate with the national line and a score of 40–44, there are 9,999 (normalized) households in the calibration sample, of whom 3,691 (normalized) are below the line (Figure 6). Thus, the poverty likelihood for this score is 3,691 ÷ 9,999 = 36.9 percent.

The same method is used to calibrate scores with estimated poverty likelihoods for the other five poverty lines.

Even though the scorecard is constructed partly based on judgment, the calibration process produces poverty likelihoods that are objective, that is, derived from survey data on expenditure and quantitative poverty lines. The poverty likelihoods would be objective even if indicators and/or points were selected without any data at all. In fact, objective scorecards of proven accuracy are often constructed using only expert judgment (Fuller, 2006; Caire, 2004; Schreiner *et al.*, 2004). Of course, the scorecard here is constructed with both data and judgment. The fact that this paper acknowledges that some choices in scorecard construction—as in any statistical analysis—are informed by judgment in no way impugns the objectivity of the poverty likelihoods, as this depends on using data in score calibration, not on using data (and nothing else) in scorecard construction.

Although the points in the Kenya scorecard are transformed coefficients from a Logit regression, scores are not converted to poverty likelihoods via the Logit formula of 2.718281828^{score} x $(1+ 2.718281828^{score})^{-1}$. This is because the Logit formula is esoteric and difficult to compute by hand. Non-specialists find it more intuitive to define the poverty likelihood as the share of households with a given score in the calibration sample who are below a poverty line. In the field, going from scores to poverty likelihoods in this way requires no arithmetic at all, just a look-up table. This non-parametric calibration can also improve accuracy, especially with large samples.

5.2 Accuracy of estimates of households' poverty likelihoods

If the relationships between indicators and poverty do not change and if the scorecard is applied to households that are representative of the same population from which the scorecard was constructed, then the calibrated scorecard produces unbiased estimates of poverty likelihoods. *Unbiased* means that in repeated samples from the same population, the average estimate matches the true poverty likelihood. The scorecard also produces unbiased estimates of poverty rates at a point in time, as well as unbiased estimates of changes in poverty rates between two points in time.[7]

Of course, the relationship between indicators and poverty does change to some unknown extent with time and also across sub-groups in Kenya's population, so the

[7] This follows because these estimates of groups' poverty rates are linear functions of the unbiased estimates of households' poverty likelihoods.

scorecard will generally be biased when applied after May 2006 (the last month of fieldwork for the 2005/6 KIHBS) or when applied with non-nationally representative sub-groups.

How accurate are estimates of households' poverty likelihoods? To get a measurement of accuracy under the assumption that the scorecard is applied to a nationally representative sample in the period from May 2005 to May 2006, the scorecard is applied to 1,000 bootstrap samples of size $n = 16{,}384$ from the validation sub-sample. Bootstrapping entails (Efron and Tibshirani, 1993):

- Score each household in the validation sample
- Draw a new bootstrap sample *with replacement* from the validation sample
- For each score, compute the true poverty likelihood in the bootstrap sample, that is, the share of households with the score and expenditure below a poverty line
- For each score, record the difference between the estimated poverty likelihood (Figure 5) and the true poverty likelihood in the bootstrap sample
- Repeat the previous three steps 1,000 times
- For each score, report the average difference between estimated and true poverty likelihoods across the 1,000 bootstrap samples
- For each score, report the two-sided interval containing the central 900, 950, or 990 differences between estimated and true poverty likelihoods

For each score range and for $n = 16{,}384$, Figure 8 shows the average difference between estimated and true poverty likelihoods as well as confidence intervals for the differences.

For the national line, the average poverty likelihood across bootstrap samples for scores of 35–39 in the validation sample is too low by 6.8 percentage points. For scores of 40–44, the estimate is too high by 2.0 percentage points.[8]

The 90-percent confidence interval for the differences for scores of 35–39 is ±4.6 percentage points (Figure 8). This means that in 900 of 1,000 bootstraps, the difference between the estimate and the true value is between –11.4 and –2.2 percentage points (because –6.8 – 4.6 = –11.4, and –6.8 + 4.6 = –2.2). In 950 of 1,000 bootstraps (95 percent), the difference is –6.8 ±4.8 percentage points, and in 990 of 1,000 bootstraps (99 percent), the difference is –6.8 ±5.3 percentage points.

For many scores below 60, Figure 8 shows differences—often large ones—between estimated poverty likelihoods and true values. This is because the validation sub-sample is a single sample that—thanks to sampling variation—differs in distribution from the construction/calibration sub-samples and from Kenya's population. For targeting, however, what matters is less the difference in all score ranges and more the difference in score ranges just above and below the targeting cut-off. This mitigates the effects of bias and sampling variation on targeting (Friedman, 1997). Section 8 below looks at targeting accuracy in detail.

[8] These differences are not zero, in spite of the estimator's unbiasedness, because the scorecard comes from a single sample. The average difference by score would be zero if samples were repeatedly drawn from the population and split into sub-samples before repeating the entire process of scorecard construction and calibration.

In addition, if estimates of groups' poverty rates are to be usefully accurate, then errors for individual households must largely balance out. This is generally the case, as discussed in the next section.

Another possible source of differences between estimates and true values is overfitting. By construction, the scorecard here is unbiased, but it may still be *overfit* when applied after the end of the KIHBS fieldwork in May 2006. That is, it may fit the data from the 2005/6 KIHBS so closely that it captures not only some timeless patterns but also some random patterns that, due to sampling variation, show up only in the 2005/6 KIHBS. Or the scorecard may be overfit in the sense that it is not robust to changes in the relationships between indicators and poverty over time or if it is not robust when applied to non-nationally representative samples.

Overfitting can be mitigated by simplifying the scorecard and by not relying only on data but also considering experience, judgment, and theory. Of course, the scorecard here does this. Combining scorecards can also help, at the cost of greater complexity.

Most errors in individual households' likelihoods, however, cancel out in the estimates of groups' poverty rates (see later sections). Furthermore, at least some of the differences come from non-scorecard sources such as changes in the relationships between indicators and poverty, sampling variation, changes in poverty lines, inconsistencies in data quality across time, and imperfections in cost-of-living adjustments across time and geography. These factors can be addressed only by

improving data quantity and quality (which is beyond the scope of the scorecard) or by reducing overfitting (which likely has limited returns, given the scorecard's parsimony).

6. Estimates of a group's poverty rate at a point in time

A group's estimated poverty rate at a point in time is the average of the estimated poverty likelihoods of the individual households in the group.

To illustrate, suppose a program samples three households on Jan. 1, 2011 and that they have scores of 20, 30, and 40, corresponding to poverty likelihoods of 77.3, 63.7 and 36.9 percent (national line, Figure 5). The group's estimated poverty rate is the households' average poverty likelihood of $(77.3 + 63.7 + 36.9) \div 3 = 59.3$ percent.[9]

6.1 Accuracy of estimated poverty rates at a point in time

For the Kenya scorecard applied to the validation sample with $n = 16{,}384$, the absolute difference between the estimated poverty rate at a point in time and the true rate is 0.4 percentage points or less for all three national lines (Figure 10, summarizing Figure 9 across poverty lines). The difference for the USAID "extreme" line is +0.1 percentage points, and the differences for the 2005 PPP lines are +1.0 and +2.1 percentage points. At least part of these differences is due to sampling variation in the validation sample and in the division of the 2005/6 KIHBS into two sub-samples. For the per-capita lines, part of the differences is also due to the scorecard being constructed based on the national line, which uses adult equivalents.

[9] The group's poverty rate is *not* the poverty likelihood associated with the average score. Here, the poverty likelihood associated with the average score of 30 is 63.7 percent. This is not the 59.3 percent found as the average of the three poverty likelihoods associated with each of the three scores.

In terms of precision, the 90-percent confidence interval for a group's estimated poverty rate at a point in time with n = 16,384 is ±0.6 percentage points or less (Figure 10). This means that in 900 of 1,000 bootstraps of this size, the difference between the estimate and the true value is within 0.6 percentage points of the average difference. In the specific case of the national line and the validation sample, 90 percent of all samples of n = 16,384 produce estimates that differ from the true value in the range of +0.3 – 0.6 = –0.3 to +0.3 + 0.6 = +0.9 percentage points. This is because +0.3 is the average difference, and ±0.6 is its 90-percent confidence interval. The average difference is +0.3 because the average scorecard estimate is too high by 0.3 percentage points; the average estimated poverty rate for the validation sample is 38.2 percent, but the true value is 37.9 percent (Figure 2).

6.2 Formula for standard errors for estimates of poverty rates

How precise are the point-in-time estimates? Because they are averages of binary (0/1, or poor/non-poor) variables, the estimates (in "large" samples) have a Normal distribution and can be characterized by their average difference vis-à-vis true values together with the standard error of the average difference.

To derive a formula for the standard errors of estimated poverty rates at a point in time from indirect measurement via poverty-assessment tools (Schreiner, 2008a), note that the textbook formula (Cochran, 1977) that relates confidence intervals with standard errors in the case of direct measurement of rates is $c = +/- z \cdot \sigma$, where:

c is a confidence interval as a proportion (*e.g.*, 0.02 for ±2 percentage points),

z is from the Normal distribution and is $\begin{cases} 1.64 \text{ for confidence levels of 90 percent} \\ 1.96 \text{ for confidence levels of 95 percent} \\ 2.58 \text{ for confidence levels of 99 percent} \end{cases}$,

σ is the standard error of the estimated poverty rate, that is, $\sqrt{\frac{p \cdot (1-p)}{n}}$,

p is the proportion of households below the poverty line in the sample, and

n is the sample size.

For example, this implies that for a sample n of 16,384 with 90-percent confidence ($z = 1.64$) and a poverty rate p of 37.9 percent (the average poverty rate in the construction/calibration sample in Figure 2 for the national line), the confidence interval c is $+/- z \cdot \sqrt{\frac{p \cdot (1-p)}{n}} = +/- 1.64 \cdot \sqrt{\frac{0.379 \cdot (1-0.379)}{16{,}384}} = \pm 0.622$ percentage points.

Scorecards, however, do not measure poverty directly, so this formula is not immediately applicable. To derive a formula for the Kenya scorecard, consider Figure 9, which reports empirical confidence intervals c for the differences for the scorecard applied to 1,000 bootstrap samples of various sample sizes from the validation sample.

For $n = 16{,}384$ and the national line, the 90-percent confidence interval is 0.620 percentage points.[10]

Thus, the 90-percent confidence interval with $n = 16{,}384$ is 0.620 percentage points for the Kenya scorecard and 0.622 percentage points for direct measurement. The ratio of the two intervals is $0.620 \div 0.622 = 1.00$.

Now consider the same case, but with $n = 8{,}192$. The confidence interval under direct measurement is $+/-1.64 \cdot \sqrt{\frac{0.379 \cdot (1-0.379)}{8{,}192}} = \pm 0.879$ percentage points. The empirical confidence interval with the Kenya scorecard (Figure 9) is 0.855 percentage points. Thus for $n = 8{,}192$, the ratio of the two intervals is $0.855 \div 0.879 = 0.97$.

This ratio of 0.97 for $n = 8{,}182$ is not far from the ratio of 1.00 for $n = 16{,}384$. Across all sample sizes of 256 or more in Figure 9, the average ratio turns out to be 0.98, implying that confidence intervals for indirect estimates of poverty rates via the Kenya scorecard and this poverty line are about the same as confidence intervals for direct estimates via the 2005/6 KIHBS. This 0.98 appears in Figure 10 as the "α factor" because if $\alpha = 0.98$, then the formula relating confidence intervals c and standard errors σ for the Kenya scorecard is $c = +/- z \cdot \alpha \cdot \sigma$. That is, formula for the standard error σ for point-in-time estimates of poverty rates via scoring is $\alpha \cdot \sqrt{\frac{p \cdot (1-p)}{n}}$.

[10] Due to rounding, Figure 9 displays 0.6, not 0.620.

In general, α can be more or less than 1.00. When less than 1.00, it means that the scorecard is more precise than direct measurement, and vice versa when α is more than 1.00. The α factor is less than 1.00 for five of the six poverty lines in Figure 10.

The formula relating confidence intervals with standard errors for poverty scoring can be rearranged to give a formula for determining sample size before measurement.[11] If $\hat{p}$ is the expected poverty rate before measurement, then the formula for sample size n based on the desired confidence level that corresponds to z and the desired confidence interval $\pm c$ is $n = \left(\frac{\alpha \cdot z}{c}\right)^2 \cdot \hat{p} \cdot (1 - \hat{p})$.

To illustrate how to use this, suppose $c = 0.05040$ and $z = 1.64$ (90-percent confidence). Then the formula gives $n = \left(\frac{0.98 \cdot 1.64}{0.04765}\right)^2 \cdot 0.379 \cdot (1 - 0.379) = 267$, not far from the sample size of 256 observed for these parameters in Figure 9 for the national line.

Of course, the α factors in Figure 10 are specific to Kenya, its poverty lines, its poverty rates, and this scorecard. The derivation of the formulas, however, is valid for any poverty-assessment tool following the approach in this paper.

[11] IRIS Center (2007a and 2007b) says that a sample size of $n = 300$ is sufficient for USAID reporting. If a poverty-assessment tool is as precise as direct measurement, if the expected (before measurement) poverty rate is 50 percent, and if the confidence level is 90 percent, then $n = 300$ implies a confidence interval of ±2.2 percentage points. In fact, USAID has not specified confidence levels or intervals. Furthermore, the expected poverty rate may not be 50 percent, and the poverty-assessment tool could be more or less precise than direct measurement.

In practice after the end of fieldwork for the KIHBS in May 2006, an organization would select a poverty line (say, the national line), select a desired confidence level (say, 90 percent, or $z = 1.64$), select a desired confidence interval (say, ± 2.0 percentage points, or $c = 0.02$), make an assumption about $\hat{p}$ (perhaps based on a previous measurement such as the 37.9 percent national average in the 2005/6 KIHBS in Figure 2), look up α (here, 0.98), assume that the scorecard will still work in the future and/or for non-nationally representative sub-groups,[12] and then compute the required sample size. In this illustration, $n = \left(\frac{0.98 \cdot 1.64}{0.02}\right)^2 \cdot 0.379 \cdot (1 - 0.379) = 1{,}520$.

[12] This paper reports accuracy for the scorecard applied to the validation sample, but it cannot test accuracy for later years or for other groups. Performance after May 2006 will resemble that in the 2005/6 KIHBS with deterioration to the extent that the relationships between indicators and poverty status change over time.

7. Estimates of changes in group poverty rates over time

The change in a group's poverty rate between two points in time is estimated as the change in the average poverty likelihood of the households in the group. With data only from the 2005/6 KIHBS, this paper cannot test estimates of change over time for Kenya, and it can only suggest approximate formulas for standard errors. Nevertheless, the relevant concepts are presented here because, in practice, pro-poor organizations can apply the scorecard to collect their own data and to measure change through time.

7.1 Warning: Change is not impact

Scoring can estimate change. Of course, poverty could get better or worse, and scoring does not indicate what caused change. This point is often forgotten or confused, so it bears repeating: poverty scoring simply estimates change, and it does not, in and of itself, indicate the reason for the change. In particular, estimating the impact of program participation requires knowing what would have happened to participants if they had not been participants. Knowing this requires either strong assumptions or a control group that resembles participants in all ways except participation. To belabor the point, poverty scoring can help estimate program impact only if there is some way to know what would have happened in the absence of the program. And that information must come from somewhere beyond poverty scoring.

7.2 Calculating estimated changes in poverty rates over time

Consider the illustration begun in the previous section. On Jan. 1, 2011, a program samples three households who score 20, 30, and 40 and so have poverty likelihoods of 77.3, 63.7, and 36.9 percent (national line, Figure 5). The group's baseline estimated poverty rate is the households' average poverty likelihood of (77.3 + 63.7 + 36.9) ÷ 3 = 59.3 percent.

After baseline, two sampling approaches are possible for the follow-up round:

- Score a new, independent sample, measuring change by cohort across samples
- Score the same sample at follow-up as at baseline

By way of illustration, suppose that a year later on Jan. 1, 2012, the program samples three additional households who are in the same cohort as the three households originally sampled (or suppose that the program scores the same three original households a second time) and finds that their scores are 25, 35, and 45 (poverty likelihoods of 67.9, 46.4, and 30.0 percent, national line, Figure 5). Their average poverty likelihood at follow-up is now (67.9 + 46.4 + 30.0) ÷ 3 = 48.1 percent, an improvement of 59.3 – 48.1 = 11.2 percentage points.[13]

This suggests that about one in nine participants in this hypothetical example crossed the poverty line in 2011.[14] Among those who started below the line, about one in five (11.2 ÷ 59.3 = 18.9 percent) on net ended up above the line.[15]

[13] Of course, such a huge reduction in poverty in one year is unlikely, but this is just an example to show how poverty scoring can be used to estimate change.
[14] This is a net figure; some people start above the line and end below it, and vice versa.

7.3 Accuracy for estimated change in two independent samples

With only the 2005/6 KIHBS, it is not possible to measure the accuracy of scorecard estimates of changes in groups' poverty rates over time. In practice, of course, local pro-poor organizations can still apply the Kenya scorecard to estimate change. The rest of this section suggests approximate formulas for standard errors and sample sizes that may be used until there is additional data.

