Simple Poverty Scorecard®
Cambodia

Mark Schreiner

1 December 2009

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

Abstract

The Simple Poverty Scorecard® uses ten low-cost indicators from the 2004 Cambodia Socio-Economic Survey to estimate the likelihood that a household has consumption 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 Cambodia to measure poverty rates, to track changes in poverty rates over time, and to segment clients for targeted services.

Acknowledgements

This paper was funded by the Ford Foundation via a grant to the Grameen Foundation. Data are from Cambodia's National Institute of Statistics. Thanks go to Nigel Biggar, Lula Chen, Frank DeGiovanni, Julia Hansen, James Knowles, Mary Jo Kochendorfer, Kao Kok, Samsen Neak, Tes Pilapil, Krysta Sadowski, Agneta Sandqvist, Tony Sheldon, Jeff Toohig, and Preeti Wali. The Simple Poverty Scorecard® is the same as what the Grameen Foundation calls the Progress out of Poverty Index® (PPI®). The PPI is a performance-management tool that the Grameen Foundation promotes so that institutions are able to achieve their social objectives more effectively.

Author

Mark Schreiner is the Director of Microfinance Risk Management, L.L.C. He is also Senior Scholar, Center for Social Development, Washington University in Saint Louis

Simple Poverty Scorecard®

			Name	Identifier
Interview ID:				
Interview date:		Participant:		
Country:	KHM	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. Eight or more	0	
	B. Seven	2	
	C. Six	6	
	D. Five	10	
	E. Four	14	
	F. Three	19	
	G. One or two	27	
2. How many children ages 7 to 15 attend school?	A. Not all	0	
	B. All, or no children ages 7 to 15	4	
3. What is the primary construction material of the outer wall of the dwelling unit occupied by the household?	A. Bamboo or thatch, makeshift, salvaged, or improvised materials, other, or no data	0	
	B. Wood or logs, plywood, galvanized iron or aluminum, or fibrous cement	2	
	C. Concrete, brick, or stone	14	
4. What type of fuel does the household mainly use for cooking?	A. Firewood or other	0	
	B. Charcoal, firewood and charcoal, liquefied petroleum gas, kerosene, publicly-provided electricity, gas and electricity, privately-generated electricity, or none/does not cook	6	
5. What toilet facility does the household have?	A. Open land	0	
	B. None	4	
	C. Pit latrine, septic tank, other without septic tank, public toilet, shared toilet, or other	6	
	D. Connected to sewerage	13	
6. How many bicycles and motorcycles does the household own?	A. No bicycles, and no motorcycles	0	
	B. One bicycle, and no motorcycles	4	
	C. Two bicycles, and no motorcycles	7	
	D. Three or more bicycles, and no motorcycles	11	
	E. One or more motorcycles (regardless of bicycles)	13	
7. Does the household own a bed set?	A. No	0	
	B. Yes	4	
8. Does the household own a wardrobe or cabinet?	A. No	0	
	B. Yes	8	
9. Does the household own a water pump?	A. No	0	
	B. Yes	5	
10. Does the household own a television?	A. No	0	
	B. Yes	6	

Score:

Simple Poverty Scorecard®
Cambodia

1. Introduction

This paper presents the Simple Poverty Scorecard®. Local, pro-poor programs in Cambodia can use it 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. For example, the 2004 Cambodia Socio-Economic Survey (CSES) runs 48 pages and asks households about a long list of expenditure items such as "In the past seven days, what was the value of cereals (rice, bread, corn, wheat flour, rice flour, corn meal, rice cakes, noodles, biscuits, etc.) consumed that the household purchased with cash? What was the value of cereal consumed that came from own produce, wages in-kind, gifts, or free collections? Now then, what is the value of fish (fresh fish, salted and dried fish, canned fish, shrimp, prawn, crab, etc.) consumed in the past seven days that the household purchased with cash? . . ."

In contrast, the indirect approach via poverty scoring is simple, quick, and inexpensive. It uses ten verifiable indicators (such as "What toilet facility does the household have?" or "Does the household own a wardrobe or cabinet?") to get a score that is highly correlated with poverty status as measured by the exhaustive survey.

The Simple Poverty Scorecard® here differs from "proxy-means tests" (Coady, Grosh, and Hoddinott, 2002) in that it is tailored to the capabilities and purposes not of national governments but rather of local, pro-poor organizations. The feasible poverty-measurement options for these organizations are typically subjective and relative (such as participatory wealth ranking by skilled field workers) or blunt (such as rules based on land-ownership or housing quality). Measurements from these approaches are not comparable across organizations nor across countries, they may be costly, and their accuracy and precision are unknown.

The Simple Poverty Scorecard® could be used by an organization to determine what share of its participants are below a poverty line (such as the Millennium Development Goals' $1.25/day line at 2005 purchase-power parity). Or it could be used by USAID's microenterprise partners to fulfill the requirement to report the share of participants who are among the poorest half of people below the national poverty line. Finally, the scorecard could be used by an organization to measure movement across a poverty line (see, for example, Daley-Harris, 2009). All these purposes call for an expenditure-based, objective tool with known accuracy. While expenditure surveys are costly even for governments, many small, local organizations can implement an inexpensive scorecard that can serve for monitoring, management, and targeting.

The statistical approach here aims to be understood by non-specialists. After all, if managers are to adopt poverty scoring on their own and apply it to inform their decisions, they must first trust that it works. Transparency and simplicity build trust. Getting "buy-in" matters; proxy-means tests and regressions on the "determinants of

poverty" have been around for three decades, but they are rarely used to inform decisions, not because they do not work, but because they are presented (when they are presented at all) as tables of regression coefficients incomprehensible to non-specialists (with cryptic indicator names such as "`LGHHSZ_2`", negative values, and many decimal places). Thanks to the predictive-modeling phenomenon known as the "flat maximum", simple scorecards are usually about as accurate as complex ones.

The technical approach here is also 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 techniques are simple, they have rarely or never been applied to poverty-assessment tools.

The scorecard (Figure 1) is based on Cambodia's 2004 CSES conducted by the National Institute of 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 non-negative integers, and total scores range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line). Non-specialists can collect data and tally scores on paper in the field in five to ten minutes.

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

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

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

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

This paper presents a single scorecard whose indicators and points are derived from data on household expenditure and Cambodia's national poverty line. Scores from this one scorecard are calibrated to poverty likelihoods for nine poverty lines.

The scorecard is constructed and calibrated using some of the data from the 2004 CSES, and its accuracy is validated on the rest of the data.

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 was built), they are—like all predictive models—biased to some extent when applied to a different population.[1]

[1] Examples include nationally representative samples at a different point in time or non-nationally representative sub-groups (Tarozzi and Deaton, 2007).

Thus, while the indirect scoring approach is less costly than the direct survey approach, it is also biased. (The survey approach is unbiased by assumption.) Estimates do not generally match true values because scoring must assume that the future relationship between indicators and poverty will be the same as in the data used to build the scorecard.[2] Of course, this assumption—ubiquitous and inevitable in predictive modeling—holds only partly.

When applied to the validation sample with bootstrap samples of n = 16,384, the difference between scorecard estimates of groups' poverty rates and the true rates at a point in time is –0.8 percentage points for the national line, and the average absolute difference is 0.4 percentage points across all nine lines. These differences are due to sampling variation and not bias; the average of each difference would be zero if the whole 2004 CSES were to be repeatedly redone and divided into sub-samples before repeating the entire process of building and calibrating scorecards.

The 90-percent confidence intervals for these estimates of a poverty rate at a point in time are +/–0.6 percentage points or less. For n = 1,024, the 90-percent intervals are +/–2.3 percentage points or less.

Section 2 below describes data and poverty lines. Sections 3 and 4 describe scorecard construction and offer guidelines for use in practice. Sections 5 and 6 detail the estimation of households' poverty likelihoods and of groups' poverty rates at a point

[2] Estimates also will not generally match true values due to changes in data collection, changes to poverty lines, imperfect adjustment of poverty lines to account for differences in cost-of-living across time or regions, and sampling variation.

in time. Section 7 discusses estimating changes in poverty rates through time. Section 8 covers targeting. Section 9 compares and contrasts the new scorecard here with existing tools for Cambodia with similar purposes. The final section is a summary.

2. Data and poverty lines

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

2.1 Data

The scorecard is based on data from 11,993 households in the 2004 CSES conducted from 1 January to 31 December 2004.[3] This is Cambodia's most recent available national expenditure survey. James Knowles graciously provided the measure of aggregate household expenditure.

For the purposes of poverty scoring, the households in the 2004 CSES 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 with data not used in construction or calibration

2.2 Poverty rates and poverty lines

2.2.1 Rates

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

[3] 3,000 additional households were interviewed in 2003 and 2005, but this paper follows Knowles (2006a) in using only the 2004 interviews to mitigate any seasonal effects.

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 count more.

For example, consider a group of two households, the first with one member and the second with two members. Suppose further that the first household has per-capita expenditure 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 person and so gives a poverty rate 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 of $2 \div (1 + 2) = 67$ percent.

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

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

Figure 2 reports poverty rates and poverty lines for Cambodia at both the household-level and the person-level for the regions of Phnom Penh, other urban, and rural, as well as for Cambodia as a whole. The Simple Poverty Scorecard® is constructed using the 2004 CSES and household-level lines, scores are calibrated to household-level poverty likelihoods, and accuracy is measured for household-level rates. This use of household-level rates reflects the belief that they are 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, calibrate scores to person-level likelihoods, and measure accuracy for person-level rates, but it is not done here.

2.2.2 Poverty lines

Knowles (2006a) derives poverty lines for the 2004 CSES in average 2004 prices.[4] The food line is defined as the observed cost—for people in the middle quintile of expenditure—of a reference food bundle providing 2,100 calories. The food line is KHR1,782 per person per day in Phnom Penh, KHR1,568 in other urban areas, and KHR1,389 in rural areas, giving an all-Cambodia household-level food-poverty rate of 16.4 percent (Figure 2).

[4] Knowles uses legacy methods from Prescott and Pradhan (1997) to enable comparison with survey data from the 1993/4 CSES.

A national poverty line is then defined as the food line plus the observed non-food expenditure for households whose total expenditure is at the food line.[5] The national line is KHR2,351 per person per day in Phnom Penh, KHR1,952 in other urban areas, and KHR1,753 in rural areas, giving an all-Cambodia household-level national poverty rate of 30.2 percent (Figure 2). Knowles (2006a) points out that about 90 percent of people below the national line live in rural areas.

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

- National
- Food
- 125% of national
- 150% of national
- 200% of national
- USAID "extreme"
- USD1.25/day 2005 PPP
- USD2.50/day 2005 PPP
- USD3.75/day 2005 PPP

For each of the nine poverty lines, Figure 2 shows the all-Cambodia lines as well as the regional lines for Phnom Penh, other urban, and rural. The national line is used to construct the scorecard.

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

[5] It is more common to define the national line as the food line plus the non-food expenditure observed for households whose food expenditure (not total expenditure) matches the food line, a convention that gives a higher line and a higher poverty rate.

The USD1.25/day 2005 PPP line is derived from:

- 2005 PPP exchange rate for "individual consumption expenditure by households" (International Comparison Project, 2008): KHR 1615.30 per USD1.00
- Consumer Price Index for Phnom Penh from the National Institute of Statistics,[6] averaging 108.90 in 2004 and 115.20 in 2005.

Given this, the USD1.25/day 2005 PPP line for Cambodia as a whole during the 2004 CSES is (Sillers, 2006):

$$(\text{2005 PPP exchange rate}) \cdot \text{USD1.25} \cdot \left(\frac{\text{CPI}_{\text{2004 average}}}{\text{CPI}_{\text{2005 average}}} \right) =$$

$$\left(\frac{\text{KHR1,615.30}}{\text{USD1.00}} \right) \cdot \text{USD1.25} \cdot \left(\frac{108.90}{115.20} \right) = \text{KHR1,908.}$$

The USD2.50/day and USD3.75/day 2005 PPP lines are multiples of the USD1.25/day line.

The 2005 PPP lines just discussed apply to Cambodia as a whole. They are adjusted for differences in cost-of-living across regions using:

- L, a given all-Cambodia 2005 PPP poverty line
- π_i, the national poverty line for region i (Phnom Penh, other urban, or rural)
- w_i, the person-level population weight for region i (0.0847458 for Phnom Penh, 0.1087201 for other urban, and 0.8065340 for rural)
- N, the number of regions (3)

The cost-of-living-adjusted 2005 PPP poverty line L_i for region i is then:

$$L_i = \frac{L \cdot \pi_i}{\left(\sum_{i=1}^{N} \pi_i \cdot w_i \right) / \sum_{i=1}^{N} w_i}.$$

[6] `http://www.nis.gov.kh/nis/CPI/mcpiPP_2004.htm` and `http://www.nis.gov.kh/nis/CPI/mcpiPP_2005.htm`, accessed 1 December 2009.

3. Scorecard construction

For Cambodia, about 100 potential indicators are prepared in the areas of:

- Family composition (such as household size)
- Education (such as school attendance)
- Housing (such as the material of outer walls)
- Ownership of durable goods (such as wardrobes and cabinets)

Figure 3 lists all the candidate indicators, ranked by the entropy-based "uncertainty coefficient" that is a measure of how well the indicator predicts poverty on its own (Goodman and Kruskal, 1979). Responses for each indicator in Figure 3 are ordered starting with those most strongly linked with higher poverty likelihoods.

