Simple Poverty Scorecard® Poverty-Assessment Tool Sri Lanka

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Abstract

The Simple Poverty Scorecard-brand poverty-assessment tool uses ten low-cost indicators from Sri Lanka's 2006/7 Household Income and Expenditure Survey to estimate the likelihood that a household has income 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 Sri Lanka to measure poverty rates, to track changes in poverty rates over time, and to segment clients for targeted services.

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Simple Poverty Scorecard® Poverty-Assessment Tool

			Name	Identifier
Interview ID:				
Interview date:		Participant:		
Country:	LKA	Field agent:		
Scorecard:	001	Service point:		
Sampling wgt.:		Number of household members:		

Indicator	Value	Points	Score
1. How many members does the household have?	A. Six or more	0	
	B. Five	6	
	C. Four	10	
	D. Three	17	
	E. One or two	21	
2. How many household members are employees of government or semi-government entities?	A. None	0	
	B. One or more	8	
3. What is the highest educational level that the female head/spouse has passed?	A. Year 1 or less	0	
	B. Years 2 to 7	1	
	C. Years 8 or 9	4	
	D. Year 10	5	
	E. No female head/spouse	5	
	F. G.C.E. (O/L) or equivalent, Year 12, or higher	13	
4. What is the principal construction material of the floors?	A. Mud, or other	0	
	B. Cement	3	
	C. Terrazzo/tile	9	
5. How many bedrooms does the household use?	A. None	0	
	B. One	1	
	C. Two	5	
	D. Three or more	7	
6. Does the household possess an electric fan?	A. No	0	
	B. Yes	9	
7. Does the household possess a television and a VCD/DVD?	A. No television	0	
	B. Television, but no VCD/DVD	3	
	C. Television and VCD/DVD	7	
8. Does the household possess a cooker (gas, kerosene, or electric)?	A. No	0	
	B. Yes	7	
9. Does the household possess a refrigerator?	A. No	0	
	B. Yes	6	
10. Does the household possess a bicycle; motorcycle, scooter, or three-wheeler; or motor car, van, bus, lorry, 2-wheel or 4-wheel tractor?	A. None	0	
	B. Bicycle only	2	
	C. Motorcycle etc., but no motor car etc. (regardless of bicycle)	9	
	D. Motor car etc. (regardless of bicycle or motorcycle etc.)	13	

Score:

Simple Poverty Scorecard® Poverty-Assessment Tool Sri Lanka

1. Introduction

Pro-poor programs in Sri Lanka can use the Simple Poverty Scorecard poverty-assessment tool to estimate the likelihood that a household has expenditure below a given poverty line, to measure groups' poverty rates at a point in time, to track changes in groups' poverty rates over time, and to segment clients for targeted services.

The direct approach to poverty measurement via surveys is difficult and costly. As a case in point, Sri Lanka's 2006/7 Household Income and Expenditure Survey (HIES) asks questions about more than 400 expenditure items, for example "In the past week, how many grams of *Kekulu* rice did the household consume? How much was this *Kekulu* rice worth in rupees? Now then, in the past week how many grams of *Samba* rice did the household consume? . . .".

In contrast, the indirect approach via the scorecard is simple, quick, and inexpensive. It uses ten verifiable indicators (such as "What is the principal construction material of the floors?" and "Does the household possess an electric fan?") to get a score that is highly correlated with poverty status as measured by expenditure from 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 local organizations are typically subjective and relative (such as participatory wealth ranking) or blunt (such as rules based on land-ownership or housing quality). These approaches may be costly, their results may not be comparable across organizations or across countries, and their accuracy and precision are unknown.

Local, pro-poor organizations can use the scorecard here for many purposes. For example, they can use it to determine the share of their participants who are below a poverty line, perhaps because they want to relate participants' poverty status to the Millennium Development Goals' $1.25/day poverty line at 2005 purchase-power parity (PPP). USAID microenterprise partners can use the scorecard to report the share of their participants who are among the poorest half of people below the national poverty line. Organizations that want to measure movement across a poverty line (for example, Daley-Harris, 2009) can also use the scorecard. In sum, the scorecard® is an expenditure-based, objective, quick, and inexpensive tool with known accuracy that can serve for measuring, management, and/or targeting. While expenditure surveys are difficult and costly even for governments, a simple, inexpensive scorecard may be feasible for many local, pro-poor organizations.

The statistical approach here aims to be understood by non-specialists. After all, if managers are to adopt the scorecard 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 local pro-poor organizations rarely use them to inform decisions. This is not because these tools do not work, but because they are presented (when they are presented at all) as tables of regression coefficients incomprehensible to non-specialists (with indicator names such as "`LGHHSZ_2`", negative points, and points with many decimal places). Thanks to the predictive-modeling phenomenon known as the "flat maximum", simple scorecards are 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 is based on data from the 2006/7 HIES conducted by Sri Lanka's Department of Census and Statistics. Indicators are selected to be:

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

All points in the scorecard are zeroes or positive 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.

The scorecard 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-capita expenditure below a given poverty line.

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

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

The scorecard can also be used for targeting services to poorer households. To help managers choose an appropriate targeting cut-off, 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 Sri Lanka's national poverty line and data on household expenditure. Scores from this scorecard are calibrated to poverty likelihoods for ten poverty lines.

The scorecard is constructed and calibrated using a sub-sample from the 2006/7 HIES. Its accuracy is then validated on a different sub-sample from the 2006/7 HIES. While all three scoring estimators are unbiased when applied to the population from which they were derived (that is, they match the true value on average in repeated

samples from the same population from which the scorecard is 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 direct survey approach is unbiased by definition.) There is bias because scoring must assume that the relationships between indicators and poverty will be the same in the future as they are in the data used to build the scorecard. Scoring must also assume that these relationships will be the same in all sub-groups and at all times as they were in Sri Lanka's population when the 2006/7 HIES was conducted. Of course, these assumptions—ubiquitous and inevitable in predictive modeling—hold only partly and hold less and less as more time passes.

When applied to the validation sample for Sri Lanka with the national poverty line and $n = 16{,}384$, the average difference between scorecard estimates of groups' poverty rates and true rates at a point in time is –0.5 percentage points. Across all ten lines, the average absolute difference is 0.3 percentage points, and the maximum absolute difference is 0.9 percentage points.

Because the validation sample is representative of the same population as the data that is used to construct the scorecard and because all the data come from the same time frame, the scorecard estimators are unbiased and these observed differences are due to sampling variation; the average difference would be zero if the 2006/7 HIES

[1] Important examples of "different populations" include nationally representative samples at another time or non-representative sub-groups (Tarozzi and Deaton, 2007).

were to be repeatedly redrawn and then divided into sub-samples before repeating the entire process of building scorecards and testing accuracy.

For n = 16,384, the 90-percent confidence intervals for these estimates are +/–0.6 percentage points or less. For n = 1,024, these intervals are +/–2.4 percentage points or less.

Section 2 below documents data, poverty rates, and poverty lines for Sri Lanka. Sections 3 and 4 describe scorecard construction and offer practical guidelines for use. 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 over time, and Section 8 covers targeting. Section 9 places the new scorecard here in the context of similar existing exercises for Sri Lanka. The final section is a summary.

2. Data and poverty lines

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

2.1 Data

The scorecard is based on data from the 18,544 households in the 2006/7 HIES. This is the most recent national expenditure survey available for Sri Lanka. Households are randomly divided into three sub-samples (Figure 2):

- *Construction* for selecting indicators and points
- *Calibration* for associating scores with poverty likelihoods
- *Validation* for measuring accuracy on 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 given group who live in households whose total household expenditure (divided by the number of members) 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, so larger households have greater weight.

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

Whether the household-level rate or the person-level rate is most 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 their 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 per household, then it might want to report household-level poverty rates.

The scorecard is constructed using Sri Lanka's 2006/7 HIES and household-level lines. Scores are calibrated to household-level poverty likelihoods, and accuracy is

measured for household-level rates. This household-level focus reflects the belief that it is the most relevant for most pro-poor organizations.

Organizations can estimate person-level poverty rates 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, to calibrate scores to person-level likelihoods, and to measure accuracy for person-level rates, but it is not done here.

2.2.2 Poverty lines

Based on the 2005/6 HIES, Figure 2 reports poverty lines and household- and person-level poverty rates for Sri Lanka as a whole and for the construction, calibration, and validation sub-samples. Figure 3 reports poverty lines and household- and person-level poverty rates for Sri Lanka as a whole and by district.

The food poverty line in Sri Lanka is defined as the average cost of 2,030 Calories for households in the 2002 HIES in the second, third, and fourth deciles of total expenditure (Nanayakkara, 2006; Suranjana Vidyaratne, 2004). In 2002, the food line was LKR31.98 per person per day.

The national poverty line (also called the "Official Poverty Line") is defined as the simple average of a "lower" food-plus-non-food line and an "upper" food-plus-non-food line. The "lower" line is the median of total expenditure for households whose *total* expenditure is within +/–10 percent of the food line (Ravallion, 1994); the upper line is the median total expenditure for households whose *food* expenditure is within +/–10 percent of the food line. In 2002, the national line was LKR73.41 per person per day.

The national line is adjusted for inflation between 2002 and 2006/7 using district-level price indices.[2] The person-weighted average of the district-level national lines is LKR75.72, giving a household-level poverty rate in the 2006/7 HIES of 12.6 percent and a person-level poverty rate of 15.2 percent (Figures 2 and 3).

[2] District lines come from K.M.R. Wickramasinghe and W.W.M.A.S. Premakumara.

Department of Census and Planning (2008) reports an all-Sri Lanka national line of LKR73.41 for the 2006/7 HIES. This is slightly lower that the district-average line of LKR75.72 because the 2006/7 all-Sri Lanka line is updated from the 2002 all Sri-Lanka line using the Colombo Consumer Price Index, while the district lines are updated using district prices indices. This paper uses the district-level lines.

The district-level food lines for the 2006/7 HIES are defined as the district's national line multiplied by 0.683767 (the ratio of the 2002 food line to the 2002 national line). This gives an average food line for Sri Lanka in the 2006/7 HIES of LKR51.78 per person per day, with a household-level poverty rate of 2.5 percent and a person-level poverty rate of 3.3 percent (Figures 2 and 3).

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

- 100% of national
- Food
- 125% of national
- 150% of national
- 200% of national
- 300% of national
- USAID "extreme"
- $1.25/day 2005 PPP
- $2.50/day 2005 PPP
- $3.75/day 2005 PPP

The lines that are multiples of the national line need no additional explanation.

The USAID "extreme" line is defined as the median aggregate household per-capita expenditure of people (not households) below the national line (U.S. Congress, 2002).

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

- 2005 PPP exchange rate for "individual consumption expenditure by households" (World Bank, 2008): LKR40.04 per $1.00
- Consumer price indices for Colombo: 4055.52 for 2005 on average, and 4983.09 during July 2006 to June 2007 (the months when the 2006/7 HIES was in the field)[3]

Using the formula in Sillers (2006), the $1.25/day 2005 PPP line for Sri Lanka as a whole for the months in which the 2006/7 HIES was in the field is:

$$(\text{2005 PPP exchange rate}) \cdot \$1.25 \cdot \frac{\text{CPI}_{\text{Ave. 2006/7}}}{\text{CPI}_{\text{Ave. 2005}}} = \left(\frac{\text{LKR40.04}}{\$1.00}\right) \cdot \$1.25 \cdot \frac{4983.09}{4055.52} = \text{LKR61.50}.$$

This is an all-Sri Lanka line. To account for differences in cost-of-living across districts, the $1.25/day line for a given district is defined as the all-Sri Lanka $1.25/day 2005 PPP line multiplied by the national line for the district and divided by the average national line.

The $2.50/day and $3.75/day 2005 PPP lines are multiples of the $1.25/day 2005 PPP line.

[3] `http://www.statistics.gov.lk/price/ccpi(new)/price%20old/ccpi/ccpi_tbl.htm`, retrieved 2 March 2010

3. Scorecard construction

For the Sri Lanka scorecard, about 90 potential indicators are initially prepared in the areas of:

- Family composition (such as household size)
- Education (such as the educational attainment of the female head/spouse)
- Employment (such as the number of household members employed by government or semi-government entities)
- Housing (such as the principal material of the floors)
- Possession of durable goods (such as refrigerators)

Figure 4 lists all the candidate indicators, ranked by the entropy-based "uncertainty coefficient" that is a measure of how well an indicator predicts poverty on its own (Goodman and Kruskal, 1979).

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, possession of an electric fan 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 (forward stepwise, based on "c"). 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.

This algorithm is a Logit analogue to the familiar R^2-based stepwise with 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 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).

The single scorecard here applies to all of Sri Lanka. Tests for Mexico and India (Schreiner, 2006a and 2006b), Jamaica (Grosh and Baker, 1995), and Sri Lanka itself (Narayan and Yoshida, 2005) suggest that segmenting scorecards by urban/rural does not improve targeting much, although such segmentation may improve the accuracy of estimated poverty rates (Tarozzi and Deaton, 2007).

4. Practical guidelines for scorecard use

The main challenge of scorecard design is not to squeeze out the last drops of accuracy but rather to improve the chances that scoring is actually used (Schreiner, 2005). When scoring projects fail, the reason is not usually technical 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 predict tolerably well, 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 want to adopt it and use it properly. Of course, accuracy is important, but so are 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 imply a lot of additional work and if the whole process generally seems to make sense.

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

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

A field worker using the paper scorecard would:

- Record participant identifiers
- Read each question verbatim from the scorecard
- Circle each response and its points
- Write the points 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 data entry and filing

4.1 Quality control

Of course, field workers must be trained. High-quality outputs require high-quality inputs. If organizations or field workers gather their own data and if they 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 random audits (Matul and Kline, 2003).[4] IRIS Center (2007a) and Toohig (2008) are useful nuts-and-bolts guides for planning, budgeting, training field

[4] If an organization does not want field workers to know the points associated with indicators, then they can use the version of Figure 1 without points and apply the points later at the central office.

workers and supervisors, logistics, sampling, interviewing, piloting, recording data, and controlling quality.

In particular, while collecting indicators for the scorecard is relatively easier than most alternatives, it is still absolutely difficult. Training and explicit definitions of the terms and concepts in the scorecard is essential.[5] For example, one study in Nigeria finds distressingly low inter-rater and test-retest correlations for indicators as seemingly simple and obvious as whether the household owns an automobile (Onwujekwe, Hanson, and Fox-Rushby, 2006).

For the example of a Mexican social program that uses self-reported indicators in the first stage of scorecard-based targeting, 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 done in the second stage of the Mexican program, field agents using the scorecard can verify responses with a home visit and correct any false reports.

[5] Appendix A is a guide for interpreting indicators in the Sri Lanka scorecard.

4.2 Implementation and sampling

In terms of implementation and sample 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

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

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
- A representative sample of a sub-group that is relevant for a particular question

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 confidence level and a desired confidence interval.

Frequency of application can be:

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

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

- Different sets of participants, with each set representative of a given group
- A single set of participants

An example bundle of implementation and design choices is illustrated by BRAC and ASA, two microlenders in Bangladesh (each with more than 7 million participants) who are applying the Simple Poverty Scorecard tool for Bangladesh (Chen and Schreiner, 2009a). Their design is that loan officers in a random sample of branches score all their clients each time they visit a homestead (about once a year) as part of their standard due diligence prior to loan disbursement. Responses in the field are recorded on paper before being sent to a central office to be entered into a spreadsheet database. The sampling plans of ASA and BRAC cover 50,000–100,000 participants each, which is far more than would be required to inform most decisions at a typical pro-poor organization.