For two equal-sized independent samples, the same logic as above can be used to derive a formula relating the confidence interval c with the standard error σ of a scorecard's estimate of the change in poverty rates over time:

$$c = +/- z \cdot \sigma = +/- z \cdot \alpha \cdot \sqrt{\frac{2 \cdot p \cdot (1-p)}{n}} \, .$$

z, c, and p are defined as above, n is the sample size at both baseline and follow-up,[16] and α is the average (across a range of bootstrapped sample sizes) of the ratio of the observed confidence interval from a scorecard and the theoretical confidence interval under direct measurement.

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[15] Poverty scoring does not reveal the reasons for this change.

[16] This means that, for a given precision and with direct measurement, estimating the change in a poverty rate between two points in time requires four times as many measurements (not twice as many) as does estimating a poverty rate at a point in time.

As before, the formula for standard errors can be rearranged to give a formula for sample sizes before indirect measurement via a scorecard, where $\hat{p}$ is based on previous measurements and is assumed equal at both baseline and follow-up:

$$n = 2 \cdot \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \hat{p} \cdot (1 - \hat{p}) .$$

For countries for which this α has been measured (Schreiner, 2010, 2009a, 2009b, 2009c, 2009d, 2009e, and 2008b; Schreiner and Woller, 2010a and 2010b; and Chen and Schreiner, 2009a and 2009b), the simple average of α across poverty lines and years for a given country and then across countries is 1.19. This is as reasonable a figure as any to use for Kenya.

To illustrate the use of the formula above to determine sample size for estimating changes in poverty rates across two independent samples, suppose the desired confidence level is 90 percent ($z = 1.64$), the desired confidence interval is 2 percentage points ($c = 0.02$), the poverty line is the national line, $\alpha = 1.19$, and $\hat{p} = 0.379$ (from Figure 2). Then the baseline sample size is $n = 2 \cdot \left(\frac{1.19 \cdot 1.64}{0.02} \right)^2 \cdot 0.379 \cdot (1 - 0.379) =$ 4,483, and the follow-up sample size is also 4,483.

7.4 Accuracy for estimated change for one sample, scored twice

Analogous to previous derivations, the general formula relating the confidence interval c to the standard error σ when using a scorecard to estimate change for a single group of households, all of whom are scored at two points in time, is:[17]

$$c = +/- z \cdot \sigma = +/- z \cdot \alpha \cdot \sqrt{\frac{p_{12} \cdot (1 - p_{12}) + p_{21} \cdot (1 - p_{21}) + 2 \cdot p_{12} \cdot p_{21}}{n}},$$

where z, c, and α are defined as usual, p_{12} is the share of all sampled households that move from below the poverty line to above it, and p_{21} is the share of all sampled households that move from above the line to below it.

The formula for standard errors can be rearranged to give a formula for sample size before measurement. This requires an estimate (based on information available before measurement) of the expected shares of all households who cross the poverty line $\hat{p}_{12}$ and $\hat{p}_{21}$. Before measurement, it is reasonable to assume that the change in the poverty rate will be zero, which implies $\hat{p}_{12} = \hat{p}_{21} = \hat{p}_*$, giving:

$$n = 2 \cdot \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \hat{p}_* .$$

[17] See McNemar (1947) and Johnson (2007). John Pezzullo helped find this formula.

Because $\hat{p}_*$ could be anything between 0–0.5, more information is needed to apply this formula. Suppose that the observed relationship between $\hat{p}_*$, the number of years y between baseline and follow-up, and $p_{\text{baseline}} \cdot (1 - p_{\text{baseline}})$ is—as in Peru (Schreiner, 2009a)—close to:

$$\hat{p}_* = -0.02 + 0.016 \cdot y + 0.47 \cdot [p_{\text{baseline}} \cdot (1 - p_{\text{baseline}})] .$$

Given this, a sample-size formula for a group of households to whom the Kenya scorecard is applied twice (once after May 2006 and then again later) is

$$n = 2 \cdot \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \{-0.02 + 0.016 \cdot y + 0.47 \cdot [p_{\text{baseline}} \cdot (1 - p_{\text{baseline}})]\}.$$

In Peru (the only other country for which there is an estimate, Schreiner 2009a), the average α across years and poverty lines is about 1.30.

To illustrate the use of this formula, suppose the desired confidence level is 90 percent ($z = 1.64$), the desired confidence interval is 2.0 percentage points ($c = 0.02$), the poverty line is the national line, and the sample will first be scored in 2011 and then again in 2014 ($y = 3$). The before-baseline poverty rate is 37.9 percent ($p_{2005/6} = 0.379$, Figure 2), and suppose $\alpha = 1.30$. Then the baseline sample size is $n = 2 \cdot \left(\frac{1.30 \cdot 1.64}{0.02} \right)^2 \cdot \{-0.02 + 0.016 \cdot 3 + 0.47 \cdot [0.379 \cdot (1 - 0.379)]\} = 3{,}151$. The same group of 3,151 households is scored at follow-up as well.

8. Targeting

When a program uses poverty scoring for targeting, households with scores at or below a cut-off are labeled *targeted* and treated—for program purposes—as if they are below a given poverty line. Households with scores above a cut-off are labeled *non-targeted* and treated—for program purposes—as if they are above a given poverty line.

There is a distinction between *targeting status* (scoring at or below a targeting cut-off) and *poverty status* (expenditure below a poverty line). Poverty status is a fact that depends on whether expenditure is below a poverty line as directly measured by a survey. In contrast, targeting status is a program's policy choice that depends on a cut-off and on an indirect estimate from a scorecard.

Targeting is successful when households truly below a poverty line are targeted (*inclusion*) and when households truly above a poverty line are not targeted (*exclusion*). Of course, no scorecard is perfect, and targeting is unsuccessful when households truly below a poverty line are not targeted (*undercoverage*) or when households truly above a poverty line are targeted (*leakage*). Figure 11 depicts these four possible targeting outcomes. Targeting accuracy varies by the cut-off score; a higher cut-off has better inclusion (but greater leakage), while a lower cut-off has better exclusion (but higher undercoverage).

Programs should weigh these trade-offs when setting a cut-off. A formal way to do this is to assign net benefits—based on a program's values and mission—to each of

the four possible targeting outcomes and then to choose the cut-off that maximizes total net benefits (Adams and Hand, 2000; Hoadley and Oliver, 1998).

Figure 12 shows the distribution of households by targeting outcome. For an example cut-off of 35–39, outcomes for the national line in the validation sample are:

- Inclusion: 27.2 percent are below the line and correctly targeted
- Undercoverage: 10.7 percent are below the line and mistakenly not targeted
- Leakage: 15.3 percent are above the line and mistakenly targeted
- Exclusion: 46.8 percent are above the line and correctly not targeted

Increasing the cut-off to 40–44 improves inclusion and undercoverage but worsens leakage and exclusion:

- Inclusion: 30.7 percent are below the line and correctly targeted
- Undercoverage: 7.2 percent are below the line and mistakenly not targeted
- Leakage: 21.7 percent are above the line and mistakenly targeted
- Exclusion: 40.4 percent are above the line and correctly not targeted

Which cut-off is preferred depends on total net benefit. If each targeting outcome has a per-household benefit or cost, then total net benefit for a given cut-off is:

(Benefit per household correctly included x Households correctly included) –
(Cost per household mistakenly not covered x Households mistakenly not covered) –
(Cost per household mistakenly leaked x Households mistakenly leaked) +
(Benefit per household correctly excluded x Households correctly excluded).

To set an optimal cut-off, a program would:

- Assign benefits and costs to possible outcomes, based on its values and mission
- Tally total net benefits for each cut-off using Figure 12 for a given poverty line
- Select the cut-off with the highest total net benefit

The most difficult step is assigning benefits and costs to targeting outcomes. A program that uses targeting—with or without scoring—should thoughtfully consider how it values successful inclusion or exclusion versus errors of undercoverage or leakage.

It is healthy to go through a process of thinking explicitly and intentionally about how possible targeting outcomes are valued.

A common choice of benefits and costs is "Total Accuracy" (IRIS Center, 2005; Grootaert and Braithwaite, 1998). With "Total Accuracy", total net benefit is the number of households correctly included or correctly excluded:

Total Accuracy =	1	x	Households correctly included	–
	0	x	Households mistakenly undercovered	–
	0	x	Households mistakenly leaked	+
	1	x	Households correctly excluded.	

Figure 12 shows "Total Accuracy" for all cut-offs for the Kenya scorecard. For the national line in the validation sample, total net benefit is greatest (74.1) for a cut-off of 30–34 or 35–39, with about three in four households in Kenya correctly classified.

"Total Accuracy" weighs successful inclusion of households below the line the same as successful exclusion of households above the line. If a program valued inclusion more (say, twice as much) than exclusion, it could reflect this by setting the benefit for inclusion to 2 and the benefit for exclusion to 1. Then the chosen cut-off would maximize (2 x Households correctly included) + (1 x Households correctly excluded).[18]

As an alternative to assigning benefits and costs to targeting outcomes and then choosing a cut-off to maximize total net benefit, a program could set a cut-off to achieve a desired poverty rate among targeted households. The third column of Figure 13 ("% targeted who are poor") shows, for the Kenya scorecard applied to the validation

[18] "BPAC" in Figure 11 is discussed in Section 9.

sample, the expected poverty rate among households who score at or below a given cut-off. For the example of the national line, targeting households who score 39 or less would target 42.5 percent of all households (second column) and produce a poverty rate among those targeted of 64.1 percent (third column).

Figure 13 also reports two other measures of targeting accuracy. The first is a version of coverage ("% of poor who are targeted"). For the example of the national line in the validation sample and a cut-off of 39 or less, 71.8 percent of all poor households are covered.

The final targeting measure in Figure 13 is the number of successfully targeted poor households for each non-poor household mistakenly targeted (right-most column). For the national line in the validation sample and a cut-off of 39 or less, covering 1.8 poor households means leaking to 1 non-poor household.

9. The context of Kenyan poverty-assessment tools

This section discusses seven existing poverty-assessment tools for Kenya in terms of their goals, methods, poverty definitions, indicators, cost, accuracy, and precision. The advantages of the new scorecard here are its use of the latest nationally representative data, its focus on feasibility for local, pro-poor organizations, its testing of accuracy and precision, and its reporting of formulas for standard errors.

9.1 Gwatkin *et al.*

Gwatkin *et al.* (2007) apply to Kenya an approach used in 56 countries with Demographic and Health Surveys (Rutstein and Johnson, 2004). They use Principal Components Analysis to make an asset index from simple, low-cost indicators available for the 8,561 households in the Kenya 2003 DHS. The PCA index is like the poverty scorecard here except that, because the DHS does not collect data on income or expenditure, it is based on a different conception of poverty, its accuracy vis-à-vis expenditure-based poverty is unknown, and it can only be assumed to be a proxy for long-term wealth/economic status.[19] Well-known examples of the PCA asset-index

[19] Still, because the indicators are similar and because the "flat maximum" is important, carefully built PCA indices and expenditure-based poverty-assessment tools may pick up the same underlying construct (perhaps "permanent income", see Bollen, Glanville, and Stecklov, 2007), and they rank households much the same. Tests of how well rankings by PCA indices correspond with rankings by expenditure-based poverty-assessment tools include Howe *et al.* (2009), Filmer and Scott (2008), Lindelow (2006), Wagstaff and Watanabe (2003), and Montgomery *et al.* (2000).

approach include Ferguson *et al.* (2003), Sahn and Stifel (2003), and Filmer and Pritchett (2001).

Gwatkin *et al.* discuss three basic uses for their index:

- Segmenting households by quintiles to see how health, population, and nutrition vary with socio-economic status
- Monitoring (via exit surveys) how well local health-service posts reach the poor
- Measuring coverage of health services via local, small-scale surveys

The first goal is akin to targeting, and the last two goals resemble the monitoring goals here, so the uses of the index are similar to those of the scorecard here.

Most of the 20 indicators in Gwatkin *et al.* are similar to those in the scorecard here in terms of their simplicity, low cost, and verifiability:

- Characteristics of the residence:
  - Type of floor
  - Type of roof
  - Type of cooking fuel
  - Source of drinking water
  - Type of toilet arrangement
  - Presence of electricity
  - Use of solar power
  - Means of waste disposal
  - Tenancy status of house
  - Tenancy status of homestead land
  - Number of people per sleeping room
- Ownership of consumer durables:
  - Radio
  - Television
  - Refrigerator
  - Telephone
  - Bicycle
  - Motorcycle or scooter
  - Car or truck
- Presence of a domestic worker
- Whether any family members work their own or family's agricultural land

The Gwatkin *et al.* index is more difficult and costly to use than the scorecard here because it cannot be computed by hand in the field, as it has 134 point values, half of them negative, and all with five decimal places.

While the scorecard here uses an expenditure-based poverty line, Gwatkin *et al.*—like all PCA asset indices—define poverty in terms of the indicators in the index. Thus, the index can be seen not as a proxy standing in for something else (such as expenditure) but rather as a direct measure of a non-expenditure-based definition of poverty. There is nothing wrong—and a lot right—about defining poverty in this way, but it is not as commonly used nor as well-understood as an expenditure-based definition.

9.2 Sahn and Stifel (2000)

Sahn and Stifel (2000) use factor analysis (a close relative of PCA that gives similar results) to construct an asset index meant to measure poverty in terms of long-term wealth. They construct their index by pooling Kenya's 1988 and 1993 DHS. Defining poverty status according to lines set at the 25^{th} and 40^{th} percentiles of the asset index, they then compare the distribution of the index and poverty rates over time (within Kenya) and across countries (Kenya and 10 other sub-Saharan countries).

For the cross-country analysis, Sahn and Stifel construct a single cross-country index from pooled DHS data for the 11 countries (plus five others for which only a

single DHS round was available). This is possible because the DHS use a common set of indicators in all rounds and countries.

The eight indicators in Sahn and Stifel are similar to those in the scorecard here in terms of their simplicity, low cost, and verifiability:

- Education of the head
- Characteristics of the residence:
  - Type of floor
  - Source of drinking water
  - Type of toilet arrangement
- Ownership of consumer durables:
  - Radio
  - Television
  - Refrigerator
  - Bicycle

Like Gwatkin *et al.*, this approach shares many of the strengths of the approach here in that it can be used for targeting and in that it is flexible, low-cost, and adaptable to diverse contexts. Because it does not require price adjustments over time or between countries—or even expenditure data—it is more adaptable in those dimensions than the scorecard here.

Sahn and Stifel also share with Gwatkin *et al.* the disadvantages of using a less-common definition of poverty and of not reporting formula for standard errors. Also, their purpose is to inform governments and donors about the broad progress of poverty-reduction efforts in Africa, not to provide a tool to help local, pro-poor organizations in their poverty-alleviation efforts.[20]

9.3 Zeller *et al.*

Like this paper, Zeller *et al.* (2006) seek to develop a practical, low-cost, accurate way to assess the poverty of participants in local pro-poor programs. Their benchmark for assessment is not absolute poverty status according to an expenditure-based poverty line but rather relative poverty compared with other households in the area.

Like Gwatkin *et al.* and Sahn and Stifel, Zeller *et al.* use PCA to combine indicators into an index. They pilot their approach with microfinance organizations in four countries, one of which is Kenya. They apply a special-purpose survey to a random sample of 200 program participants and a comparison group of 300 non-participants in the program area, comparing the indices' distribution by terciles to see whether program participants tend to be poorer.

[20] Booysen *et al.* (2008) covers Kenya is a way similar to Sahn and Stifel except that they use Multiple Correspondence Analysis instead of factor analysis, they look at both poverty rates and inequality, and they use three DHS rounds rather than two.

Zeller *et al.* start the construction process with a long list of potential indicators and narrow it down based on their correlation with expenditure on clothing, eventually selecting 15 indicators in the PCA analysis:

- Characteristics of the residence:
  - Type of wall
  - Source of drinking water
  - Type of toilet arrangement
  - Presence of electricity
- Education:
  - Education of the household head
  - Percentage of adults who are literate
- Assets:
  - Number of televisions
  - Value of radios
  - Value of electrical devices
  - Value of assets per person/adult
- Food security and resilience:
  - Episodes of hunger in the past 30 days
  - Episodes of hunger in the past 12 months
  - Number of days with luxury food 1
  - Number of days with luxury food 2
- Per-capita expenditure on clothing

Like all asset indices (and like the scorecard here), Zeller *et al.*'s index can rank households and be applied in diverse contexts. Its weakness is its less-common definition of poverty, as well as its small, non-nationally representative sample. Most important, many of the specific indicators in their index for Kenya are difficult and costly to collect. For example, most households cannot easily estimate the value of their radios, let alone the value of their electrical devices, to say nothing of the value of their assets or their expenditure on clothing. Also, the food-security indicators relate to historical events and so are inherently non-verifiable. Even if all these indicators could

be collected accurately, they would probably not rank households much better—thanks to the "flat maximum"—than indices using simpler, less-costly indicators. Finally, Zeller *et al.* do not report the precise wording of their indicators nor do they report points, so a local pro-poor organization in Kenya cannot simply pick up their tool and use it.