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

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

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

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

A series of two-indicator scorecards are then built, each based on the one-indicator scorecard selected from the first step, with a second candidate indicator added. The best two-indicator scorecard is then selected, again based on "c" and judgment. These steps are repeated until the scorecard has 10 indicators.

The final step is to transform the Logit coefficients into non-negative integers such that total scores range from 0 (most likely below a poverty line) to 100 (least likely below a poverty line).[7]

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

The single scorecard here applies to all of Cambodia. In India and Mexico (Schreiner, 2006 and 2005a), Sri Lanka (Narayan and Yoshida, 2005), and Jamaica (Grosh and Baker, 1995), segmenting poverty-assessment tools by urban/rural does not improve targeting accuracy much, although it may improve the accuracy of estimates of poverty rates (Tarozzi and Deaton, 2007).

[7] Dean Caire was the first to make a scorecard with this type of point scheme.

For Cambodia, Knowles (2006b) says that segmenting by region is justified because targeting accuracy by geographical zone (Plains, Tonle Sap, Coastal, and Plateau/mountains) differs between a single all-Cambodia scorecard versus region-specific scorecards. These differences, however, are not always improvements, and they may be due to different baseline poverty rates across zones. Indeed, aggregate targeting accuracy with the single all-Cambodia scorecard in Knowles (2006b) is better than the aggregated results from region-specific scorecards.

4. Practical guidelines for scorecard use

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

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

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

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

A field worker using the paper scorecard would:

- Record participant identifiers and household size
- Read each question from the scorecard
- Circle the 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 filing or data entry

Of course, field workers must be trained. Quality outputs depend on quality inputs. If organizations or field workers gather their own data and if 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).[8] IRIS Center (2007a) and Toohig (2008) are useful nuts-and-bolts guides for budgeting, training field workers and supervisors, logistics, sampling, interviewing, piloting, recording data, and controlling quality.

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

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

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

In general, design depends on the questions that the organization wants to answer. For sampling, an organization must make choices about:

- Who will apply the scorecards
- 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 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[9]

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

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

- With different sets of participants, as long as all sets are representative of the same population
- With the same set of participants

[9] Rather than all participants, an organization might score only new participants, so as to know their poverty status before any effect that participation might have.

An example set of choices were made by BRAC and ASA, two microlenders in Bangladesh (each with more than 7 million participants) who are applying the Simple Poverty Scorecard® (Chen and Schreiner, 2009a). Their design is that loan officers in a random sample of branches will score all participants each time they visit a homestead (about once a year) as part of their standard due diligence prior to loan disbursement. Responses are recorded on paper in the field before being sent to a central office to be entered into a database. ASA's and BRAC's sampling plans cover 50,000–100,000 participants each.

5. Estimates of household poverty likelihoods

The sum of scorecard points for a household is called the *score*. For Cambodia, 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 increases the likelihood of being above a given poverty line, but it does not necessarily double the likelihood.

To get absolute units, scores must be converted to *poverty likelihoods*, that is, probabilities of being below a poverty line. This is done via simple look-up tables. For the example of the national line, scores of 20–24 have a poverty likelihood of 45.3 percent, and scores of 25–29 have a poverty likelihood of 34.3 percent (Figure 4).

The poverty likelihood associated with a score varies by poverty line. For example, scores of 20–24 are associated with a poverty likelihood of 45.3 percent for the national line but 24.6 percent for the food line.[10]

[10] Starting with Figure 4, many figures have nine versions, one for each of the nine poverty lines. They are grouped by poverty line. Single tables that pertain to all poverty lines are placed with the first group of 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 5), there are 14,127 (normalized) households in the calibration sub-sample with a score of 20–24, of whom 6,401 (normalized) are below the poverty line. The estimated poverty likelihood associated with a score of 20–24 is then 45.3 percent, because 6,401 ÷ 14,127 = 45.3 percent.

To illustrate with the national line and a score of 25–29, there are 13,625 (normalized) households in the calibration sample, of whom 4,669 (normalized) are below the line (Figure 5). Thus, the poverty likelihood for this score is 4,669 ÷ 13,625 = 34.3 percent.

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

Figure 6 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 20–24 falls in the following ranges with probability:

- 19.3 percent below the USAID "extreme" line
- 5.3 percent between the USAID "extreme" and the food lines
- 20.7 percent between the food and the national lines
- 5.1 percent between the national and the $1.25/day 2005 PPP lines
- 15.4 percent between the $1.25/day 2005 PPP and the 125% of national lines
- 13.0 percent between the 125% and 150% of national lines
- 12.9 percent between the 150% and 200% of national lines

- 0.2 percent between the 200% of national and $2.50/day 2005 PPP lines
- 6.4 percent between the $2.50/day and $3.75/day 2005 PPP lines
- 1.8 percent above $3.75/day 2005 PPP

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

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

5.2 Accuracy of estimates of households' poverty likelihoods

As long as the relationship between indicators and poverty does not change and as long as the scorecard is applied to households that are representative of the same population from which the scorecard was constructed, then 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.[11]

Of course, the relationship between indicators and poverty does change to some unknown extent with time and also across sub-groups in Cambodia's population, so the scorecard will generally be biased when applied after 2004 or when applied with non-nationally representative sub-groups.

How accurate are estimates of households' poverty likelihoods when the assumptions of no change and of representativeness hold? To measure, the scorecard is applied to 1,000 bootstrap samples of size $n = 16{,}384$ from the validation sub-sample. Bootstrapping entails (Efron and Tibshirani, 1993):

- Score each household in the validation sample
- Draw a new bootstrap sample *with replacement* from the validation sample
- For each score, compute the true poverty likelihood in the bootstrap sample, that is, the share of households with the score and expenditure below a poverty line

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

- For each score, record the difference between the estimated poverty likelihood (Figure 4) 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 7 shows the average difference between estimated and true poverty likelihoods, as well as confidence intervals for the differences.

For the national line, the average poverty likelihood across bootstrap samples for scores of 20–24 in the validation sample is too low by 1.5 percentage points. For scores of 25–29, the estimate is too low by 1.0 percentage points.[12]

The 90-percent confidence interval for the differences for scores of 20–24 is +/–1.7 percentage points (Figure 7). This means that in 900 of 1,000 bootstraps, the difference between the estimate and the true value is between –3.2 and +0.2 percentage points (because –1.5 – 1.7 = –3.2, and –1.5 + 1.7 = +0.2). In 950 of 1,000 bootstraps (95 percent), the difference is –1.5 +/–2.0 percentage points, and in 990 of 1,000 bootstraps (99 percent), the difference is –1.5 +/–2.8 percentage points.

For all scores of 59 and below, Figure 7 shows differences between estimated poverty likelihoods and true values. This is because the validation sub-sample is a

[12] 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 process of scorecard building and calibration.

single sample that—thanks to sampling variation—differs in distribution from the construction/calibration sub-samples and from Cambodia's population. For targeting, however, what matters is less the difference in all score ranges and more the difference in score ranges just above and below the targeting cut-off. This mitigates the effects of bias and sampling variation on targeting (Friedman, 1997). Section 8 below looks at targeting accuracy in detail.

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

Another possible source of differences between estimates and true values is overfitting. By construction, the scorecard here is unbiased, but it may still be *overfit* when applied after the end of the CSES fieldwork in 2004. That is, it may fit the 2004 CSES data so closely that it captures not only some timeless patterns but also some random patterns that, due to sampling variation, show up only in the 2004 CSES. Or the scorecard may be overfit in the sense that it is not robust to changes in the relationships between indicators and poverty over time or when it is applied to sub-groups that are not nationally representative.

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. Combining scorecards can also help, at the cost of greater complexity.

Most errors in individual households' likelihoods cancel out in the estimates of groups' poverty rates (see next section). Furthermore, at least some of the differences come from non-scorecard sources such as changes in the relationship between indicators and poverty, sampling variation, changes in poverty lines, inconsistencies in data collection, and imperfections in cost-of-living adjustments across time and geography. These factors can be addressed only by improving data quantity and quality (which is beyond the scope of the scorecard) or by reducing overfitting (which likely has limited returns, given the scorecard's parsimony).

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

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

To illustrate, suppose a program samples three households on Jan. 1, 2009 and that they have scores of 20, 30, and 40, corresponding to poverty likelihoods of 45.3, 21.9, and 9.4 percent (national line, Figure 4). The group's estimated poverty rate is the households' average poverty likelihood of $(45.3 + 21.9 + 9.4) \div 3 = 25.5$ percent.[13]

6.1 Accuracy of estimated poverty rates at a point in time

For the Cambodia scorecard applied to the validation sample with $n = 16{,}384$, the absolute differences between the estimated poverty rate at a point in time and the true rate are 0.8 percentage points or less (Figure 9, summarizing Figure 8 across poverty lines). The average absolute difference across the nine poverty lines is 0.4 percentage points. At least part of these differences is due to sampling variation in the validation sample and in the random division of the 2004 CSES into three sub-samples.

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). This means that in 900 of 1,000 bootstraps of this size, the difference

[13] 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 21.9 percent. This is not the 25.5 percent found as the average of the three poverty likelihoods associated with each of the three scores.

between the estimate and the true value is within 0.6 percentage points of the average difference. In the specific case of the national line and the validation sample, 90 percent of all samples of $n = 16{,}384$ produce estimates that differ from the true value in the range of –0.8 – 0.5 = –1.3 to –0.8 + 0.5 = –0.3 percentage points. This is because –0.8 is the average difference, and +/–0.5 is its 90-percent confidence interval. The average difference is –0.8 because the average scorecard estimate is too low by 0.8 percentage points; the estimated poverty rate is 30.3 percent for the validation sample, but the true value is 31.1 percent (Figure 2).

6.2 Formula for standard errors for estimates of poverty rates

How precise are the point-in-time estimates? To derive a formula for the standard errors of estimated poverty rates at a point in time from indirect measurement via scorecards (Schreiner, 2008a), first note that in "large" samples, the average difference between estimates and true values has a Normal distribution. Then note that the textbook formula (Cochran, 1977) that relates confidence intervals with standard errors in the case of direct measurement of poverty status via an expenditure survey is $c = +/- z \cdot \sigma$, where:

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

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

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

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

n is the sample size.

For example, this implies that for a sample n of 16,384 with 90-percent confidence ($z = 1.64$) and a poverty rate p of 29.7 percent (the average poverty rate in the construction and calibration samples in Figure 2 for the national line), the confidence interval c is $+/- z \cdot \sqrt{\frac{p \cdot (1-p)}{n}} = +/- 1.64 \cdot \sqrt{\frac{0.297 \cdot (1-0.297)}{16{,}384}} = +/-0.00585$, or about +/–0.585 percentage points.

Poverty scoring, however, does not measure poverty directly, so this formula is not applicable. To derive a formula for the Cambodia scorecard, consider Figure 8, which reports empirical confidence intervals c for the differences for the scorecard applied to 1,000 bootstrap samples of various sample sizes from the validation sample. For $n = 16{,}384$ and the national line, the 90-percent confidence interval is 0.505 percentage points.[14]

Thus, the 90-percent confidence interval with $n = 16{,}384$ is +/–0.505 percentage points for the Cambodia scorecard and +/–0.585 percentage points for direct measurement. The ratio of the two intervals is $0.505 \div 0.585 = 0.86$.

[14] Due to rounding, Figure 8 displays 0.5, not 0.505.

Now consider the same case, but with $n = 8{,}192$. The confidence interval under direct measurement is $+/-1.64 \cdot \sqrt{\frac{0.297 \cdot (1-0.297)}{8{,}192}} = +/-0.00828$, or about +/–0.828 percentage points. The empirical confidence interval with the Cambodia scorecard (Figure 8) is 0.00715, or 0.715 percentage points. Thus for $n = 8{,}192$, the ratio of the two intervals is $0.715 \div 0.828 = 0.86$.

This ratio of 0.86 for $n = 8{,}192$ matches the ratio of 0.86 for $n = 16{,}384$. Across all sample sizes of 256 or more in Figure 8, the average ratio turns out to be 0.89, implying that confidence intervals for indirect estimates of poverty rates via the Cambodia scorecard and this poverty line are about 11 percent narrower than confidence intervals for direct estimates via the 2004 CSES. 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 Cambodia scorecard is $c = +/- z \cdot \alpha \cdot \sigma$. That is, formula for the standard error σ for point-in-time estimates of poverty rates via scoring is $\alpha \cdot \sqrt{\frac{p \cdot (1-p)}{n}}$.

In general, α can 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 the poverty lines in Figure 9.

The formula relating confidence intervals to standard errors for poverty scoring can be rearranged to give a formula for determining sample size before measurement.[15] If $\hat{p}$ is the expected poverty rate before measurement, then the formula for sample size n based on the desired confidence level that corresponds to z and the desired confidence interval $+/-c$ is $n = \left(\frac{\alpha \cdot z}{c}\right)^2 \cdot \hat{p} \cdot (1 - \hat{p})$.