5. Estimates of household poverty likelihoods

The sum of scorecard points for a household is called the *score*. For Sri Lanka, 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 poverty line, the scores themselves have only relative units. For example, doubling the score does not double the likelihood of being above a poverty line.

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 with the 2006/7 HIES, scores of 15–19 correspond to a poverty likelihood of 39.8 percent, and scores of 20–24 correspond to a poverty likelihood of 27.7 percent (Figure 5).

The poverty likelihood associated with a score varies by poverty line. For example, scores of 15–19 are associated with a poverty likelihood of 39.8 percent for the national line but 9.1 percent for the food line.[6]

[6] From Figure 5 on, many figures have ten versions, one for each of the ten poverty lines. Single tables relevant for all lines are placed with the tables for the national line.

5.1 Calibrating scores with poverty likelihoods

A given score is non-parametrically 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.

For the example of the national line (Figure 6), there are 6,842 (normalized) households in the calibration sub-sample with a score of 15–19, of whom 2,725 (normalized) are below the poverty line. The estimated poverty likelihood associated with a score of 15–19 is then 39.8 percent, because 2,725 ÷ 6,842 = 0.398.

As another illustration, consider the national line and a score of 20–24. Now there are 8,331 (normalized) households in the calibration sample, of whom 2,309 (normalized) are below the line (Figure 6). Thus, the poverty likelihood for this score is 2,309 ÷ 8,331 = 0.277, or 27.7 percent.

The same method is used to calibrate scores with estimated poverty likelihoods for all ten poverty lines.

Figure 7 shows, for all scores, the likelihood that expenditure falls in a range demarcated by two adjacent poverty lines. For example, the daily expenditure of someone with a score of 15–19 falls in the following ranges with probability:

- 9.1 percent less than the food line
- 11.0 percent between the food line and $1.25/day 2005 PPP
- 19.8 percent between $1.25/day 2005 PPP and 100% of the national line
- 28.4 percent between 100% of the national line and 125% of the national line
- 16.6 percent between 125% of the national line and 150% of the national line
- 4.2 percent between 150% of the national line and $2.50/day 2005 PPP
- 6.5 percent between $2.50/day 2005 PPP and 200% of the national line
- 2.5 percent between 200% of the national line and $3.75/day 2005 PPP
- 1.4 percent between $3.75/day 2005 PPP and 300% of the national line
- 0.6 percent more than 300% of national

Even though the scorecard is constructed partly based on judgment, this 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 based only on 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 Sri Lanka 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. It is 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. Converting scores to poverty likelihoods requires no arithmetic at all, just a look-up table. This non-parametric calibration can also improve accuracy, especially with large calibration samples.

5.2 Accuracy of estimates of households' poverty likelihoods

As long as the relationships between indicators and poverty do not change and as long as the scorecard is applied to households who are representative of the same population from which the scorecard is constructed, this calibration process 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]

But the relationships between indicators and poverty do change with time, and they also change across sub-groups in Sri Lanka's population. Thus, the scorecard will generally be biased when applied after the June 2007 end date of fieldwork for the 2006/7 HIES (as it must be applied in practice) or when applied with non-nationally

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

representative sub-groups (as it probably will be applied by local, pro-poor organizations).

How accurate are these estimates of households' poverty likelihoods, given the assumption of representativeness? To check, 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 who have 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 in the validation sample, the average poverty likelihood across bootstrap samples for scores of 15–19 is too low by 4.4 percentage points. For scores of 20–24, the estimate is too low by 3.8 percentage points.[8]

[8] These differences are not zero, despite 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 construction and calibration process.

The 90-percent confidence interval for the differences for scores of 15–19 is +/–3.5 percentage points (Figure 8). This means that in 900 of 1,000 bootstraps, the difference between the estimate and the true value is between –7.9 and –0.9 percentage points (because –4.4 – 3.5 = –7.9, and –4.4 + 3.5 = –0.9). In 950 of 1,000 bootstraps (95 percent), the difference is –4.4 +/–3.7 percentage points, and in 990 of 1,000 bootstraps (99 percent), the difference is –4.4 +/–4.1 percentage points.

For most scores, Figure 8 shows differences—a few of them large—between estimated poverty likelihoods and true values. The differences are not all zero because the validation sub-sample is a single, finite sample that—thanks to sampling variation—differs in distribution from the construction/calibration sub-samples and from the Sri Lanka population. Also, some score ranges have few households in them, increasing the importance of sampling variation.

For targeting, what matters is less the differences across all score ranges and more the differences in score ranges just above and just 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.

Of course, if estimates of groups' poverty rates are to be usefully accurate, then errors for individual households must largely balance out. As discussed in the next section, this is the case for Sri Lanka.

Another possible source of bias is overfitting. By construction, the scorecard here is unbiased, but it may still be *overfit* when applied after the end of fieldwork for the

2006/7 HIES. That is, the scorecard may fit the 2006/7 data so closely that it captures not only some real patterns but also some false patterns that, due to sampling variation, show up only in the 2006/7 data. 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. Finally, the scorecard could also be overfit if it is not robust when applied to samples from non-nationally representative sub-groups.

Overfitting can be mitigated by simplifying the scorecard and by not relying only on data but rather also considering experience, judgment, and theory. Of course, the scorecard here does this. Bootstrapping scorecard construction—which is not done here—can also mitigate overfitting by reducing (but not eliminating) dependence on a single sampling instance. Combining scorecards can also help, at the cost of complexity. Simplifying the scorecard can also reduce overfitting (at the cost of decreased precision), although the scorecard is already parsimonious with limited scope for simplification. Often the best option is simply to update the scorecard as soon as new data is available from a national expenditure survey.

In any case, errors in individual households' likelihoods largely balance out in the estimates of groups' poverty rates (see the next section). Furthermore, much of the differences between scorecard estimates and true values may come from non-scorecard sources. These factors can be addressed only by improving data quantity and quality, which is beyond the scope of the scorecard.

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, 2010 and that they have scores of 20, 30, and 40, corresponding to poverty likelihoods of 27.7, 10.3, and 3.6 percent (national line, Figure 5). The group's estimated poverty rate is the households' average poverty likelihood of $(27.7 + 10.3 + 3.6) \div 3 = 13.9$ percent.[9]

6.1 Accuracy of estimated poverty rates at a point in time

How accurate is this estimate? For a range of sample sizes, Figure 10 reports average differences between estimated and true poverty rates as well as precision (confidence intervals for the differences) for the scorecard applied to 1,000 bootstrap samples from the validation sample.

Summarizing Figure 10 across poverty lines and years for $n = 16{,}384$, Figure 9 shows that the absolute differences between estimated poverty rates and true rates for the scorecard applied to the validation sample are 0.9 percentage points or less. The average absolute difference across the ten poverty lines for the validation sample is 0.3 percentage points.

[9] The group's poverty rate is *not* the poverty likelihood associated with the average score. Here, the average score is $(20 + 30 + 40) \div 3 = 30$, and the poverty likelihood associated with the average score is 10.3 percent. This is not the 13.9 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 9); in 900 of 1,000 bootstraps of this size, the absolute difference between the estimate and the average estimate is 0.6 percentage points or less.

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 –0.5 – 0.4 = –0.9 to –0.5 + 0.4 = –0.1 percentage points. This is because –0.5 is the average difference and +/–0.4 is its 90-percent confidence interval. The average difference is –0.5 because the average scorecard estimate is too low by 0.5 percentage points; the scorecard tends to estimate a poverty rate of 12.5 percent for the validation sample, but the true value is 13.0 percent (Figure 2).

Part of these differences is due to sampling variation in the division of the 2006/7 HIES into three sub-samples. Of course, estimates of poverty rates at a point in time from now on will be most accurate for periods that resemble 2006/7.

6.2 Standard-error formula for estimates of poverty rates at a point in time

How precise are the point-in-time estimates? Because they are averages, the estimates have a Normal distribution and can be characterized by their average difference vis-à-vis true values, along 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 for indirect measurement via scorecards (Schreiner, 2008a), note that the textbook formula (Cochran, 1977) that relates confidence intervals with standard errors in the case of direct measurement of poverty 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, with a sample $n = 16{,}384$, 90-percent confidence ($z = 1.64$), and a poverty rate p of 13.0 percent (the true rate in the validation sample for the national line in Figure 2), the confidence interval c is

$$+/- z \cdot \sqrt{\frac{p \cdot (1-p)}{n}} = +/- 1.64 \cdot \sqrt{\frac{0.130 \cdot (1-0.130)}{16{,}384}} = +/–0.431 \text{ percentage points.}$$

The scorecard, however, does not measure poverty directly, so this formula is not applicable. To derive a formula for the Sri Lanka scorecard, consider Figure 10, 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, the national line, and the validation sub-sample, the 90-percent confidence

interval is +/–0.380 percentage points.[10] Thus, the ratio of confidence intervals for the scorecard versus direct measurement is 0.380 ÷ 0.431 = 0.88.

Now consider the same case, but with n = 8,192. The confidence interval under direct measurement is $+/-1.64 \cdot \sqrt{\frac{0.130 \cdot (1-0.130)}{8{,}192}} = +/-0.609$ percentage points. The empirical confidence interval with the Sri Lanka scorecard for the national line (Figure 10) is +/–0.545 percentage points. Thus for n = 8,192, the ratio for the scorecard to direct measurement is 0.545 ÷ 0.609 = 0.89.

This ratio of 0.89 for n = 8,192 is not far from the ratio of 0.88 for n = 16,384. Indeed, across all sample sizes of 256 or more in Figure 10, the average ratio turns out to be 0.89, implying that confidence intervals for indirect estimates of poverty rates via the Sri Lanka scorecard and the national poverty line are about 11 percent narrower than those for direct estimates. This 0.89 appears in Figure 9 as the "α factor" because if $\alpha = 0.89$, then the formula relating confidence intervals c and standard errors σ for the Sri Lanka scorecard is $c = +/- z \cdot \alpha \cdot \sigma$. The standard error for point-in-time estimates of poverty rates via scoring is $\alpha \cdot \sqrt{\frac{p \cdot (1-p)}{n}}$.

In general, α could be more or less than 1.00. When α is less than 1.00, it means that the scorecard is more precise than direct measurement. This occurs for all ten lines for the validation sample in Figure 9.

[10] Due to rounding, Figure 10 displays 0.4, not 0.380.

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

To illustrate how to use this, suppose $c = 0.03050$ and $z = 1.64$ (90-percent confidence), and $\hat{p} = 0.1240$ (the average poverty rate for the national line in the construction and calibration sub-samples, Figure 2). Then the formula gives $n = \left(\frac{0.89 \cdot 1.64}{0.03050}\right)^2 \cdot 0.1240 \cdot (1 - 0.1240) = 248$, close to the sample size of 256 observed for these parameters in Figure 10.

Of course, the α factors in Figure 9 are specific to Sri Lanka, its poverty lines, its poverty rates, and this scorecard. The method for deriving the formulas, however, is valid for any scorecard following the basic approach in this paper.

In practice after the end of the 2006/7 HIES fieldwork in June 2007, 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,

[11] IRIS Center (2007a and 2007b) says that a sample size of $n = 300$ is sufficient for reporting estimated poverty rates to USAID. 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 tool could be more or less precise than direct measurement.

+/–2.0 percentage points, or $c = 0.02$), make an assumption about $\hat{p}$ (perhaps based on a previous measurement such as the 12.6-percent average for the national line in Figure 2), look up α (here, 0.89), assume that the scorecard will work the same in the future and/or for non-nationally representative sub-groups,[12] and then compute the required sample size. In this illustration, $n = \left(\frac{0.89 \cdot 1.64}{0.02}\right)^2 \cdot 0.126 \cdot (1 - 0.126) = 587$.

[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 will deteriorate with time to the extent that the relationships between indicators and poverty change and to the extent that a sub-group is not nationally representative.

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 for 2006/7 only, this paper cannot estimate changes over time, nor can it present sample-size formula for the Sri Lanka scorecard. Nevertheless, the relevant concepts are presented here because, in practice, pro-poor organizations can apply the scorecard to measure change over time.

7.1 Warning: Change is not impact

Scoring can estimate change. Of course, change could be for the better or for the worse, and scoring does not indicate what caused change. This point is often forgotten, confused, or ignored, so it bears repeating: the scorecard 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 on poverty status 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, the scorecard 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 the scorecard.

7.2 Calculating estimated changes in poverty rates over time

Consider the illustration begun in the previous section. On Jan. 1, 2010, a program samples three households who score 20, 30, and 40 and so have poverty likelihoods of 27.7, 10.3, and 3.6 percent (national line, Figure 5). The group's baseline estimated poverty rate is the households' average poverty likelihood of (27.7 + 10.3 + 3.6) ÷ 3 = 13.9 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, 2011, 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 now 25, 35, and 45 (poverty likelihoods of 16.0, 3.0, and 0.4 percent, national line, Figure 5). Their average poverty likelihood at follow-up is (16.0 + 3.0 + 0.4) ÷ 3 = 6.5 percent, an improvement of 13.9 – 6.5 = 7.4 percentage points.[13]

This suggests that about one of 14 participants moved above the poverty line in 2010. (This is a net figure; some people start above the line and end below it, and vice versa.) Among those who started below the line, more than half (7.4 ÷ 13.9 = 53.2

[13] Of course, such a huge reduction in poverty is unlikely in a year's time, but this is just an example to show how the scorecard can be used to estimate change.

percent) ended up above the line. Of course, the scorecard does not reveal the reasons for this change.

7.3 Accuracy for estimated change in two independent samples

For two equal-sized independent samples, the same logic as in the previous section 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 before, n is the sample size at both baseline and follow-up,[14] and α is the average (across a range of bootstrapped sample sizes) of the ratio of the observed confidence intervals from a scorecard and the theoretical confidence intervals from the textbook formula for direct measurement for two equal-sized independent samples.

[14] This means that, for a given precision and with direct measurement, estimating the change in a poverty rate over 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 average of α (first averaged across poverty lines and years for a given country, and then averaged across countries) is 1.19. This is as reasonable a figure as any to use for Sri Lanka.

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 $\hat{p} = 0.126$ (from Figure 2). Then the baseline sample size is $n = 2 \cdot \left(\frac{1.19 \cdot 1.64}{0.02} \right)^2 \cdot 0.126 \cdot (1 - 0.126) =$ 2,098, and the follow-up sample size is also 2,098.

7.4 Accuracy for estimated change for one sample, scored twice

The general formula relating the confidence interval c to the standard error σ when using scoring to estimate change for a single group of households, all of whom are scored at two points in time, is:[15]

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

z, c, and α are defined as before, 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.

As usual, the formula for σ can be rearranged to give a formula for sample size n 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 overall change in the poverty rate will be zero, which implies $\hat{p}_{12} = \hat{p}_{21} = \hat{p}_*$, giving:

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

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

$\hat{p}_*$ could be anything between 0 and 0.5, so more information is needed before applying 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 Sri Lanka scorecard is applied twice (once after the end of field work for the 2006/7 HIES 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 a data-based 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 be scored first in 2010 and then again in 2013 (so $y = 3$). The before-baseline poverty rate is 12.6 percent ($p_{2006/7} = 0.126$, Figure 2), and suppose $\alpha = 1.30$. Then the baseline sample size is $n = 2 \cdot \left(\frac{1.3 \cdot 1.64}{0.02} \right)^2 \cdot \{-0.02 + 0.016 \cdot 3 + 0.47 \cdot [0.126 \cdot (1 - 0.126)]\} = 1{,}813$. The same group of 1,813 households is scored at follow-up as well.