9.4 Stifel and Christiaensen

Like Sahn and Stifel, Stifel and Christiaensen (2007) build an asset index to track changes in poverty using the poverty-mapping approach (see below). They differ in that they use Kenya's 1997 WMS and relate indicators to an absolute, expenditure-based poverty line. In addition to the WMS, their data sources include:

- 1993, 1998, and 2003 DHS
- District-level malaria data from the 1992, 1994, and 1997 WMS
- District-level infrastructure data from the 1999 Census
- District-level rainfall data from the Famine Early Warning System

Stifel and Christiaensen's poverty-assessment tool estimates expenditure. It is constructed from data in the 1997 WMS using only indicators matched in both the WMS and the DHS. It is then applied to predict household expenditure in the various years of the DHS (which does not collect expenditure). Similar exercises for other countries include Azzarri *et al.* (2005), Kijima and Lanjouw (2003), Simler, Harrower, and Massingarela (2003), and Filmer and Pritchett (2001).

At the household-level, Stifel and Christiaensen seek indicators that have returns that do not vary much over time (leading to the exclusion of labor and land). At the

macro level, they seek indicators that are location-specific, vary annually, and are likely to affect asset returns (such as rainfall and malaria incidence).

Given potential indicators meeting these criteria, Stifel and Christiaensen build three regional tools (Nairobi, other urban, and rural) with stepwise least-squares regression on the logarithm of per-capita expenditure. Their selected indicators are:

- Demographics:
  - Household size
  - Dependency ratio
- Education:
  - Education of the household head
  - Share of household members with secondary education
  - Share of household members with post-secondary education
- Characteristics of the residence:
  - Type of floor
  - Type of roof
  - Source of drinking water
  - Type of toilet arrangement
- Ownership of household durables:
  - Radio
  - Television
  - Refrigerator
  - Bicycle
- Cluster and district characteristics:
  - Share of households with:
    - Low-quality floors
    - Piped water
    - Refrigerator
    - Electricity
  - Cluster-average share of household heads with education:
    - Primary
    - Secondary
    - Post-secondary
  - Cluster-average share of households with someone with post-secondary education

- Rainfall and health:
  - — Deviation of early-season rain from long-run average
  - — Malaria prevalence
  - — Average household height-for-age *z*-score

Most of Stifel and Christiaensen's indicators are simple, inexpensive, and verifiable. Of course, the district-level indicators are more complex, and the dependency ratio requires division. Also, they do not directly measure accuracy/precision, nor do they report sample-size formula. Their use of district-level indicators makes their index more applicable at the national level (as they intend) than at the household level.

When Stifel and Christianensen's tools constructed with Kenya's 1997 WMS is applied to that same data (that is, *in-sample*) to estimate poverty rates, bias ranges from –1 to –2 percentage points. Such in-sample tests overstate accuracy. (If the scorecard here were applied in-sample, bias would be exactly zero.) When the new scorecard here is applied *out-of-sample*—that is, to data not used to construct the scorecard—bias ranges from +0.3 to +2.1 percentage points (Figure 10). Thus, the scorecard here is not more biased than Stifel and Christianensen's tool. Still, the comparison is imperfect because the tools use different data at different times.

For precision, Stifel and Christianensen report a standard error of 1.7 percentage points for an in-sample poverty-rate estimate (n = 10,639). Ignoring again the in-sample overstatement of precision, the implied α factor is about 3.5, suggesting that the scorecard here (out-of-sample α of 0.85 to 1.06, Figure 10) is more precise.

In general, Stifel and Christiaensen do well what they intend to do, which is estimate national expenditure-based poverty rates for years without a national

expenditure survey. And although they did not have access to the final 2005/6 KIHBS and so could not test accuracy out-of-sample, they do get a reasonable idea of accuracy via triangulation with other macroeconomic indicators.

9.5 IRIS Center

USAID commissioned IRIS Center ("IRIS", 2010) to build a poverty-assessment tool so that USAID's microenterprise partners in Kenya can report on their participants' poverty rates. The tool is based on the $1.25/day 2005 PPP poverty line. Overall, the IRIS tool is like the one here, except it is less transparent, it uses more indicators (18 versus 10), and its accuracy is not published.[21]

Like this paper, IRIS uses the 2005/6 KIHBS. After comparing several statistical approaches and imputing missing data[22], IRIS settles on a quantile regression (Koenker and Hallock, 2001) that estimates not poverty likelihoods but rather the 49th percentile of the logarithm of per-capita household expenditure. Unlike the non-parametric, poverty-likelihood approach here, IRIS' estimator of poverty rates is non-linear in estimated expenditure and so is biased. Its indicators are:

- Demographics:
  - — Household size
  - — Structure of household headship
  - — Age of head

[21] Anthony Leegwater sent unpublished accuracy results in personal communication.
[22] Multiple imputation is done with the ICE algorithm in STATA.

- Characteristics of the residence:
  - — Number of rooms
  - — Type of floor
  - — Source of drinking water
  - — Type of toilet arrangement
  - — Main source of cooking fuel
- Ownership of consumer durables:
  - — Number of refrigerators
  - — Number of charcoal *jikos*
  - — Number of electric irons
  - — Number of radios
  - — Radio/cassette/CD player
  - — Electric/gas cooker
  - — Charcoal iron
- Whether any household member raises or owns livestock
- Location:
  - — Province
  - — Urban/rural

These indicators are simple, inexpensive, and verifiable. IRIS reports only the questionnaire used to collect data and not the actual tool or its points, so actual indicators may differ slightly from those listed here.

The purpose of the IRIS tool is to estimate poverty rates for USAID. The unpublished accuracy tests indicate that out-of-sample bias is essentially zero. The tests also include inclusion, undercoverage, leakage, and exclusion, as well as Total Accuracy and the "Balanced Poverty Accuracy Criterion", a measure of accuracy invented by IRIS (2005) that USAID has adopted as its criterion for certifying poverty-assessment tools. BPAC considers accuracy both in terms of the estimated poverty rate (the purpose of the IRIS tool) and in terms of inclusion (a targeting purpose that IRIS disavows). The formula is:

BPAC = (Inclusion – |Undercoverage – Leakage|) x [100 ÷ (Inclusion+Undercoverage)].

BPAC for IRIS for the $1.25/day 2005 PPP line is 71.2, while the scorecard here with a cut-off of 39 or less has a BPAC of 59.7 (Figure 12). If scores are not grouped, then a cut-off of 37 or less gives a BPAC of 64.9.

In terms of total accuracy, the IRIS tool achieves 79.3, while the new scorecard here with a cut-off of 39 or less reaches 74.1.

Thus, the IRIS tool is more accurate. The comparison here is clean in that both tools use the same data, the same poverty line, and out-of-sample tests.

Beyond accuracy, the two tools differ in their transparency: IRIS does not publish the actual tool, and the accuracy results reported here are unpublished. The precision of estimated poverty rates is not published, nor are standard errors.

IRIS states that its tool should not be used for targeting,[23] and IRIS doubts that its tool is useful for measuring changes in poverty rates, noting that "it is unclear that the tools will be able to identify real changes in poverty over time due to their inherent measurement errors. Unless the changes in the poverty rate are exceptionally large and the tools exceptionally accurate, the changes identified are likely to be contained within the margin of error."[24] In contrast, this paper supports these uses, providing the means by which users can decide whether the results are accurate enough for their purposes.

[23] `http://www.povertytools.org/faq/faq.html#11`, retrieved 19 February 2009.
[24] `http://www.povertytools.org/faq/faq.html#12`, retrieved 19 February 2009.

9.6 Ndeng'e *et al.*

Ndeng'e *et al.* (2003) use the 1997 WMS to build 16 poverty-assessment tools (urban/rural by province) that are then applied to data from Kenya's 1999 Census to estimate poverty rates at the level of Kenya's provinces, districts, divisions, and locations. This is the "poverty mapping" approach of Elbers, Lanjouw, and Lanjouw (2003) and Hentschel *et al.* (2000). The purpose of Ndeng'e *et al.*'s poverty map is to produce "comprehensive, reliable, and timely spatial indicators of poverty status . . . [so as to] build sustained time-series benchmarks for poverty measurement in Kenya necessary for institutionalising an effective monitoring and evaluation system for the effective implementation and targeting of poverty programmes" (p. 3).

Ndeng'e *et al.* use stepwise regression to predict the logarithm of per-capita expenditure using data from the 1997 WMS and indicators found in both in the WMS and the Census. They apply the tools to households in the Census to estimate poverty rates at various levels of disaggregation. The poverty-mapping estimates are more precise than direct estimates based on the WMS. Finally, Ndeng'e *et al.* make poverty maps that quickly show—in a way that is clear for non-specialists—how poverty rates vary across political constituencies.

Poverty mapping in Ndeng'e *et al.* (and poverty mapping in general) is similar to poverty scoring in this paper in that they both:

- Build scorecards with nationally representative survey data and then apply them to other data on sub-groups that may not be nationally representative
- Use simple, verifiable indicators that are quick and inexpensive to collect
- Provide unbiased estimates when their assumptions hold
- Are used to estimate poverty rates for groups
- Seek to be useful in practice and so aim to be understood by non-specialists

Strengths of poverty mapping include that it:

- Has formally established theoretical properties
- Can be applied straightforwardly to measures of well-being beyond poverty rates
- Requires less data for tool construction and calibration
- Includes community-level indicators
- Uses only indicators that appear in a census

Strengths of poverty scoring include that it:

- Is simpler in terms of both construction and application
- Tests accuracy empirically
- Associates poverty likelihoods with scores non-parametrically
- Uses judgment and theory in scorecard construction to reduce overfitting
- Estimates poverty likelihoods for individual households
- Reports straightforward formulas for standard errors

The basic difference between the two approaches is that poverty mapping seeks to help governments design and target pro-poor policies, while poverty scoring seeks to help local pro-poor organizations to manage their social performance.[25]

[25] Another apparent difference is that the developers of the poverty-mapping approach (Elbers, Lanjouw, and Lanjouw, 2003; Demombynes *et al.*, 2002) say that it is too inaccurate to be used for targeting individual households, while Schreiner (2008c) supports such targeting as a legitimate, potentially useful application of poverty scoring. Recently, the developers of poverty mapping seem to have taken a small step away from their original position (Elbers *et al.*, 2007).

Ndeng'e *et al.* do not report indicators or points, so local, pro-poor organizations cannot use their tools. They also do not report bias (not having a standard against which to measure it). While they do report standard errors, the implied precision cannot be compared to the precision of the scorecard here because of different assumptions about how the scorecard would be used and because Ndenge *et al.* do not report their poverty line nor the number of households in each political constituency.

9.7 Christiaensen *et al.*

Christiaensen *et al.* (2008) use the poverty-mapping approach to construct regional (Nairobi, urban, and rural) poverty-assessment tools for Kenya based on the 1997 WMS, using only indicators matched between the WMS and the 2005/6 KIHBS. Their goal is to check the stability of the relationships between indicators and poverty over time. If the relationships are stable, it bodes well for the use of poverty-assessment tools to track changes in poverty rates.[26] To this end, Christiaensen *et al.* apply their tool constructed from the 1997 WMS to the 2005/6 KHIBS, comparing estimates to true values out-of-sample.

Using the national poverty line, Christiaensen *et al.*'s estimate for the 2005/6 person-level poverty rate for all of Kenya is 1.1 percentage points too low with a standard error of 0.6 percentage points. Assuming $n = 13{,}158$ and using Kenya's 1997

[26] Although Christiaensen *et al.* (p. 5) say that their paper is the "first contribution" in this regard, it is preceded by Schreiner (2008a and 2008b).

WMS person-level poverty rate of 50.8 percent for $\hat{p}$, the implied α factor for Christiaensen *et al.*'s set of tools when applied to two representative samples is 0.97.[27] This suggests that it is reasonable to use poverty scoring—at least for Kenya in this period—for tracking changes in poverty rates, as the relationships between indicators and poverty apparently did not change much.

Although Christiaensen *et al.* do not report tool points, they do report 22 indicators, all of them simple, inexpensive-to-collect, and verifiable:

- Demographics:
  - — Household size
  - — Sex of head
  - — Age/sex composition of household
- Education of the head
- Characteristics of the residence:
  - — Type of floor
  - — Type of roof
  - — Source of drinking water
  - — Type of toilet arrangement
  - — Presence of electricity
- Ownership of consumer durables:
  - — Radio
  - — Television
  - — Stereo
  - — Gas/electric stove
  - — Fan
  - — Telephone
  - — Sofa
  - — Sewing machine
  - — Refrigerator
  - — Animal cart
  - — Bicycle
  - — Motorcycle
  - — Car

[27] These are for estimates over time and so are not comparable to those in Figure 10.

10. Conclusion

This paper presents the Simple Poverty Scorecard®. Pro-poor organizations in Kenya can use it to estimate the likelihood that a household has expenditure below a given poverty line, to estimate the poverty rate of a group of households at a point in time, and to estimate changes in the poverty rate of a group of households between two points in time. The scorecard can also be used for targeting.

The scorecard is inexpensive to use and can be understood by non-specialists. It is designed to be practical for local pro-poor organizations who want to improve how they monitor and manage their social performance.

The scorecard is built with half of the data from Kenya's 2005/6 KIHBS, tested on the other half, and calibrated to six poverty lines.

Accuracy and precision are reported for estimates of households' poverty likelihoods, groups' poverty rates at a point in time, and changes in groups' poverty rates over time. Of course, the scorecard's estimates of changes are not the same as estimates of program impact. Targeting accuracy is also reported.

When the scorecard is applied to the validation sample with n = 16,384, the absolute difference between estimates and true poverty rates for groups of households at a point in time for the three national poverty lines is +0.4 percentage points or less. For the USAID "extreme" line, the difference is +0.1 percentage points, and for the \$1.25/day and \$2.50/day 2005 PPP lines, the differences are +1.0 and +2.1 percentage

points. For $n = 16{,}384$ and 90-percent confidence, the precision of these differences is ± 0.6 percentage points or better.

If a program wants to use the scorecard for targeting, then the results here provide the information needed to select a cut-off that fits its values and mission.

Although the statistical technique is innovative, and although technical accuracy is important, the design of the scorecard here focuses on transparency and ease-of-use. After all, a perfectly accurate scorecard is worthless if programs feel so daunted by its complexity or its cost that they do not even try to use it. For this reason, the scorecard is kept simple, using ten indicators that are inexpensive to collect and that are straightforward to verify. Points are all zeros or positive integers, and scores range from 0 to 100. Scores are related to poverty likelihoods via simple look-up tables, and targeting cut-offs are likewise simple to apply. The design attempts to facilitate adoption by helping managers understand and trust scoring and by allowing non-specialists to generate scores quickly in the field.

In summary, the Simple Poverty Scorecard® is a practical, objective way for pro-poor programs in Kenya to estimate poverty rates, track changes in poverty rates over time, and target services. The same approach can be applied to any country with similar data from a national income or expenditure survey.

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Appendix:
Guide to Interpretation of Scorecard Indicators

The following information comes from:

Kenya Central Bureau of Statistics. (2005) *Interviewer's Manual: 2004/5 Kenya Integrated Household Budget Survey*, Nairobi: Ministry of Planning and National Development.

1. How many members does the household have?

According to the *Interviewer's Manual*, pp. 10–11: "A household is:

- A person or a group of people living in the same compound (fenced or unfenced)
- Answerable to the same head
- Sharing a common source of food and/or income as a single unit in the sense that they have common housekeeping arrangements (that is, share or are supported by a common budget).

"It is important to note the three elements of this definition namely: do they live in the same compound? Are they answerable to the same and one head? Do they share a common source of food and/or income? If any of the responses is "No", then this is not one household but several. It is possible that individuals who are not members of the household may be residing with the household at the time of the survey. In most cases, but not all, someone who does not regularly live with the household during the survey period, based on some criterion (i.e. how many months has member lived in the household) is not a current member of the household.

"The definition of who is and who is not a household member is given below. It is important to recognize that members of a household need not necessarily be related by blood or by marriage. On the other hand, not all those who are related and are living in the same compound or dwelling are necessarily members of the same household. Two brothers who live in the same dwelling with their own wives and children may or may not form a common housekeeping arrangement. If they do not, they should be considered separate households.

"One should make a distinction between *family* and *household*. The first reflects social relationships, blood descent, and marriage. The second is used here to identify an economic unit. While families and households are often the same, this is not necessarily the case. You must be cautious and use the criteria provided on household membership

to determine which individuals make up a particular household. In the case of polygamous unions and extended family systems, household members are distributed over two or more dwellings. If these dwelling units are in the same compound or nearby (but necessarily within the same Enumeration Area) and they have a common housekeeping arrangement with a common household budget, the residents of these separate dwelling units should be treated as one household.