To illustrate how to use this, suppose $c = 0.04415$ and $z = 1.64$ (90-percent confidence). Then the formula gives $n = \left(\frac{0.89 \cdot 1.64}{0.04415}\right)^2 \cdot 0.297 \cdot (1 - 0.297) = 228$, not far from the sample size of 256 observed for these parameters for the national line in Figure 8.

Of course, the α factors in Figure 9 are specific to Cambodia, its poverty lines, its poverty rates, and this scorecard. The derivation of the formulas, however, is valid for any poverty-assessment tool following the approach in this paper.

In practice after the end of fieldwork for the CSES in 2004, an organization would select a poverty line (say, the national line), select a desired confidence level (say, 90 percent, or $z = 1.64$), select a desired confidence interval (say, +/–2.0 percentage points, or $c = 0.02$), make an assumption about $\hat{p}$ (perhaps based on a

[15] IRIS Center (2007a and 2007b) says that a sample size of $n = 300$ is sufficient for USAID reporting. If a scorecard 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 scorecard could be more or less precise than direct measurement.

previous measurement such as the 30.2 percent national average in the 2004 CSES in Figure 2), look up α (here, 0.89), assume that the scorecard will still work in the future and/or for non-nationally representative sub-groups,[16] and then compute the required sample size. In this illustration, $n = \left(\frac{0.89 \cdot 1.64}{0.02}\right)^2 \cdot 0.302 \cdot (1 - 0.302) = 1{,}123$.

[16] This paper reports accuracy for the scorecard applied to the validation sample, but it cannot test accuracy for later years or for other groups. Performance after 2004 will resemble that in the 2004 CSES with deterioration to the extent that the relationships between indicators and poverty status change over time.

7. Estimates of changes in group poverty rates over time

The change in a group's poverty rate between two points in time is estimated as the change in the average poverty likelihood of the households in the group. With data only from the 2004 CSES, this paper cannot test estimates of change over time for Cambodia, and it can only suggest approximate formulas for standard errors. Nevertheless, the relevant concepts are presented here because, in practice, pro-poor organizations can apply the scorecard to collect their own data and measure change through time.

7.1 Warning: Change is not impact

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

7.2 Calculating estimated changes in poverty rates over time

Consider the illustration begun in the previous section. On Jan. 1, 2009, a program samples three households who score 20, 30, and 40 and so have poverty likelihoods of 45.3, 21.9, and 9.4 percent (national line, Figure 4). The group's baseline estimated poverty rate is the households' average poverty likelihood of (45.3 + 21.9 + 9.4) ÷ 3 = 25.5 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, 2010, the program samples three additional households who are in the same cohort as the three households originally sampled (or suppose that the program scores the same three original households a second time) and finds that their scores are 25, 35, and 45 (poverty likelihoods of 34.3, 13.4, and 3.5 percent, national line, Figure 4). Their average poverty likelihood at follow-up is now (34.3 + 13.4 + 3.5) ÷ 3 = 17.1 percent, an improvement of 25.5 – 17.1 = 8.4 percentage points.[17]

This suggests that about one in twelve participants in this hypothetical example crossed the poverty line in 2009.[18] Among those who started below the line, about one in three (8.4 ÷ 25.5 = 32.9 percent) on net ended up above the line.[19]

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

7.3 Accuracy for estimated change in two independent samples

With only the 2004 CSES, it is not possible to measure the accuracy of scorecard estimates of changes in groups' poverty rates over time. In practice, of course, local pro-poor organizations can still apply the Cambodia scorecard to estimate change. The rest of this section suggests approximate formulas for standard errors and sample sizes that may be used until there is additional data.

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

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

z, c, and p are defined as above, n is the sample size at both baseline and follow-up,[20] and α is the average (across a range of bootstrapped sample sizes) of the ratio of the observed confidence interval from a scorecard and the theoretical confidence interval under direct measurement.

---

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

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

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

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

For the countries for which this α has been measured (Schreiner 2009a, 2009b, 2009c, 2009d, and 2008b and Chen and Schreiner, 2009a and 2009b), the average α across countries, poverty lines, and years is 1.04, which seems a reasonable figure to use for Cambodia.

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, $\alpha = 1.04$, and $\hat{p} = 0.302$ (from Figure 2). Then the baseline sample size is $n = 2 \cdot \left(\frac{1.04 \cdot 1.64}{0.02} \right)^2 \cdot 0.302 \cdot (1 - 0.302) =$ 3,067, and the follow-up sample size is also 3,067.

7.4 Accuracy for estimated change for one sample, scored twice

Analogous to previous derivations, the general formula relating the confidence interval c to the standard error σ when using a scorecard to estimate change for a single group of households, all of whom are scored at two points in time, is:[21]

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

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

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

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

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

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

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

Given this, a sample-size formula for a group of households to whom the Cambodia scorecard is applied twice (once after 2004 and then again later) is:

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

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

To illustrate the use of this formula, suppose the desired confidence level is 90 percent ($z = 1.64$), the desired confidence interval is 2.0 percentage points ($c = 0.02$), the poverty line is the national line, and the sample will first be scored in 2009 and then again in 2012 ($y = 3$). The before-baseline poverty rate is 30.2 percent ($p_{2004} = 0.302$, Figure 2), and suppose $\alpha = 1.30$. Then the baseline sample size is $n = 2 \cdot \left(\frac{1.30 \cdot 1.64}{0.02} \right)^2 \cdot \{ -0.02 + 0.016 \cdot 3 + 0.47 \cdot [0.302 \cdot (1 - 0.302)] \} = 2{,}889$. The same group of 2,889 households is scored at follow-up as well.

8. Targeting

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

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

Targeting is successful when households truly below a poverty line are targeted (*inclusion*) and when households truly above a poverty line are not targeted (*exclusion*). Of course, no scorecard is perfect, and targeting is unsuccessful when households truly below a poverty line are not targeted (*undercoverage*) or when households truly above a poverty line are targeted (*leakage*). Figure 10 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. A formal way to do this is to assign net benefits—based on a program's values and mission—to each of

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

Figure 11 shows the distribution of households by targeting outcome. For an example cut-off of 20–24, outcomes for the national line in the validation sample are:

- Inclusion: 21.2 percent are below the line and correctly targeted
- Undercoverage: 9.9 percent are below the line and mistakenly not targeted
- Leakage: 14.4 percent are above the line and mistakenly targeted
- Exclusion: 54.5 percent are above the line and correctly not targeted

Increasing the cut-off to 25–29 improves inclusion and undercoverage but worsens leakage and exclusion:

- Inclusion: 25.9 percent are below the line and correctly targeted
- Undercoverage: 5.2 percent are below the line and mistakenly not targeted
- Leakage: 23.3 percent are above the line and mistakenly targeted
- Exclusion: 45.6 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 11 for a given poverty line
- Select the cut-off with the highest total net benefit

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

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

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

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

Figure 11 shows "Total Accuracy" for all cut-offs for the Cambodia scorecard. For the national line in the validation sample, total net benefit is greatest (76.5) for a cut-off of 19 or less, with about three in four households in Cambodia correctly classified.

"Total Accuracy" weighs successful inclusion of households below the line the same as successful exclusion of households above the line. If a program valued inclusion more (say, twice as much) than exclusion, it could reflect this by setting the benefit for inclusion to 2 and the benefit for exclusion to 1. Then the chosen cut-off would maximize (2 x Households correctly included) + (1 x Households correctly excluded).[22]

As an alternative to assigning benefits and costs to targeting outcomes and then choosing a cut-off to maximize total net benefit, a program could set a cut-off to achieve a desired poverty rate among targeted households. The third column of Figure

[22] Figure 11 also reports "BPAC", discussed in Section 9.

12 ("% targeted who are poor") shows, for the Cambodia scorecard applied to the validation sample, the expected poverty rate among households who score at or below a given cut-off. For the example of the national line in the validation sample, targeting households who score 24 or less would target 35.6 percent of all households (second column) and produce a poverty rate among those targeted of 59.5 percent (third column).

Figure 12 also reports two other measures of targeting accuracy. The first is a version of coverage ("% of poor who are targeted"). For the example of the national line in the validation sample and a cut-off of 24 or less, 68.1 percent of all poor households are covered.

The final targeting measure in Figure 12 is the number of successfully targeted poor households for each non-poor household mistakenly targeted (right-most column). For the national line in the validation sample and a cut-off of 24 or less, covering 1.5 poor households means leaking to 1 non-poor household.

9. Comparison with existing poverty-assessment tools

This section discusses five existing poverty-assessment tools for Cambodia in terms of their goals, methods, poverty lines, indicators, accuracy, precision, and cost. The comparative strengths of the new scorecard are its low cost, its simplicity and transparency, its out-of-sample tests, and its reporting of accuracy and standard errors.

9.1 Fujii

With the goal of improving the targeting of pro-poor programs, Fujii (2006) uses poverty-assessment tools to construct a "poverty map" (Elbers, Lanjouw, and Lanjouw, 2003) that quickly and straightforwardly shows non-specialists how poverty rates differ across communes in Cambodia.[23]

Following the standard poverty-mapping approach, Fujii uses stepwise least-squares to predict the logarithm of per-capita household consumption, using only indicators in both the 1997 CSES and the 1998 Cambodia National Population Census. Tools are built for Phnom Penh, other urban, and rural using poverty lines that Fujii defines so that the all-Cambodia, person-level poverty rate is 36.1 percent.

The tools are then applied to households in the 2008 census to estimate commune-level poverty rates that are more precise than those from only CSES data.

[23] Fujii also overlays an "education map" on Cambodia's poverty map, and Fujii (2005) presents a "malnutrition map".

Poverty mapping in Fujii and poverty scoring 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[24]

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 scorecard construction and calibration
- Includes community-level indicators
- Uses only indicators that appear in a census

Strengths of poverty scoring include that it:

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

The basic difference between the two approaches is that poverty mapping seeks to help governments design pro-poor policies, while poverty scoring seeks to help small, local pro-poor organizations to manage their outreach when implementing policies.[25]

[24] Fujii (2007) describes the diffusion of Cambodia's poverty map among potential users.
[25] Another apparent difference is that the developers of the poverty-mapping approach (Elbers, Lanjouw, and Lanjouw, 2003; Demombynes *et al.*, 2002) say that it is too inaccurate to be used for targeting particular households, while Schreiner (2008c) supports such targeting as a legitimate, potentially useful application of poverty

Fujii's three tools are large, complex, and probably overfit. They are not designed for use in the field. For example, the rural tool has 16 household indicators, more than 21 community indicators, and 13 interactions (such as "30-year average maximum wind speed in December" with "main source of lighting is a kerosene lamp/pump lantern").

It is not possible to compare the differences between estimated poverty rates and true values for Fujii versus the new scorecard here, as the 1998 Census does not collect expenditure data. Likewise, it is difficult to compare precision, as Fujii reports standard errors for estimated poverty rates only after averaging across communes.

9.2 IRIS Center

USAID commissioned IRIS Center ("IRIS", 2008a) to build a poverty-assessment tool for use by its Cambodian microenterprise partners for reporting on their participants' poverty rates. Thus, IRIS considers only the USAID "extreme" poverty line. In its derivation, IRIS uses the national line in 2004 average prices based on CSES households interviewed in 2004 (Knowles, 2006a). IRIS applies this line to all 14,978 households in the 2003/4/5 CSES, leading to different regional poverty lines and a

---

scoring. Recently, the developers of poverty mapping seem to have taken some small steps away from their original position (Elbers *et al.*, 2007).

household-level poverty rate of 15.3 percent (rather than the 14.4 percent reported here in Figure 2).[26]

After comparing several statistical approaches, IRIS settles on quantile regression (Koenker and Hallock, 2001), choosing a quantile so as to maximize their preferred measure of accuracy. IRIS' 16 indicators are:[27]

- Household demographics:
  - — Household size
  - — Sex of the household head
  - — Age of the household head
- Education: Number of people 18 and older (excluding the head) who can read
- Characteristics of the residence:
  - — Type of roof
  - — Source of energy for lighting
  - — Main fuel for cooking
- Asset ownership:
  - — Suitcases
  - — Televisions
  - — Video-tape players/recorders
  - — Dining sets
  - — Wardrobes or cabinets
  - — Motorcycles
- Past behavior:
  - — Whether the household boiled or otherwise treated its drinking water in the past month
  - — How many times the household consumed fish/fish paste, squid, shrimp and prawns, etc., at home in the past seven days
  - — How many times the household ate other meat, such as beef, pork, chicken, and duck, at home in the past seven days

Most of IRIS' indicators are simple to collect and verify. The indicators of past behavior, however, are not verifiable.

[26] The data source and derivation process are inferred, as IRIS does not document them.
[27] IRIS does not report the actual scorecard, so this list is based on their questionnaire.

IRIS does not report its tool's points; the only way to compute its index is with free IRIS-provided software which reports only an estimate of a group's poverty rate. This set-up precludes using the tool for targeting.