8. Targeting

When a program uses the scorecard 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* (having 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 cut-off; a higher cut-off has better inclusion (but greater leakage), while a lower cut-off has better exclusion (but higher undercoverage).

A program should weigh these trade-offs when setting a cut-off. An explicit, transparent 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 19 or less and the scorecard applied to the validation sample, outcomes for the national line are:

- Inclusion: 6.6 percent are below the line and correctly targeted
- Undercoverage: 6.4 percent are below the line and mistakenly not targeted
- Leakage: 7.0 percent are above the line and mistakenly targeted
- Exclusion: 80.1 percent are above the line and correctly not targeted

Increasing the cut-off to 24 or less improves inclusion and undercoverage but worsens leakage and exclusion:

- Inclusion: 9.0 percent are below the line and correctly targeted
- Undercoverage: 4.0 percent are below the line and mistakenly not targeted
- Leakage: 12.9 percent are above the line and mistakenly targeted
- Exclusion: 74.1 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. Any 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 successfully included or successfully 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 Sri Lanka scorecard. For the national line in the validation sample, total net benefit is greatest (87.8) for a cut-off of 9 or less, correctly classifying almost nine in ten households in Sri Lanka.

Of course, this is not impressive; "Total Accuracy" is almost maximized by not targeting anyone, as the low (12.6 percent) poverty rate for the national line makes it difficult to compensate for reduced exclusion with increased inclusion. And "Total Accuracy" is a bit of a straw person, as it weighs successful inclusion of households below the line the same as successful exclusion of households above the line. In practice, inclusion is usually more valuable than exclusion. If a program values 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).[16] For Sri Lanka and the national line in the validation sample, this objective is maximized for a cut-off of 19 or less.

As an alternative to assigning benefits and costs to targeting outcomes and then choosing a cut-off to maximize total net benefits, 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 the expected poverty rate among Sri Lanka households who score at or below a given cut-off. For the example of the national line and the validation sample, targeting households who score 19 or less would target 13.5 percent of all households (second column) and produce a poverty rate among those targeted of 48.6 percent (third column).

Figure 13 also reports two other measures of targeting accuracy. The first is a version of inclusion ("% of poor who are targeted"). For the example of the national line and the validation sample with a cut-off of 19 or less, 50.6 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).

[16] Figure 12 also reports "BPAC", the Balanced Poverty Accuracy Criteria adopted by USAID as its way of certifying poverty-assessment tools. IRIS Center (2005) says that BPAC considers accuracy in terms of the estimated poverty rate and in terms of inclusion. BPAC = (Inclusion – |Undercoverage – Leakage|) x [100 ÷ (Inclusion+Undercoverage)].

For the national line, the validation sample, and a cut-off of 19 or less, covering 0.9 poor households means leaking to one non-poor household.

9. Context of poverty-assessment tools for Sri Lanka

This section discusses two existing poverty-assessment tools for Sri Lanka in terms of their goals, methods, poverty lines, 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 out-of-sample, and its reporting of formulas for standard errors.

9.1 World Bank

World Bank (2005) uses poverty-assessment tools to construct a "poverty map" (Elbers, Lanjouw, and Lanjouw, 2003; Hentschel *et al.*, 2000) of estimated poverty rates for Sri Lanka at the sub-district level. The goal is "to rejuvenate the slow poverty alleviation process" (p. 1).

World Bank and Vishwanath and Yoshida (2007) say that the map helped show mistargeting by Sri Lanka's massive *Samurdhi* cash-transfer program, stimulating demand for better targeting. When *Samurdhi* was being reformed, the poverty map was used to select 113 of the poorest Divisional Secretariats for initial efforts.

World Bank builds 26 regional tools using least-squares stepwise regression on the logarithm of per-capita expenditure for households in the 2002 HIES, selecting only indicators also collected by the 2001 Census of Population and Housing.

The 26 tools are applied to 2001 census data to estimate poverty rates, using the national poverty line. At the sub-district level, the poverty-mapping estimates are more precise than direct estimates from the HIES. Finally, World Bank makes "poverty maps" that quickly show—in a way that is clear for non-specialists—how poverty rates vary across sub-districts.

Poverty mapping in World Bank and the scorecard in this paper are similar in that they both:

- Build poverty-assessment tools 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 the scorecard 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—and only a single scorecard—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 the scorecard seeks to help local pro-poor organizations manage their outreach when implementing policies.[17]

The 2002 HIES differs from the 2006/7 HIES in that it does not ask about characteristics of the residence nor asset possession, classes that account for seven of the ten indicators in the new scorecard here. World Bank can thus include these indicators only as cluster-level averages from the census. World Bank's 26 tools have 16 indicators on average, selected via stepwise from the following 27 indicators, most of which are simple, inexpensive to collect, and verifiable:

- Household demographics:
  - — Number of household members
  - — Dependency ratio
  - — Sex of head
  - — Age of head (and its square)
  - — Marital status of head
  - — Religion of head
  - — Ethnic group of head
- Education of household members:
  - — Education of the head
  - — Education of the spouse of the head
  - — Highest educational attainment of any household member
- Employment of household members:
  - — Occupation of the head
  - — Occupation of the spouse of the head

[17] 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 the scorecard. Recently, the developers of poverty mapping seem to have taken a small step away from their original position (Elbers *et al.*, 2007).

  - — Industry of the head
  - — Employment status of head
  - — Number of income earners
  - — Whether the spouse of the head earns income
- Cluster average characteristics of the residence:
  - — Type of wall
  - — Type of floor
  - — Type of roof
  - — Type of structure
  - — Age of structure
  - — Tenancy status
  - — Type of toilet arrangement
  - — Source of drinking water
  - — Source of energy for lighting
  - — Type of cooking fuel

In addition, some of the 26 World Bank tools use some of 14 combination indicators, such as "household size if the head is a widow".

The World Bank poverty-map tools are not intended for field use by local, pro-poor organizations. While most indicators are simple and verifiable, other require calculating ratios, squares, or combinations. There are 26 tools, and none of the actual indicators or point values are published.

Because the 2001 census does not measure of expenditure, World Bank cannot test accuracy *out-of-sample*, that is, using data that was not used to construct the tool. While World Bank does report standard errors (a central feature of poverty maps), it does not report sample sizes, so the precision of the estimates of poverty rates cannot be compared with those in this paper.

9.2 Narayan and Yoshida

In the poverty-scoring literature, the paper that most resembles the paper here (and similar papers for other countries by the present author) is Narayan and Yoshida (2005). As discussed below, however, there are still some differences.[18]

The purpose of Narayan and Yoshida's poverty-assessment tool is to improve the efficiency of targeting of social transfers in Sri Lanka by enhancing "objectivity and transparency, thereby minimizing the scope of political interference in the selection process" (p. 1). Their preface says that "this formula has been accepted as the method of targeting *Samurdhi* transfers in the North and East of Sri Lanka."

The approach in this paper shares a number of features with that of Narayan and Yoshida. In particular, both:

- Present a simple, transparent tool "based on easily observable and verifiable indicators" (p. 1) designed for ease of interpretation and thus acceptance by policymakers and by users in the field
- Report the actual tool, including indicators and points
- Transform points to integers
- Encourage the use of the tool for targeting
- Respect the "flat maximum" phenomenon and thus do not make the tools uselessly fancy. Tests by Narayan and Yoshida find that simple models target about as well as complex ones and that an all-Sri Lanka tool targets about as well as segmented urban/rural tools

[18] The present author independently developed the approach in this paper over the course of 2006–8 before running across Narayan and Yoshida.

The two approaches also differ in some ways:

- This paper encourages scoring not only for targeting but also for estimating poverty rates at a point in time and for estimating changes in poverty rates over time
- The scorecard here uses more recent data (2006/7 HIES versus 1999/2000 Sri Lanka Integrated Survey)
- The scorecard here can be applied by hand in the field because it does not require multiplication, division, adding a constant, dealing with negative points, interpreting 0/1 indicators, or taking logarithms
- The scorecard here reports standard-error formula for estimated poverty rates, while Narayan and Yoshida report standard errors for measures of targeting accuracy
- In construction:
    - This paper uses household-level weights rather than person-level weights
    - This paper uses Logit to estimate poverty likelihoods rather than least-squares stepwise regression to estimate the logarithm of expenditure
- Narayan and Yoshida include some community-level indicators, versus none here
- This paper has 10 indicators, versus 27
- Narayan and Yoshida report simulations of changes in welfare if scoring replaced the then-current *Samurdhi* process

The indicators in Narayan and Yoshida's tool are simple and verifiable:

- Demographics:
    - Household size
    - Structure of headship
    - Marital status of head
    - Age of head
- Education:
    - Highest grade passed by the head
    - Whether all children ages 5–16 attend school
- Employment: Whether head is salaried or self-employed
- Residence characteristics:
    - Tenancy status
    - Type of walls
    - Type of cooking fuel
    - Type of toilet
    - Number of rooms per household member
- Asset ownership:
    - Radio/CD/cassette player
    - TV/video player
    - Fan
    - Cooker (kerosene/gas/electric)

    - Sewing machine
    - Refrigerator
    - Bicycle/tricycle
    - Motorcycle/scooter
    - Car/van
    - Tractor
- Agricultural assets:
    - Presence of livestock
    - Acres of cultivable land
- Location
- Community characteristics:
    - Presence of a bank
    - Presence of Divisional Secretariat

How do the two poverty-assessment tools compare in terms of accuracy? The comparison tends to favor Narayan and Yoshida in three ways. First, they use person-level weights in construction and testing. This paper uses household-level weights for construction, but comparability requires that it be tested using person-level weights.

Second, the scorecard here is built with region-specific poverty lines, while Narayan and Yoshida use a single line for all of Sri Lanka. For the comparison, the scorecard here is applied to all-Sri Lanka poverty lines that give poverty rates similar to those of the poverty lines in Narayan and Yoshida. Because the scorecard here is being used in a way for which it is not tailored, it is at a disadvantage.

Third, all tests here are out-of-sample. Narayan and Yoshida report some out-of-sample tests and some in-sample tests. Their out-of-sample tests, however, use the same data to choose indicators—although not to derive points—in both construction and testing. Being partly in-sample gives Narayan and Yoshida an advantage. Their

comparison of results in-sample and out-of-sample suggest that in-sample tests tend to overstate targeting accuracy by 6 to 9 percent.

Given these caveats, how do the two poverty-assessment tools compare in terms of the bias of estimates of poverty rates at a point in time?[19] For a poverty line at the 30th percentile of the actual distribution of expenditure, Narayan and Yoshida report (p. 15) bias of –4 percentage points. For a poverty line that gives a 30-percent poverty rate, bias for the scorecard here is smaller (+0.4 percentage points).

For targeting—the sole purpose of Narayan and Yoshida—a cut-off at the 30th percentile of predicted expenditure and a poverty line that gives a poverty rate of 30 percent leads to inclusion of 18.9 percent and exclusion of 58.9 percent. Applied to a similar poverty line and a cut-off of 24 or less, the scorecard here has inclusion of 18.5 percent and exclusion of 61.9. Thus, the two scorecards have about the same targeting accuracy.

[19] Narayan and Yoshida do not promote this use, but it is still a valid use.

10. Conclusion

This paper presents the scorecard. Pro-poor programs in Sri Lanka 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 a sub-sample of data from the 2006/7 HIES, calibrated to ten poverty lines, and tested on a different sub-sample from the 2006/7 HIES.

Accuracy is 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 in poverty rates are not the same as estimates of program impact. Targeting accuracy and formula for standard errors are also reported.

When the scorecard is applied to the validation sample with $n = 16{,}384$, the absolute difference between estimates and true poverty rates at a point in time is 0.9 percentage points or less and averages (across the ten poverty lines) 0.3 percentage

points. With 90-percent confidence, the precision of these differences for all lines is +/– 0.6 percentage points or less.

For targeting, programs can use the results reported here to select a cut-off that fits their mission and values.

Although the statistical technique is innovative, and although technical accuracy is important, the design of the scorecard 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 seeks to facilitate adoption by helping managers understand and trust scoring and by allowing non-specialists to generate scores quickly in the field.

In sum, the scorecard is a practical, objective way for pro-poor programs in Sri Lanka to measure poverty rates, track changes in poverty rates over time, and target services, provided that it is applied during a period similar to 2006/7 and to groups that are nationally representative. The same approach can be applied to any country with similar data from a national income or expenditure survey.

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Guide to Interpretation of Scorecard Indicators

The following comes from the HIES 2006/7 Enumerator's Manual, translated by Nimmi Ariyaratne. Thanks go as well to David Bartocha.

1. How many members does the household have?

Household members include (pp. 8–9) those "normally resident within this household unit as well as those temporarily residing outside of the house. This includes domestic helpers and lodgers if they are normally resident within the household unit. . . .

A household is a unit of one person/group of people who live together and collectively prepare/share meals for each other. They do not necessarily have to be related. Domestic helpers and boarders who live and share meals with other household members are to be considered part of the household.

Persons who normally reside within the household, but who have left temporarily for a period of less than a month (on vacation/business/for treatment etc.) are to be considered part of the household. Family members residing elsewhere for work/education purposes for periods greater than one month do not count as household members. Lodgers (who may stay in the same house/compound but live separately from the household and who do not share meals and household activities) and visitors, who normally reside elsewhere, do not count as household members."

2. How many household members are employees of government or semi-government entities?

There is no additional information about this indicator.

3. What is the highest educational level that the female head/spouse has passed?

According to p. 8, "the head of the household is normally an elderly member or the member who earns the highest income. However, consider whomever (male or female) who has been naturally selected by household members as the head of the household."

If the head of the household is male with a spouse, then the *female head/spouse* is the spouse of the head. If the head of the household is female, then the female head/spouse is the head. If the head of the household is male without a spouse, then there is no female head/spouse.

4. What is the principal construction material of the floors?

There is no additional information about this indicator.

5. How many bedrooms does the household use?

Only rooms used exclusively for sleeping count. For example, if all household activities (sleeping, eating, visiting, etc.) take place in a room, then that room is not a bedroom.

6. Does the household possess an electric fan?

Only electric fans possessed by the household count, be they new or used.

7. Does the household possessed a television and a VCD/DVD?

Only televisions and VCD/DVDs possessed by the household count, be they new or used.

8. Does the household possessed a cooker (gas, kerosene, or electric)?

Only cookers possessed by the household count, be they new or used.

9. Does the household possessed a refrigerator?

Only refrigerators possessed by the household count, be they new or used.

10. Does the household possessed a bicycle; motorcycle, scooter, or three-wheeler; or motor car, van, bus, lorry, 2-wheel or 4-wheel tractor?

Only bicycles, motorcycles, scooters, three-wheelers, motor cars, vans, buses, lorries, 2-wheel tractors, and 4-wheel tractor possessed by the household count, be they new or used.