"The head of household is the person commonly regarded by the household members as their head. The head would usually be the main income earner and decision maker for the household, but you should accept the decision of the household members as to who is their head. There must be one and only one head in the household. If more than one individual in a potential household claims headship or if individuals within a potential household give conflicting statements as to who is the head of household, it is very likely that you are dealing with two or more households, rather than one. In such cases, it is extremely important that you apply the criteria provided to delimit membership in the survey household. Having identified a social unit that shares a common housekeeping arrangement—that is, a household—it then becomes necessary to determine who is and who is not a member of that household. After listing all potential household members (question B02), in order to determine which of these individuals are household members, the KIHBS uses information on how many months during the past 12 months a potential household member has been away from the household (question B07). Those individuals who have been absent from the household for more than 9 months during the past 12 months—that is, have been resident in the household for less than 3 of the past 12 months—should not be considered household members.

"However, there are several exceptions to this rule:

- Young infants less than 3 months old
- New spouses who have recently come into the household and are now residing with the household
- Household members residing in an institution elsewhere, but still dependent on the household. This principally includes boarding-school students. However, it does not include military personnel, prisoners, or other individuals who are not primarily dependent on the household for their welfare

"It is important to highlight that non-relatives who are resident in the household for more than three months are included in a common household keeping arrangement under the head of household and are considered household members. However, servants, other hired workers, and lodgers (individuals who pay to reside in the dwelling of the household) should not be considered to be household members if they have their own household elsewhere which they head or upon which they are dependent."

2. What is the highest school grade that the female head/spouse has completed?

The *female head/spouse* is:

- The head of the household, if the head is female
- The spouse of the head of the household, if the head is male and has a spouse
- Non-existent, if the head is male and does not have a spouse

According to the *Interviewer's Manual*, pp. 11: "The *head of household* is the person commonly regarded by the household members as their head. The head would usually be the main income earner and decision maker for the household, but you should accept the decision of the household members as to who is their head. There must be one and only one head in the household. If more than one individual in a potential household claims headship or if individuals within a potential household give conflicting statements as to who is the head of household, it is very likely that you are dealing with two or more households, rather than one."

In terms of the meaning of *highest grade completed*, the *Interviewer's Manual* (p. 24) states the following: "To be recorded as completing a grade, the person must have actually finished the level in question. A person may have attended a class level, but not completed it. For all persons attending school this year, the highest level completed should be one year lower than the highest level reached. And for persons not attending school this year the highest level completed may be the same as the highest level reached or one level below it, but not greater. For example, someone who attended Standard 6 but never finished that class would be recorded as having completed Standard 5, and someone currently attending Form 3 would be recorded as having completed Form 2. . . .

"Older individuals may have attended school when the Kenyan educational system was different from what it is now. . . .

"If the respondent did not attend formal school, code 'Other', for the non-formal schooling, system *e.g.*, Nduksis, Madrassa, and special school programmes."

3. What kind of business (type of industry) is the main occupation of the male head/spouse connected with?

The *male head/spouse* is:

- The head of the household, if the head is male
- The spouse of the head of the household, if the head is female and has a spouse
- Non-existent, if the head is female and does not have a spouse

According to the *Interviewer's Manual*, pp. 11: "The *head of household* is the person commonly regarded by the household members as their head. The head would usually be the main income earner and decision maker for the household, but you should accept the decision of the household members as to who is their head. There must be one and only one head in the household. If more than one individual in a potential household claims headship or if individuals within a potential household give conflicting statements as to who is the head of household, it is very likely that you are dealing with two or more households, rather than one."

According to the Interviewer's Manual (p. 36): "This question is to determine the economic sector in which the respondent works. . . .

"*Industry* refers to the economic activity of the establishment in which an employed person worked during the survey reference period or last worked if unemployed. This activity is defined in terms the kinds of goods produced, or services offered by the economic unit or establishment in which the person works. The branch of economic activity of a person does not depend on one's occupation. Therefore, if a driver reports working in a factory producing suitcases and handbags, the activity would be considered as "Manufacturing". It should also be pointed out that the terms *Industry* and *Economic Activity* are interchangeably used to mean the same thing. Industrial codes . . . are based on the 1990 edition of the UN International Standard Industrial Classification (ISIC-1990) of all economic activities."

According to the 2005/6 KIHBS questionnaire (p. 16), the *survey reference period* for the *main occupation* for the purpose of this indicator is the main occupation in the past 7 days, if the person worked in the past 7 days. If the person did not work in the past 7 days, but did work in the past 12 months, then the main occupation is that of the past 12 months.

According to the *Interviewer's Manual* (p. 131), the definition of the 1990 edition of the United Nations' International Standard Industrial Classification (ISIC–1990) for the sector of "Agriculture, hunting, forestry, fishing, mining, or quarrying" comprises the following:

- Agriculture and forestry:
    - — Coffee plantations
    - — Tea plantations
    - — Sugar plantations
    - — Sisal plantations
    - — Mixed farming
    - — Ranches
    - — Other agricultural activities not elsewhere classified
    - — Processing co-operatives of small farms

    - — Agricultural services
    - — Hunting, trapping and game propagation
    - — Forestry
    - — Charcoal burning
    - — Logging
    - — Ocean and coastal fishing
    - — Inland water fishing
- Mining and quarrying:
    - — Stone quarrying, clay and sand pits
    - — Chemical and fertilizer mineral mining
    - — Mining and quarrying not elsewhere classified

4. How many habitable rooms does this household occupy in its main dwelling (do not count bathrooms, toilets, storerooms, or garage)?

According to p. 44 of the Interviewer's Guide, "*habitable rooms* refers to those that are used for living and excludes bathrooms, toilets, storerooms, garages, etc.

"If a room is used for functions beyond those conventionally accepted, then they may be included as habitable rooms, *e.g.*, if a garage or store is as well used for sleeping, then it will be included among the habitable rooms. A room that is divided by a curtain or some cartons should just be considered as one room.

"Remember to include all rooms that are habitable even though they may currently be underutilized such as is the case with guest rooms. Enter the number of rooms for the main dwelling.

"In rural areas, make sure you have registered all the habitable rooms in the other dwellings including the boy's quarters. It is common in rural areas for separate kitchens to be used by the girls for sleeping; in this case the kitchen should be included as a habitable room."

The above implies that:

- Count separate kitchens (apart from the main dwelling) if someone sleeps there
- Do not count separate kitchens (apart from the main dwelling) if no one sleeps there
- Count kitchens that are part of the main dwelling

5. The floor of the main dwelling is predominantly made of what material?

According to p. 46 of the *Interviewer's Guide*: "Please capture the material of the floor finish (refers to final materials applied on the floor). For example, a house could have a cement floor which has been capped by tiles; in this case, the floor finish is tiles and not cement.

"Other decorative materials such as carpets should not be considered as floor finish material. Do not make assumptions, since in some dwelling units the sitting room might have tiles while the rest of the house is simply cement floor. Always confirm with the respondent whether the floor finish material is uniform in the whole house. For cases where a mixture of floor finishes are applied, code the one that covers the greatest floor surface."

6. What is the main source of lighting fuel for the household?

According to p. 49 of the *Interviewer's Manual*, households often use several sources of lighting fuel, but many of those are not regularly used. Record the main lighting fuel.

7. What kind of iron does your household own?

The *Interviewer's Manual* provides no additional information about this indicator.

8. How many mosquito nets does your household own?

The *Interviewer's Manual* provides no additional information about this indicator.

9. How many towels does your household own?

The *Interviewer's Manual* provides no additional information about this indicator.

10. How many frying pans does your household own?

The *Interviewer's Manual* provides no additional information about this indicator.

Figure 2: National poverty lines, and poverty rates for all of Kenya, for the construction/calibration sample, and for the validation sample, by poverty line and by household-level/person-level

Region	Line or Rate	HHs or People	HHs Surveyed	Poverty lines (KES/adult equivalent/day) and rates (%)			
					National lines		Poorest 1/2
				Food	100%	150%	< 100% Natl.
All Kenya							
	Line	People		36.28	61.22	91.83	27.58
	Rate	HHs	12,644	14.7	37.9	60.7	17.3
	Rate	People		19.3	46.4	68.9	23.2
Construction and calibration (Selecting indicators and points, and associating scores with poverty likelihoods)							
	Rate	HHs	6,329	14.8	37.9	60.7	17.7
Validation (Measuring accuracy)							
	Rate	HHs	6,315	14.7	37.9	60.8	16.9

Source: 2005/6 KIHBS

Poverty lines in units of daily per-adult equivalent KES in average prices for all of Kenya during 2005/6 KIHBS fieldwork.

Figure 2: International 2005 and 2011 PPP poverty lines, and poverty rates for all of Kenya, for the construction/calibration sample, and for the validation sample, by poverty line and by household-level/person-level

	Line	HHs		Poverty lines (KES/adult equivalent/day) and rates (%)					
	or	or	HHs	2005 PPP				2011 PPP	
Region	Rate	People	Surveyed	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
All Kenya									
	Line	People		44.20	70.72	88.40	141.45	38.34	62.56
	Rate	HHs	12,644	36.2	58.5	68.3	83.7	29.8	52.9
	Rate	People		46.1	68.7	77.8	90.0	38.7	63.5
Construction and calibration (Selecting indicators and points, and associating scores with poverty likelihoods)									
	Rate	HHs	6,329	36.1	58.5	68.2	83.0	29.8	53.1
Validation (Measuring accuracy)									
	Rate	HHs	6,315	36.3	58.5	68.4	84.3	29.7	52.8

Source: 2005/6 KIHBS

Poverty lines in units of daily per-capita KES in average prices for all of Kenya during 2005/6 KIHBS fieldwork.

Figure 3 (All of Kenya): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		49.97	98.73	148.09	27.58	44.79	71.67	89.59	143.34	38.86	63.40
	Rate (HHs)	4,431	5.1	26.0	47.3	2.4	8.0	21.7	31.7	57.0	5.4	17.2
	Rate (people)		7.7	33.1	55.5	3.8	11.8	29.1	40.5	66.6	8.1	23.9
Rural	Line		32.94	52.08	78.12	27.58	44.06	70.49	88.11	140.98	38.22	62.35
	Rate (HHs)	8,213	17.9	41.8	65.1	22.2	45.5	70.7	80.4	92.5	37.9	64.8
	Rate (people)		22.2	49.6	72.2	28.0	54.5	78.4	86.9	95.7	46.1	73.2
Overall	Line		36.28	61.22	91.83	27.58	44.20	70.72	88.40	141.45	38.34	62.56
	Rate (HHs)	12,644	14.7	37.9	60.7	17.3	36.2	58.5	68.3	83.7	29.8	52.9
	Rate (people)		19.3	46.4	68.9	23.2	46.1	68.7	77.8	90.0	38.7	63.5

Figure 3 (Nairobi): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		50.82	100.40	150.60	27.58	45.55	72.89	91.11	145.77	39.52	64.47
	Rate (HHs)	598	3.1	17.5	35.1	1.7	4.5	15.6	22.5	47.2	2.6	12.0
	Rate (people)		3.1	20.9	39.0	2.0	5.8	18.7	27.5	53.7	3.2	15.0
Rural	Line		50.82	100.40	150.60	27.58	45.55	72.89	91.11	145.77	39.52	64.47
	Rate (HHs)	598	3.1	17.5	35.1	1.7	4.5	15.6	22.5	47.2	2.6	12.0
	Rate (people)		3.1	20.9	39.0	2.0	5.8	18.7	27.5	53.7	3.2	15.0
Overall	Line		46.95	92.76	139.14	27.58	42.09	67.34	84.17	134.67	36.51	59.56
	Rate (HHs)	456	5.1	22.7	45.0	2.4	8.3	18.4	26.3	56.1	7.1	14.6
	Rate (people)		10.9	30.9	53.4	4.9	15.6	26.3	35.5	67.1	14.1	22.3

Figure 3 (Central): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		46.95	92.76	139.14	27.58	42.09	67.34	84.17	134.67	36.51	59.56
	Rate (HHs)	456	5.1	22.7	45.0	2.4	8.3	18.4	26.3	56.1	7.1	14.6
	Rate (people)		10.9	30.9	53.4	4.9	15.6	26.3	35.5	67.1	14.1	22.3
Rural	Line		31.80	50.28	75.42	27.58	42.54	68.06	85.07	136.11	36.90	60.20
	Rate (HHs)	989	7.6	23.9	48.4	8.6	24.9	52.3	64.6	85.8	18.3	44.2
	Rate (people)		11.0	30.3	55.1	12.7	32.8	60.7	72.0	89.5	25.4	53.4
Overall	Line		33.31	54.50	81.76	27.58	42.49	67.99	84.98	135.97	36.86	60.14
	Rate (HHs)	1,445	7.3	23.8	47.9	7.7	22.6	47.7	59.5	81.7	16.8	40.2
	Rate (people)		11.0	30.3	54.9	11.9	31.1	57.3	68.3	87.2	24.2	50.3

Figure 3 (Coast (Mombasa)): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		50.35	99.46	149.19	27.58	45.13	72.20	90.26	144.41	39.15	63.87
	Rate (HHs)	541	3.2	28.4	53.2	1.7	5.0	21.2	34.3	62.5	3.5	15.4
	Rate (people)		4.9	38.4	65.8	2.7	7.4	32.0	46.6	76.2	4.8	25.0
Rural	Line		32.83	51.90	77.86	27.58	43.91	70.26	87.82	140.51	38.09	62.14
	Rate (HHs)	658	28.5	59.4	80.9	34.8	63.8	84.0	90.1	96.9	56.5	81.0
	Rate (people)		35.5	70.0	88.3	45.0	75.4	91.3	95.2	98.6	69.1	89.5
Overall	Line		39.20	69.21	103.82	27.58	44.35	70.97	88.71	141.93	38.47	62.77
	Rate (HHs)	1,199	16.8	45.1	68.1	19.5	36.7	55.0	64.3	81.0	32.0	50.7
	Rate (people)		24.4	58.5	80.1	29.6	50.7	69.7	77.5	90.4	45.7	66.0

Figure 3 (Eastern): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		48.96	96.72	145.07	27.58	43.88	70.21	87.76	140.42	38.06	62.11
	Rate (HHs)	552	5.3	23.2	49.9	1.9	6.7	19.5	28.6	56.5	4.9	15.5
	Rate (people)		9.9	32.8	61.8	4.0	12.4	30.1	41.0	69.8	9.2	24.1
Rural	Line		33.23	52.55	78.82	27.58	44.45	71.13	88.91	142.25	38.56	62.91
	Rate (HHs)	1,749	19.1	45.1	67.1	23.0	47.5	72.9	82.3	93.7	39.0	67.2
	Rate (people)		22.9	51.7	72.3	28.2	54.8	78.4	87.2	95.8	46.1	73.4
Overall	Line		34.12	55.03	82.55	27.58	44.42	71.07	88.84	142.15	38.53	62.87
	Rate (HHs)	2,301	17.9	43.2	65.6	21.2	44.0	68.3	77.7	90.5	36.1	62.8
	Rate (people)		22.2	50.7	71.7	26.8	52.4	75.7	84.6	94.4	44.0	70.7

Figure 3 (North Eastern): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		52.46	103.64	155.45	27.58	47.02	75.23	94.04	150.47	40.79	66.55
	Rate (HHs)	181	27.1	64.0	86.8	14.8	33.6	65.4	76.0	90.9	27.0	56.4
	Rate (people)		35.9	74.9	93.2	19.7	43.9	76.8	84.7	96.0	35.9	69.7
Rural	Line		35.25	55.74	83.61	27.58	47.15	75.45	94.31	150.89	40.90	66.73
	Rate (HHs)	300	39.2	65.6	81.8	49.1	70.5	89.8	93.4	98.4	66.1	85.3
	Rate (people)		45.6	73.0	86.5	56.3	77.7	93.1	96.6	99.3	73.6	89.7
Overall	Line		37.91	63.15	94.73	27.58	47.13	75.41	94.27	150.83	40.88	66.71
	Rate (HHs)	481	37.4	65.4	82.6	43.9	65.0	86.1	90.8	97.2	60.2	81.0
	Rate (people)		44.1	73.3	87.5	50.6	72.4	90.6	94.7	98.8	67.7	86.6

Figure 3 (Nyanza (Kisumu)): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		52.08	102.89	154.33	27.58	46.68	74.69	93.37	149.39	40.49	66.07
	Rate (HHs)	652	7.2	35.8	61.2	1.8	13.6	27.6	38.7	67.7	8.7	24.6
	Rate (people)		9.8	39.2	66.4	2.0	16.5	32.0	42.6	72.3	10.0	28.2
Rural	Line		34.58	54.68	82.02	27.58	46.26	74.01	92.52	148.03	40.13	65.47
	Rate (HHs)	1,380	18.5	42.0	66.9	22.8	46.5	73.5	83.9	94.9	39.6	66.6
	Rate (people)		20.8	47.4	72.5	26.6	53.1	80.0	89.0	97.3	45.4	73.5
Overall	Line		37.06	61.50	92.25	27.58	46.32	74.11	92.64	148.22	40.18	65.55
	Rate (HHs)	2,032	16.9	41.1	66.1	19.8	41.9	67.1	77.6	91.1	35.3	60.7
	Rate (people)		19.2	46.2	71.7	23.1	47.9	73.2	82.4	93.8	40.4	67.1