IRIS' preferred measure of accuracy is the "Balanced Poverty Accuracy Criterion", and USAID adopted BPAC as its criterion for certifying poverty-assessment tools (IRIS Center, 2005). BPAC depends on inclusion and on the difference between the estimated poverty rate and its true value (equivalent to the difference between undercoverage and leakage). The BPAC formula is:

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

A higher BPAC is preferred; for Cambodia, IRIS (2008b) reports a BPAC of 46.4. For the new scorecard here and the USAID "extreme" line, BPAC is highest (53.7) for a cut-off of 24 or lower (Figure 11). The gap between BPAC here and that of IRIS is even larger than these figures suggest, as IRIS measures BPAC in-sample (that is, using the same data for both testing and for tool construction), something known to overstate accuracy.

The key distinction between the new scorecard here and IRIS is transparency and usability: IRIS requires more data (some of it non-verifiable), only estimates poverty rates for groups, and does not report standard errors nor its tool's points.

9.3 Knowles

Knowles (2006a and 2006b) uses the 2004 CSES to build and test poverty-assessment tools for Cambodia. In terms of purpose, approach, and spirit, Knowles' papers are similar to Narayan and Yoshida (2005) as well as the new scorecard here.

9.3.1 Knowles (2006a)

Knowles (2006a) is the main source of content for World Bank (2006) as well as Ministry of Planning (2006). Although the document focuses on the derivation of poverty lines and their use to estimate poverty rates directly from the 2004 CSES, one chapter presents and tests a poverty-assessment tool.

Knowles first selects 14 indicators by eye-balling their associations with poverty in simple cross-tabulations of the entire 2003/4/5 CSES (not just households interviewed in 2004). After randomly dividing the data into construction and validation samples, Knowles uses person-weighted Logit with the construction sample to build one tool for poverty status by the food line and a second tool for poverty status by the national line. The indicators are simple, inexpensive-to-collect, and verifiable:

- Household demographics: Number of members
- Characteristics of the residence:
  - — Type of roof
  - — Type of walls
  - — Source of lighting
- Asset ownership:
  - — Radio
  - — Television
  - — Motorcycle
  - — Bed

- Village-level indicators:
  - — Presence of a food shop
  - — Population
  - — Distance to the nearest all-weather road
  - — Availability of electricity
  - — Availability of gas
- Identity of the region

Accuracy is measured by applying the two tools to a validation sample, targeting people whose estimated poverty likelihoods (by the Logit formula) are less than 20.0 percent (for the food line) or 35.0 percent (for the national line).

To enable comparison, the new scorecard here is applied to households in its validation sub-sample, with the results weighted by people. Because the new scorecard is built with household weights, this puts it at a disadvantage vis-à-vis Knowles. Furthermore, Knowles builds two tools for the two poverty lines, while this paper presents a single scorecard, calibrated to both the food and national lines. Again, this puts the new scorecard at a disadvantage. Finally, the new scorecard is tested completely out-of-sample, while Knowles chooses indicators—although not points—based on data that included households in his validation sample. This also puts the new scorecard at a disadvantage.

It turns out that the two tools have about the same targeting accuracy. For a cut-off that targets 77.8 percent of people below the food line (versus 76.4 percent for Knowles), the new scorecard excludes 73.8 percent of people above the food line (versus 70.4 percent for Knowles). Likewise, a cut-off that targets 78.3 percent of people below

the national line (versus 78.2 percent Knowles) leads to the new scorecard excluding 70.2 percent of those above the line, versus 69.8 percent for Knowles.

9.3.2 Knowles (2006b)

Like the IDPoor program (see below), Knowles (2006b) focuses solely on a poverty-assessment tool meant to standardize efforts to target the poor in Cambodia. Like this paper and like IDPoor, its goals include being accurate, cost-effective, transparent, and feasible for community-level users.

Knowles (2006b) uses the 11,384 rural households outside of Phnom Penh from the 2003/4/5 CSES. Rather than using Logit, he builds a single tool using stepwise least-squares regression on the logarithm of per-capital household expenditure with person-level weights. The 18 indicators are:

- Household demographics:
  - — Number of members
  - — Number of members ages 5 or younger
  - — Marital status of the household head
- Education: Number of literate members ages 15 or older
- Economic activity in the past twelve months:
  - — Whether the household collected firewood, charcoal, timber, or other forest products
  - — Whether any household member operated a business
- Characteristics of the residence:
  - — Type of roof
  - — Type of outer wall
  - — Source of energy for lighting
  - — Type of toilet arrangement
- Asset ownership:
  - — Pigs
  - — Wardrobe or cabinet
  - — Television
  - — Video-tape recorder/player
  - — Cell phone

    - — Motorcycle
- Village population
- Province

Except for the two indicators that refer to past economic activity, all of these indicators are simple, inexpensive-to-collect, and verifiable.

Knowles (2006b) estimates poverty rates as the share of people in households whose estimated expenditure is below a given poverty line. For the food line and $n =$ 11,384, Knowles' in-sample estimate is too low by 6.3 percentage points, and for the national line, it is too low by 10.2 percentage points. For comparison, when the new scorecard here is applied to rural households outside of Phnom Penh in its validation sample with person weights and $n = 1{,}024$, the estimated poverty rate is too low by 1.4 percentage points for the food line and too low by 2.6 percentage points for the national line.

After selecting indicators based on the full sample and estimating poverty rates, Knowles (2006b) randomly divides the data into a construction sample for setting points and a validation sample for testing accuracy. The data is divided this way five times, points are estimated five times, and accuracy is measured five times.

A comparison of targeting accuracy again tends to favor Knowles. First, Knowles' test is only partially out-of-sample, as indicators are chosen based on the full sample. Second, the new scorecard here is constructed based on all households interviewed in 2004 with household weights, not on only rural households outside of

Phnom Penh interviewed in 2003/4/5 with person weights. Third, the new scorecard has 10 indicators rather than 18 (two of which are non-verifiable).

For the food line, targeting the lowest-scoring 22.5 percent of people and averaging results across Knowles' five split samples leads to better targeting for Knowles of poor people (54.9 percent versus 53.8) and better exclusion of non-poor people (89.9 percent versus 86.3). For the national line, Knowles is more accurate when targeting the poor among the lowest-scoring 39.8 percent of people (67.5 percent versus 64.0 here) but no better when excluding non-poor people (78.8 percent versus 79.0 here). Because the comparison favors Knowles, it seems fair to say that the two scorecards have about the same targeting accuracy.

Like this paper, Knowles (2006b) wants to make a poverty-assessment tool that is easy to use. To this end, Knowles presents a three-page tool (versus one page here) whose points are regression coefficients multiplied by 1,000 and then rounded to whole numbers. Still, Knowles' tool requires multiplication and subtraction of up to four digits, while the new scorecard requires only the addition of one- or two-digit integers, many of which are zero.

9.4 Identification of Poor Households Program

Cambodia's Identification of Poor Households Program (IDPoor) aims to standardize an approach to poverty-assessment tools so to improve the targeting of rural development efforts by all relevant actors. The system uses a nine-page

questionnaire (Ministry of Planning, 2008a) with more than 30 questions that lead to about 11 indicators that fit common sense and that lead "to poverty categorisation that much more closely matches local perceptions of poverty than the proxy indicators derived from [Knowles' 2006b] regression analysis of the socioeconomic survey."[28] Some questions are not assigned points but rather are used to help detect exceptional cases for possible overrides (Ministry of Planning, 2009). The system is based "largely on existing practical experience in poverty identification in Cambodia by GTZ and NGOs".

IDPoor uses an index cut-off that is selected to make the expected percentage (among all rural households in Cambodia) classed as "Poor Level 1" correspond more or less to the 16-percent poverty rate in the 2004 CSES for the food poverty line (allowing for some poverty reduction since then). Likewise, the share of rural households with indexes in the range classed as "Poor Level 2" is meant to correspond more or less with the 17-percent share between the food line and the national line in the 2004 CSES. This calibration is based on indexes from about 4,000 pilot households in 20 villages in three provinces in early 2007. Later tests in six provinces in 2009 showed that actual poverty rates for both classes came out at about 14 percent.

As here and in Knowles (2006b), IDPoor places a premium on voluntary take-up by local users. While this paper and Knowles (2006b) encourage buy-in via a simple, quick, inexpensive, verifiable poverty-assessment tool based on survey data, IDPoor

[28] For most households, the relevant indicators for IDPoor are similar to those in Knowles (2006b), and IDPoor's point system—not being data-based—is inferior.

encourages buy-in via avoiding gross targeting errors and through extensive community participation. As explained in IDPoor's excellent *Implementation Manual* (Ministry of Planning, 2008b, p. 2), "A key emphasis has been to maximize implementation by government structures and community representatives in order to build local capacity and enhance sustainability. The identification procedures also involve a high degree of participation and consultation with villagers themselves. This increases the transparency of the process and the accuracy of the results, and therefore the acceptability to local people."

IDPoor interviews are done by the elected members of a Village Representative Group. The VRG also evaluates possible overrides.[29] The process is (Ministry of Planning, 2009 and 2008b):

- List all households in a village
- Exclude households from interviews that are obviously non-poor, based on the judgment of the VRG
- Interview all remaining households
- Draft a list of poor households using both poverty indexes and items without points:
    - — Class as "Poor Level 1" or "very poor" those with indexes of 59–68
    - — Class as "Poor Level 2" or "poor" those with indexes of 45–58
    - — Class those with indexes of 44 or less as "Others" or "Non-poor"
- Discuss exceptional cases in the VRG, allowing overrides of up to 10 percent of classifications based information from items without points and local knowledge of circumstances
- Review the modified list with the Commune Council and other key community members
- Display in the village the draft list of poor households
- Consult with villagers at a formal meeting to identify possible misclassifications

[29] SBK Research and Development (2008) reports that the interviews and subsequent participatory process can strain the usually already-busy members of the VRG.

- Prepare a revised list and display again before submitting to the Commune Council for final review and resolution of pending override requests
- Send documents to the provincial Department of Planning for data entry
- Photograph all poor households
- Prepare and distribute Equity Cards with household identification number, photo, and poverty class
- Update every two years

Because IDPoor is explicitly about qualifying for assistance, all households, villages, and communes would seem to have incentives to maximize the number of households classed as poor. Still, in areas covered in 2009, about 28 percent of households were classed as "poor" or "very poor", and few cases were reclassified due to non-index-based considerations, suggesting that gaming has not been common. Indeed, IDPoor provincial coordinators report little—if any—evidence of villages systematically exaggerating the number of households classed as "poor" or "very poor".[30]

Like any approach, IDPoor has trade-offs. Its strength (and its weakness) is the use of a relative, local, subjective, and implicit definition of poverty as a complement to a quantitative, verifiable poverty-assessment tool.[31] In terms of strengths, IDPoor avoids the worst mistakes of undercoverage, and it effectively achieves community buy-in and acceptance.

[30] Julian Hansen, personal communication.

[31] The accuracy of the scorecard, relative to the objective poverty lines in this paper, is known. While the IDPoor tool is accepted as accurate by villagers, its accuracy by any other standard is unknown. Research planned for 2010 will compare its results to an objective standard.

Still, local implementation—coupled with subjectivity and non-verifiability in both overrides and tool indicators—increases the risk of leakage.[32] The possibility of subjective overrides is a two-edged sword. On the one hand, it encourages the use of local knowledge to avoid egregious errors. On the other hand, without an explicit definition of poverty, villages can—at least in theory—use subjective overrides to exaggerate the average poverty status of its households. As mentioned above, however, to date there is no evidence of this.

The lack of a benchmark also allows IDPoor to sweep under the rug the fact that it sometimes makes errors and that the extent of its errors is unknown. In terms of harmonization, the IDPoor *process* is exceptionally well-documented and thus standardized across Cambodia, but it is not clear how the *results* from a standardized process with relative, local, and subjective aspects can be aggregated or compared across villages, communes, or larger regions.

Still, the IDPoor approach is excellent for local buy-in and acceptance. If the incentives to overstate poverty continue to be contained, then this buy-in and acceptance is probably more important than other considerations, as it will allow IDPoor not only to focus greater attention by decision-makers and service providers on

[32] Examples of subjective or non-verifiable indicators include "General condition of the house?" and "In the past 12 months, did the household owe or borrow rice?" Perhaps more importantly, responses to IDPoor indicators—like those for the scorecard here—may simply be fabricated by enumerators. The scorecard differs from IDPoor in that there is no explicit process for subjective overrides whose appropriateness is difficult to verify.

the poor but also actually help get things done. Would that all countries had pro-poor targeting efforts as broad-based and well-designed. Perhaps the simple data-based scorecard in this paper, coupled with a process of local cross-checks for overriding a few exceptional cases, can accomplish the same ends with lower costs, greater knowledge of accuracy, and similar community buy-in.

10. Conclusion

Pro-poor programs in Cambodia can use the Simple Poverty Scorecard® to segment clients for targeted services as well as to estimate:

- The likelihood that a household has expenditure below a given poverty line
- The poverty rate of a population at a point in time
- The change in the poverty rate of a population between two points in time

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 part of the data from the 2004 CSES, tested on a different part of the 2004 CSES, and calibrated to nine poverty lines (national, food, 125% of national, 150% of national, 200% of national, USAID "extreme", USD1.25/day 2005 PPP, USD2.50/day 2005 PPP, and USD3.75/day 2005 PPP).

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

When the scorecard is applied to the validation sample with $n = 16{,}384$, the absolute difference between estimates versus true poverty rates for groups of households at a point in time is always less than 0.8 percentage points and averages—across the nine poverty lines—about 0.4 percentage points. For $n = 16{,}384$ and 90-percent

confidence, the precision of these differences is +/–0.6 percentage points or less, which is better than with direct measurement.