Figure 2: Poverty rates and sample sizes, by sub-sample, weight level, and poverty line

			% with expenditure below a poverty line									
			National						USAID	International 2005 PPP		
Sub-sample	**Item**	**Households**	**100%**	**Food**	**125%**	**150%**	**200%**	**300%**	**'Extreme'**	**$1.25/day**	**$2.50/day**	**$3.75/day**
All Sri Lanka	Poverty line (LKR/person/day)	18,544	75.72	51.78	94.65	113.58	151.44	227.16	63.17	61.50	123.00	184.50
	Poverty rate (household level)	18,544	12.6	2.5	23.5	35.2	53.8	75.1	6.0	5.6	40.5	65.2
	Poverty rate (person level)	18,544	15.2	3.3	27.4	40.0	58.5	78.5	7.5	7.2	45.3	69.3
Construction												
Selecting indicators and weights	Poverty rate (household level)	6,143	12.5	2.6	23.4	35.5	54.6	75.3	6.1	5.7	40.6	65.9
Calibration												
Associating scores with likelihoods	Poverty rate (household level)	6,213	12.3	2.5	23.6	35.4	54.5	75.4	5.8	5.6	40.9	65.4
Validation												
Measuring accuracy	Poverty rate (household level)	6,188	13.0	2.5	23.5	34.8	52.3	74.6	5.9	5.6	39.9	64.2
Change in household-level poverty rate (percentage points)												
From construction/calibration to validation			–0.6	+0.1	+0.0	+0.7	+2.3	+0.8	+0.0	+0.1	+0.8	+1.4

Source: 2006/7 HIES

Figure 3: Poverty rates by district and poverty line (household-level weights)

District	Line or rate	Poverty rate (%) and poverty line (LKR/person/day)									
		National						USAID	International 2005 PPP		
		100%	Food	125%	150%	200%	300%	'Extreme'	$1.25/day	$2.50/day	$3.75/day
All Sri Lanka	Line	75.72	51.78	94.65	113.58	151.44	227.16	63.17	61.50	123.00	184.50
	Rate	12.6	2.5	23.5	35.2	53.8	75.1	6.0	5.6	40.5	65.2
Colombo	Line	81.79	55.92	102.23	122.68	163.57	245.36	71.01	66.43	132.85	199.28
	Rate	3.9	0.8	8.3	16.1	30.0	55.7	2.0	1.66	19.85	43.04
Gampaha	Line	77.78	53.18	97.23	116.67	155.56	233.34	68.43	63.17	126.35	189.52
	Rate	7.2	1.0	14.0	23.1	42.9	66.6	3.7	2.56	27.77	54.97
Kalutara	Line	79.77	54.55	99.72	119.66	159.55	239.32	64.32	64.79	129.58	194.38
	Rate	10.3	2.3	19.6	33.1	49.7	71.1	4.8	5.16	37.83	60.62
Kandy	Line	75.22	51.43	94.02	112.83	150.44	225.65	59.45	61.09	122.18	183.28
	Rate	13.9	3.4	24.9	38.6	57.2	74.7	6.4	6.79	43.93	65.81
Matale	Line	72.69	49.70	90.86	109.03	145.37	218.06	57.92	59.04	118.07	177.11
	Rate	15.7	2.9	28.4	39.9	56.7	77.5	6.9	7.31	43.98	67.95
Nuwara Eliya	Line	78.66	53.78	98.32	117.99	157.32	235.98	65.10	63.89	127.77	191.66
	Rate	27.5	5.4	45.2	60.8	79.8	91.2	13.2	12.21	67.92	87.17
Galle	Line	75.49	51.62	94.36	113.23	150.97	226.46	59.71	61.31	122.62	183.93
	Rate	10.7	2.6	20.1	32.5	50.9	73.5	4.9	5.62	37.37	62.63
Matara	Line	71.94	49.19	89.92	107.90	143.87	215.81	62.23	58.43	116.85	175.28
	Rate	11.7	1.3	25.9	36.3	54.5	76.0	5.8	4.36	40.63	65.76
Hambantota	Line	70.75	48.38	88.44	106.13	141.51	212.26	58.70	57.47	114.93	172.40
	Rate	10.5	1.2	21.4	31.8	55.5	77.4	4.7	4.37	37.81	65.84
Batticaloa	Line	82.57	56.46	103.22	123.86	165.15	247.72	72.95	67.07	134.13	201.20
	Rate	9.5	0.6	21.1	33.7	57.4	84.2	4.7	3.09	40.61	74.43
Ampara	Line	76.97	52.63	96.22	115.46	153.94	230.92	59.82	62.52	125.03	187.55
	Rate	8.7	1.5	19.7	33.0	57.0	81.2	4.2	4.64	40.56	69.12
Kurunegala	Line	71.70	49.02	89.62	107.54	143.39	215.09	60.55	58.23	116.46	174.70
	Rate	12.9	2.7	25.0	36.9	56.8	79.4	6.2	5.08	42.04	70.22
Puttalam	Line	73.89	50.53	92.37	110.84	147.79	221.68	63.92	60.02	120.03	180.05
	Rate	10.6	1.4	21.1	33.6	54.4	77.9	5.3	4.49	40.02	66.61
Anuradhapura	Line	69.60	47.59	87.00	104.40	139.20	208.80	58.21	56.53	113.06	169.59
	Rate	12.7	2.3	20.5	31.6	52.6	73.7	5.9	5.35	37.54	62.39
Polonnaruwa	Line	72.50	49.57	90.62	108.75	144.99	217.49	58.54	58.88	117.76	176.65
	Rate	10.0	2.6	21.3	31.0	50.7	76.4	4.4	4.94	35.18	64.71
Badulla	Line	75.13	51.37	93.91	112.69	150.25	225.38	59.79	61.02	122.04	183.05
	Rate	21.0	4.8	38.3	50.9	68.9	84.5	9.3	10.40	57.11	77.11
Monaragala	Line	69.52	47.54	86.90	104.28	139.04	208.57	56.10	56.47	112.93	169.40
	Rate	29.20	8.2	47.9	63.6	78.7	93.1	14.2	14.63	66.98	87.62
Ratnapura	Line	73.23	50.08	91.54	109.85	146.47	219.70	60.30	59.48	118.96	178.44
	Rate	21.5	4.8	36.6	51.2	68.2	85.8	10.0	9.59	58.02	78.23
Kegalle	Line	75.16	51.40	93.96	112.75	150.33	225.49	61.81	61.05	122.10	183.14
	Rate	18.4	3.5	35.2	49.3	68.9	88.2	8.6	8.2	55.5	82.0

Source: 2006/7 HIES. The survey did not include the Northern Province or Trincomalee.

Figure 3 (cont.): Poverty rates by district and poverty line (person-level weights)

	Line or	Poverty rate (%) and poverty line (LKR/person/day)									
		National						USAID	International 2005 PPP		
District	**rate**	**100%**	**Food**	**125%**	**150%**	**200%**	**300%**	**'Extreme'**	**$1.25/day**	**$2.50/day**	**$3.75/day**
All Sri Lanka	Line	75.72	51.78	94.65	113.58	151.44	227.16	63.17	61.50	123.00	184.50
	Rate	15.2	3.3	27.4	40.0	58.5	78.5	7.5	7.2	45.3	69.3
Colombo	Line	81.79	55.92	102.23	122.68	163.57	245.36	71.01	66.43	132.85	199.28
	Rate	5.4	1.0	10.8	20.3	36.1	61.3	2.7	2.2	24.9	49.1
Gampaha	Line	77.78	53.18	97.23	116.67	155.56	233.34	68.43	63.17	126.35	189.52
	Rate	8.7	1.2	16.1	26.2	47.0	70.7	4.4	3.1	31.2	59.2
Kalutara	Line	79.77	54.55	99.72	119.66	159.55	239.32	64.32	64.79	129.58	194.38
	Rate	13.0	3.0	24.4	39.4	55.5	76.9	6.2	6.9	44.2	66.6
Kandy	Line	75.22	51.43	94.02	112.83	150.44	225.65	59.45	61.09	122.18	183.28
	Rate	17.0	4.6	29.8	44.6	63.2	78.4	8.5	8.9	49.9	70.8
Matale	Line	72.69	49.70	90.86	109.03	145.37	218.06	57.92	59.04	118.07	177.11
	Rate	18.9	3.9	33.8	45.7	62.0	80.3	9.4	10.0	49.6	72.6
Nuwara Eliya	Line	78.66	53.78	98.32	117.99	157.32	235.98	65.10	63.89	127.77	191.66
	Rate	33.8	6.6	53.4	68.3	85.5	94.2	16.8	16.0	75.3	91.2
Galle	Line	75.49	51.62	94.36	113.23	150.97	226.46	59.71	61.31	122.62	183.93
	Rate	13.7	3.7	25.3	38.6	56.1	77.0	6.7	7.5	43.7	67.4
Matara	Line	71.94	49.19	89.92	107.90	143.87	215.81	62.23	58.43	116.85	175.28
	Rate	14.6	2.0	30.1	41.1	59.4	79.1	7.3	5.4	45.4	70.1
Hambantota	Line	70.75	48.38	88.44	106.13	141.51	212.26	58.70	57.47	114.93	172.40
	Rate	12.7	1.8	23.5	33.9	57.9	79.6	6.0	5.7	39.7	67.9
Batticaloa	Line	82.57	56.46	103.22	123.86	165.15	247.72	72.95	67.07	134.13	201.20
	Rate	10.7	0.7	24.3	38.6	62.3	86.8	5.1	3.1	46.0	78.2
Ampara	Line	76.97	52.63	96.22	115.46	153.94	230.92	59.82	62.52	125.03	187.55
	Rate	10.9	2.0	23.7	39.4	63.4	84.6	5.4	6.1	46.8	73.9
Kurunegala	Line	71.70	49.02	89.62	107.54	143.39	215.09	60.55	58.23	116.46	174.70
	Rate	15.4	3.8	28.7	41.3	61.1	82.5	7.7	6.6	46.4	74.1
Puttalam	Line	73.89	50.53	92.37	110.84	147.79	221.68	63.92	60.02	120.03	180.05
	Rate	13.1	2.1	24.9	38.1	58.7	80.7	6.5	5.4	44.6	70.1
Anuradhapura	Line	69.60	47.59	87.00	104.40	139.20	208.80	58.21	56.53	113.06	169.59
	Rate	14.9	3.0	23.0	35.1	55.8	76.9	7.4	6.7	41.0	65.7
Polonnaruwa	Line	72.50	49.57	90.62	108.75	144.99	217.49	58.54	58.88	117.76	176.65
	Rate	12.7	3.8	24.9	35.1	55.6	78.8	6.2	6.7	39.4	68.6
Badulla	Line	75.13	51.37	93.91	112.69	150.25	225.38	59.79	61.02	122.04	183.05
	Rate	23.7	6.4	42.5	56.0	73.1	87.0	11.7	12.9	62.1	80.7
Monaragala	Line	69.52	47.54	86.90	104.28	139.04	208.57	56.10	56.47	112.93	169.40
	Rate	33.16	10.4	52.3	66.9	81.1	94.2	16.5	17.3	70.3	89.3
Ratnapura	Line	73.23	50.08	91.54	109.85	146.47	219.70	60.30	59.48	118.96	178.44
	Rate	26.6	6.2	42.9	57.6	72.7	88.1	13.1	12.6	63.5	81.8
Kegalle	Line	75.16	51.40	93.96	112.75	150.33	225.49	61.81	61.05	122.10	183.14
	Rate	21.0	4.6	40.2	54.8	73.3	90.2	10.4	10.1	60.8	84.3

Source: 2006/7 HIES. The survey did not include the Northern Province or Trincomalee.