Figure 3 (Rift Valley (Nakuru)): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		47.84	94.52	141.78	27.58	42.89	68.62	85.77	137.23	37.20	60.69
	Rate (HHs)	931	7.0	33.9	56.0	3.6	12.2	27.6	42.6	63.5	7.9	22.0
	Rate (people)		11.3	42.4	65.5	6.1	17.7	37.1	53.4	73.7	12.4	30.2
Rural	Line		32.58	51.51	77.26	27.58	43.58	69.72	87.15	139.45	37.80	61.67
	Rate (HHs)	2,213	17.4	41.4	63.9	21.8	45.4	69.9	79.2	90.8	38.0	64.4
	Rate (people)		20.8	49.1	71.7	26.1	54.1	78.2	86.9	95.4	45.6	73.2
Overall	Line		34.44	56.75	85.13	27.58	43.49	69.59	86.99	139.18	37.73	61.55
	Rate (HHs)	3,144	15.6	40.1	62.5	18.7	39.7	62.6	72.9	86.1	32.8	57.1
	Rate (people)		19.7	48.3	71.0	23.6	49.7	73.2	82.8	92.7	41.5	67.9

Figure 3 (Western): Poverty lines and poverty rates by urban/rural, by poverty line, and by household-level/person-level

			National lines			Poorest 1/2	Intl. 2005 PPP				Intl. 2011 PPP	
		n	Food	100%	150%	< 100% Natl.	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Urban	Line		47.81	94.45	141.68	27.58	42.86	68.57	85.71	137.14	37.17	60.65
	Rate (HHs)	520	11.3	42.7	67.5	4.8	17.7	39.4	51.8	73.6	12.8	32.1
	Rate (people)		16.6	51.9	74.5	7.8	24.8	49.4	62.3	82.0	19.0	40.7
Rural	Line		32.09	50.73	76.10	27.58	42.92	68.67	85.84	137.34	37.23	60.74
	Rate (HHs)	924	19.5	47.2	72.8	26.7	53.6	78.6	88.0	96.3	43.5	73.6
	Rate (people)		23.8	53.3	77.8	32.6	61.3	84.1	92.5	97.9	50.5	79.9
Overall	Line		33.32	54.16	81.24	27.58	42.91	68.66	85.83	137.33	37.22	60.74
	Rate (HHs)	1,444	18.7	46.7	72.3	24.5	50.0	74.6	84.3	94.0	40.4	69.4
	Rate (people)		23.2	53.2	77.5	30.6	58.5	81.4	90.1	96.7	48.0	76.8

Figure 4: Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
11,021	What is the highest school grade that the female head/spouse has completed? (None, or pre-school; Primary standards 1 to 6; Primary standard 7; Primary standard 8, or secondary forms 1 to 3; No female head/spouse; Secondary form 4 or higher)
10,996	How many towels does your household own? (None; One; Two or more)
10,340	What kind of stoves/cookers does your household own? (None; *Jiko* only; Kerosene (no electric/gas or microwave, regardless of *jiko*); Electric/gas or microwave (regardless of kerosene or *jiko*))
9,176	The floor of the main dwelling is predominantly made of what material? (Wood, earth, or other; Cement, or tiles)
8,904	How many members does the household have? (Nine or more; Seven or eight; Six; Five; Four; Three; One or two)
8,625	How many household members are 18-years-old or younger? (Six or more; Five; Four; Three; Two; One; None)
8,566	What is the main source of lighting fuel for the household? (Collected firewood, purchased firewood, grass, or dry cell (torch); Paraffin, candles, biogas, or other; Electricity, solar, or gas)
8,289	How many household members are 17-years-old or younger? (Six or more; Five; Four; Three; Two; One; None)
8,146	What is the main source of cooking fuel for the household? (Collected firewood, biomass residue, or grass; Purchased firewood; Charcoal; Paraffin, biogas, or other; Electricity, or gas/LPG)
7,894	How many household members are 16-years-old or younger? (Six or more; Five; Four; Three; Two; One; None)
7,502	How many household members are 15-years-old or younger? (Four or more; Three; Two; One; None)
7,458	The roof of the main dwelling is predominantly made of what material? (Grass, *makuti*, tin, other; Corrugated iron sheets; Tiles, concrete, or asbestos sheets)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
7,309	What is the main source of drinking water for the household over the past month? (Protected spring; River/ponds/streams; Unprotected dug well/springs; Other; Public tap; Tubewell/borehole with pump; Protected dug well; Tanker truck/vendor; Piped into plot/yard, or rain water collection; Piped into dwelling, or bottled water)
7,273	What is the main toilet facility for this household? (Bucket or none, other, or not all household members use the same toilet; Shallow uncovered pit latrine; Shallow covered pit latrine; Deep uncovered pit latrine; Deep covered pit latrine; Shallow VIP latrine; Deep VIP latrine; Flush toilet)
7,188	What is the main/primary type of appliance used for cooking? (Traditional stone fire; Ordinary *jiko*; Improved traditional stone fire; Improved *jiko*; Kerosene stove, gas cooker, electric cooker, or other)
7,151	Can the female head/spouse read in any language? (Cannot read at all; Can read part of a sentence; Can read whole sentence, or no sentence in required language; No female head/spouse)
6,857	What is the highest school grade that the male head/spouse has completed? (None, pre-school, or Standard 1 of primary; Standards 2 to 6 of primary; Standard 7 of primary; No male head/spouse; Standard 8 of primary, or form 1 of secondary; Form 2 or 3 of secondary; Form 4 of secondary or higher)
6,805	How many household members are 14-years-old or younger? (Four or more; Three; Two; One; None)
6,774	The walls of the main dwelling are made predominantly of what material? (Grass/straw, mud/wood, tin, other; Mud/cement; Brick/block; Wood only; Stone, or corrugated iron sheets)
6,745	How many cellular handsets does your household own? (None; One; Two or more)
6,346	How many household members are 13-years-old or younger? (Four or more; Three; Two; One; None)
6,224	How many curtains or accessories does your household own? (None; One; Two or more)
6,195	What kind of iron does your household own? (None; Charcoal; Electric)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
6,148	Are all household members ages 6 to 17 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 17)
6,114	Are all household members ages 6 to 15 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 15)
6,112	What type of dwelling does the household live in? (HSE; Shanty *manyatta*/traditional house; House/bungalow; Swahili; Other; Flat, or maisonnette)
6,075	How many kerosene stoves does your household own? (None; One; Two or more)
5,943	Are all household members ages 6 to 16 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 16)
5,793	Are all household members ages 6 to 14 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 14)
5,765	Are all household members ages 6 to 18 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 18)
5,743	Does the household usually have electricity working in the dwelling? (No; Yes)
5,693	How many household members are 12-years-old or younger? (Three or more; Two; One; None)
5,603	Are all household members ages 6 to 13 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 13)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
5,459	How many household members are 11-years-old or younger? (Three or more; Two; One; None)
5,212	Are all household members ages 6 to 12 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 12)
5,079	How many sofa sets does your household own? (None; One; Two or more)
5,004	Are all household members ages 6 to 11 currently attending school (or if school is not in session, did all attend school in the session just completed and plan to attend next session)? (No; Yes; No one ages 6 to 11)
4,694	What is the tenure status of the household in its main residence? (Owner-occupied (nomads); Owner-occupied; Free; Rented; Employer provided (subsidized or free))
4,613	Does your household own any table clothes/mats? (No; Yes)
4,589	What is the main occupation of the female head/spouse? (No occupation; Elementary occupations; Skilled farm, fishery, and wildlife and related workers; Armed forces, legislators, administrators, and managers, professionals, technicians and associated professionals, secretarial, clerical services, and related workers, service workers, shop and market salesworkers, craft and related trades workers, or plant and machine operators and assemblers; No female head/spouse)
4,265	Does your household own any electric/gas cookers or microwave ovens? (No; Yes)
4,227	What is the main occupation of the male head/spouse? (No occupation; Skilled farm, fishery, and wildlife and related workers; No male head/spouse; Elementary occupations; Craft and related trades workers; Legislators, administrators, and managers, professionals, technicians and associated professionals, secretarial, clerical services, and related workers, service workers, shop and market salesworkers, or plant and machine operators and assemblers)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
4,184	Does your household own any electric irons? (No; Yes)
4,010	What kind of business (type of industry) is the main occupation of the female head/spouse connected with? (Does not work; Agriculture, hunting, forestry, and fishing, or mining and quarrying; Wholesale and retail trade, and restaurants and hotels, or community, social, and personal services; Manufacturing, electricity, gas, and water, construction, transport, storage, and communication, financing, insurance, real estate, and business services, or activities not adequately defined; No female head/spouse)
4,000	What kind of business (type of industry) is the main occupation of the male head/spouse connected with? (Does not work; No male head/spouse; Agriculture, hunting, forestry, fishing, mining, or quarrying; Any others)
3,966	How old is the female head/spouse? (61 or older; 56 to 60; 51 to 55; 46 to 50; 41 to 45; 36 to 40; 31 to 35; 26 to 30; 21 to 25; 20 or younger; No female head/spouse)
3,959	Can the male head/spouse read in any language? (Cannot read at all; Can read part of a sentence; No male head/spouse; Can read whole sentence, or no sentence in required language)
3,748	How many frying pans does your household own? (None; One; Two or more)
3,517	How does the household dispose of its garbage? (Farm/garden, or other; Burning; Community group; Garbage pit; Public garbage heap; Collected by local authority; Collected by private firm, or neighborhood)
3,391	How many charcoal *jikos* does your household own? (None; One; Two or more)
3,175	In their main occupation, are any household members are legislators, administrators, managers, professionals, technicians and associated professionals, or secretarial, clerical services, and related workers? (No; Yes)
3,068	Does your household own any wall units? (No; Yes)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
3,033	How many household members work in a business in agriculture, animal husbandry, hunting, fishing, mining, or quarrying? (Four or more; Three; Two; One; None)
2,985	What is the marital status of the female head/spouse? (Polygamous married, separated, or divorced; Widow, or monogamous married; Living together; Never married; No female head/spouse)
2,975	How many household members are 6-years-old or younger? (Two or more; One; None)
2,922	In their main occupation, how many household members are in elementary occupations or are skilled farm, fishery, and wildlife and related workers? (Four or more; Three; Two; One; None)
2,899	Did the female head/spouse work in the past seven days or have a job, business, or other economic or farming activity to return to? (Worked on own/family agricultural holdings, seeking work, doing nothing, retired, homemaker, full-time student, incapacitated, other; Worked for pay, on leave, sick leave, worked on own/family business; No female head/spouse)
2,825	What was the status of the male head/spouse in his main employment? (Does not work; Unpaid family worker, apprentice, or other; No male head/spouse; Own-account worker; Working employer, or paid employee)
2,807	What was the status of the female head/spouse in her main employment? (Does not work; Unpaid family worker, apprentice, or other; Own-account worker; Paid employee; Working employer, or no female head/spouse)
2,760	Does your household own any glasses? (No; Yes)
2,697	Did the male head/spouse work in the past seven days or have a job, business, or other economic or farming activity to return to? (Worked on own/family agricultural holdings, seeking work, doing nothing, retired, homemaker, full-time student, incapacitated, or other; No male head/spouse; Worked for pay, oOn leave, sick leave, or worked on own/family business)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
2,591	Does any member of the household farm crops, whether self-employed or as a tenant, and how many goats (dairy, meat, or immature) does the household own? (Does not farm, and does not own goats; Farms, but owns no goats; Farms, and owns one or two goats; Does not farm, but owns some goats)
2,511	Does your household own any wardrobes? (No; Yes)
2,477	Does any member of the household farm crops, whether self-employed or as a tenant, and how many sheep (wool, hair, or immature) or goats (dairy, meat, or immature) does the household own? (Does not farm, and does not own sheep or goats; Farms, but owns no sheep or goats; Farms, and owns one or two sheep or goats; Farms, and owns three or more sheep or goats; Does not farm, but owns some sheep or goats)
2,464	Does your household own any coffee tables? (No; Yes)
2,353	How old is the male head/spouse? (61 or older; No male head/spouse; 56 to 60; 51 to 55; 46 to 50; 41 to 45; 36 to 40; 31 to 35; 26 to 30; 25 or younger)
2,292	Does the kitchen of the household have a chimney? (No; Yes)
2,279	In their main occupation, how many household members are skilled farm, fishery, and wildlife and related workers? (Four or more; Three; Two; One; None)
2,276	Does any member of the household farm crops, whether self-employed or as a tenant, and how many exotic cattle (dairy, beef, or calves) does the household own? (Does not farm, and does not own exotic cattle; Farms, and owns no exotic cattle; Farms, and owns one or two exotic cattle; Farms, and owns three or more exotic cattle; Does not farm, but owns some exotic cattle)
2,217	What is the structure of household headship? (Female head/spouse only; Both male and female heads/spouses; Male head/spouse only)
2,034	How many household members worked in the past seven days or have a job, business, or other economic or farming activity to return to? (Four or more; Three; Two; One; None)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
2,030	What is the location of the main cooking area/kitchen? (Outdoors, or other; Enclosed (detached); Indoors (without partition); Enclosed (attached); Indoors (with partition))
2,024	Does your household own any dining tables, coffee tables, dressing tables, or writing/study tables? (No; Yes)
1,958	Is the toilet facility located within the dwelling unit? (No; Yes)
1,849	Does any member of the household farm crops, whether self-employed or as a tenant, and how many sheep (wool, hair, or immature) does the household own? (Does not farm, and does not own sheep; Farms, but owns no sheep; Farms, and owns one or two sheep; Does not farm, but owns some sheep)
1,827	How many habitable rooms does this household occupy in its main dwelling (do not count bathrooms, toilets, storerooms, or garage)? (One; Two; Three; Four or more)
1,797	How many mosquito nets does your household own? (None; One; Two or more)
1,779	Does any member of the household farm crops, whether self-employed or as a tenant, and how many exotic or Zebu cattle (dairy, beef, or calves) or donkeys, camels, horses or mules does the household own? (Does not farm, and does not own cattle or pack animals; Farms, and owns none, one, or two cattle and/or pack animals; Farms, and owns three or more cattle and/or pack animals; Does not farm, but owns some cattle and/or pack animals)
1,715	Does your household own any motorcycles, pick ups, or cars? (No; Yes)
1,708	Does any member of the household farm crops, whether self-employed or as a tenant, and how many Zebu cattle (dairy, beef, or calves) does the household own? (Does not farm, and does not own Zebu cattle; Farms, and owns no Zebu cattle; Farms, and owns one or two Zebu cattle; In agriculture, and owns three or more Zebu cattle; Does not farm, but owns some Zebu cattle)
1,679	Does your household own any pre-recorded cassettes? (No; Yes)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
1,559	Does your household own any charcoal irons? (No; Yes)
1,544	Are any household members paid employees? (No; Yes)
1,534	Does any member of the household farm crops, whether self-employed or as a tenant, and how many exotic or Zebu cattle (dairy, beef, or calves) does the household own? (Does not farm, and does not own cattle; Farms, and owns none, one, or two cattle; Farms, and owns three or more cattle; Does not farm, but owns some cattle)
1,483	What is the total floor area of all the rooms in the main dwelling in square meters? (29 or less; 30 to 49; 50 or more)
1,426	Does your household own any calculators? (No; Yes)
1,282	Does the household own any baby furniture, baby carriages/prams, baby cots, walkers, feeding bottles, or potties? (No; Yes)
1,275	Does any member of the household farm crops, whether self-employed or as a tenant, and how many Poultry (chicken layers, chicken broilers, indigenous chickens, chicks, ducks, geese, ostriches, or turkeys) does the household own? (Does not farm, and does not own poultry; Farms, but owns no poultry; Farms, and owns poultry; Does not farm, but owns some poultry)
1,275	Does any member of the household farms crops, whether self-employed or as a tenant, and how many livestock of any kind does the household own? (Does not farm, and does not own livestock; Farms, but owns no livestock; Farms, and owns livestock; Does not farm, but owns some livestock)
1,251	Are any household members engaged in casual, part-time labour for someone who is not a member of the household at any time over the past 12 months? (Yes; No)
1,190	Did any member of the household engage in farming in the last 12 months, whether self-employed or as a tenant? (Yes; No)

Figure 4 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
1,184	Does your household own any pressure cookers? (No; Yes)
1,183	Does your household own any beds? (No; Yes)
1,135	Do any household members attend a private school (church, Muslim, or other)? (No; Yes)
1,031	How many wooden stools does your household own? (None; One; Two or more)
973	Does your household own any side boards? (No; Yes)
923	How do you mainly store water at home? (Other; Bucket/jerry can/drums; Does not store water at home; Container, or water tank)
901	How many household members are unpaid family workers or apprentices? (Two or more; One; None)
892	What is the marital status of the male head/spouse? (Polygamous married, divorced, or widower; No male head/spouse; Monogamous married, living together, separated, or never married)
688	Does the household own any bed covers, bed sheets, blankets, or pillows? (No; Yes)
662	Can any household members read a whole sentence? (No; Yes)
660	Does your household own any dressing tables? (No; Yes)
560	Does your household own any radio/cassette/CD players or hi-fi stereos? (No; Yes)
376	How many bowls does your household own? (Two or less; Three or more)
368	Does your household own any bicycles, motorcycles, pick ups, or cars? (No; Yes)
199	Does your household own any writing/study tables? (No; Yes)
195	Does your household own any dining tables? (No; Yes)
179	Does your household own any chairs? (No; Yes)
170	How many paraffin lamps does your household own? (None; One; Two; Three or more)
136	Does the household own any donkeys, camels, horses, or mules? (Yes; No)
78	Does your household own any bicycles? (No; Yes)
24	Are any household members working employers or own-account workers? (Yes; No)
0	In their main occupation, are any household members in elementary occupations? (Yes; No)

Source: 2005/6 KIHBS and the national poverty line

National Poverty Line Tables

(and Tables Pertaining to All Six Poverty Lines)

Figure 5 (National line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	95.4
5–9	95.0
10–14	85.8
15–19	82.5
20–24	77.3
25–29	67.9
30–34	63.7
35–39	46.4
40–44	36.9
45–49	30.0
50–54	17.8
55–59	13.9
60–64	6.1
65–69	4.6
70–74	3.8
75–79	0.0
80–84	0.4
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (National line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	147	÷	154	=	95.4
5–9	967	÷	1,018	=	95.0
10–14	1,822	÷	2,124	=	85.8
15–19	3,593	÷	4,354	=	82.5
20–24	5,319	÷	6,879	=	77.3
25–29	5,643	÷	8,310	=	67.9
30–34	5,815	÷	9,123	=	63.7
35–39	4,886	÷	10,523	=	46.4
40–44	3,691	÷	9,999	=	36.9
45–49	3,047	÷	10,151	=	30.0
50–54	1,741	÷	9,791	=	17.8
55–59	1,056	÷	7,618	=	13.9
60–64	392	÷	6,422	=	6.1
65–69	225	÷	4,849	=	4.6
70–74	155	÷	4,122	=	3.8
75–79	0	÷	2,597	=	0.0
80–84	5	÷	1,347	=	0.4
85–89	0	÷	463	=	0.0
90–94	0	÷	110	=	0.0
95–100	0	÷	43	=	0.0

Number of all households normalized to sum to 100,000.