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

Although the statistical technique is innovative, and although technical accuracy is important, the design of the Simple Poverty 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 (most likely below a poverty line) to 100 (least likely below a poverty line). Scores are related to poverty likelihoods via simple look-up tables, and targeting cut-offs are likewise simple to apply. The design attempts to facilitate adoption by helping managers understand and trust scoring and by allowing non-specialists to generate scores quickly in the field.

In sum, the Simple Poverty Scorecard® is a practical, objective way for pro-poor programs in Cambodia to monitor poverty rates, track changes in poverty rates over time, and target services. The same approach can be applied to any country with similar data.

References

Adams, Niall M.; and David J. Hand. (2000) "Improving the Practice of Classifier Performance Assessment", *Neural Computation*, Vol. 12, pp. 305–311.

Baesens, Bart; Van Gestel, Tony; Viaene, Stijn; Stepanova, Maria; Suykens, Johan A. K.; and Jan Vanthienen. (2003) "Benchmarking State-of-the-Art Classification Algorithms for Credit Scoring", *Journal of the Operational Research Society*, Vol. 54, pp. 627–635.

Caire, Dean. (2004) "Building Credit Scorecards for Small Business Lending in Developing Markets", `microfinance.com/English/Papers/Scoring_SMEs_Hybrid.pdf`, accessed 1 December 2009.

Chen, Shiyuan; and Mark Schreiner. (2009a) "Simple Poverty Scorecard®: Bangladesh", `SimplePovertyScorecard.com/BGD_2005_ENG.pdf`, accessed 9 January 2016.

_____. (2009b) "Simple Poverty Scorecard®: Vietnam", `SimplePovertyScorecard.com/VNM_2006_ENG.pdf`, accessed 1 December 2009.

Coady, David; Grosh, Margaret; and John Hoddinott. (2002) "The Targeting of Transfers in Developing Countries: Review of Experience and Lessons" `hdl.handle.net/10986/14902`, retrieved 3 November 2015.

Cochran, William G. (1977) *Sampling Techniques, Third Edition*.

Daley-Harris, Sam. (2009) *State of the Microcredit Summit Campaign Report 2009*, `microcreditsummit.org/state_of_the_campaign_report/`, accessed 1 December 2009.

Dawes, Robyn M. (1979) "The Robust Beauty of Improper Linear Models in Decision Making", *American Psychologist*, Vol. 34, No. 7, pp. 571–582.

Demombynes, Gabriel; Elbers, Chris; Lanjouw, Jenny; Lanjouw, Peter; Mistiaen, Johan; and Berk Özler. (2002) "Producing an Improved Geographic Profile of Poverty: Methodology and Evidence from Three Developing Countries", World Institute for Development Economics Research Discussion Paper No. 2002/39, `go.worldbank.org/UMQCZ1BW00`, accessed 1 December 2009.

Efron, Bradley; and Robert J. Tibshirani. (1993) *An Introduction to the Bootstrap*.

Elbers, Chris; Fujii, Tomoki; Lanjouw, Peter; Özler, Berk; and Wesley Yin. (2007) "Poverty Alleviation through Geographic Targeting: How Much Does Disaggregation Help?", *Journal of Development Economics*, Vol. 83, pp. 198–213.

_____.; Lanjouw, Jean O.; and Peter Lanjouw. (2003) "Micro-Level Estimation of Poverty and Inequality", *Econometrica*, Vol. 71, No. 1, pp. 355–364.

Friedman, Jerome H. (1997) "On Bias, Variance, 0–1 Loss, and the Curse-of-Dimensionality", *Data Mining and Knowledge Discovery*, Vol. 1, pp. 55–77.

Fujii, Tomoki. (2007) "To Use or Not to Use? Poverty Mapping in Cambodia", pp. 125–142 in Tara Bedi, Aline Coudouel, and Kenneth Simler (eds) *More Than a Pretty Picture: Using Poverty Maps to Design Better Policies and Interventions*.

_____. (2006) "Commune-Level Estimation of Poverty Measures and Its Application in Cambodia", pp. 289–314 in Ravi Kanbur, Anthony J. Venables, and Guanghua Wan (eds.) *Spatial Disparities in Human Development: Perspectives from Asia*.

_____. (2005) "Micro-level Estimation of Child Malnutrition Indicators and Its Application in Cambodia", World Bank Policy Research Working Paper No. 3662, `go.worldbank.org/VJVC99CE00`, accessed 1 December 2009.

Fuller, Rob. (2006) "Measuring the Poverty of Microfinance Clients in Haiti", `microfinance.com/English/Papers/Scoring_Poverty_Haiti_Fuller.pdf`, accessed 1 December 2009.

Goodman, Leo A.; and Kruskal, William H. (1979) *Measures of Association for Cross Classification*.

Grootaert, Christiaan; and Jeanine Braithwaite. (1998) "Poverty Correlates and Indicator-Based Targeting in Eastern Europe and the Former Soviet Union", World Bank Policy Research Working Paper No. 1942, `go.worldbank.org/VPMWVLU8E0`, accessed 1 December 2009.

Grosh, Margaret; and Judy L. Baker. (1995) "Proxy Means Tests for Targeting Social Programs: Simulations and Speculation", World Bank LSMS Working Paper No. 118, `go.worldbank.org/W9OWN57PD0`, accessed 1 December 2009.

Hand, David J. (2006) "Classifier Technology and the Illusion of Progress", *Statistical Science*, Vol. 22, No. 1, pp. 1–15.

Hoadley, Bruce; and Robert M. Oliver. (1998) "Business Measures of Scorecard Benefit", *IMA Journal of Mathematics Applied in Business and Industry*, Vol. 9, pp. 55–64.

International Comparison Project. (2008) "Tables of Results", siteresources.worldbank.org/ICPINT/Resources/icp-final-tables.pdf, accessed 1 December 2009.

IRIS Center. (2008a) "Client Assessment Survey—Cambodia", povertytools.org/USAID_documents/Tools/Current_Tools/USAID_PAT_CMB_7_2008.xls, accessed 1 December 2009.

_____. (2008b) "Accuracy Results for 20 Poverty Assessment Tool Countries" povertytools.org/other_documents/PAT_20_country_accuracy_results_Dec2008.pdf, accessed 1 December 2009.

_____. (2007a) "Manual for the Implementation of USAID Poverty Assessment Tools", povertytools.org/training_documents/Manuals/USAID_PAT_Manual_Eng.pdf, accessed 1 December 2009.

_____. (2007b) "Introduction to Sampling for the Implementation of PATs", povertytools.org/training_documents/Sampling/Introduction_Sampling.ppt, accessed 1 December 2009.

_____. (2005) "Notes on Assessment and Improvement of Tool Accuracy", povertytools.org/other_documents/AssessingImproving_Accuracy.pdf, accessed 1 December 2009.

Johnson, Glenn. (2007) "Lesson 3: Two-Way Tables—Dependent Samples", http://www.stat.psu.edu/online/development/stat504/03_2way/53_2way_compare.htm, accessed 1 December 2009.

Knowles, James C. (2006a) "A New Set of Poverty Estimates for Cambodia, 1993/94 to 2004", Revision 28.11.06, Report to the EAS Country Units of the World Bank, JKinUSA@aol.com.

_____. (2006b) "Proxy Indicators for the Identification of Poor Households in Cambodia", Report to the EAS Country Units of the World Bank, JKinUSA@aol.com.

Koenker, Roger; and Kevin F. Hallock. (2001) "Quantile Regression", *Journal of Economic Perspectives*, Vol. 15, No. 4, pp. 143–156.

Kolesar, Peter; and Janet L. Showers. (1985) "A Robust Credit-Screening Model Using Categorical Data", *Management Science*, Vol. 31, No. 2, pp. 124–133.

Lovie, Alexander D.; and Patricia Lovie. (1986) "The Flat-Maximum Effect and Linear Scoring Models for Prediction", *Journal of Forecasting*, Vol. 5, pp. 159–168.

Martinelli, César; and Susan W. Parker. (2007) "Deception and Misreporting in a Social Program", ciep.itam.mx/~martinel/lies4.pdf, accessed 1 December 2009.

Matul, Michal; and Sean Kline. (2003) "Scoring Change: Prizma's Approach to Assessing Poverty", Microfinance Centre for Central and Eastern Europe and the New Independent States Spotlight Note No. 4, www.mfc.org.pl/doc/Research/ImpAct/SN/MFC_SN04_eng.pdf, accessed 1 December 2009.

McNemar, Quinn. (1947) "Note on the Sampling Error of the Difference between Correlated Proportions or Percentages", *Psychometrika*, Vol. 17, pp. 153–157.

Ministry of Planning. (2009) "Identification of Poor Households (IDPoor) in Cambodia", www.mop.gov.kh/LinkClick.aspx?fileticket=ycYNM107k0I%3d&tabid=154&mid=646, accessed 1 December 2009.

_____. (2008a) "Questionnaire for Identification of Poor Households", www.mop.gov.kh/LinkClick.aspx?fileticket=DF5pBVZUGwQ%3d&tabid=154&mid=644, accessed 1 December 2009.

_____. (2008b) *Implementation Manual on the Procedures for Identification of Poor Households*, www.mop.gov.kh/LinkClick.aspx?fileticket=%2bn%2f1McOYvG0%3d&tabid=154&mid=644, accessed 1 December 2009.

_____. (2006) *A Poverty Profile of Cambodia, 2004*, www.mop.gov.kh/LinkClick.aspx?fileticket=5UwPSU9lqZY%3d&tabid=191&mid=611, accessed 1 December 2009.

Myers, James H.; and Edward W. Forgy. (1963) "The Development of Numerical Credit Evaluation Systems", *Journal of the American Statistical Association*, Vol. 58, No. 303, pp. 779–806.

Narayan, Ambar; and Nobuo Yoshida. (2005) "Proxy Means Tests for Targeting Welfare Benefits in Sri Lanka", World Bank Report No. SASPR–7, www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/08/09/000090341_20050809094744/Rendered/PDF/332580PAPER0SASPR17.pdf, accessed 1 December 2009.

Onwujekwe, Obinna; Hanson, Kara; and Julia Fox-Rushby. (2006) "Some Indicators of Socio-Economic Status May Not Be Reliable and the Use of Indices with These Data Could Worsen Equity", *Health Economics*, Vol. 15, pp. 639–644.

Prescott, Nicholas; and Menno Pradhan. (1997) "A Poverty Profile of Cambodia", World Bank Discussion Paper No. 373, www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1997/10/01/000009265_3971126124351/Rendered/PDF/multi_page.pdf, accessed 1 December 2009.

SAS Institute Inc. (2004) "The LOGISTIC Procedure: Rank Correlation of Observed Responses and Predicted Probabilities", in *SAS/STAT User's Guide, Version 9*, support.sas.com/documentation/cdl/en/statug/63033/HTML/default/statug_logistic_sect035.htm, accessed 1 December 2009.

SBK Research and Development. (2008) "Survey of Implementers and Stakeholders at Sub-National Level on Issues Relating to Identification of Poor Households in Kratie and Seim Reap Provinces, March–May 2008", www.mop.gov.kh/LinkClick.aspx?fileticket=aDYvSKkMA9c%3d&tabid=154&mid=644, accessed 1 December 2009.

Schreiner, Mark. (2009a) "Simple Poverty Scorecard®: Peru (revised):", SimplePovertyScorecard.com/PER_2007_ENG.pdf, accessed 9 Jaunary 2009.

_____. (2009b) "Simple Poverty Scorecard®: Philippines", SimplePovertyScorecard.com/PHL_2002_ENG.pdf, accessed 1 December 2009.

_____. (2009c) "Simple Poverty Scorecard®: Mexico", SimplePovertyScorecard.com/MEX_2008_ENG.pdf, accessed 9 January 2016.

_____. (2009d) "Simple Poverty Scorecard®: Pakistan", SimplePovertyScorecard.com/PAK_2005_ENG.pdf, accessed 1 December 2009.

_____. (2008a) "Simple Poverty Scorecard®: Peru", SimplePovertyScorecard.com/PER_2003_ENG.pdf, accessed 9 January 2015.

_____. (2008b) "Simple Poverty Scorecard®: India", SimplePovertyScorecard.com/IND_2005_ENG.pdf, accessed 9 January 2016.

_____. (2008c) "Simple Poverty Scorecard®: Ecuador", SimplePovertyScorecard.com/ECU_2005_ENG.pdf, accessed 1 December 2009.

_____. (2006) "Is One Simple Poverty Scorecard® Enough for India?", microfinance.com/English/Papers/Scoring_Poverty_India_Segments.pdf, accessed 1 December 2009.

_____. (2005a) "Índice de Calificación de la Pobreza®: México", SimplePovertyScorecard.com/MEX_2002_SPA.pdf, accessed 9 January 2016.

_____. (2005b) "IRIS Questions on the Simple Poverty Scorecard®", microfinance.com/English/Papers/Scoring_Poverty_Response_to_IRIS.pdf, accessed 1 December 2009.