Figure 4: Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
1,359	Does the household possess a domestic and/or mobile telephone? (None; Mobile, but not domestic; Domestic, but not mobile; Both)
1,237	Does the household possess an electric fan? (No; Yes)
1,083	Does the household possess a refrigerator? (No; Yes)
1,039	Does the household possess a cooker (gas, kerosene, or electric)? (No; Yes)
1,013	What is the highest educational level that the female head/spouse has passed? (Year 1 or less; Years 2 to 7; Years 8 or 9; Year 10; No female head/spouse; G.C.E. (O/L) or equivalent, Year 12, or higher)
918	Does the household possess a domestic telephone? (No; Yes)
878	What is the highest educational level that a household member has passed? (Year 8 or less; Year 9; Year 10; Year 12, or G.C.E. (O/L) or equivalent; G.C.E.(A/L) or equivalent, GAQ/GSQ, degree, post-graduate degree, or diploma)
836	Does the household possess a television and a VCD/DVD? (No television; Television, but no VCD/DVD; Television and VCD/DVD)
833	What is the highest educational level that the male head/spouse has passed? (Year 2 or less; Years 3 to 5; Years 6; Year 7; Year 8; Years 9 or 10; No male head/spouse; Year 12, G.C.E. (O/L) or equivalent, G.C.E.(A/L) or equivalent, GAQ/GSQ, degree, post-graduate degree, or diploma)
721	What is the principal type of lighting for the household? (Kerosene; Solar energy; Other; Electricity or generator/battery)
685	Does the household possess a mobile telephone? (No; Yes)
661	Does the household possess a sewing machine? (No; Yes)
648	What is the total floor area of the residence of the household (square feet)? (Less than 100; 100 to 249; 250 to 499; 500 to 749; 750 or more)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
625	What is the principal construction material of the floors? (Mud, or other; Cement; Terrazzo/tile)
622	How many household members are 18-years-old or younger? (Three or more; Two; One; None)
589	Does the household possess a television? (No; Yes)
586	How many household members are 17-years-old or younger? (Three or more; Two; One; None)
562	In their main line of work, how many household members are in elementary occupations or are skilled workers in agriculture and fishing? (Two or more; One; None)
548	Does the household possess a motorcycle, scooter, three-wheeler; or motor car, van, bus, lorry, 2-wheel tractor, or 4-wheel tractor? (None; Motorcycle, scooter, three-wheeler, but no motor car, van, bus, lorry, 2-wheel tractor, or 4-wheel tractor; Motor car, van, bus, lorry, 2-wheel tractor, or 4-wheel tractor (regardless of motorcycle, scooter, three-wheeler))
548	What is the main source of drinking water for the household? (Unprotected well, river/tank/streams, or other; Tap outside premises (main line); Stream water collected and distributed by pipe lines; Protected well outside premises; Tube well; Protected well within premises; Tap within unit/premises (main line))
545	How many household members are 17-years-old or younger? (Three or more; Two; One; None)
540	Does the household possess a bicycle; motorcycle, scooter, or three-wheeler; or motor car, van, bus, lorry, 2-wheel or 4-wheel tractor? (None; Bicycle only; Motorcycle etc., but no motor car etc. (regardless of bicycle); Motor car etc. (regardless of bicycle or motorcycle etc.))
524	How many household members are 15-years-old or younger? (Three or more; Two; One; None)
506	How many household members are 14-years-old or younger? (Three or more; Two; One; None)
499	Does the household possess a bicycle, motorcycle, scooter, or three-wheeler? (None; Bicycle only; Motorcycle, scooter, or three-wheeler only)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
493	Does the household possess a motorcycle, scooter, or three-wheeler? (No; Yes)
490	Does the household possess a VCD/DVD? (No; Yes)
489	How many household members are 13-years-old or younger? (Three or more; Two; One; None)
485	What is the principal type of cooking fuel for the household? (Firewood, kerosene, saw dust/paddy husk, or other; Gas, or electricity)
482	How many members does the household have? (Six or more; Five; Four; Three; One or two)
481	How many bedrooms does the household use? (None; One; Two; Three or more)
456	How many household members are 12-years-old or younger? (Three or more; Two; One; None)
454	What is the principal construction material of the roof of the residence of the household? (Metal sheets, *cadjan*/*palmyrah*/straw, or other; Tile; Asbestos, or concrete)
439	What type of toilet does the household use, and is it shared with others? (None, pit (shared or private), or other; Pour flush (shared), or water seal (shared); Pour flush (private) or water seal (private))
436	In their main line of work, how many household members are legislators, senior officials, managers, professionals, technicians and associated professionals, or clerks/office workers? (None; One or more)
425	How many household members work in a business in financial intermediation, real estate, business, and rentals, public administration and defense, obligatory social-security programs, education, social work and health care? (None; One or more)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
413	In what sector/area of activity is the main line of work of the male head/spouse? (Private households with domestic servants; Agriculture, animal husbandry, hunting, fishing, mining, quarrying, and related activities; Electricity, gas, and water; Does not work, or hotels and restaurants; There is no male head/spouse; Manufacturing and industry; Wholesale and retail trade, repair of vehicles, personal effects, and household appliances; Logistics, storage, and communications, financial intermediation, real estate, business, and rentals, education, social work and health care, other community, social, and personal services, or international organizations; Public administration and defense, and obligatory social-security programs)
393	What is the main occupation of the male head/spouse? (Elementary occupations; Skilled workers in agriculture and fishing; Craft and related trades workers; There is no male head/spouse; Does not work; Armed forces, legislators, senior officials and managers, professionals, technicians and associated professionals, clerks, service workers and shop and market salesworkers, and plant and machine operators and assemblers)
385	How many household members are 11-years-old or younger? (Three or more; Two; One; None)
356	In their main line of work, how many household members are in elementary occupations in their main line of work? (One or more; None)
356	What is the principal construction material of the walls of the residence of the household? (Pressed soil blocks, mud, planks or metal sheets, *cadjan/palmyrah*, or other; *Cabook*, or cement block; Brick)
313	Does the household possess a washing machine? (No; Yes)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
311	What is the main occupation of the female head/spouse? (Elementary occupations; Skilled workers in agriculture and fishing; Craft and related trades workers; Does not work; There is no female head/spouse; Armed forces; Legislators, senior officials and managers, professionals, technicians and associated professionals, clerks, service workers and shop and market salesworkers, or plant and machine operators and assemblers)
308	How does the household dispose of garbage? (Dumped/thrown away outside premises, dumped within premises, or other; Buried/burned; Processed for fertilizer; Collected by garbage truck)
302	In what sector/area of activity is the main line of work of the female head/spouse? (Agriculture, animal husbandry, hunting, fishing, mining, quarrying, and related activities, or private households with domestic servants; Manufacturing and industry; Does not work; No female head/spouse; Other)
299	How many household members are employees of government or semi-government entities? (None; One or more)
286	Do all household members ages 6 to 15 go to school? (No; Yes; No children in this age range)
284	Do all household members ages 6 to 17 go to school? (No; Yes; No children in this age range)
276	Do all household members ages 6 to 18 go to school? (No; Yes; No children in this age range)
273	Do all household members ages 6 to 16 go to school? (No; Yes; No children in this age range)
270	Do all household members ages 6 to 14 go to school? (No; Yes; No children in this age range)
260	Does the household possess a motor car, van, bus, lorry, 2-wheel tractor, or 4-wheel tractor? (No; Yes)
259	Do all household members ages 6 to 13 go to school? (No; Yes; No children in this age range)
254	What is the employment type of the male head/spouse? (Private sector employee, or unpaid family worker; Own account worker; There is no male head/spouse; Government employee, semi-government employee, or employer; Does not work)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
244	What is the employment type of the female head/spouse? (Private sector employee; Unpaid family worker; Does not work; Own account worker; There is no female head/spouse; Government employee, semi-government employee, or employer)
232	How many household members are private-sector employees? (Two or more; One; None)
220	Do all household members ages 6 to 12 go to school? (No; Yes; No children in this age range)
218	How many household members work in a business in agriculture, animal husbandry, hunting, fishing, mining, or quarrying? (Two or more; One; None)
201	Do all household members ages 6 to 11 go to school? (No; Yes; No children in this age range)
171	Does the household possess a radio/cassette player? (No; Yes)
150	How many household members are 6-years-old or younger? (Two or more; One; None)
143	What type of structure is the residence of the household? (Line room/row house, slum/shanty, or other; Detached house, or attached house/annex; Flat)
126	In their main line of work, how many household members have are skilled workers in agriculture and fishing? (Two or more; One; None)
118	What is the tenure status of the household in its residence? (Freely received/received as a gift, rent-free, encroached, or other; Constructed or purchased by an occupant; Inherited, or compensated; Rent/lease)
94	What religion does the female head/spouse follow? (Hindu; Buddhist; Islam; There is no female head/spouse; Roman Catholic, other Christian, or other)
80	What ethnicity is the female head/spouse? (Indian Tamil; Sri Lanka Tamil; Sri Lanka Moors, Malay, Burgher, or other; Sinhala; No female head/spouse)
75	How many household members are employed? (Three or more; Two; One; None)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
75	In their main line of work, how many household members are service workers and shop and market salesworkers, craft and related trades workers, or plant and machine operators and assemblers? (Two or more; One; None)
67	What religion does the male head/spouse follow? (Hindu; Buddhist; Islam; There is no male head/spouse; Roman Catholic, other Christian, or other)
67	What is the main activity of the female head/spouse? (Unable or too old to work, or other; Employed; Household work; There is no female head/spouse; Unemployed, or student)
63	Does the household possess a water pump? (No; Yes)
52	What ethnicity is the male head/spouse? (Indian Tamil; Sri Lanka Tamil; Sri Lanka Moors, Malay, Burgher, or Other; Sinhala; No male head/spouse)
46	How old is the male head/spouse? (40 to 44; 35 to 39; 45 to 49; 60 or older; There is no male head/spouse; 50 to 54; 34 or younger; 55 to 59)
45	Does the household possess a pesticide sprayer? (No; Yes)
38	How many household members are government employees, semi-government employees, or private-sector employees? (Two or more; One; None)
38	Does the household possess any goats or sheep? (Yes; No)
35	How old is the female head/spouse? (35 to 39; 40 to 44; 34 or younger; 60 or older; 45 to 49; 55 to 59; 50 to 54; There is no female head/spouse)
29	Does any member of the household possess any agricultural land? (No; Yes)
19	Does any member of the household possess any agricultural land or any cattle, buffaloes, goats, sheep, or pigs? (No; Yes)
18	What is the marital status of the male head/spouse? (Widowed, divorced, or separated; No male head/spouse, never-married, or married)

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

Uncertainty coefficient	Indicator (responses are ordered starting with those associated with higher poverty likelihoods)
10	Does the household possess a bicycle? (No; Yes)
9	Does any member of the household possess any cattle, buffaloes, goats, sheep, or pigs? (No; Yes)
6	What is the main activity of the male head/spouse? (Employed, household work, or other; Unable or too old to work; There is no male head/spouse; Unemployed, or student)
5	Does the household possess a paddy blower? (No; Yes)
4	Does the household possess any pigs? (No; Yes)
0	Does the household possess any cattle or buffaloes? (No; Yes)
0	What is the marital status of the male head/spouse? (Widowed, divorced, or separated; Married; No female head/spouse, or never-married)
0	How many household members are own-account workers without employees (None; One or more)

Source: 2006/7 HIES and the national poverty line.

National Poverty Line

(and tables pertaining to all ten 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	83.2
5–9	59.6
10–14	57.4
15–19	39.8
20–24	27.7
25–29	16.0
30–34	10.3
35–39	3.0
40–44	3.6
45–49	0.4
50–54	0.0
55–59	0.4
60–64	0.0
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
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	501	÷	602	=	83.2
5–9	976	÷	1,638	=	59.6
10–14	2,554	÷	4,447	=	57.4
15–19	2,725	÷	6,842	=	39.8
20–24	2,309	÷	8,331	=	27.7
25–29	1,982	÷	12,392	=	16.0
30–34	1,149	÷	11,121	=	10.3
35–39	270	÷	9,051	=	3.0
40–44	253	÷	6,962	=	3.6
45–49	27	÷	6,230	=	0.4
50–54	0	÷	7,008	=	0.0
55–59	27	÷	6,212	=	0.4
60–64	0	÷	5,091	=	0.0
65–69	0	÷	4,733	=	0.0
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 7 (All poverty lines): Distribution of household poverty likelihoods across ranges demarcated by poverty lines

	Likelihood of expenditure in range demarcated by poverty lines per day per adult equivalent									
	<Food	=>Food and <$1.25/day	=>$1.25/day and <100% Natl.	=>100% Natl. and <125% Natl.	=>125% Natl. and <150% Natl.	=>150% Natl. and <$2.50/day	=>$2.50/day and <200% Natl.	=>200% Natl. and <$3.75/day	=>$3.75/day and <300% Natl.	=>300% Natl.
Score	<LKR52	=>LKR52 and <LKR63	=>LKR62 and <LKR76	=>LKR76 and <LKR95	=>LKR95 and <LKR114	=>LKR114 and <LKR123	=>LKR123 and <LKR151	=>LKR151 and <LKR185	=>LKR185 and <LKR227	=>LKR227
0–4	26.9	29.4	26.9	6.5	7.4	0.0	3.0	0.0	0.0	0.0
5–9	23.3	17.5	18.8	20.2	12.9	1.1	4.5	0.0	0.1	1.5
10–14	18.2	14.2	25.1	19.9	14.0	1.2	6.3	1.2	0.0	0.0
15–19	9.1	11.0	19.8	28.4	16.6	4.2	6.5	2.5	1.4	0.6
20–24	4.0	7.8	15.9	23.7	19.0	8.4	9.6	5.3	3.5	2.8
25–29	2.3	4.0	9.7	17.7	17.2	8.6	19.9	8.9	6.5	5.3
30–34	0.6	1.9	7.8	15.0	17.5	6.2	20.1	12.3	9.4	9.2
35–39	0.3	0.2	2.4	10.0	15.4	7.7	19.8	15.0	12.0	17.0
40–44	0.0	0.6	3.0	7.4	12.4	10.3	20.6	19.3	11.5	14.8
45–49	0.4	0.0	0.0	5.8	10.5	5.5	20.4	15.4	11.4	30.6
50–54	0.0	0.0	0.0	1.7	6.4	4.9	11.7	21.3	20.3	33.7
55–59	0.0	0.0	0.4	2.3	2.7	2.1	11.1	17.6	19.4	44.5
60–64	0.0	0.0	0.0	0.9	2.1	2.5	7.7	9.3	19.9	57.7
65–69	0.0	0.0	0.0	0.0	2.6	0.9	6.2	6.8	18.2	65.4
70–74	0.0	0.0	0.0	0.0	0.0	0.0	1.7	8.5	10.7	79.1
75–79	0.0	0.0	0.0	0.0	0.0	0.0	1.3	7.6	12.8	78.4
80–84	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.9	3.6	92.5
85–89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	99.6
90–94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
95–100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0

Note: All poverty likelihoods in percentage units.

The USAID "extreme" line is omitted because it is very close to the $1.25/day 2005 PPP line.

Figure 8 (National line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	+18.5	9.2	10.9	14.0
5–9	–6.6	5.8	6.3	8.0
10–14	+7.6	3.2	3.8	4.8
15–19	–4.4	3.5	3.7	4.1
20–24	–3.8	3.1	3.3	3.8
25–29	–2.0	1.8	1.9	2.2
30–34	+2.2	1.1	1.3	1.7
35–39	–2.5	1.8	1.9	2.1
40–44	+0.8	0.9	1.0	1.3
45–49	–1.3	1.0	1.1	1.3
50–54	–0.5	0.4	0.5	0.5
55–59	+0.4	0.0	0.0	0.0
60–64	–0.0	0.1	0.1	0.1
65–69	+0.0	0.0	0.0	0.0
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 (All 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 for the scorecard applied to the validation sample

	Poverty line									
	National						USAID	International 2005 PPP		
	100%	Food	125%	150%	200%	300%	'Extreme'	$1.25/day	$2.50/day	$3.75/day
Estimate minus true value										
2005/6 scorecard applied to 2005/6 validation	–0.5	+0.1	+0.0	+0.0	+0.8	–0.9	+0.0	+0.2	+0.1	–0.8
Precision of difference										
2005/6 scorecard applied to 2005/6 validation	0.4	0.2	0.5	0.5	0.6	0.5	0.3	0.3	0.5	0.5
α factor										
2005/6 scorecard applied to 2005/6 validation	0.89	0.99	0.89	0.84	0.87	0.91	0.96	0.96	0.82	0.89
Precision is measured as 90-percent confidence intervals in units of +/– percentage points.										
Differences and precision estimated from 1,000 bootstraps of size 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 (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	+0.4	56.1	70.7	78.3
4	–0.1	26.6	31.9	45.1
8	–0.4	17.6	22.3	28.9
16	–0.6	12.7	14.6	19.4
32	–0.7	8.5	10.7	14.2
64	–0.7	6.1	7.6	9.8
128	–0.7	4.5	5.4	7.0
256	–0.6	3.1	3.7	5.0
512	–0.6	2.2	2.6	3.5
1,024	–0.5	1.5	1.8	2.5
2,048	–0.5	1.1	1.3	1.7
4,096	–0.5	0.8	0.9	1.2
8,192	–0.5	0.5	0.6	0.8
16,384	–0.5	0.4	0.4	0.6

Figure 11 (All poverty lines): Possible 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	0.4	12.6	0.2	86.8	87.3	–92.1
5–9	1.5	11.5	0.7	86.3	87.8	–71.2
10–14	3.6	9.4	3.1	83.9	87.6	–20.7
15–19	6.6	6.4	7.0	80.1	86.6	+46.4
20–24	9.0	4.0	12.9	74.1	83.1	+0.9
25–29	11.2	1.8	23.1	63.9	75.1	–77.8
30–34	12.1	0.9	33.3	53.7	65.9	–156.2
35–39	12.6	0.4	41.8	45.2	57.8	–222.0
40–44	12.8	0.2	48.6	38.5	51.3	–274.0
45–49	12.9	0.1	54.7	32.3	45.3	–321.2
50–54	13.0	0.0	61.6	25.4	38.3	–374.8
55–59	13.0	0.0	67.9	19.2	32.1	–422.6
60–64	13.0	0.0	72.9	14.1	27.1	–461.8
65–69	13.0	0.0	77.7	9.3	22.3	–498.2
70–74	13.0	0.0	80.7	6.3	19.3	–521.3
75–79	13.0	0.0	83.6	3.4	16.4	–544.1
80–84	13.0	0.0	85.3	1.7	14.7	–557.3
85–89	13.0	0.0	86.6	0.4	13.4	–567.2
90–94	13.0	0.0	86.9	0.1	13.1	–569.2
95–100	13.0	0.0	87.0	0.0	13.0	–570.2

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, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	70.0	3.2	2.3:1
5–9	2.2	67.2	11.6	2.0:1
10–14	6.7	54.0	27.8	1.2:1
15–19	13.5	48.6	50.6	0.9:1
20–24	21.9	41.1	69.2	0.7:1
25–29	34.3	32.6	86.0	0.5:1
30–34	45.4	26.7	93.2	0.4:1
35–39	54.4	23.2	97.1	0.3:1
40–44	61.4	20.9	98.8	0.3:1
45–49	67.6	19.1	99.5	0.2:1
50–54	74.6	17.4	99.9	0.2:1
55–59	80.8	16.1	99.9	0.2:1
60–64	85.9	15.1	100.0	0.2:1
65–69	90.7	14.3	100.0	0.2:1
70–74	93.7	13.9	100.0	0.2:1
75–79	96.6	13.4	100.0	0.2:1
80–84	98.3	13.2	100.0	0.2:1
85–89	99.6	13.0	100.0	0.1:1
90–94	99.9	13.0	100.0	0.1:1
95–100	100.0	13.0	100.0	0.1:1

Food Poverty Line

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	26.9
5–9	23.3
10–14	18.2
15–19	9.1
20–24	4.0
25–29	2.3
30–34	0.6
35–39	0.3
40–44	0.0
45–49	0.4
50–54	0.0
55–59	0.0
60–64	0.0
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