Figure 8 (National line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–4.6	2.3	2.3	2.3
5–9	+0.0	3.2	3.9	5.0
10–14	–5.8	4.0	4.2	4.6
15–19	+0.1	2.7	3.2	4.0
20–24	+7.4	2.6	3.2	3.9
25–29	+6.2	2.4	2.9	4.1
30–34	+3.7	2.4	2.9	4.0
35–39	–6.8	4.6	4.8	5.3
40–44	+2.0	2.3	2.7	3.4
45–49	+3.5	2.3	2.6	3.6
50–54	–3.1	2.5	2.7	3.1
55–59	–6.1	4.2	4.5	5.0
60–64	–1.1	1.6	1.9	2.5
65–69	+0.2	1.3	1.5	2.0
70–74	+3.2	0.4	0.4	0.6
75–79	–1.6	1.3	1.4	1.6
80–84	+0.4	0.0	0.0	0.0
85–89	+0.0	0.0	0.0	0.0
90–94	+0.0	0.0	0.0	0.0
95–100	+0.0	0.0	0.0	0.0

Figure 9 (National line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	–0.3	68.9	79.8	88.2
4	+0.5	37.8	46.1	61.7
8	+0.1	26.7	32.5	42.9
16	+0.4	19.6	23.3	29.7
32	+0.6	13.5	15.8	20.6
64	+0.2	9.7	11.0	14.5
128	+0.1	6.7	8.1	10.3
256	+0.2	4.8	5.6	7.1
512	+0.2	3.4	4.0	5.3
1,024	+0.2	2.5	2.9	3.7
2,048	+0.3	1.8	2.0	2.7
4,096	+0.3	1.2	1.4	1.9
8,192	+0.3	0.9	1.0	1.3
16,384	+0.3	0.6	0.7	1.0

Figure 10 (National poverty lines): Differences, precision of differences, and the α factor for bootstrapped estimates of poverty rates for groups of households at a point in time, scorecard applied to the validation sample

	Poverty lines			
	National lines			Poorest 1/2
	Food	**100%**	**150%**	**< 100% Natl.**
Error (estimate minus true value)	+0.4	+0.3	+0.3	+1.1
Precision of difference	0.4	0.6	0.6	0.4
α factor for precision	0.92	0.98	1.06	0.88
Results pertain to the 2005/6 scorecard applied to the 2005/6 validation sample.				
Errors (differences between estimates and true values) are displayed in units of percentage points.				
Precision is measured as 90-percent confidence intervals of estimates in units of ± percentage points.				
Error and precision estimated from 1,000 bootstraps with n = 16,384.				
α is estimated from 1,000 bootstrap samples of n = 256, 512, 1,024, 2,048, 4,096, 8,192, and 16,384.				

Figure 10 (International 2005 and 2011 PPP poverty lines): Differences, precision of differences, and the α factor for bootstrapped estimates of poverty rates for groups of households at a point in time, scorecard applied to the validation sample

	Poverty lines					
	2005 PPP				2011 PPP	
	$1.25	$2.00	$2.50	$4.00	$1.90	$3.10
Error (estimate minus true value)	+1.0	+2.3	+2.1	–0.5	+1.0	+2.1
Precision of difference	0.5	0.6	0.6	0.5	0.5	0.6
α factor for precision	0.85	0.95	0.98	1.06	0.88	0.92
Results pertain to the 2005/6 scorecard applied to the 2005/6 validation sample.						
Errors (differences between estimates and true values) are displayed in units of percentage points.						
Precision is measured as 90-percent confidence intervals of estimates in units of ± percentage points.						
Error and precision estimated from 1,000 bootstraps with n = 16,384.						
α is estimated from 1,000 bootstrap samples of n = 256, 512, 1,024, 2,048, 4,096, 8,192, and 16,384.						

Figure 11 (All poverty lines): Possible types of outcomes from targeting by poverty score

True poverty status	Targeting segment: Targeted	Targeting segment: Non-targeted
Below poverty line	**Inclusion** Under poverty line Correctly Targeted	**Undercoverage** Under poverty line Mistakenly Non-targeted
Above poverty line	**Leakage** Above poverty line Mistakenly Targeted	**Exclusion** Above poverty line Correctly Non-targeted

Figure 12 (National line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
0–4	0.2	37.7	0.0	62.1	62.3	–99.2
5–9	1.1	36.8	0.0	62.1	63.2	–93.9
10–14	3.1	34.8	0.2	61.9	64.9	–83.2
15–19	6.7	31.3	1.0	61.1	67.7	–62.3
20–24	11.5	26.4	3.0	59.1	70.5	–31.4
25–29	16.7	21.2	6.1	56.0	72.7	+4.4
30–34	22.0	15.9	10.0	52.1	74.1	+42.3
35–39	27.2	10.7	15.3	46.8	74.1	+59.7
40–44	30.7	7.2	21.7	40.4	71.1	+42.6
45–49	33.4	4.5	29.2	32.9	66.4	+23.0
50–54	35.5	2.4	36.9	25.2	60.7	+2.6
55–59	37.0	0.9	43.1	19.0	56.0	–13.6
60–64	37.5	0.4	49.0	13.1	50.6	–29.3
65–69	37.8	0.1	53.5	8.6	46.3	–41.3
70–74	37.8	0.1	57.6	4.5	42.3	–52.0
75–79	37.9	0.0	60.1	2.0	39.9	–58.7
80–84	37.9	0.0	61.5	0.6	38.5	–62.2
85–89	37.9	0.0	61.9	0.2	38.1	–63.4
90–94	37.9	0.0	62.1	0.0	37.9	–63.7
95–100	37.9	0.0	62.1	0.0	37.9	–63.8

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 (National line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	0.2	100.0	0.4	Only poor targeted
5–9	1.2	96.6	3.0	28.0:1
10–14	3.3	92.7	8.1	12.7:1
15–19	7.7	86.9	17.5	6.6:1
20–24	14.5	79.0	30.3	3.8:1
25–29	22.8	73.2	44.1	2.7:1
30–34	32.0	68.7	58.0	2.2:1
35–39	42.5	64.1	71.8	1.8:1
40–44	52.5	58.6	81.1	1.4:1
45–49	62.6	53.4	88.3	1.1:1
50–54	72.4	49.1	93.7	1.0:1
55–59	80.0	46.2	97.6	0.9:1
60–64	86.5	43.3	98.9	0.8:1
65–69	91.3	41.4	99.7	0.7:1
70–74	95.4	39.6	99.8	0.7:1
75–79	98.0	38.7	100.0	0.6:1
80–84	99.4	38.1	100.0	0.6:1
85–89	99.8	38.0	100.0	0.6:1
90–94	100.0	37.9	100.0	0.6:1
95–100	100.0	37.9	100.0	0.6:1

Food Poverty Line Tables

Figure 5 (Food line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	95.4
5–9	72.6
10–14	57.1
15–19	47.4
20–24	37.8
25–29	32.8
30–34	23.5
35–39	12.7
40–44	9.9
45–49	4.7
50–54	1.9
55–59	0.9
60–64	0.5
65–69	0.9
70–74	0.2
75–79	0.0
80–84	0.4
85–89	0.0
90–94	0.0
95–100	0.0

Figure 8 (Food line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–4.6	2.3	2.3	2.3
5–9	–4.9	6.0	7.0	9.7
10–14	–7.6	6.2	6.7	7.6
15–19	–1.5	3.6	4.2	5.8
20–24	+3.6	2.5	3.0	4.2
25–29	+6.0	2.1	2.7	3.6
30–34	+2.6	2.0	2.3	3.1
35–39	–2.5	2.1	2.3	2.7
40–44	+0.1	1.7	2.0	2.5
45–49	+1.3	0.7	0.8	1.0
50–54	–0.6	0.7	0.8	1.1
55–59	–3.2	2.2	2.3	2.5
60–64	+0.3	0.2	0.2	0.3
65–69	+0.9	0.0	0.0	0.0
70–74	+0.1	0.1	0.1	0.1
75–79	+0.0	0.0	0.0	0.0
80–84	+0.4	0.0	0.0	0.0
85–89	+0.0	0.0	0.0	0.0
90–94	+0.0	0.0	0.0	0.0
95–100	+0.0	0.0	0.0	0.0

Figure 9 (Food line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+0.0	57.1	67.3	76.9
4	+0.4	27.5	33.9	43.8
8	+0.5	18.6	23.0	32.0
16	+0.8	12.5	14.9	20.9
32	+0.4	8.9	10.9	14.7
64	+0.3	6.6	8.0	10.3
128	+0.3	4.5	5.4	6.9
256	+0.3	3.2	3.9	4.9
512	+0.3	2.5	2.8	3.7
1,024	+0.3	1.7	2.0	2.6
2,048	+0.4	1.2	1.4	1.8
4,096	+0.4	0.8	0.9	1.3
8,192	+0.4	0.6	0.7	0.9
16,384	+0.4	0.4	0.5	0.7

Figure 12 (Food line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
0–4	0.2	14.5	0.0	85.3	85.5	–97.9
5–9	0.9	13.7	0.2	85.1	86.1	–85.6
10–14	2.3	12.4	1.0	84.3	86.6	–62.0
15–19	4.4	10.3	3.2	82.1	86.5	–17.7
20–24	6.7	7.9	7.8	77.5	84.3	+45.0
25–29	9.2	5.5	13.7	71.7	80.8	+6.7
30–34	11.1	3.6	20.9	64.4	75.5	–42.6
35–39	12.7	2.0	29.8	55.5	68.2	–103.3
40–44	13.6	1.1	38.9	46.5	60.1	–165.3
45–49	14.1	0.6	48.6	36.8	50.9	–231.3
50–54	14.4	0.3	58.1	27.3	41.6	–296.2
55–59	14.6	0.0	65.4	19.9	34.5	–346.4
60–64	14.6	0.0	71.8	13.5	28.2	–390.0
65–69	14.6	0.0	76.7	8.7	23.3	–423.1
70–74	14.7	0.0	80.8	4.6	19.2	–451.2
75–79	14.7	0.0	83.4	2.0	16.6	–468.9
80–84	14.7	0.0	84.7	0.6	15.3	–478.1
85–89	14.7	0.0	85.2	0.2	14.8	–481.3
90–94	14.7	0.0	85.3	0.0	14.7	–482.0
95–100	14.7	0.0	85.3	0.0	14.7	–482.3

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 (Food line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	0.2	100.0	1.1	Only poor targeted
5–9	1.2	80.2	6.4	4.0:1
10–14	3.3	68.8	15.5	2.2:1
15–19	7.7	57.6	30.1	1.4:1
20–24	14.5	46.3	45.9	0.9:1
25–29	22.8	40.1	62.5	0.7:1
30–34	32.0	34.6	75.5	0.5:1
35–39	42.5	29.9	86.6	0.4:1
40–44	52.5	25.9	92.8	0.3:1
45–49	62.6	22.5	96.0	0.3:1
50–54	72.4	19.8	98.0	0.2:1
55–59	80.0	18.3	99.7	0.2:1
60–64	86.5	16.9	99.9	0.2:1
65–69	91.3	16.0	99.9	0.2:1
70–74	95.4	15.4	100.0	0.2:1
75–79	98.0	15.0	100.0	0.2:1
80–84	99.4	14.7	100.0	0.2:1
85–89	99.8	14.7	100.0	0.2:1
90–94	100.0	14.7	100.0	0.2:1
95–100	100.0	14.7	100.0	0.2:1

150% of the National Poverty Line Tables

Figure 5 (150% of national line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	96.5
15–19	95.7
20–24	93.2
25–29	89.1
30–34	83.3
35–39	75.7
40–44	64.8
45–49	64.3
50–54	49.4
55–59	41.8
60–64	32.3
65–69	20.4
70–74	11.1
75–79	4.1
80–84	6.7
85–89	4.1
90–94	0.0
95–100	0.0

Figure 8 (150% of national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+0.0	0.0	0.0	0.0
5–9	+0.0	0.0	0.0	0.0
10–14	–0.2	1.6	1.9	2.4
15–19	+2.0	1.8	2.1	2.7
20–24	+1.4	1.3	1.6	2.1
25–29	+0.1	1.5	1.7	2.3
30–34	–3.4	2.5	2.6	2.9
35–39	–0.3	1.9	2.2	2.9
40–44	–1.0	2.2	2.6	3.4
45–49	+8.4	2.5	3.0	3.9
50–54	+0.2	2.4	2.9	3.8
55–59	+1.5	2.7	3.3	4.4
60–64	+7.9	2.5	2.9	3.7
65–69	–13.2	8.4	8.7	9.2
70–74	–6.3	4.8	5.1	5.5
75–79	+0.6	1.3	1.5	2.1
80–84	–0.6	2.8	3.3	4.9
85–89	+3.4	0.8	1.0	1.3
90–94	+0.0	0.0	0.0	0.0
95–100	+0.0	0.0	0.0	0.0

Figure 9 (150% of national line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	–0.2	69.3	81.5	91.0
4	+0.8	39.6	47.0	60.5
8	+0.4	28.0	33.0	42.8
16	+0.8	21.6	25.2	33.1
32	+0.7	14.4	17.1	21.4
64	+0.5	10.0	11.5	16.1
128	+0.3	7.5	8.6	10.9
256	+0.3	5.5	6.4	7.8
512	+0.3	3.7	4.2	5.7
1,024	+0.3	2.7	3.1	4.2
2,048	+0.3	2.0	2.3	3.0
4,096	+0.3	1.3	1.6	2.1
8,192	+0.3	0.9	1.1	1.5
16,384	+0.3	0.6	0.8	1.1

Figure 12 (150% of national line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
0–4	0.2	60.6	0.0	39.2	39.4	–99.5
5–9	1.2	59.6	0.0	39.2	40.4	–96.1
10–14	3.2	57.5	0.1	39.2	42.4	–89.3
15–19	7.3	53.4	0.3	38.9	46.2	–75.3
20–24	13.6	47.2	1.0	38.3	51.8	–53.8
25–29	20.9	39.9	2.0	37.3	58.1	–28.1
30–34	28.6	32.2	3.4	35.9	64.5	–0.3
35–39	36.5	24.3	6.0	33.2	69.7	+30.0
40–44	43.2	17.6	9.3	29.9	73.1	+57.4
45–49	48.9	11.8	13.7	25.5	74.4	+77.4
50–54	53.7	7.1	18.8	20.5	74.1	+69.1
55–59	56.6	4.1	23.4	15.8	72.4	+61.5
60–64	58.3	2.4	28.1	11.1	69.4	+53.7
65–69	59.8	1.0	31.5	7.7	67.5	+48.1
70–74	60.4	0.3	35.0	4.2	64.7	+42.4
75–79	60.6	0.1	37.4	1.8	62.4	+38.4
80–84	60.8	0.0	38.6	0.6	61.4	+36.4
85–89	60.8	0.0	39.1	0.2	60.9	+35.7
90–94	60.8	0.0	39.2	0.0	60.8	+35.5
95–100	60.8	0.0	39.2	0.0	60.8	+35.4