_____. (2002) *Scoring: The Next Breakthrough in Microfinance?* CGAP Occasional Paper No. 7, collab2.cgap.org//gm/document-1.9.29797/3276_076.pdf, accessed 1 December 2009.

_____; Matul, Michal; Pawlak, Ewa; and Sean Kline. (2004) "The Simple Poverty Scorecard®: Lessons from a Microlender in Bosnia-Herzegovina", microfinance.com/English/Papers/Scoring_Poverty_in_BiH_Short.pdf, accessed 1 December 2009.

Sillers, Don. (2006) "National and International Poverty Lines: An Overview", Washington, D.C.: United States Agency for International Development, pdf.usaid.gov/pdf_docs/Pnadh069.pdf, retrieved 31 May 2012.

Stillwell, William G.; Barron, F. Hutton; and Ward Edwards. (1983) "Evaluating Credit Applications: A Validation of Multi-Attribute Utility Weight Elicitation Techniques", *Organizational Behavior and Human Performance*, Vol. 32, pp. 87–108.

Tarozzi, Alessandro; and Angus Deaton. (2007) "Using Census and Survey Data to Estimate Poverty and Inequality for Small Areas", princeton.edu/~deaton/downloads/20080301SmallAreas_FINAL.pdf, accessed 1 December 2009.

Toohig, Jeff. (2008) "PPI Pilot Training Guide", progressoutofpoverty.org/toolkit, accessed 1 December 2009.

United States Congress. (2004) "Microenterprise Results and Accountability Act of 2004 (HR 3818 RDS)", November 20, smith4nj.com/laws/108-484.pdf, retrieved 11 January 2017.

Wainer, Howard. (1976) "Estimating Coefficients in Linear Models: It Don't Make No Nevermind", *Psychological Bulletin*, Vol. 83, pp. 223–227.

World Bank. (2006) *Cambodia: Halving Poverty by 2015? Poverty Assessment 2006*, go.worldbank.org/0VEL0T5SZ0, accessed 1 December 2009.

Zeller, Manfred. (2004) "Review of Poverty Assessment Tools", povertytools.org/other_documents/Review%20of%20PAT%20Tools.pdf, accessed 1 December 2009.

Figure 2: Sample sizes and household poverty rates by sub-sample and poverty line, and poverty lines by region

			Poverty rates (% with expenditure below a poverty line) and poverty lines								
				National lines				USAID	Intl. 2005 PPP		
Sub-sample	Level	Sample size	100%	Food	125%	150%	200%	'Extreme'	$1.25/day	$2.50/day	$3.75/day
Poverty Rates:											
All Cambodia	Households	11,993	30.2	16.4	45.7	57.9	73.8	14.4	33.2	75.8	88.7
	People		34.7	19.7	50.8	62.5	77.1	17.4	37.9	78.8	90.1
Construction											
Selecting indicators	Households	3,970	29.7	16.1	45.4	58.0	73.8	14.0	32.8	75.9	88.5
and points	People		33.8	19.3	49.9	62.1	76.8	16.8	37.1	78.6	89.8
Calibration											
Associating scores	Households	4,007	29.7	16.1	45.7	57.8	73.9	13.9	33.2	75.9	88.5
with likelihoods	People		34.2	19.2	50.9	62.6	77.2	16.9	38.0	78.9	90.1
Validation											
Measuring accuracy	Households	4,016	31.1	17.1	46.1	58.0	73.8	15.2	33.6	75.6	89.0
	People		36.0	20.6	51.5	62.7	77.3	18.4	38.5	78.9	90.5
	Poverty lines:										
	Phnom Penh	1,110	2,351	1,782	2,938	3,526	4,702	1,739	2,459	4,918	7,377
	Other urban	1,709	1,952	1,568	2,440	2,928	3,904	1,505	2,042	4,084	6,126
	Rural	9,174	1,753	1,389	2,191	2,629	3,506	1,329	1,833	3,666	5,499
	All Cambodia	11,993	1,825	1,441	2,281	2,737	3,650	1,383	1,908	3,817	5,726

Source: 2004 CSES. All poverty lines are in KHR per person per day in average 2004 prices.

Figure 3: Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
932	What is the main source of lighting for your household? (Kerosene lamp, none, or other; Battery; Privately-generated electricity/generator; Publicly-provided electricity;)
781	Does anyone in your household collect collect firewood, charcoal, timber, other forest products, palm juice, root crops, herbs, honey or hunt wild animals or birds? (Forest products and edibles, or no data; Forest products, but no edibles; Edibles, but no forest products, or no forest products and no edibles)
766	Does anyone in your household collect firewood, charcoal, timber or other forest products? (Yes, or no data; No)
718	How many members ages 13 or younger does the household have? (Four or more; Three; Two; One; None)
714	Does the household have a bath with WC? (No bath and no WC; WC only or bath only, but not both; Bath and WC)
712	What toilet facility does the household have? (Open land; None; Pit latrine, septic tank, other without septic tank, public toilet, shared toilet, or other; Connected to sewerage)
711	How many members ages 17 or younger does the household have? (Five or more; Four; Three; Two; One; None)
697	How many members ages 14 or younger does the household have? (Four or more; Three; Two; One; None)
670	How many members ages 18 or younger does the household have? (Five or more; Four; Three; Two; One; None)
665	How many members ages 15 or younger does the household have? (Four or more; Three; Two; One; None)
653	What is the primary construction material of the inner wall of the dwelling unit occupied by the household? (Bamboo or thatch, makeshift, salvaged, or improvised materials, other, or no data; Wood or logs, plywood, galvanized iron or aluminum, or fibrous cement; Concrete, brick, or stone)
653	What is the primary construction material of the outer wall of the dwelling unit occupied by the household? (Bamboo or thatch, makeshift, salvaged, or improvised materials, other, or no data; Wood or logs, plywood, galvanized iron or aluminum, or fibrous cement; Concrete, brick, or stone)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
652	Does the household own a dining set (table and chairs), a bed set, or a wardrobe or cabinet? (No; Yes)
648	How many members ages 12 or younger does the household have? (Four or more; Three; Two; One; None)
611	How many members ages 16 or younger does the household have? (Four or more; Three; Two; One; None)
597	Does the household own a wardrobe or cabinet? (No; Yes)
593	Does the household own a cell phone? (No; Yes)
583	How many members ages 11 or younger does the household have? (Three or more; Two; One; None)
583	Does the household own an electric fan? (No; Yes)
580	What the main source of drinking water in the dry season for your household? (Dug unprotected well, other, or no data; Dug protected well; Pond, river, or stream; Tubed/piped well or borehole; Rainwater; Public tap, tanker truck, vendor, or otherwise purchased; Piped in dwelling or on premises)
576	Does the household own a motorcycle, car, or jeep/van? (No; Yes)
568	What the main source of drinking water in the wet season for your household? (Dug unprotected well; Dug protected well; Pond, river, or stream; Tubed/piped well or borehole; Rainwater; Public tap, tanker truck, vendor, otherwise purchased, or other; Piped in dwelling or on premises)
557	What is the primary construction material of the roof of the housing/dwelling unit occupied by your household? (Thatch, salvaged materials, mixed but predominantly made of thatch or salvaged materials, plastic sheets, other, or no data; Galvanized iron or aluminum; Tiles; Fibrous cement or mixed but predominantly made of galvanized iron/aluminium, tiles, or fibrous cement; Concrete)
541	Does the household own a motorcycle? (No; Yes)
528	Does anyone in your household produce any crops, including fruits and vegetables, own any livestock or fish (or other aquatic product like frogs or crocodiles), collect firewood, charcoal, timber or other forest products, or collect palm juice, root crops, herbs, honey or hunt wild animals or birds? (Yes; No, or no data)
524	What type of fuel does the household mainly use for cooking? (Firewood or other; Charcoal, firewood and charcoal, liquefied petroleum gas, kerosene, publicly-provided electricity, gas and electricity, privately-generated electricity, or none/does not cook)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
510	What is the highest level of education completed by a household member? (Class one to four, other, no data, or pre-school/kindergarten; Never went to school or none; Class five or six; Class seven; Class eight to ten; Class eleven; Class twelve, secondary school certificate, technical/vocational pre-secondary diploma/certificate, technical/vocational post-secondary diploma/certificate, college/university undergraduate, college/university graduate, or post-graduate)
505	Does the household own a bed set? (No; Yes)
472	How many members does the household have? (Eight or more; Seven; Six; Five; Four; Three; One or two)
467	Does the household own a television? (No; Yes)
451	How many household members worked in agriculture, hunting, forestry, or fishing? (Five or more; Four; Three; Two; One; None)
449	What is the primary construction material of the floor of the housing/dwelling unit occupied by your household? (Wooden planks, bamboo strips, or other; Earth or clay; Parquet or polished wood; Cement, polished stone, marble, or ceramic tiles)
448	How many household members were skilled agricultural or fishery workers? (Five or more; Four; Three; Two; One; None)
445	How often does your household boil or otherwise treat its drinking water? (Never; Sometimes; Always)
419	If anyone in the household works in agriculture, hunting, forestry, or fishing, does the household have a shed for poultry/animals? (No one works in agriculture etc.; No; Yes)
410	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many harrows, rakes, hoes, spades, axes, etc. does the household own? (None; One; Two; Three; Four; Five; Six or more; No one works in agriculture etc.)
406	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many plots of land does the household owns or operates land used for vegetable gardening, agricultural or farming activities--crop cultivation, livestock raising, fishing and fish breeding, and (private) forestry (do not include residential land not used to cultivate any crops)? (One; No one owns or operates land for agriculture etc.; Two; Three or more; No one works in agriculture etc.)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
401	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many chickens, ducks, and quail does the household currently own? (One to four; Five to six; None; Seven to twelve; Thirteen or more; No one works in agriculture etc.)
398	Does the household own an electric iron? (No; Yes)
396	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many pigs does the household currently own? (None; One; Two or more; No one works in agriculture etc.)
384	If anyone in the household works in agriculture, hunting, forestry, or fishing, does the household own a plough? (One or more; None; No one works in agriculture etc.)
380	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many cattle does the household currently own? (One; None, or two or more; No one works in agriculture etc.)
378	What is the floor area of the housing/dwelling unit occupied by your household in square meters? (19 or less; 20 to 29; 30 to 39; 40 to 49; 50 to 59; 60 or more;)
377	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many cattle, buffaloes, or horses/ponies does the household currently own? (One or more; None; No one works in agriculture etc.)
376	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many cattle, buffaloes, horses/ponies, pigs, sheep, or goats does the household currently own? (None; One or more; No one works in agriculture etc.)
376	If anyone in the household works in agriculture, hunting, forestry, or fishing, does anyone in the household own or operate land used for vegetable gardening, agricultural or farming activities--crop cultivation, livestock raising, fishing and fish breeding, and (private) forestry (do not include residential land not used to cultivate any crops)? (No; Yes; No one works in agriculture etc.)
376	If anyone in the household works in agriculture, hunting, forestry, or fishing, does the household currently own any cattle, buffaloes, horses/ponies, pigs, sheep, goats, chickens, ducks, quail, or other livestock? (None; One or more; No one works in agriculture etc.)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
376	If anyone in the household works in agriculture, hunting, forestry, or fishing, how many buffaloes does the household currently own? (None; One or more; No one works in agriculture etc.)
376	If anyone in the household works in agriculture, hunting, forestry, or fishing, does the household currently own any cattle, buffaloes, horses/ponies, pigs, sheep, goats, chickens, ducks, quail, or other livestock? (None; One or more; No one works in agriculture etc.)
363	What is the highest level of education that the female head/spouse has completed? (Never went to school, none. Other, or no data; Pre-school/kindergarten, Class one, or Class two; No female head/spouse; Class three or Class four; Class five; Class six; Class seven or more)
360	How many children ages 7 to 15 attend school? (Not all; All, or no children ages 5 to 15)
360	How many bicycles and motorcycles does the household own? (No bicycles, and no motorcycles; One bicycle, and no motorcycles; Two bicycles, and no motorcycles; Three or more bicycles, and no motorcycles; One or more motorcycles (regardless of bicycles))
351	How many children ages 7 to 13 attend school? (Not all; All, or no children ages 5 to 13)
345	How many children ages 7 to 14 attend school? (Not all; All, or no children ages 5 to 14)
341	How many members ages 5 or younger does the household have? (Two or more; One; None)
338	What is the highest level of education that the male head/spouse has completed? (Never went to school, or none; Pre-school/kindergarten, Class one to five, other, or no data; No male head/spouse; Class six or seven; Class eight or higher)
329	How many children ages 7 to 12 attend school? (Not all; All, or no children ages 5 to 12)
320	Can the female head/spouse read or write a simple message in any language? (No, or no data; No female head/spouse; Yes)
320	How many children ages 7 to 17 attend school? (Not all; All, or no children ages 5 to 17)
318	How many children ages 7 to 11 attend school? (Not all; All, or no children ages 5 to 11)
311	How many children ages 7 to 16 attend school? (Not all; All, or no children ages 5 to 16)
306	How many children ages 7 to 18 attend school? (Not all; All, or no children ages 5 to 18)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
292	Under what type of employer did the male head/spouse work? (Domestic servant; Self-employer farmer; No male head/spouse; Does not work; Non-farm self-employed; State enterprise ,private enterprise, joint venture, foreign government, international organization, NGO, local NGO, or other; Government)
292	Does anyone in your household produce any crops, including fruits and vegetables, or own any livestock or fish (or other aquatic product like frogs or crocodiles)? (No, or no data; Yes)
260	Does the household own a dining set (table and chairs)? (No; Yes)
257	Does your household produce any crops, including fruits and vegetables? (Yes; No)
256	In what kind of economic activity (like agriculture, manufacturing, construction, trade, or service) did the male head/spouse work in the past 7 days? (Agriculture, hunting, forestry, or fishing; Manufacturing, mining, quarrying, or construction; No male head/spouse; Other)
255	What was the primary occupation of the male head/spouse during the past 7 days (beggar and sex worker are occupations)? (Skilled agricultural or fishery worker; Elementary occupation; No male head/spouse; Does not work; Others)
239	Did anyone in your household run an enterprise or business during the past 12 months? (No; Yes)
234	What was the primary occupation of the female head/spouse during the past 7 days (beggar and sex worker are occupations)? (Skilled agricultural or fishery worker; Craft and related trades worker; Does not work; No female head/spouse; Other)
222	Does the household own a video tape/recorder/player? (No; Yes)
220	In what kind of economic activity (like agriculture, manufacturing, construction, trade, or service) did the female head/spouse work in the past 7 days? (Agriculture, hunting, forestry, or fishing; Does not work; No female head/spouse; Other; Wholesale and retail trade, repair of motor vehicles, motorcycles, and personal and household goods)
217	Can the male head/spouse read or write a simple message in any language? (No, or no data; No male head/spouse; Yes)
211	Does anyone in your household own any livestock? (No, or no data; Yes)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
210	Under what type of employer did the female head/spouse work? (Domestic servant; Self-employed farmer; Does not work; Non-farm self-employed; Other)
208	Does anyone in your household own any livestock or fish (or other aquatic product like frogs or crocodiles)? (No livestock nor fish; Some livestock and/or some fish, or no data)
176	How many rooms in the dwelling unit are used by your household (other than kitchen, toilet, and bathrooms)? (One, or no data/homeless; Two or more)
173	How many household members are self-employed in agriculture? (Four or more; Three; Two; One; None)
148	Does the household own a stereo? (No; Yes)
135	How many household members work as domestic servants? (One or more; None)
133	Does the household own a car or jeep/van? (No; Yes)
129	Does anyone in your household collect palm juice, root crops, herbs, honey or hunt wild animals or birds? (Yes, or no data; No)
114	Does the household have a compound? (Yes, or no data; No)
112	How many household members can read or write a simple message in any language? (Three or more; Two; One; None)
94	How many household members did any work at all, even one hour, during the past 7 days (worked on farm, private or public sector, own account or in a business belonging to someone else in your household etc.), or had a job from which they were temporarily absent (e.g., due to holiday or illness)? (Six or more; Five; Four; None;)
93	Does the household have a separate kitchen? (No; Yes)
87	Does the household own a suitcase? (No; Yes)
83	How old is the female head/spouse in completed years? (32 to 41; 42 to 49; 31 or younger; No female head/spouse; 50 or more)
82	Does the household have a balcony? (No; Yes)
64	Does the household own a radio? (No; Yes)