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

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	162	÷	602	=	26.9
5–9	382	÷	1,638	=	23.3
10–14	808	÷	4,447	=	18.2
15–19	621	÷	6,842	=	9.1
20–24	333	÷	8,331	=	4.0
25–29	285	÷	12,392	=	2.3
30–34	65	÷	11,121	=	0.6
35–39	29	÷	9,051	=	0.3
40–44	0	÷	6,962	=	0.0
45–49	27	÷	6,230	=	0.4
50–54	0	÷	7,008	=	0.0
55–59	0	÷	6,212	=	0.0
60–64	0	÷	5,091	=	0.0
65–69	0	÷	4,733	=	0.0
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 (Food line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	–3.9	8.5	10.3	13.8
5–9	+1.2	4.6	5.3	6.8
10–14	+5.5	2.2	2.6	3.2
15–19	–1.8	1.8	1.9	2.6
20–24	+0.1	1.0	1.2	1.7
25–29	+0.3	0.6	0.6	0.9
30–34	–0.5	0.5	0.5	0.6
35–39	+0.0	0.2	0.3	0.4
40–44	–0.3	0.3	0.3	0.4
45–49	+0.4	0.0	0.0	0.0
50–54	+0.0	0.0	0.0	0.0
55–59	+0.0	0.0	0.0	0.0
60–64	+0.0	0.0	0.0	0.0
65–69	+0.0	0.0	0.0	0.0
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 10 (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	+0.2	9.1	28.3	59.7
4	+0.5	12.4	15.5	22.4
8	+0.3	8.1	9.9	15.9
16	+0.0	6.2	7.9	10.0
32	–0.0	4.4	5.2	7.1
64	+0.0	3.2	3.8	5.1
128	+0.1	2.2	2.7	3.6
256	+0.1	1.6	1.8	2.5
512	+0.1	1.1	1.4	1.8
1,024	+0.1	0.8	0.9	1.2
2,048	+0.1	0.6	0.7	0.9
4,096	+0.1	0.4	0.5	0.6
8,192	+0.1	0.3	0.3	0.4
16,384	+0.1	0.2	0.2	0.3

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	2.3	0.4	97.1	97.3	–68.1
5–9	0.5	1.9	1.7	95.8	96.4	+11.7
10–14	1.1	1.4	5.6	91.9	93.0	–125.6
15–19	1.8	0.7	11.7	85.8	87.6	–371.8
20–24	2.1	0.4	19.8	77.7	79.8	–695.4
25–29	2.3	0.2	31.9	65.6	67.9	–1,183.2
30–34	2.4	0.1	42.9	54.6	57.0	–1,625.0
35–39	2.5	0.0	52.0	45.6	48.0	–1,987.3
40–44	2.5	0.0	58.9	38.6	41.1	–2,266.1
45–49	2.5	0.0	65.1	32.4	34.9	–2,516.3
50–54	2.5	0.0	72.1	25.4	27.9	–2,797.9
55–59	2.5	0.0	78.3	19.2	21.7	–3,047.4
60–64	2.5	0.0	83.4	14.1	16.6	–3,252.0
65–69	2.5	0.0	88.2	9.3	11.8	–3,442.1
70–74	2.5	0.0	91.2	6.3	8.8	–3,562.6
75–79	2.5	0.0	94.1	3.4	5.9	–3,681.3
80–84	2.5	0.0	95.8	1.7	4.2	–3,750.1
85–89	2.5	0.0	97.1	0.4	2.9	–3,801.9
90–94	2.5	0.0	97.4	0.1	2.6	–3,812.3
95–100	2.5	0.0	97.5	0.0	2.5	–3,817.4

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, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	32.1	7.8	0.5:1
5–9	2.2	24.1	21.7	0.3:1
10–14	6.7	16.0	43.1	0.2:1
15–19	13.5	13.2	71.7	0.2:1
20–24	21.9	9.4	82.7	0.1:1
25–29	34.3	6.7	92.8	0.1:1
30–34	45.4	5.4	97.8	0.1:1
35–39	54.4	4.5	99.1	0.0:1
40–44	61.4	4.1	100.0	0.0:1
45–49	67.6	3.7	100.0	0.0:1
50–54	74.6	3.3	100.0	0.0:1
55–59	80.8	3.1	100.0	0.0:1
60–64	85.9	2.9	100.0	0.0:1
65–69	90.7	2.7	100.0	0.0:1
70–74	93.7	2.7	100.0	0.0:1
75–79	96.6	2.6	100.0	0.0:1
80–84	98.3	2.5	100.0	0.0:1
85–89	99.6	2.5	100.0	0.0:1
90–94	99.9	2.5	100.0	0.0:1
95–100	100.0	2.5	100.0	0.0:1

125% of the National Poverty Line

Figure 5 (125% of the 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	89.7
5–9	79.8
10–14	77.4
15–19	68.2
20–24	51.4
25–29	33.7
30–34	25.4
35–39	13.0
40–44	11.1
45–49	6.3
50–54	1.7
55–59	2.7
60–64	0.9
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (125% of the national line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	540	÷	602	=	89.7
5–9	1,307	÷	1,638	=	79.8
10–14	3,441	÷	4,447	=	77.4
15–19	4,669	÷	6,842	=	68.2
20–24	4,279	÷	8,331	=	51.4
25–29	4,176	÷	12,392	=	33.7
30–34	2,819	÷	11,121	=	25.4
35–39	1,178	÷	9,051	=	13.0
40–44	770	÷	6,962	=	11.1
45–49	389	÷	6,230	=	6.3
50–54	122	÷	7,008	=	1.7
55–59	168	÷	6,212	=	2.7
60–64	43	÷	5,091	=	0.9
65–69	0	÷	4,733	=	0.0
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 (125% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	+16.0	8.5	10.4	14.1
5–9	–4.1	4.0	4.8	6.1
10–14	+3.1	2.7	3.3	4.1
15–19	+3.7	2.5	2.9	3.9
20–24	–3.1	2.7	3.0	3.5
25–29	–1.9	1.9	2.1	2.8
30–34	+0.8	2.0	2.3	3.2
35–39	–3.2	2.4	2.6	3.0
40–44	+1.8	1.5	1.7	2.3
45–49	+1.5	1.2	1.4	1.9
50–54	–0.1	0.7	0.8	0.9
55–59	+1.6	0.5	0.5	0.8
60–64	+0.1	0.5	0.6	0.9
65–69	–0.5	0.4	0.5	0.6
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 10 (125% of the 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	+0.5	63.0	77.6	88.6
4	+0.5	31.3	37.7	48.3
8	+0.5	21.9	25.6	32.8
16	–0.1	14.9	17.5	23.4
32	+0.0	10.4	12.6	17.4
64	+0.1	7.6	9.0	12.1
128	+0.0	5.6	6.6	8.8
256	+0.0	3.9	4.5	6.0
512	–0.1	2.7	3.4	4.3
1,024	+0.0	2.0	2.3	3.1
2,048	+0.0	1.4	1.6	2.1
4,096	+0.0	1.0	1.1	1.4
8,192	+0.0	0.7	0.8	1.0
16,384	+0.0	0.5	0.6	0.7

Figure 12 (125% of the 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	0.5	23.0	0.1	76.4	76.9	–95.4
5–9	1.8	21.6	0.4	76.1	78.0	–82.6
10–14	5.1	18.3	1.6	75.0	80.1	–49.7
15–19	9.6	13.9	4.0	72.6	82.1	–1.6
20–24	13.9	9.5	7.9	68.6	82.5	+52.5
25–29	18.3	5.2	16.0	60.6	78.8	+31.9
30–34	20.8	2.7	24.6	52.0	72.8	–4.7
35–39	22.2	1.3	32.2	44.3	66.5	–37.2
40–44	22.9	0.6	38.5	38.0	60.9	–64.1
45–49	23.2	0.3	44.4	32.1	55.3	–89.4
50–54	23.3	0.1	51.3	25.2	48.6	–118.5
55–59	23.4	0.1	57.4	19.1	42.5	–144.7
60–64	23.4	0.0	62.5	14.1	37.5	–166.2
65–69	23.5	0.0	67.2	9.3	32.8	–186.3
70–74	23.5	0.0	70.2	6.3	29.8	–199.0
75–79	23.5	0.0	73.1	3.4	26.9	–211.6
80–84	23.5	0.0	74.9	1.7	25.1	–218.9
85–89	23.5	0.0	76.1	0.4	23.9	–224.4
90–94	23.5	0.0	76.4	0.1	23.6	–225.5
95–100	23.5	0.0	76.5	0.0	23.5	–226.1

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

Figure 13 (125% of the national line): For a given score cut-off, the percentage of all households who are targeted, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	79.5	2.0	3.9:1
5–9	2.2	82.2	7.8	4.6:1
10–14	6.7	76.6	21.8	3.3:1
15–19	13.5	70.7	40.8	2.4:1
20–24	21.9	63.7	59.3	1.8:1
25–29	34.3	53.4	77.9	1.1:1
30–34	45.4	45.8	88.6	0.8:1
35–39	54.4	40.8	94.6	0.7:1
40–44	61.4	37.2	97.4	0.6:1
45–49	67.6	34.3	98.7	0.5:1
50–54	74.6	31.3	99.4	0.5:1
55–59	80.8	29.0	99.7	0.4:1
60–64	85.9	27.3	99.9	0.4:1
65–69	90.7	25.9	100.0	0.3:1
70–74	93.7	25.1	100.0	0.3:1
75–79	96.6	24.3	100.0	0.3:1
80–84	98.3	23.9	100.0	0.3:1
85–89	99.6	23.6	100.0	0.3:1
90–94	99.9	23.5	100.0	0.3:1
95–100	100.0	23.5	100.0	0.3:1

150% of the National Poverty Line

Figure 5 (150% of the 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	97.1
5–9	92.7
10–14	91.3
15–19	84.8
20–24	70.4
25–29	50.9
30–34	42.8
35–39	28.4
40–44	23.4
45–49	16.8
50–54	8.2
55–59	5.4
60–64	3.0
65–69	2.6
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (150% of the national line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	584	÷	602	=	97.1
5–9	1,519	÷	1,638	=	92.7
10–14	4,062	÷	4,447	=	91.3
15–19	5,805	÷	6,842	=	84.8
20–24	5,861	÷	8,331	=	70.4
25–29	6,305	÷	12,392	=	50.9
30–34	4,760	÷	11,121	=	42.8
35–39	2,574	÷	9,051	=	28.4
40–44	1,630	÷	6,962	=	23.4
45–49	1,046	÷	6,230	=	16.8
50–54	572	÷	7,008	=	8.2
55–59	332	÷	6,212	=	5.4
60–64	150	÷	5,091	=	3.0
65–69	121	÷	4,733	=	2.6
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 (150% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	+13.2	7.7	8.8	10.9
5–9	–3.5	2.6	2.7	3.1
10–14	+4.0	2.1	2.4	3.1
15–19	–0.2	1.8	2.2	2.9
20–24	+2.4	2.2	2.7	3.6
25–29	–5.8	3.9	4.1	4.4
30–34	+4.2	2.1	2.5	3.4
35–39	–4.0	3.1	3.2	3.5
40–44	+3.9	2.0	2.5	3.2
45–49	+0.3	2.2	2.6	3.4
50–54	+0.2	1.3	1.6	2.1
55–59	–0.7	1.4	1.6	2.1
60–64	+0.3	1.0	1.1	1.5
65–69	–0.5	1.0	1.2	1.7
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 10 (150% of the 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	+0.8	61.2	84.0	94.2
4	+0.3	34.5	41.4	54.2
8	+0.1	23.8	28.7	41.1
16	–0.0	16.8	20.5	27.6
32	+0.1	12.1	14.6	19.0
64	+0.0	8.5	10.4	13.8
128	–0.0	6.0	7.2	10.0
256	–0.0	4.2	4.8	6.1
512	–0.1	2.9	3.4	4.4
1,024	+0.0	2.0	2.4	3.3
2,048	+0.0	1.5	1.7	2.3
4,096	+0.0	1.0	1.2	1.7
8,192	+0.0	0.7	0.9	1.1
16,384	+0.0	0.5	0.6	0.8

Figure 12 (150% of the 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	0.5	34.2	0.1	65.2	65.7	–96.8
5–9	2.1	32.7	0.2	65.1	67.2	–87.6
10–14	5.9	28.8	0.7	64.5	70.5	–63.6
15–19	11.7	23.1	1.9	63.4	75.0	–27.5
20–24	17.2	17.5	4.6	60.6	77.8	+12.4
25–29	24.1	10.6	10.1	55.1	79.3	+68.0
30–34	28.3	6.4	17.1	48.2	76.5	+50.9
35–39	31.2	3.5	23.2	42.0	73.2	+33.2
40–44	32.6	2.2	28.8	36.4	69.0	+17.0
45–49	33.5	1.3	34.1	31.1	64.6	+1.8
50–54	34.1	0.7	40.5	24.7	58.8	–16.6
55–59	34.5	0.3	46.4	18.9	53.3	–33.5
60–64	34.6	0.1	51.3	13.9	48.5	–47.7
65–69	34.7	0.0	55.9	9.3	44.1	–60.9
70–74	34.8	0.0	58.9	6.3	41.1	–69.5
75–79	34.8	0.0	61.9	3.4	38.1	–78.0
80–84	34.8	0.0	63.6	1.7	36.4	–82.9
85–89	34.8	0.0	64.9	0.4	35.1	–86.7
90–94	34.8	0.0	65.1	0.1	34.9	–87.4
95–100	34.8	0.0	65.2	0.0	34.8	–87.8

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

Figure 13 (150% of the national line): For a given score cut-off, the percentage of all households who are targeted, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	87.3	1.5	6.9:1
5–9	2.2	93.0	6.0	13.4:1
10–14	6.7	89.0	17.1	8.1:1
15–19	13.5	86.2	33.5	6.2:1
20–24	21.9	78.7	49.5	3.7:1
25–29	34.3	70.5	69.5	2.4:1
30–34	45.4	62.4	81.5	1.7:1
35–39	54.4	57.3	89.8	1.3:1
40–44	61.4	53.0	93.7	1.1:1
45–49	67.6	49.5	96.4	1.0:1
50–54	74.6	45.7	98.1	0.8:1
55–59	80.8	42.6	99.2	0.7:1
60–64	85.9	40.3	99.6	0.7:1
65–69	90.7	38.3	100.0	0.6:1
70–74	93.7	37.1	100.0	0.6:1
75–79	96.6	36.0	100.0	0.6:1
80–84	98.3	35.3	100.0	0.5:1
85–89	99.6	34.9	100.0	0.5:1
90–94	99.9	34.8	100.0	0.5:1
95–100	100.0	34.8	100.0	0.5:1