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 (150% of national line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	0.2	100.0	0.3	Only poor targeted
5–9	1.2	100.0	1.9	Only poor targeted
10–14	3.3	97.7	5.3	43.1:1
15–19	7.7	95.8	12.1	22.9:1
20–24	14.5	93.3	22.3	13.9:1
25–29	22.8	91.3	34.3	10.5:1
30–34	32.0	89.5	47.1	8.5:1
35–39	42.5	85.9	60.1	6.1:1
40–44	52.5	82.3	71.1	4.6:1
45–49	62.6	78.1	80.5	3.6:1
50–54	72.4	74.1	88.3	2.9:1
55–59	80.0	70.7	93.2	2.4:1
60–64	86.5	67.4	96.0	2.1:1
65–69	91.3	65.5	98.4	1.9:1
70–74	95.4	63.3	99.5	1.7:1
75–79	98.0	61.8	99.8	1.6:1
80–84	99.4	61.1	100.0	1.6:1
85–89	99.8	60.9	100.0	1.6:1
90–94	100.0	60.8	100.0	1.6:1
95–100	100.0	60.8	100.0	1.5:1

Tables for the line marking the poorest half of people below 100% of national line

Figure 5 (Line marking the poorest half of people below 100% of national line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	95.4
5–9	79.5
10–14	61.3
15–19	51.0
20–24	48.5
25–29	40.2
30–34	30.6
35–39	17.4
40–44	12.5
45–49	5.4
50–54	1.8
55–59	1.0
60–64	0.0
65–69	0.0
70–74	0.2
75–79	0.0
80–84	0.4
85–89	0.0
90–94	0.0
95–100	0.0

Figure 8 (Line marking the poorest half of people below 100% of national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (±percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	-4.6	-4.6	-4.6	-4.6
5–9	-0.6	-6.4	5.3	-7.3
10–14	-13.6	-18.0	-9.5	-18.7
15–19	-7.7	-11.4	-4.2	-11.9
20–24	9.2	6.5	11.7	6.2
25–29	6.2	3.7	8.7	3.3
30–34	3.6	1.4	5.7	0.9
35–39	-3.5	-5.7	-1.4	-6.0
40–44	4.9	3.7	6.0	3.5
45–49	2.3	1.6	2.9	1.4
50–54	0.3	-0.1	0.7	-0.3
55–59	-1.0	-1.7	-0.3	-1.9
60–64	-0.5	-0.9	-0.2	-0.9
65–69	-0.1	-0.2	0.0	-0.2
70–74	0.2	0.2	0.2	0.2
75–79	0.0	0.0	0.0	0.0
80–84	0.4	0.4	0.4	0.4
85–89	0.0	0.0	0.0	0.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 9 (Line marking the poorest half of people below 100% of national line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+1.1	58.9	65.5	77.9
4	+1.9	27.7	34.8	45.8
8	+1.8	19.2	22.9	31.5
16	+1.7	13.6	15.7	21.6
32	+1.2	9.4	12.1	16.0
64	+1.2	6.5	7.8	10.7
128	+1.1	4.5	5.4	7.4
256	+1.2	3.4	4.0	4.9
512	+1.1	2.3	2.8	3.6
1,024	+1.1	1.7	2.1	2.7
2,048	+1.1	1.2	1.4	1.8
4,096	+1.2	0.9	1.0	1.3
8,192	+1.2	0.6	0.7	0.9
16,384	+1.1	0.4	0.5	0.7

Figure 12 (Line marking the poorest half of people below 100% of national line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.2	16.7	0.0	83.1	83.3	–98.2
≤9	1.0	15.9	0.2	82.9	83.9	–87.3
≤14	2.5	14.4	0.8	82.3	84.8	–65.7
≤19	5.0	11.9	2.6	80.5	85.5	–25.0
≤24	7.8	9.1	6.7	76.4	84.2	+32.3
≤29	10.8	6.1	12.1	71.0	81.8	+28.6
≤34	13.1	3.8	18.8	64.3	77.4	–11.5
≤39	15.1	1.8	27.4	55.7	70.8	–62.3
≤44	16.0	0.8	36.4	46.7	62.7	–115.8
≤49	16.5	0.4	46.2	36.9	53.4	–173.4
≤54	16.7	0.2	55.8	27.4	44.0	–230.1
≤59	16.8	0.1	63.2	19.9	36.7	–274.3
≤64	16.9	0.0	69.6	13.5	30.4	–312.0
≤69	16.9	0.0	74.4	8.7	25.6	–340.6
≤74	16.9	0.0	78.5	4.6	21.5	–365.0
≤79	16.9	0.0	81.1	2.0	18.9	–380.4
≤84	16.9	0.0	82.5	0.6	17.5	–388.4
≤89	16.9	0.0	83.0	0.2	17.0	–391.1
≤94	16.9	0.0	83.1	0.0	16.9	–391.8
≤100	16.9	0.0	83.1	0.0	16.9	–392.0

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 (Line marking the poorest half of people below 100% of national line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.2	100.0	0.9	Only poor targeted
≤9	1.2	83.1	5.8	4.9:1
≤14	3.3	76.0	14.8	3.2:1
≤19	7.7	65.5	29.7	1.9:1
≤24	14.5	53.8	46.2	1.2:1
≤29	22.8	47.2	63.8	0.9:1
≤34	32.0	41.1	77.8	0.7:1
≤39	42.5	35.5	89.3	0.5:1
≤44	52.5	30.6	95.0	0.4:1
≤49	62.6	26.3	97.5	0.4:1
≤54	72.4	23.0	98.7	0.3:1
≤59	80.0	21.0	99.6	0.3:1
≤64	86.5	19.5	99.9	0.2:1
≤69	91.3	18.5	100.0	0.2:1
≤74	95.4	17.7	100.0	0.2:1
≤79	98.0	17.2	100.0	0.2:1
≤84	99.4	17.0	100.0	0.2:1
≤89	99.8	16.9	100.0	0.2:1
≤94	100.0	16.9	100.0	0.2:1
≤100	100.0	16.9	100.0	0.2:1

$1.25/day 2005 PPP Poverty Line Tables

Figure 5 ($1.25/day 2005 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	97.2
10–14	83.7
15–19	87.6
20–24	81.1
25–29	70.7
30–34	63.1
35–39	48.4
40–44	35.1
45–49	25.4
50–54	8.7
55–59	7.8
60–64	1.0
65–69	1.1
70–74	0.2
75–79	0.0
80–84	0.4
85–89	0.0
90–94	0.0
95–100	0.0

Figure 8 ($1.25/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+0.0	0.0	0.0	0.0
5–9	+0.2	2.4	2.8	3.8
10–14	–8.7	5.4	5.6	6.0
15–19	+5.0	2.6	3.1	4.3
20–24	+6.7	2.5	2.9	3.7
25–29	+5.0	2.4	2.9	3.9
30–34	+3.1	2.3	2.7	4.0
35–39	–6.3	4.2	4.5	4.8
40–44	+3.3	2.1	2.6	3.4
45–49	+6.3	1.8	2.1	2.9
50–54	–4.0	2.8	2.9	3.2
55–59	–0.8	1.5	1.7	2.2
60–64	–0.6	0.6	0.8	1.1
65–69	+0.8	0.3	0.3	0.4
70–74	–0.3	0.4	0.4	0.6
75–79	–0.7	0.7	0.8	0.9
80–84	+0.4	0.0	0.0	0.0
85–89	+0.0	0.0	0.0	0.0
90–94	+0.0	0.0	0.0	0.0
95–100	+0.0	0.0	0.0	0.0

Figure 9 ($1.25/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	–1.1	64.0	77.8	87.3
4	–0.2	35.1	43.8	59.5
8	+0.7	24.5	29.7	40.9
16	+1.1	16.6	20.3	26.6
32	+1.2	12.6	14.6	19.5
64	+1.1	8.7	10.3	12.8
128	+1.0	5.8	7.0	9.7
256	+0.9	4.2	5.1	6.8
512	+0.9	3.0	3.6	4.8
1,024	+0.9	2.1	2.5	3.3
2,048	+0.9	1.5	1.7	2.3
4,096	+1.0	1.1	1.2	1.7
8,192	+1.0	0.7	0.9	1.2
16,384	+1.0	0.5	0.6	0.8

Figure 12 ($1.25/day 2005 PPP line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
0–4	0.2	36.1	0.0	63.7	63.9	–99.1
5–9	1.2	35.1	0.0	63.7	64.8	–93.6
10–14	3.1	33.2	0.2	63.5	66.6	–82.4
15–19	6.7	29.6	0.9	62.8	69.5	–60.4
20–24	11.9	24.4	2.7	61.0	72.9	–27.3
25–29	17.5	18.8	5.4	58.3	75.8	+11.1
30–34	22.9	13.4	9.1	54.6	77.5	+51.1
35–39	28.4	7.9	14.1	49.6	78.0	+61.1
40–44	31.9	4.4	20.6	43.1	74.9	+43.2
45–49	34.1	2.2	28.6	35.1	69.2	+21.2
50–54	35.4	0.9	37.1	26.6	62.0	–2.1
55–59	36.1	0.2	44.0	19.7	55.8	–21.2
60–64	36.2	0.1	50.3	13.4	49.6	–38.5
65–69	36.2	0.1	55.1	8.6	44.9	–51.8
70–74	36.3	0.0	59.2	4.5	40.8	–63.1
75–79	36.3	0.0	61.7	2.0	38.3	–70.2
80–84	36.3	0.0	63.1	0.6	36.9	–73.9
85–89	36.3	0.0	63.6	0.2	36.4	–75.1
90–94	36.3	0.0	63.7	0.0	36.3	–75.4
95–100	36.3	0.0	63.7	0.0	36.3	–75.6

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 ($1.25/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	0.2	100.0	0.4	Only poor targeted
5–9	1.2	98.1	3.2	52.3:1
10–14	3.3	93.7	8.5	14.8:1
15–19	7.7	87.7	18.5	7.1:1
20–24	14.5	81.6	32.7	4.4:1
25–29	22.8	76.5	48.1	3.2:1
30–34	32.0	71.5	63.0	2.5:1
35–39	42.5	66.8	78.2	2.0:1
40–44	52.5	60.7	87.8	1.5:1
45–49	62.6	54.4	93.8	1.2:1
50–54	72.4	48.8	97.4	1.0:1
55–59	80.0	45.0	99.4	0.8:1
60–64	86.5	41.9	99.7	0.7:1
65–69	91.3	39.7	99.8	0.7:1
70–74	95.4	38.0	99.9	0.6:1
75–79	98.0	37.0	100.0	0.6:1
80–84	99.4	36.5	100.0	0.6:1
85–89	99.8	36.3	100.0	0.6:1
90–94	100.0	36.3	100.0	0.6:1
95–100	100.0	36.3	100.0	0.6:1

$2.00/day 2005 PPP Poverty Line Tables

Figure 5 ($2.00/day 2005 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	98.6
15–19	96.6
20–24	94.8
25–29	91.8
30–34	90.0
35–39	79.0
40–44	69.7
45–49	63.1
50–54	41.6
55–59	29.1
60–64	16.3
65–69	11.4
70–74	2.5
75–79	4.4
80–84	0.4
85–89	4.1
90–94	0.0
95–100	0.0

Figure 8 ($2.00/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (±percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0
10–14	-1.4	-1.4	-1.4	-1.4
15–19	1.1	-0.4	2.7	-0.6
20–24	-0.1	-1.2	1.1	-1.4
25–29	-1.3	-2.5	0.0	-2.7
30–34	2.3	0.7	3.8	0.4
35–39	-1.2	-3.0	0.7	-3.4
40–44	1.2	-1.0	3.5	-1.3
45–49	18.4	15.9	20.9	15.4
50–54	0.4	-2.1	2.8	-2.4
55–59	0.7	-1.6	3.2	-2.0
60–64	0.4	-1.8	2.7	-2.2
65–69	0.1	-2.3	2.3	-2.7
70–74	-0.8	-1.7	0.2	-2.0
75–79	2.3	1.3	3.2	1.1
80–84	-3.4	-5.8	-1.4	-6.2
85–89	4.1	4.1	4.1	4.1
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 9 ($2.00/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+1.1	64.1	80.5	89.0
4	+2.1	34.3	43.8	57.1
8	+2.2	25.0	31.0	43.2
16	+2.7	18.6	21.7	31.1
32	+2.6	13.3	15.4	22.3
64	+2.4	9.4	11.2	14.6
128	+2.2	6.9	8.0	10.9
256	+2.1	4.7	5.8	7.8
512	+2.2	3.5	4.1	5.5
1,024	+2.3	2.3	2.9	3.8
2,048	+2.3	1.8	2.1	2.8
4,096	+2.3	1.2	1.4	1.8
8,192	+2.3	0.9	1.0	1.4
16,384	+2.3	0.6	0.7	0.9

Figure 12 ($2.00/day 2005 PPP line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.2	58.4	0.0	41.5	41.6	–99.5
≤9	1.2	57.3	0.0	41.5	42.7	–96.0
≤14	3.3	55.2	0.0	41.5	44.8	–88.7
≤19	7.5	51.0	0.2	41.3	48.8	–74.1
≤24	14.0	44.5	0.6	40.9	54.9	–51.3
≤29	21.6	36.9	1.2	40.3	61.9	–24.0
≤34	29.6	28.9	2.4	39.1	68.7	+5.2
≤39	38.1	20.4	4.4	37.1	75.2	+37.7
≤44	45.1	13.4	7.4	34.1	79.1	+66.7
≤49	50.2	8.3	12.4	29.1	79.3	+78.8
≤54	54.3	4.2	18.1	23.4	77.7	+69.0
≤59	56.6	1.9	23.5	18.0	74.6	+59.9
≤64	57.6	0.9	28.9	12.6	70.2	+50.6
≤69	58.2	0.3	33.1	8.3	66.5	+43.4
≤74	58.4	0.1	37.1	4.4	62.8	+36.7
≤79	58.5	0.1	39.6	1.9	60.4	+32.4
≤84	58.5	0.0	40.9	0.6	59.1	+30.2
≤89	58.5	0.0	41.3	0.2	58.7	+29.4
≤94	58.5	0.0	41.4	0.0	58.6	+29.2
≤100	58.5	0.0	41.5	0.0	58.5	+29.1

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 ($2.00/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.2	100.0	0.3	Only poor targeted
≤9	1.2	100.0	2.0	Only poor targeted
≤14	3.3	100.0	5.6	Only poor targeted
≤19	7.7	97.9	12.8	46.3:1
≤24	14.5	96.1	23.9	24.8:1
≤29	22.8	94.8	37.0	18.1:1
≤34	32.0	92.6	50.6	12.4:1
≤39	42.5	89.7	65.1	8.7:1
≤44	52.5	85.9	77.0	6.1:1
≤49	62.6	80.2	85.9	4.1:1
≤54	72.4	75.0	92.8	3.0:1
≤59	80.0	70.7	96.7	2.4:1
≤64	86.5	66.6	98.4	2.0:1
≤69	91.3	63.7	99.4	1.8:1
≤74	95.4	61.2	99.8	1.6:1
≤79	98.0	59.6	99.9	1.5:1
≤84	99.4	58.9	100.0	1.4:1
≤89	99.8	58.6	100.0	1.4:1
≤94	100.0	58.5	100.0	1.4:1
≤100	100.0	58.5	100.0	1.4:1

$2.50/day 2005 PPP Poverty Line Tables

Figure 5 ($2.50/day 2005 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	99.3
15–19	99.1
20–24	99.2
25–29	96.2
30–34	95.4
35–39	91.0
40–44	82.7
45–49	75.5
50–54	61.1
55–59	44.0
60–64	29.0
65–69	20.0
70–74	9.4
75–79	6.0
80–84	2.2
85–89	4.1
90–94	0.0
95–100	0.0

Figure 8 ($2.50/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+0.0	0.0	0.0	0.0
5–9	+0.0	0.0	0.0	0.0
10–14	–0.7	0.3	0.3	0.3
15–19	–0.3	0.4	0.5	0.7
20–24	+1.2	0.7	0.9	1.2
25–29	–1.3	1.0	1.1	1.1
30–34	+1.9	1.2	1.4	1.7
35–39	+0.8	1.4	1.6	2.0
40–44	+3.9	2.1	2.5	3.1
45–49	+11.2	2.5	3.0	4.1
50–54	+0.4	2.3	2.7	3.6
55–59	–1.8	2.7	3.2	4.2
60–64	+1.2	2.5	2.9	4.2
65–69	+1.1	2.8	3.4	4.2
70–74	+5.3	1.1	1.3	1.7
75–79	–0.2	2.0	2.4	3.3
80–84	–3.3	3.0	3.4	4.3
85–89	+3.5	0.8	1.0	1.2
90–94	+0.0	0.0	0.0	0.0
95–100	+0.0	0.0	0.0	0.0