Figure 3 (cont.): Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Answers ordered starting with those most strongly linked with higher poverty likelihoods)
58	How old is the male head/spouse in completed years? (40 to 49; 30 to 39; 29 or younger; No male head/spouse; 50 or more)
57	How many household members are self-employed in non-agriculture? (None; One; Two; Three or more)
56	How many bicycles does the household own? (None; One; Two or more)
54	Does the household own a water pump? (No; Yes)
40	How many batteries does the household own? (None; One; Two or more)
14	What is the legal status of the dwelling? (Owned by the household, or other; Rented, or not owned but no rent is paid)
8	Does anyone in your household raise any fish (or other aquatic product like frogs or crocodiles)? (No, or no data; Yes)
8	Is the male head/spouse a paid employee? (No; No male head/spouse; Yes)
7	How many household members are paid employees? (Two or more; One; None)
6	How many household members work and are not self-employed and are not domestic servants? (One or more; None)
5	What is the marital status of the female head/spouse? (Currently married; Widowed; No female head/spouse; Never married, living together, divorced, separated, or no data)
3	What is the marital status of the male head/spouse? (Never married; No female head/spouse; Currently married; Widowed, living together, divorced, separated, or no data)
2	Did the male head/spouse do any work at all, even one hour, during the past 7 days (worked on farm, private or public sector, own account or in a business belonging to someone else in your household etc.), or did the male head/spouse have a job from which he was temporarily absent (e.g., due to holiday or illness)? (Yes; No male head/spouse; No)
1	How many household members are own-account workers/self-employed? (None; One; Two or more)
1	What is the structure of household headship? (Both male and female heads/spouses; Female head/spouse only; Male head/spouse only)
0.7	Is the female head/spouse a paid employee? (No; Yes; No female head/spouse)
0.6	Does the household own a row boat or motor boat? (Yes; No)

Source: 2004 CSES and the national poverty line

National Poverty Line Tables

(and Tables Pertaining to All Nine Poverty Lines)

Figure 4 (National poverty 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	85.8
5–9	73.6
10–14	68.1
15–19	56.1
20–24	45.3
25–29	34.3
30–34	21.9
35–39	13.4
40–44	9.4
45–49	3.5
50–54	4.0
55–59	2.4
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 5 (National poverty line): Derivation of estimated poverty likelihoods associated with scores

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0–4	1,148	÷	1,338	=	85.8
5–9	1,812	÷	2,462	=	73.6
10–14	5,866	÷	8,619	=	68.1
15–19	5,067	÷	9,034	=	56.1
20–24	6,401	÷	14,127	=	45.3
25–29	4,669	÷	13,625	=	34.3
30–34	2,689	÷	12,305	=	21.9
35–39	1,656	÷	12,407	=	13.4
40–44	635	÷	6,774	=	9.4
45–49	169	÷	4,818	=	3.5
50–54	142	÷	3,540	=	4.0
55–59	72	÷	3,013	=	2.4
60–64	0	÷	2,544	=	0.0
65–69	0	÷	1,904	=	0.0
70–74	0	÷	1,592	=	0.0
75–79	0	÷	1,078	=	0.0
80–84	0	÷	693	=	0.0
85–89	0	÷	87	=	0.0
90–94	0	÷	0	=	#N/A
95–100	0	÷	40	=	0.0

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

Figure 6: Distribution of household poverty likelihoods across expenditure ranges demarcated by poverty lines

	Likelihood of having expenditure in range demarcated by poverty lines in KHR per day per person									
Score	<USAID <KHR1,383	=>USAID and <Food =>KHR1,383 and <KHR1,441	=>Food and <100% Natl. =>KHR1,441 and <KHR1,825	=>100% Natl. and <$1.25/day =>KHR1,825 and <KHR1,908	=>$1.25/day and <125% Natl. =>KHR1,908 and <KHR2,281	=>125% Natl. and <150% Natl. =>KHR2,281 and <KHR2,737	=>150% Natl. and <200% Natl. =>KHR2,737 and <KHR3,650	=>200% Natl. and <$2.50/day =>KHR3,650 and <KHR3,817	=>$2.50/day and <$3.75/day =>KHR3,817 and <KHR5,726	=>$3.75/day =>KHR5,726
0–4	75.4	0.0	10.4	0.0	3.1	8.5	2.6	0.0	0.0	0.0
5–9	44.7	6.2	22.7	2.7	8.1	9.7	3.8	0.0	2.1	0.0
10–14	44.3	2.4	21.4	3.2	14.0	6.4	4.8	0.4	2.6	0.7
15–19	27.8	3.9	24.4	6.0	16.2	8.6	8.4	1.3	1.2	2.3
20–24	19.3	5.3	20.7	5.1	15.4	13.0	12.9	0.2	6.4	1.8
25–29	12.7	2.7	18.9	5.5	19.0	16.6	14.6	1.7	6.9	1.4
30–34	7.6	0.4	13.8	4.1	16.6	15.7	21.1	3.1	11.4	6.2
35–39	4.3	1.3	7.8	2.8	13.1	15.8	24.0	3.5	19.3	8.2
40–44	2.7	0.4	6.4	2.9	7.9	15.3	27.6	3.1	19.2	14.7
45–49	0.0	0.0	3.5	1.0	5.4	13.0	26.9	4.1	29.5	16.6
50–54	0.7	1.4	1.9	0.5	3.8	6.7	22.0	0.6	30.0	32.4
55–59	0.0	0.0	2.4	0.0	2.3	6.2	15.6	3.4	28.0	42.1
60–64	0.0	0.0	0.0	0.0	3.0	6.1	14.9	3.6	27.5	45.0
65–69	0.0	0.0	0.0	0.0	1.4	1.1	20.1	2.4	27.4	47.7
70–74	0.0	0.0	0.0	0.0	0.0	1.9	6.3	3.7	26.0	62.2
75–79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	19.8	78.4
80–84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	25.4	65.1
85–89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
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

All poverty likelihoods in percentage units.

Figure 7 (National poverty line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–3.1	3.3	4.0	5.4
5–9	–8.9	6.0	6.3	6.8
10–14	–3.0	2.4	2.7	3.2
15–19	–2.0	2.2	2.6	3.2
20–24	–1.5	1.7	2.0	2.8
25–29	–1.0	1.7	1.9	2.5
30–34	+2.0	1.4	1.8	2.3
35–39	–1.9	1.6	1.7	1.9
40–44	+2.0	1.3	1.5	2.0
45–49	–0.3	1.2	1.4	1.8
50–54	+2.0	1.0	1.2	1.6
55–59	+1.9	0.5	0.5	0.7
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	–1.6	1.6	1.8	2.1
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 8 (National poverty 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	+0.7	60.9	73.1	82.2
4	–0.9	33.3	38.3	47.9
8	–0.4	24.3	28.4	36.0
16	–0.8	18.2	21.5	27.2
32	–0.7	11.9	14.2	19.2
64	–0.8	8.7	10.1	13.1
128	–0.9	6.3	7.4	9.7
256	–0.8	4.4	5.2	6.8
512	–0.8	3.0	3.7	5.0
1,024	–0.8	2.2	2.6	3.5
2,048	–0.8	1.5	1.8	2.3
4,096	–0.8	1.1	1.3	1.6
8,192	–0.8	0.7	0.9	1.1
16,384	–0.8	0.5	0.6	0.8

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, scorecard applied to the validation sample

	Poverty line																				
	National lines										USAID			Intl. 2005 PPP							
	100%		Food		125%		150%		200%		'Extreme'			$1.25/day		$2.50/day		$3.75/day			
Estimate minus true value																					
Scorecard applied to validation sample	–0.8		–0.4		+0.3		+0.3		+0.4		–0.5			+0.3		+0.6		–0.2			
Precision of difference																					
Scorecard applied to validation sample	0.5		0.4		0.6		0.5		0.5		0.4			0.5		0.5		0.4			
α for sample size																					
Scorecard applied to validation sample	0.89		0.89		0.86		0.84		0.83		0.92			0.89		0.84		0.86			
Precision is measured as 90-percent confidence intervals in units of +/– percentage points.																					
Differences and precision estimated from 500 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 (All poverty lines): Possible types of outcomes from targeting by poverty score

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

Figure 11 (National poverty 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	1.2	29.9	0.2	68.7	69.9	–91.9
5–9	3.2	27.9	0.6	68.3	71.5	–77.5
10–14	9.3	21.8	3.1	65.8	75.1	–30.1
15–19	14.5	16.6	6.9	62.0	76.5	+15.6
20–24	21.2	9.9	14.4	54.5	75.7	+53.7
25–29	25.9	5.2	23.3	45.6	71.6	+25.2
30–34	28.4	2.7	33.1	35.8	64.2	–6.3
35–39	30.3	0.8	43.6	25.3	55.6	–40.1
40–44	30.8	0.3	49.9	19.0	49.8	–60.2
45–49	31.0	0.1	54.5	14.4	45.4	–75.1
50–54	31.1	0.0	58.0	10.9	42.0	–86.3
55–59	31.1	0.0	61.0	7.9	39.0	–95.9
60–64	31.1	0.0	63.5	5.4	36.5	–104.1
65–69	31.1	0.0	65.4	3.5	34.6	–110.2
70–74	31.1	0.0	67.0	1.9	33.0	–115.3
75–79	31.1	0.0	68.1	0.8	31.9	–118.7
80–84	31.1	0.0	68.8	0.1	31.2	–120.9
85–89	31.1	0.0	68.8	0.0	31.2	–121.2
90–94	31.1	0.0	68.8	0.0	31.2	–121.2
95–100	31.1	0.0	68.9	0.0	31.1	–121.4