200% of the National Poverty Line

Figure 5 (200% of the 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	98.3
10–14	98.8
15–19	95.5
20–24	88.4
25–29	79.3
30–34	69.2
35–39	56.0
40–44	54.4
45–49	42.7
50–54	24.7
55–59	18.5
60–64	13.1
65–69	9.6
70–74	1.7
75–79	1.3
80–84	2.1
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (200% of the national line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	602	÷	602	=	100.0
5–9	1,610	÷	1,638	=	98.3
10–14	4,394	÷	4,447	=	98.8
15–19	6,535	÷	6,842	=	95.5
20–24	7,360	÷	8,331	=	88.4
25–29	9,831	÷	12,392	=	79.3
30–34	7,690	÷	11,121	=	69.2
35–39	5,067	÷	9,051	=	56.0
40–44	3,785	÷	6,962	=	54.4
45–49	2,658	÷	6,230	=	42.7
50–54	1,730	÷	7,008	=	24.7
55–59	1,150	÷	6,212	=	18.5
60–64	666	÷	5,091	=	13.1
65–69	454	÷	4,733	=	9.6
70–74	50	÷	2,999	=	1.7
75–79	38	÷	2,954	=	1.3
80–84	36	÷	1,715	=	2.1
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 (200% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	+13.3	7.3	8.4	10.5
5–9	–0.9	0.8	1.0	1.1
10–14	+2.9	1.3	1.5	2.0
15–19	+0.8	1.1	1.4	1.8
20–24	–1.0	1.4	1.7	2.2
25–29	+1.8	1.7	2.0	2.5
30–34	+0.2	1.9	2.3	3.0
35–39	+2.5	2.3	2.7	3.3
40–44	+7.0	2.8	3.2	4.1
45–49	+1.2	2.7	3.3	4.2
50–54	–0.2	2.3	2.7	3.3
55–59	–5.9	4.3	4.6	5.3
60–64	+0.7	2.0	2.5	3.4
65–69	+1.5	1.7	1.9	2.4
70–74	–3.6	2.7	2.9	3.1
75–79	+1.3	0.0	0.0	0.0
80–84	+2.1	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 10 (200% of the 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	63.2	80.4	94.4
4	+0.4	35.4	42.8	57.2
8	–0.1	24.2	28.7	39.2
16	+0.6	17.6	21.7	28.8
32	+0.8	12.6	15.5	20.4
64	+0.7	9.4	11.3	14.2
128	+0.7	6.4	7.5	9.7
256	+0.6	4.4	5.2	6.8
512	+0.7	3.1	3.7	4.7
1,024	+0.8	2.4	2.7	3.4
2,048	+0.8	1.6	1.8	2.3
4,096	+0.8	1.1	1.3	1.7
8,192	+0.8	0.8	0.9	1.1
16,384	+0.8	0.6	0.7	0.8

Figure 12 (200% of the 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	0.5	51.7	0.1	47.7	48.2	–97.8
5–9	2.2	50.1	0.1	47.6	49.8	–91.6
10–14	6.4	45.8	0.2	47.5	53.9	–74.9
15–19	12.9	39.4	0.6	47.1	60.0	–49.5
20–24	20.3	32.0	1.6	46.1	66.4	–19.4
25–29	29.9	22.4	4.3	43.4	73.3	+22.7
30–34	37.3	15.0	8.1	39.6	76.9	+58.1
35–39	42.2	10.1	12.3	35.5	77.6	+76.5
40–44	45.4	6.8	15.9	31.8	77.2	+69.5
45–49	47.9	4.4	19.7	28.0	75.9	+62.3
50–54	49.7	2.6	24.9	22.8	72.6	+52.4
55–59	51.1	1.2	29.8	18.0	69.0	+43.1
60–64	51.7	0.6	34.2	13.5	65.2	+34.6
65–69	52.1	0.2	38.5	9.2	61.3	+26.3
70–74	52.3	0.0	41.4	6.3	58.6	+20.9
75–79	52.3	0.0	44.3	3.4	55.7	+15.2
80–84	52.3	0.0	46.0	1.7	54.0	+11.9
85–89	52.3	0.0	47.3	0.4	52.7	+9.5
90–94	52.3	0.0	47.6	0.1	52.4	+9.0
95–100	52.3	0.0	47.7	0.0	52.3	+8.7

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

Figure 13 (200% of the national line): For a given score cut-off, the percentage of all households who are targeted, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	91.2	1.1	10.4:1
5–9	2.2	96.9	4.1	30.9:1
10–14	6.7	96.4	12.3	26.5:1
15–19	13.5	95.2	24.6	20.0:1
20–24	21.9	92.7	38.8	12.7:1
25–29	34.3	87.4	57.2	6.9:1
30–34	45.4	82.2	71.3	4.6:1
35–39	54.4	77.5	80.6	3.4:1
40–44	61.4	74.0	86.9	2.9:1
45–49	67.6	70.8	91.6	2.4:1
50–54	74.6	66.6	95.1	2.0:1
55–59	80.8	63.2	97.7	1.7:1
60–64	85.9	60.2	98.9	1.5:1
65–69	90.7	57.5	99.7	1.4:1
70–74	93.7	55.8	100.0	1.3:1
75–79	96.6	54.1	100.0	1.2:1
80–84	98.3	53.2	100.0	1.1:1
85–89	99.6	52.5	100.0	1.1:1
90–94	99.9	52.3	100.0	1.1:1
95–100	100.0	52.3	100.0	1.1:1

300% of the National Poverty Line

Figure 5 (300% of the 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	98.5
10–14	100.0
15–19	99.4
20–24	97.2
25–29	94.7
30–34	90.8
35–39	83.0
40–44	85.2
45–49	69.4
50–54	66.3
55–59	55.6
60–64	42.3
65–69	34.6
70–74	20.9
75–79	21.6
80–84	7.5
85–89	0.4
90–94	0.0
95–100	0.0

Figure 6 (300% of the national line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	602	÷	602	=	100.0
5–9	1,613	÷	1,638	=	98.5
10–14	4,447	÷	4,447	=	100.0
15–19	6,801	÷	6,842	=	99.4
20–24	8,094	÷	8,331	=	97.2
25–29	11,733	÷	12,392	=	94.7
30–34	10,100	÷	11,121	=	90.8
35–39	7,514	÷	9,051	=	83.0
40–44	5,932	÷	6,962	=	85.2
45–49	4,325	÷	6,230	=	69.4
50–54	4,644	÷	7,008	=	66.3
55–59	3,451	÷	6,212	=	55.6
60–64	2,154	÷	5,091	=	42.3
65–69	1,640	÷	4,733	=	34.6
70–74	625	÷	2,999	=	20.9
75–79	639	÷	2,954	=	21.6
80–84	129	÷	1,715	=	7.5
85–89	5	÷	1,289	=	0.4
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 (300% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	0.1
5–9	–1.5	0.8	0.8	0.8
10–14	+0.1	0.2	0.2	0.3
15–19	+0.5	0.5	0.6	0.7
20–24	–0.4	0.7	0.9	1.2
25–29	+0.9	1.0	1.3	1.6
30–34	+0.9	1.3	1.6	2.1
35–39	–0.5	1.8	2.1	2.6
40–44	+6.7	2.3	2.7	3.6
45–49	–8.3	5.2	5.4	5.9
50–54	–6.3	4.3	4.5	4.9
55–59	–5.2	4.0	4.3	4.7
60–64	–7.3	5.2	5.5	6.2
65–69	–1.0	3.0	3.7	4.7
70–74	–1.2	3.4	3.9	5.1
75–79	+9.6	2.6	3.1	4.1
80–84	+3.8	1.9	2.2	2.9
85–89	–1.8	1.8	2.0	2.6
90–94	+0.0	0.0	0.0	0.0
95–100	+0.0	0.0	0.0	0.0

Figure 10 (300% of the 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	–2.3	63.6	75.3	86.9
4	–1.8	30.9	39.1	52.5
8	–1.4	21.1	24.8	35.6
16	–0.7	15.3	18.4	25.4
32	–0.5	11.4	13.4	17.0
64	–0.6	8.1	9.8	12.8
128	–0.7	5.8	6.8	9.3
256	–0.9	4.0	4.7	6.5
512	–0.8	2.9	3.4	4.3
1,024	–0.8	2.1	2.4	3.3
2,048	–0.8	1.5	1.7	2.4
4,096	–0.8	1.0	1.2	1.6
8,192	–0.9	0.7	0.8	1.1
16,384	–0.9	0.5	0.6	0.8

Figure 12 (300% of the 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	0.6	74.0	0.0	25.4	26.0	–98.4
5–9	2.2	72.3	0.0	25.4	27.7	–94.0
10–14	6.7	67.9	0.0	25.4	32.1	–82.1
15–19	13.4	61.2	0.1	25.3	38.7	–63.9
20–24	21.5	53.0	0.3	25.1	46.7	–41.8
25–29	33.3	41.3	1.0	24.4	57.7	–9.5
30–34	43.2	31.3	2.1	23.3	66.5	+18.8
35–39	50.8	23.8	3.6	21.8	72.6	+41.1
40–44	56.3	18.3	5.1	20.3	76.6	+57.8
45–49	61.0	13.6	6.6	18.8	79.8	+72.5
50–54	65.9	8.7	8.8	16.7	82.5	+88.3
55–59	69.4	5.2	11.5	14.0	83.3	+84.6
60–64	71.7	2.9	14.2	11.2	82.9	+81.0
65–69	73.4	1.2	17.3	8.2	81.6	+76.9
70–74	74.1	0.5	19.6	5.9	80.0	+73.8
75–79	74.5	0.1	22.1	3.3	77.8	+70.3
80–84	74.6	0.0	23.8	1.6	76.2	+68.1
85–89	74.6	0.0	25.0	0.4	75.0	+66.4
90–94	74.6	0.0	25.3	0.1	74.7	+66.1
95–100	74.6	0.0	25.4	0.0	74.6	+65.9

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

Figure 13 (300% of the national line): For a given score cut-off, the percentage of all households who are targeted, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	99.8	0.8	462.2:1
5–9	2.2	99.9	3.0	1,722.1:1
10–14	6.7	99.8	8.9	509.1:1
15–19	13.5	99.2	18.0	123.8:1
20–24	21.9	98.6	28.9	69.4:1
25–29	34.3	97.1	44.6	33.6:1
30–34	45.4	95.3	58.0	20.3:1
35–39	54.4	93.3	68.1	14.0:1
40–44	61.4	91.7	75.5	11.1:1
45–49	67.6	90.2	81.8	9.2:1
50–54	74.6	88.3	88.3	7.5:1
55–59	80.8	85.8	93.0	6.1:1
60–64	85.9	83.5	96.2	5.1:1
65–69	90.7	81.0	98.4	4.3:1
70–74	93.7	79.1	99.4	3.8:1
75–79	96.6	77.1	99.9	3.4:1
80–84	98.3	75.8	100.0	3.1:1
85–89	99.6	74.9	100.0	3.0:1
90–94	99.9	74.7	100.0	2.9:1
95–100	100.0	74.6	100.0	2.9:1

USAID "Extreme" Poverty Line

Figure 5 (USAID "extreme" 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	59.3
5–9	40.9
10–14	33.7
15–19	20.2
20–24	12.1
25–29	6.6
30–34	3.0
35–39	0.6
40–44	0.6
45–49	0.4
50–54	0.0
55–59	0.0
60–64	0.0
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (USAID "extreme" line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	357	÷	602	=	59.3
5–9	669	÷	1,638	=	40.9
10–14	1,499	÷	4,447	=	33.7
15–19	1,382	÷	6,842	=	20.2
20–24	1,011	÷	8,331	=	12.1
25–29	815	÷	12,392	=	6.6
30–34	328	÷	11,121	=	3.0
35–39	57	÷	9,051	=	0.6
40–44	40	÷	6,962	=	0.6
45–49	27	÷	6,230	=	0.4
50–54	0	÷	7,008	=	0.0
55–59	0	÷	6,212	=	0.0
60–64	0	÷	5,091	=	0.0
65–69	0	÷	4,733	=	0.0
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 (USAID "extreme" line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	+19.1	9.1	10.6	14.6
5–9	–4.5	5.3	6.2	8.4
10–14	+2.8	3.0	3.6	4.6
15–19	–2.2	2.3	2.6	3.5
20–24	+1.8	1.5	1.8	2.2
25–29	+1.2	0.9	1.0	1.4
30–34	–1.2	1.0	1.1	1.3
35–39	–1.0	0.8	0.8	0.9
40–44	+0.1	0.3	0.4	0.5
45–49	–0.7	0.6	0.7	1.0
50–54	–0.2	0.2	0.2	0.3
55–59	+0.0	0.0	0.0	0.0
60–64	+0.0	0.0	0.0	0.0
65–69	+0.0	0.0	0.0	0.0
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 10 (USAID "extreme" 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	43.3	60.8	69.0
4	+0.3	18.1	22.8	34.6
8	+0.1	12.8	15.5	23.3
16	–0.1	9.4	10.9	15.1
32	–0.1	6.5	7.8	11.1
64	–0.1	4.7	5.4	7.3
128	+0.0	3.2	3.9	5.3
256	+0.0	2.3	2.8	3.5
512	–0.0	1.7	2.0	2.6
1,024	+0.0	1.2	1.4	1.8
2,048	+0.0	0.8	1.0	1.3
4,096	+0.0	0.6	0.7	0.9
8,192	+0.0	0.4	0.5	0.7
16,384	+0.0	0.3	0.4	0.5

Figure 12 (USAID "extreme" 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	0.3	5.7	0.3	93.7	94.0	–85.4
5–9	1.0	5.0	1.3	92.8	93.8	–45.8
10–14	2.2	3.7	4.4	89.6	91.9	+25.2
15–19	3.7	2.2	9.8	84.3	88.0	–65.2
20–24	4.6	1.4	17.3	76.8	81.3	–191.3
25–29	5.2	0.7	29.0	65.0	70.2	–388.9
30–34	5.7	0.3	39.7	54.4	60.0	–568.6
35–39	5.8	0.1	48.6	45.5	51.3	–718.3
40–44	5.9	0.1	55.5	38.5	44.4	–834.9
45–49	5.9	0.0	61.7	32.4	38.3	–938.9
50–54	5.9	0.0	68.7	25.4	31.3	–1,056.6
55–59	5.9	0.0	74.9	19.2	25.1	–1,161.2
60–64	5.9	0.0	80.0	14.1	20.0	–1,246.9
65–69	5.9	0.0	84.7	9.3	15.3	–1,326.6
70–74	5.9	0.0	87.7	6.3	12.3	–1,377.1
75–79	5.9	0.0	90.7	3.4	9.3	–1,426.8
80–84	5.9	0.0	92.4	1.7	7.6	–1,455.7
85–89	5.9	0.0	93.7	0.4	6.3	–1,477.4
90–94	5.9	0.0	93.9	0.1	6.1	–1,481.8
95–100	5.9	0.0	94.1	0.0	5.9	–1,483.9

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

Figure 13 (USAID "extreme" line): For a given score cut-off, the percentage of all households who are targeted, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	44.1	4.5	0.8:1
5–9	2.2	43.8	16.5	0.8:1
10–14	6.7	33.6	37.8	0.5:1
15–19	13.5	27.5	62.6	0.4:1
20–24	21.9	20.9	76.8	0.3:1
25–29	34.3	15.2	87.9	0.2:1
30–34	45.4	12.5	95.4	0.1:1
35–39	54.4	10.7	98.1	0.1:1
40–44	61.4	9.6	98.8	0.1:1
45–49	67.6	8.8	99.7	0.1:1
50–54	74.6	8.0	100.0	0.1:1
55–59	80.8	7.3	100.0	0.1:1
60–64	85.9	6.9	100.0	0.1:1
65–69	90.7	6.6	100.0	0.1:1
70–74	93.7	6.3	100.0	0.1:1
75–79	96.6	6.1	100.0	0.1:1
80–84	98.3	6.0	100.0	0.1:1
85–89	99.6	6.0	100.0	0.1:1
90–94	99.9	5.9	100.0	0.1:1
95–100	100.0	5.9	100.0	0.1:1