Figure 9 ($2.50/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+2.0	65.7	76.8	91.4
4	+1.7	35.3	41.0	53.0
8	+1.7	25.8	30.8	40.2
16	+2.2	18.4	22.4	29.1
32	+2.2	13.5	15.9	20.6
64	+2.2	9.7	11.3	14.2
128	+2.0	6.4	7.8	10.0
256	+2.0	4.7	5.5	6.9
512	+2.1	3.3	3.9	5.0
1,024	+2.1	2.3	2.7	3.8
2,048	+2.1	1.6	2.0	2.6
4,096	+2.1	1.2	1.4	1.9
8,192	+2.1	0.8	1.0	1.3
16,384	+2.1	0.6	0.7	0.9

Figure 12 ($2.50/day 2005 PPP line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
0–4	0.2	68.2	0.0	31.6	31.8	–99.5
5–9	1.2	67.2	0.0	31.6	32.8	–96.6
10–14	3.3	65.1	0.0	31.6	34.9	–90.4
15–19	7.6	60.8	0.0	31.6	39.2	–77.7
20–24	14.3	54.0	0.2	31.4	45.8	–57.8
25–29	22.4	46.0	0.4	31.2	53.6	–33.8
30–34	30.9	37.5	1.1	30.5	61.4	–8.1
35–39	40.4	28.0	2.1	29.5	69.8	+21.1
40–44	48.4	19.9	4.0	27.6	76.0	+47.6
45–49	55.6	12.8	7.1	24.5	80.1	+72.9
50–54	61.5	6.9	11.0	20.7	82.1	+84.0
55–59	64.9	3.4	15.1	16.5	81.5	+77.9
60–64	66.8	1.6	19.6	12.0	78.8	+71.3
65–69	67.8	0.6	23.5	8.1	75.9	+65.6
70–74	68.1	0.3	27.3	4.3	72.4	+60.0
75–79	68.3	0.1	29.7	1.9	70.2	+56.5
80–84	68.4	0.0	31.0	0.6	69.0	+54.7
85–89	68.4	0.0	31.5	0.2	68.5	+54.0
90–94	68.4	0.0	31.6	0.0	68.4	+53.8
95–100	68.4	0.0	31.6	0.0	68.4	+53.8

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 ($2.50/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	0.2	100.0	0.2	Only poor targeted
5–9	1.2	100.0	1.7	Only poor targeted
10–14	3.3	100.0	4.8	Only poor targeted
15–19	7.7	99.5	11.1	212.1:1
20–24	14.5	98.7	21.0	75.7:1
25–29	22.8	98.1	32.7	50.3:1
30–34	32.0	96.6	45.2	28.4:1
35–39	42.5	95.0	59.0	18.9:1
40–44	52.5	92.3	70.8	12.0:1
45–49	62.6	88.7	81.3	7.9:1
50–54	72.4	84.9	89.9	5.6:1
55–59	80.0	81.1	95.0	4.3:1
60–64	86.5	77.3	97.7	3.4:1
65–69	91.3	74.3	99.2	2.9:1
70–74	95.4	71.4	99.6	2.5:1
75–79	98.0	69.7	99.9	2.3:1
80–84	99.4	68.8	100.0	2.2:1
85–89	99.8	68.5	100.0	2.2:1
90–94	100.0	68.4	100.0	2.2:1
95–100	100.0	68.4	100.0	2.2:1

$4.00/day 2005 PPP Poverty Line Tables

Figure 5 ($4.00/day 2005 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	100.0
15–19	99.5
20–24	99.7
25–29	99.3
30–34	98.2
35–39	98.5
40–44	95.1
45–49	94.4
50–54	88.5
55–59	75.1
60–64	63.7
65–69	47.4
70–74	30.3
75–79	23.5
80–84	9.7
85–89	7.3
90–94	0.0
95–100	0.0

Figure 8 ($4.00/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (±percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0
10–14	0.0	0.0	0.0	0.0
15–19	-0.5	-0.5	-0.5	-0.5
20–24	-0.1	-0.3	0.1	-0.3
25–29	-0.7	-0.7	-0.7	-0.7
30–34	-0.7	-1.1	-0.3	-1.2
35–39	2.1	1.3	3.0	1.2
40–44	0.7	-0.7	2.1	-0.8
45–49	2.7	1.4	4.1	1.1
50–54	-0.3	-1.7	1.2	-1.9
55–59	-2.9	-5.1	-0.5	-5.4
60–64	0.7	-2.2	4.0	-2.7
65–69	-13.2	-16.5	-9.8	-17.2
70–74	-1.2	-4.9	2.3	-5.6
75–79	5.7	2.1	8.9	1.6
80–84	-2.4	-6.3	1.2	-7.1
85–89	5.3	3.4	6.7	3.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 9 ($4.00/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	–1.4	58.1	70.5	86.6
4	–1.7	29.2	35.2	46.4
8	–1.4	20.7	24.6	34.5
16	–1.1	15.5	19.3	24.3
32	–0.6	11.3	13.2	17.4
64	–0.4	8.1	9.4	12.3
128	–0.5	5.5	6.7	8.9
256	–0.4	3.9	4.7	6.4
512	–0.4	2.7	3.2	4.3
1,024	–0.5	2.0	2.4	3.0
2,048	–0.4	1.4	1.7	2.2
4,096	–0.4	1.0	1.2	1.5
8,192	–0.4	0.7	0.8	1.1
16,384	–0.5	0.5	0.6	0.8

Figure 12 ($4.00/day 2005 PPP line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.2	84.1	0.0	15.7	15.9	–99.6
≤9	1.2	83.1	0.0	15.7	16.9	–97.2
≤14	3.3	81.0	0.0	15.7	19.0	–92.2
≤19	7.7	76.6	0.0	15.7	23.4	–81.8
≤24	14.5	69.8	0.0	15.7	30.2	–65.5
≤29	22.8	61.5	0.0	15.7	38.5	–45.8
≤34	31.8	52.5	0.2	15.5	47.3	–24.4
≤39	42.0	42.3	0.5	15.2	57.2	+0.2
≤44	51.6	32.7	0.9	14.8	66.4	+23.5
≤49	60.9	23.3	1.7	14.0	75.0	+46.6
≤54	69.4	14.9	3.0	12.7	82.1	+68.3
≤59	75.3	9.0	4.7	11.0	86.3	+84.3
≤64	79.3	5.0	7.1	8.6	87.9	+91.5
≤69	82.1	2.1	9.2	6.5	88.7	+89.1
≤74	83.5	0.8	11.9	3.8	87.3	+85.9
≤79	84.1	0.2	14.0	1.7	85.8	+83.4
≤84	84.3	0.0	15.1	0.6	84.9	+82.1
≤89	84.3	0.0	15.6	0.2	84.4	+81.5
≤94	84.3	0.0	15.7	0.0	84.3	+81.4
≤100	84.3	0.0	15.7	0.0	84.3	+81.4

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 ($4.00/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.2	100.0	0.2	Only poor targeted
≤9	1.2	100.0	1.4	Only poor targeted
≤14	3.3	100.0	3.9	Only poor targeted
≤19	7.7	100.0	9.1	Only poor targeted
≤24	14.5	99.9	17.2	668.6:1
≤29	22.8	99.9	27.1	1,051.6:1
≤34	32.0	99.5	37.7	192.9:1
≤39	42.5	98.8	49.8	83.6:1
≤44	52.5	98.3	61.2	58.1:1
≤49	62.6	97.3	72.3	35.9:1
≤54	72.4	95.9	82.4	23.2:1
≤59	80.0	94.1	89.3	15.9:1
≤64	86.5	91.8	94.1	11.1:1
≤69	91.3	89.9	97.5	8.9:1
≤74	95.4	87.5	99.1	7.0:1
≤79	98.0	85.7	99.7	6.0:1
≤84	99.4	84.8	100.0	5.6:1
≤89	99.8	84.4	100.0	5.4:1
≤94	100.0	84.3	100.0	5.4:1
≤100	100.0	84.3	100.0	5.4:1

$1.90/day 2011 PPP Poverty Line Tables

Figure 5 ($1.90/day 2011 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	93.3
10–14	79.3
15–19	79.5
20–24	67.6
25–29	63.2
30–34	52.4
35–39	39.4
40–44	27.5
45–49	14.4
50–54	5.9
55–59	4.2
60–64	0.9
65–69	0.4
70–74	0.2
75–79	0.0
80–84	0.4
85–89	0.0
90–94	0.0
95–100	0.0

Figure 8 ($1.90/day 2011 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (±percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	1.2	-3.0	5.8	-3.6
10–14	-10.4	-13.0	-7.6	-13.3
15–19	0.8	-1.9	3.6	-2.6
20–24	4.9	2.3	7.7	1.8
25–29	7.7	5.2	10.2	4.7
30–34	4.5	2.1	6.8	1.6
35–39	-3.2	-5.4	-1.0	-5.7
40–44	2.7	0.7	4.8	0.4
45–49	2.6	1.1	3.9	0.8
50–54	-3.3	-4.7	-2.0	-5.0
55–59	-0.9	-2.0	0.1	-2.2
60–64	0.4	0.0	0.7	-0.1
65–69	0.0	-0.3	0.3	-0.3
70–74	0.2	0.2	0.2	0.2
75–79	0.0	0.0	0.0	0.0
80–84	0.4	0.4	0.4	0.4
85–89	0.0	0.0	0.0	0.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 9 ($1.90/day 2011 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	–0.1	67.9	76.6	86.8
4	+0.7	33.8	40.2	58.1
8	+1.1	23.2	27.7	36.4
16	+1.3	16.0	20.1	26.2
32	+1.1	11.9	13.9	18.7
64	+1.1	8.1	9.8	12.5
128	+1.0	5.8	6.9	8.5
256	+1.0	3.9	5.1	6.5
512	+0.9	3.0	3.5	4.3
1,024	+0.9	2.1	2.4	3.2
2,048	+1.0	1.4	1.7	2.3
4,096	+1.0	1.0	1.3	1.7
8,192	+1.0	0.7	0.9	1.1
16,384	+1.0	0.5	0.6	0.8

Figure 12 ($1.90/day 2011 PPP line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.2	29.6	0.0	70.3	70.4	–99.0
≤9	1.1	28.6	0.1	70.2	71.3	–92.3
≤14	3.0	26.8	0.3	69.9	72.9	–78.9
≤19	6.4	23.3	1.2	69.0	75.5	–52.7
≤24	10.8	18.9	3.7	66.5	77.3	–14.8
≤29	15.6	14.2	7.3	63.0	78.5	+29.2
≤34	19.8	9.9	12.1	58.2	78.0	+59.2
≤39	24.2	5.5	18.3	52.0	76.2	+38.4
≤44	26.9	2.9	25.6	44.7	71.5	+13.8
≤49	28.3	1.4	34.4	35.9	64.2	–15.6
≤54	29.2	0.5	43.2	27.0	56.2	–45.5
≤59	29.6	0.1	50.4	19.9	49.5	–69.6
≤64	29.7	0.0	56.8	13.5	43.2	–91.0
≤69	29.7	0.0	61.6	8.7	38.4	–107.2
≤74	29.7	0.0	65.7	4.6	34.3	–121.1
≤79	29.7	0.0	68.3	2.0	31.7	–129.8
≤84	29.7	0.0	69.7	0.6	30.3	–134.3
≤89	29.7	0.0	70.1	0.2	29.9	–135.9
≤94	29.7	0.0	70.2	0.0	29.8	–136.3
≤100	29.7	0.0	70.3	0.0	29.7	–136.4

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 ($1.90/day 2011 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.2	100.0	0.5	Only poor targeted
≤9	1.2	95.6	3.8	21.9:1
≤14	3.3	90.1	10.0	9.1:1
≤19	7.7	83.9	21.6	5.2:1
≤24	14.5	74.3	36.3	2.9:1
≤29	22.8	68.1	52.3	2.1:1
≤34	32.0	62.1	66.7	1.6:1
≤39	42.5	56.9	81.4	1.3:1
≤44	52.5	51.2	90.4	1.0:1
≤49	62.6	45.1	95.1	0.8:1
≤54	72.4	40.3	98.2	0.7:1
≤59	80.0	37.0	99.7	0.6:1
≤64	86.5	34.3	99.9	0.5:1
≤69	91.3	32.6	100.0	0.5:1
≤74	95.4	31.1	100.0	0.5:1
≤79	98.0	30.3	100.0	0.4:1
≤84	99.4	29.9	100.0	0.4:1
≤89	99.8	29.8	100.0	0.4:1
≤94	100.0	29.7	100.0	0.4:1
≤100	100.0	29.7	100.0	0.4:1

$3.10/day 2011 PPP Poverty Line Tables

Figure 5 ($3.10/day 2011 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	96.8
15–19	96.4
20–24	92.5
25–29	87.9
30–34	85.7
35–39	73.0
40–44	62.6
45–49	54.6
50–54	30.2
55–59	22.5
60–64	10.2
65–69	7.0
70–74	1.7
75–79	2.3
80–84	0.4
85–89	0.0
90–94	0.0
95–100	0.0

Figure 8 ($3.10/day 2011 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (±percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0
10–14	-1.7	-2.7	-0.6	-2.9
15–19	1.7	0.2	3.5	-0.1
20–24	-0.5	-1.7	0.8	-1.9
25–29	-0.7	-2.2	0.9	-2.4
30–34	1.8	0.1	3.5	-0.2
35–39	1.0	-1.1	3.0	-1.4
40–44	3.4	1.0	5.7	0.5
45–49	16.3	13.7	18.6	13.3
50–54	-2.7	-5.0	-0.5	-5.4
55–59	1.4	-0.7	3.5	-1.1
60–64	0.4	-1.5	2.0	-1.9
65–69	-2.3	-4.4	-0.2	-4.8
70–74	0.4	-0.2	1.0	-0.4
75–79	0.8	-0.2	1.6	-0.4
80–84	0.2	-0.1	0.4	-0.2
85–89	0.0	0.0	0.0	0.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 9 ($3.10/day 2011 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+1.4	71.4	79.7	90.0
4	+2.0	34.4	43.2	60.5
8	+2.2	26.0	31.4	41.0
16	+2.4	18.2	22.7	31.2
32	+2.4	12.9	15.5	21.2
64	+2.2	9.0	10.6	13.9
128	+2.0	6.5	7.4	10.0
256	+2.0	4.6	5.6	7.5
512	+2.1	3.3	4.0	5.0
1,024	+2.1	2.3	2.7	3.5
2,048	+2.1	1.7	2.0	2.6
4,096	+2.1	1.2	1.4	1.9
8,192	+2.1	0.8	1.1	1.4
16,384	+2.1	0.6	0.7	0.9

Figure 12 ($3.10/day 2011 PPP line): Households by targeting classification and score, along with "Total Accuracy" and BPAC, scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.2	52.6	0.0	47.2	47.4	–99.4
≤9	1.2	51.6	0.0	47.2	48.4	–95.6
≤14	3.3	49.5	0.0	47.2	50.5	–87.6
≤19	7.4	45.4	0.2	47.0	54.4	–71.5
≤24	13.7	39.1	0.8	46.4	60.1	–46.5
≤29	21.0	31.8	1.8	45.4	66.4	–16.9
≤34	28.5	24.2	3.4	43.8	72.3	+14.6
≤39	36.1	16.6	6.3	40.9	77.0	+49.0
≤44	42.1	10.6	10.4	36.9	79.0	+79.3
≤49	46.5	6.2	16.1	31.1	77.7	+69.5
≤54	49.8	3.0	22.6	24.6	74.4	+57.1
≤59	51.5	1.3	28.5	18.7	70.2	+45.9
≤64	52.2	0.6	34.3	12.9	65.1	+35.0
≤69	52.6	0.1	38.7	8.5	61.2	+26.7
≤74	52.7	0.1	42.7	4.5	57.2	+19.1
≤79	52.8	0.0	45.3	2.0	54.7	+14.2
≤84	52.8	0.0	46.6	0.6	53.4	+11.7
≤89	52.8	0.0	47.1	0.2	52.9	+10.8
≤94	52.8	0.0	47.2	0.0	52.8	+10.6
≤100	52.8	0.0	47.2	0.0	52.8	+10.5

Inclusion, undercoverage, leakage, and exclusion normalized to sum to 100.

Figure 13 ($3.10/day 2011 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successfully targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.2	100.0	0.3	Only poor targeted
≤9	1.2	100.0	2.2	Only poor targeted
≤14	3.3	99.1	6.2	105.1:1
≤19	7.7	96.8	14.0	29.9:1
≤24	14.5	94.5	26.0	17.0:1
≤29	22.8	92.0	39.8	11.5:1
≤34	32.0	89.3	54.1	8.3:1
≤39	42.5	85.1	68.5	5.7:1
≤44	52.5	80.3	79.8	4.1:1
≤49	62.6	74.3	88.2	2.9:1
≤54	72.4	68.8	94.4	2.2:1
≤59	80.0	64.3	97.6	1.8:1
≤64	86.5	60.3	98.8	1.5:1
≤69	91.3	57.6	99.7	1.4:1
≤74	95.4	55.2	99.9	1.2:1
≤79	98.0	53.8	100.0	1.2:1
≤84	99.4	53.1	100.0	1.1:1
≤89	99.8	52.9	100.0	1.1:1
≤94	100.0	52.8	100.0	1.1:1
≤100	100.0	52.8	100.0	1.1:1