$1.25/Day 2005 PPP Poverty Line

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	56.2
5–9	40.8
10–14	32.4
15–19	20.1
20–24	11.8
25–29	6.3
30–34	2.5
35–39	0.6
40–44	0.6
45–49	0.4
50–54	0.0
55–59	0.0
60–64	0.0
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 ($1.25/day 2005 PPP line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	339	÷	602	=	56.2
5–9	668	÷	1,638	=	40.8
10–14	1,439	÷	4,447	=	32.4
15–19	1,374	÷	6,842	=	20.1
20–24	985	÷	8,331	=	11.8
25–29	779	÷	12,392	=	6.3
30–34	277	÷	11,121	=	2.5
35–39	51	÷	9,051	=	0.6
40–44	42	÷	6,962	=	0.6
45–49	27	÷	6,230	=	0.4
50–54	0	÷	7,008	=	0.0
55–59	0	÷	6,212	=	0.0
60–64	0	÷	5,091	=	0.0
65–69	0	÷	4,733	=	0.0
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

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) from the validation sample, 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	+16.0	9.1	10.6	14.6
5–9	–4.4	5.4	6.2	8.4
10–14	+3.5	2.9	3.3	4.7
15–19	–0.8	2.2	2.5	3.4
20–24	+2.3	1.4	1.7	2.1
25–29	+1.8	0.8	1.0	1.2
30–34	–1.2	1.0	1.1	1.3
35–39	–1.0	0.8	0.8	0.9
40–44	–0.0	0.4	0.4	0.5
45–49	–0.7	0.6	0.7	1.0
50–54	–0.2	0.2	0.2	0.3
55–59	+0.0	0.0	0.0	0.0
60–64	+0.0	0.0	0.0	0.0
65–69	+0.0	0.0	0.0	0.0
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 10 ($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	+0.1	43.9	60.3	69.2
4	+0.6	17.6	22.4	33.2
8	+0.4	12.5	15.0	22.6
16	+0.1	8.9	10.8	15.0
32	+0.0	6.3	7.6	10.6
64	+0.1	4.6	5.3	7.2
128	+0.2	3.1	3.8	5.1
256	+0.2	2.3	2.7	3.4
512	+0.2	1.6	1.9	2.5
1,024	+0.2	1.1	1.4	1.8
2,048	+0.2	0.8	0.9	1.3
4,096	+0.2	0.6	0.7	0.9
8,192	+0.2	0.4	0.5	0.6
16,384	+0.2	0.3	0.4	0.4

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	0.3	5.3	0.3	94.1	94.4	–84.4
5–9	1.0	4.6	1.3	93.2	94.1	–42.2
10–14	2.2	3.4	4.5	89.9	92.1	+18.4
15–19	3.5	2.0	10.0	84.4	87.9	–80.3
20–24	4.3	1.3	17.6	76.9	81.2	–216.2
25–29	4.9	0.7	29.4	65.1	69.9	–429.3
30–34	5.3	0.3	40.1	54.3	59.6	–622.3
35–39	5.4	0.1	49.0	45.5	50.9	–782.3
40–44	5.5	0.1	55.9	38.5	44.0	–906.7
45–49	5.5	0.0	62.1	32.4	37.9	–1,017.9
50–54	5.6	0.0	69.1	25.4	30.9	–1,143.8
55–59	5.6	0.0	75.3	19.2	24.7	–1,255.7
60–64	5.6	0.0	80.4	14.1	19.6	–1,347.3
65–69	5.6	0.0	85.1	9.3	14.9	–1,432.6
70–74	5.6	0.0	88.1	6.3	11.9	–1,486.6
75–79	5.6	0.0	91.1	3.4	8.9	–1,539.8
80–84	5.6	0.0	92.8	1.7	7.2	–1,570.7
85–89	5.6	0.0	94.1	0.4	5.9	–1,593.9
90–94	5.6	0.0	94.3	0.1	5.7	–1,598.5
95–100	5.6	0.0	94.4	0.0	5.6	–1,600.8

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, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	44.1	4.8	0.8:1
5–9	2.2	43.3	17.5	0.8:1
10–14	6.7	32.2	38.8	0.5:1
15–19	13.5	26.0	63.3	0.4:1
20–24	21.9	19.7	77.5	0.2:1
25–29	34.3	14.2	87.4	0.2:1
30–34	45.4	11.6	94.8	0.1:1
35–39	54.4	10.0	97.7	0.1:1
40–44	61.4	8.9	98.7	0.1:1
45–49	67.6	8.2	99.7	0.1:1
50–54	74.6	7.4	100.0	0.1:1
55–59	80.8	6.9	100.0	0.1:1
60–64	85.9	6.5	100.0	0.1:1
65–69	90.7	6.1	100.0	0.1:1
70–74	93.7	5.9	100.0	0.1:1
75–79	96.6	5.7	100.0	0.1:1
80–84	98.3	5.6	100.0	0.1:1
85–89	99.6	5.6	100.0	0.1:1
90–94	99.9	5.6	100.0	0.1:1
95–100	100.0	5.6	100.0	0.1:1

$2.50/Day 2005 PPP Poverty Line

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	97.1
5–9	93.8
10–14	92.6
15–19	89.1
20–24	78.8
25–29	59.4
30–34	49.0
35–39	36.1
40–44	33.7
45–49	22.3
50–54	13.0
55–59	7.4
60–64	5.4
65–69	3.4
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 ($2.50/day 2005 PPP line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	584	÷	602	=	97.1
5–9	1,537	÷	1,638	=	93.8
10–14	4,116	÷	4,447	=	92.6
15–19	6,094	÷	6,842	=	89.1
20–24	6,562	÷	8,331	=	78.8
25–29	7,366	÷	12,392	=	59.4
30–34	5,452	÷	11,121	=	49.0
35–39	3,271	÷	9,051	=	36.1
40–44	2,348	÷	6,962	=	33.7
45–49	1,388	÷	6,230	=	22.3
50–54	914	÷	7,008	=	13.0
55–59	462	÷	6,212	=	7.4
60–64	275	÷	5,091	=	5.4
65–69	161	÷	4,733	=	3.4
70–74	0	÷	2,999	=	0.0
75–79	0	÷	2,954	=	0.0
80–84	0	÷	1,715	=	0.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

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) from the validation sample, 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	+13.2	7.7	8.8	10.9
5–9	–3.5	2.5	2.6	2.7
10–14	+2.8	1.9	2.2	3.1
15–19	+1.0	1.7	2.0	2.5
20–24	+3.9	2.2	2.5	3.3
25–29	–4.2	3.0	3.2	3.5
30–34	+0.5	2.1	2.6	3.4
35–39	–3.8	3.0	3.2	3.5
40–44	+5.9	2.3	2.8	3.5
45–49	+0.2	2.3	2.7	3.5
50–54	+1.7	1.6	1.9	2.6
55–59	–1.9	1.7	1.9	2.5
60–64	+0.7	1.3	1.5	2.1
65–69	–0.1	1.1	1.3	1.7
70–74	+0.0	0.0	0.0	0.0
75–79	+0.0	0.0	0.0	0.0
80–84	+0.0	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 10 ($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	+0.3	62.9	78.2	93.6
4	+0.3	34.5	41.7	55.8
8	–0.0	25.0	29.2	40.4
16	–0.1	17.1	20.3	26.5
32	+0.0	12.0	14.3	19.7
64	+0.0	8.6	11.0	13.8
128	+0.0	6.0	7.1	9.9
256	+0.1	4.2	5.0	6.2
512	+0.0	2.9	3.4	4.6
1,024	+0.1	2.1	2.5	3.1
2,048	+0.1	1.5	1.8	2.3
4,096	+0.1	1.0	1.2	1.6
8,192	+0.1	0.7	0.8	1.1
16,384	+0.1	0.5	0.6	0.8

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	0.5	39.4	0.1	60.0	60.5	–97.2
5–9	2.1	37.8	0.1	59.9	62.0	–89.1
10–14	6.1	33.9	0.6	59.5	65.6	–68.0
15–19	12.0	27.9	1.5	58.6	70.6	–36.0
20–24	18.2	21.8	3.7	56.4	74.5	+0.2
25–29	26.0	13.9	8.2	51.8	77.9	+50.9
30–34	31.3	8.6	14.0	46.0	77.4	+64.9
35–39	34.9	5.0	19.5	40.6	75.5	+51.2
40–44	36.9	3.1	24.5	35.5	72.4	+38.6
45–49	38.1	1.8	29.5	30.5	68.7	+26.1
50–54	38.9	1.0	35.7	24.4	63.3	+10.7
55–59	39.5	0.4	41.3	18.7	58.3	–3.4
60–64	39.8	0.2	46.2	13.9	53.7	–15.5
65–69	39.9	0.0	50.7	9.3	49.3	–27.0
70–74	39.9	0.0	53.7	6.3	46.3	–34.5
75–79	39.9	0.0	56.7	3.4	43.3	–41.9
80–84	39.9	0.0	58.4	1.7	41.6	–46.1
85–89	39.9	0.0	59.7	0.4	40.3	–49.4
90–94	39.9	0.0	59.9	0.1	40.1	–50.0
95–100	39.9	0.0	60.1	0.0	39.9	–50.3

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, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	87.3	1.3	6.9:1
5–9	2.2	93.9	5.3	15.5:1
10–14	6.7	91.1	15.3	10.3:1
15–19	13.5	89.0	30.2	8.1:1
20–24	21.9	83.1	45.5	4.9:1
25–29	34.3	76.0	65.2	3.2:1
30–34	45.4	69.1	78.5	2.2:1
35–39	54.4	64.2	87.5	1.8:1
40–44	61.4	60.0	92.3	1.5:1
45–49	67.6	56.4	95.4	1.3:1
50–54	74.6	52.2	97.5	1.1:1
55–59	80.8	48.9	99.0	1.0:1
60–64	85.9	46.3	99.6	0.9:1
65–69	90.7	44.1	100.0	0.8:1
70–74	93.7	42.7	100.0	0.7:1
75–79	96.6	41.3	100.0	0.7:1
80–84	98.3	40.6	100.0	0.7:1
85–89	99.6	40.1	100.0	0.7:1
90–94	99.9	40.0	100.0	0.7:1
95–100	100.0	39.9	100.0	0.7:1

$3.75/Day 2005 PPP Poverty Line

Figure 5 ($3.75/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	98.3
10–14	100.0
15–19	98.0
20–24	93.7
25–29	88.2
30–34	81.4
35–39	71.0
40–44	73.7
45–49	58.1
50–54	46.0
55–59	36.1
60–64	22.4
65–69	16.4
70–74	10.2
75–79	8.9
80–84	4.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 ($3.75/day 2005 PPP line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	602	÷	602	=	100.0
5–9	1,610	÷	1,638	=	98.3
10–14	4,447	÷	4,447	=	100.0
15–19	6,708	÷	6,842	=	98.0
20–24	7,803	÷	8,331	=	93.7
25–29	10,931	÷	12,392	=	88.2
30–34	9,057	÷	11,121	=	81.4
35–39	6,427	÷	9,051	=	71.0
40–44	5,129	÷	6,962	=	73.7
45–49	3,617	÷	6,230	=	58.1
50–54	3,225	÷	7,008	=	46.0
55–59	2,244	÷	6,212	=	36.1
60–64	1,141	÷	5,091	=	22.4
65–69	778	÷	4,733	=	16.4
70–74	306	÷	2,999	=	10.2
75–79	261	÷	2,954	=	8.9
80–84	68	÷	1,715	=	4.0
85–89	0	÷	1,289	=	0.0
90–94	0	÷	259	=	0.0
95–100	0	÷	126	=	0.0

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

Figure 8 ($3.75/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) from the validation sample, 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	+12.1	7.0	8.5	10.6
5–9	–1.7	0.8	0.8	0.8
10–14	+1.7	0.9	1.1	1.4
15–19	+1.0	0.9	1.1	1.4
20–24	+0.7	1.3	1.5	2.0
25–29	–1.2	1.2	1.4	1.9
30–34	–1.5	1.6	1.9	2.5
35–39	–1.1	2.1	2.5	3.4
40–44	+7.6	2.5	3.0	4.0
45–49	–0.1	2.6	3.1	4.1
50–54	–2.7	2.8	3.2	4.1
55–59	–10.6	6.9	7.2	7.8
60–64	–4.1	3.5	3.6	4.7
65–69	–3.2	2.9	3.1	3.9
70–74	+0.4	2.3	2.8	3.5
75–79	+5.7	1.3	1.5	1.9
80–84	+2.7	1.0	1.3	1.5
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 10 ($3.75/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	–1.6	68.8	79.5	87.3
4	–1.6	36.0	44.0	56.1
8	–1.3	25.0	29.8	39.4
16	–0.8	18.3	20.8	26.9
32	–0.3	13.0	15.6	19.4
64	–0.5	8.8	10.8	14.5
128	–0.6	6.4	7.5	10.3
256	–0.8	4.5	5.4	6.8
512	–0.8	3.1	3.7	5.0
1,024	–0.8	2.2	2.7	3.4
2,048	–0.8	1.6	1.9	2.4
4,096	–0.8	1.1	1.3	1.7
8,192	–0.8	0.7	0.9	1.2
16,384	–0.8	0.5	0.6	0.9

Figure 12 ($3.75/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	0.6	63.7	0.0	35.7	36.3	–98.2
5–9	2.2	62.0	0.0	35.7	37.9	–93.1
10–14	6.6	57.7	0.1	35.7	42.2	–79.3
15–19	13.2	51.0	0.3	35.4	48.7	–58.4
20–24	21.0	43.3	0.9	34.9	55.8	–33.3
25–29	32.0	32.2	2.2	33.6	65.6	+3.2
30–34	41.1	23.1	4.3	31.5	72.6	+34.6
35–39	47.6	16.6	6.8	29.0	76.6	+58.8
40–44	52.2	12.0	9.2	26.6	78.8	+76.8
45–49	55.7	8.5	11.9	23.9	79.6	+81.5
50–54	59.2	5.1	15.4	20.3	79.5	+76.0
55–59	61.7	2.6	19.2	16.6	78.3	+70.2
60–64	62.9	1.3	23.0	12.7	75.7	+64.2
65–69	63.8	0.4	26.8	8.9	72.7	+58.2
70–74	64.1	0.1	29.5	6.2	70.3	+54.0
75–79	64.2	0.0	32.4	3.4	67.6	+49.6
80–84	64.2	0.0	34.1	1.7	65.9	+46.9
85–89	64.2	0.0	35.4	0.4	64.6	+44.9
90–94	64.2	0.0	35.6	0.1	64.4	+44.5
95–100	64.2	0.0	35.8	0.0	64.2	+44.3

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

Figure 13 ($3.75/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted, the percentage of targeted households who are poor, the percentage of poor households who are targeted, and the number of poor households who are successful targeted (inclusion) 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	0.6	93.3	0.9	13.9:1
5–9	2.2	98.2	3.4	54.4:1
10–14	6.7	98.4	10.2	61.4:1
15–19	13.5	97.7	20.6	41.7:1
20–24	21.9	95.9	32.6	23.7:1
25–29	34.3	93.6	49.9	14.5:1
30–34	45.4	90.6	64.0	9.6:1
35–39	54.4	87.5	74.1	7.0:1
40–44	61.4	85.0	81.3	5.7:1
45–49	67.6	82.4	86.7	4.7:1
50–54	74.6	79.3	92.1	3.8:1
55–59	80.8	76.3	96.0	3.2:1
60–64	85.9	73.2	97.9	2.7:1
65–69	90.7	70.4	99.4	2.4:1
70–74	93.7	68.5	99.8	2.2:1
75–79	96.6	66.5	100.0	2.0:1
80–84	98.3	65.3	100.0	1.9:1
85–89	99.6	64.5	100.0	1.8:1
90–94	99.9	64.3	100.0	1.8:1
95–100	100.0	64.2	100.0	1.8:1