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

Figure 12 (National poverty line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	88.4	3.8	7.6:1
5–9	3.8	84.2	10.3	5.3:1
10–14	12.4	75.1	30.0	3.0:1
15–19	21.5	67.7	46.7	2.1:1
20–24	35.6	59.5	68.1	1.5:1
25–29	49.2	52.7	83.4	1.1:1
30–34	61.5	46.2	91.4	0.9:1
35–39	73.9	41.0	97.4	0.7:1
40–44	80.7	38.2	99.1	0.6:1
45–49	85.5	36.3	99.7	0.6:1
50–54	89.0	34.9	99.9	0.5:1
55–59	92.1	33.8	99.9	0.5:1
60–64	94.6	32.9	99.9	0.5:1
65–69	96.5	32.2	99.9	0.5:1
70–74	98.1	31.7	99.9	0.5:1
75–79	99.2	31.4	100.0	0.5:1
80–84	99.9	31.2	100.0	0.5:1
85–89	100.0	31.1	100.0	0.5:1
90–94	100.0	31.1	100.0	0.5:1
95–100	100.0	31.1	100.0	0.5:1

National Food Poverty Line Tables

Figure 4 (National 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	75.4
5–9	50.9
10–14	46.6
15–19	31.7
20–24	24.6
25–29	15.4
30–34	8.0
35–39	5.6
40–44	3.0
45–49	0.0
50–54	2.1
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 7 (National food line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–5.3	4.7	5.1	6.9
5–9	–12.4	8.2	8.6	9.4
10–14	–1.1	2.1	2.7	3.6
15–19	–4.5	3.3	3.5	3.9
20–24	+1.4	1.4	1.7	2.2
25–29	–1.1	1.3	1.5	2.0
30–34	+1.0	1.0	1.2	1.5
35–39	+1.8	0.7	0.8	1.0
40–44	+1.4	0.6	0.7	1.0
45–49	–0.9	0.7	0.8	0.9
50–54	+2.1	0.0	0.0	0.0
55–59	–0.5	0.5	0.5	0.7
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 8 (National 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	–1.5	61.0	65.6	71.5
4	–0.4	27.6	31.5	37.5
8	+0.3	19.4	22.0	29.5
16	–0.2	14.5	17.1	22.2
32	–0.3	9.9	11.5	14.7
64	–0.3	7.4	8.8	11.5
128	–0.3	5.3	6.2	8.6
256	–0.3	3.6	4.4	6.2
512	–0.4	2.6	3.0	4.0
1,024	–0.4	1.7	2.0	2.6
2,048	–0.4	1.2	1.4	2.0
4,096	–0.4	0.8	1.0	1.4
8,192	–0.4	0.6	0.7	1.0
16,384	–0.4	0.4	0.5	0.7

Figure 11 (National 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	1.1	16.1	0.3	82.6	83.7	–86.0
5–9	2.6	14.5	1.2	81.7	84.4	–62.4
10–14	6.7	10.4	5.7	77.2	83.9	+11.8
15–19	10.0	7.1	11.5	71.4	81.4	+32.9
20–24	13.3	3.9	22.3	60.6	73.8	–30.4
25–29	15.5	1.6	33.7	49.2	64.8	–96.7
30–34	16.4	0.7	45.1	37.8	54.2	–163.6
35–39	16.9	0.2	57.0	25.9	42.8	–233.0
40–44	17.0	0.1	63.7	19.2	36.3	–271.9
45–49	17.1	0.0	68.4	14.5	31.6	–299.8
50–54	17.1	0.0	72.0	10.9	28.0	–320.4
55–59	17.1	0.0	74.9	7.9	25.1	–337.9
60–64	17.1	0.0	77.5	5.4	22.5	–352.8
65–69	17.1	0.0	79.4	3.5	20.6	–363.9
70–74	17.1	0.0	81.0	1.9	19.0	–373.2
75–79	17.1	0.0	82.1	0.8	17.9	–379.5
80–84	17.1	0.0	82.8	0.1	17.2	–383.6
85–89	17.1	0.0	82.8	0.0	17.2	–384.1
90–94	17.1	0.0	82.8	0.0	17.2	–384.1
95–100	17.1	0.0	82.9	0.0	17.1	–384.3

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

Figure 12 (National food line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	79.5	6.2	3.9:1
5–9	3.8	69.4	15.4	2.3:1
10–14	12.4	54.1	39.2	1.2:1
15–19	21.5	46.5	58.3	0.9:1
20–24	35.6	37.3	77.5	0.6:1
25–29	49.2	31.6	90.8	0.5:1
30–34	61.5	26.7	95.9	0.4:1
35–39	73.9	22.9	98.9	0.3:1
40–44	80.7	21.1	99.6	0.3:1
45–49	85.5	20.0	99.9	0.2:1
50–54	89.0	19.2	99.9	0.2:1
55–59	92.1	18.6	100.0	0.2:1
60–64	94.6	18.1	100.0	0.2:1
65–69	96.5	17.7	100.0	0.2:1
70–74	98.1	17.4	100.0	0.2:1
75–79	99.2	17.3	100.0	0.2:1
80–84	99.9	17.1	100.0	0.2:1
85–89	100.0	17.1	100.0	0.2:1
90–94	100.0	17.1	100.0	0.2:1
95–100	100.0	17.1	100.0	0.2:1

125% of the National Poverty Line Tables

Figure 4 (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	88.9
5–9	84.4
10–14	85.3
15–19	78.2
20–24	65.8
25–29	58.8
30–34	42.5
35–39	29.2
40–44	20.2
45–49	10.0
50–54	8.3
55–59	4.7
60–64	3.0
65–69	1.4
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 7 (125% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–4.5	3.4	3.7	4.4
5–9	–11.7	6.6	6.7	6.9
10–14	+0.5	1.6	1.9	2.7
15–19	+2.1	1.9	2.2	2.9
20–24	+0.1	1.7	1.9	2.5
25–29	+0.2	1.6	2.0	2.5
30–34	+3.2	1.8	2.2	3.2
35–39	–0.5	1.7	2.0	2.5
40–44	+1.9	1.9	2.3	3.1
45–49	–2.1	2.0	2.3	3.0
50–54	–1.5	2.1	2.5	3.5
55–59	+1.5	1.3	1.5	1.9
60–64	+1.9	0.9	1.0	1.4
65–69	+0.4	0.9	1.1	1.4
70–74	+0.0	0.0	0.0	0.0
75–79	–1.6	1.6	1.8	2.1
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 8 (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	+2.2	61.6	74.5	88.1
4	+0.5	33.8	39.5	52.0
8	+0.9	23.9	29.3	38.7
16	+0.4	18.4	22.0	29.0
32	+0.4	12.6	14.8	19.4
64	+0.3	8.9	10.5	12.9
128	+0.2	6.4	7.3	10.4
256	+0.3	4.4	5.5	7.0
512	+0.3	3.0	3.6	5.1
1,024	+0.3	2.3	2.7	3.4
2,048	+0.3	1.5	1.7	2.4
4,096	+0.3	1.1	1.3	1.6
8,192	+0.3	0.8	0.9	1.1
16,384	+0.3	0.6	0.6	0.8

Figure 11 (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	1.2	44.9	0.1	53.8	55.0	–94.4
5–9	3.6	42.5	0.2	53.7	57.3	–83.9
10–14	10.9	35.2	1.5	52.4	63.4	–49.3
15–19	17.8	28.3	3.6	50.3	68.1	–14.8
20–24	27.2	18.9	8.4	45.5	72.7	+36.2
25–29	35.1	11.0	14.1	39.8	75.0	+69.5
30–34	40.0	6.1	21.5	32.4	72.4	+53.3
35–39	43.7	2.4	30.2	23.7	67.4	+34.5
40–44	45.0	1.1	35.7	18.2	63.2	+22.6
45–49	45.6	0.5	39.9	14.0	59.6	+13.4
50–54	45.9	0.2	43.1	10.8	56.7	+6.5
55–59	46.0	0.1	46.0	7.9	53.9	+0.2
60–64	46.1	0.0	48.5	5.4	51.4	–5.3
65–69	46.1	0.0	50.4	3.5	49.6	–9.4
70–74	46.1	0.0	52.0	1.9	48.0	–12.8
75–79	46.1	0.0	53.1	0.8	46.9	–15.1
80–84	46.1	0.0	53.8	0.1	46.2	–16.6
85–89	46.1	0.0	53.9	0.0	46.1	–16.8
90–94	46.1	0.0	53.9	0.0	46.1	–16.8
95–100	46.1	0.0	53.9	0.0	46.1	–16.9

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

Figure 12 (125% of the national line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	92.7	2.7	12.7:1
5–9	3.8	94.7	7.8	17.9:1
10–14	12.4	88.2	23.7	7.4:1
15–19	21.5	83.1	38.7	4.9:1
20–24	35.6	76.5	59.0	3.2:1
25–29	49.2	71.4	76.2	2.5:1
30–34	61.5	65.0	86.7	1.9:1
35–39	73.9	59.2	94.9	1.4:1
40–44	80.7	55.8	97.6	1.3:1
45–49	85.5	53.3	98.9	1.1:1
50–54	89.0	51.6	99.6	1.1:1
55–59	92.1	50.0	99.9	1.0:1
60–64	94.6	48.7	99.9	0.9:1
65–69	96.5	47.7	100.0	0.9:1
70–74	98.1	47.0	100.0	0.9:1
75–79	99.2	46.5	100.0	0.9:1
80–84	99.9	46.2	100.0	0.9:1
85–89	100.0	46.1	100.0	0.9:1
90–94	100.0	46.1	100.0	0.9:1
95–100	100.0	46.1	100.0	0.9:1

150% of the National Poverty Line Tables

Figure 4 (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	97.4
5–9	94.2
10–14	91.6
15–19	86.9
20–24	78.8
25–29	75.4
30–34	58.2
35–39	45.0
40–44	35.4
45–49	23.0
50–54	15.0
55–59	10.9
60–64	9.1
65–69	2.4
70–74	1.9
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 7 (150% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+2.2	2.5	3.0	3.8
5–9	–4.5	2.7	2.8	2.9
10–14	+0.2	1.3	1.6	2.0
15–19	–1.0	1.4	1.7	2.2
20–24	+0.4	1.4	1.7	2.2
25–29	+3.0	1.5	1.9	2.4
30–34	+0.7	1.9	2.3	3.3
35–39	+0.3	1.8	2.2	2.8
40–44	+1.5	2.3	2.9	3.7
45–49	–2.2	2.5	3.0	4.0
50–54	–7.2	5.1	5.4	6.5
55–59	+1.3	2.2	2.6	3.5
60–64	+4.1	1.8	2.1	2.8
65–69	–1.2	1.8	2.1	2.7
70–74	+1.9	0.0	0.0	0.0
75–79	–2.0	1.9	2.1	2.4
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 8 (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	+2.1	69.3	77.9	89.4
4	+0.9	33.8	39.5	52.0
8	+0.9	23.9	29.7	37.5
16	+0.3	17.6	20.2	27.6
32	+0.4	12.1	14.9	19.3
64	+0.4	8.9	10.4	13.3
128	+0.3	6.1	7.2	10.3
256	+0.3	4.3	5.2	6.9
512	+0.4	3.0	3.6	4.4
1,024	+0.4	2.1	2.5	3.4
2,048	+0.3	1.5	1.8	2.5
4,096	+0.3	1.0	1.2	1.8
8,192	+0.3	0.8	1.0	1.2
16,384	+0.3	0.5	0.6	0.9

Figure 11 (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	1.3	56.7	0.1	41.9	43.2	–95.5
5–9	3.7	54.3	0.1	41.9	45.6	–87.1
10–14	11.7	46.4	0.8	41.2	52.9	–58.5
15–19	19.6	38.4	1.9	40.1	59.7	–29.3
20–24	30.7	27.3	4.9	37.1	67.8	+14.3
25–29	40.5	17.5	8.7	33.3	73.7	+54.6
30–34	47.6	10.5	14.0	28.0	75.6	+75.9
35–39	53.1	4.9	20.8	21.2	74.3	+64.2
40–44	55.5	2.5	25.2	16.8	72.3	+56.6
45–49	56.7	1.3	28.8	13.2	69.9	+50.3
50–54	57.5	0.5	31.6	10.4	67.9	+45.6
55–59	57.8	0.2	34.3	7.7	65.5	+40.9
60–64	57.9	0.1	36.7	5.3	63.2	+36.7
65–69	58.0	0.0	38.5	3.5	61.4	+33.6
70–74	58.0	0.0	40.1	1.9	59.8	+30.8
75–79	58.0	0.0	41.2	0.8	58.8	+29.0
80–84	58.0	0.0	41.9	0.1	58.1	+27.8
85–89	58.0	0.0	42.0	0.0	58.0	+27.7
90–94	58.0	0.0	42.0	0.0	58.0	+27.7
95–100	58.0	0.0	42.0	0.0	58.0	+27.6

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

Figure 12 (150% of the national line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	95.6	2.2	21.6:1
5–9	3.8	97.7	6.4	41.6:1
10–14	12.4	93.8	20.1	15.2:1
15–19	21.5	91.3	33.8	10.5:1
20–24	35.6	86.3	52.9	6.3:1
25–29	49.2	82.2	69.8	4.6:1
30–34	61.5	77.3	82.0	3.4:1
35–39	73.9	71.9	91.6	2.6:1
40–44	80.7	68.8	95.7	2.2:1
45–49	85.5	66.3	97.7	2.0:1
50–54	89.0	64.5	99.1	1.8:1
55–59	92.1	62.8	99.6	1.7:1
60–64	94.6	61.2	99.8	1.6:1
65–69	96.5	60.1	99.9	1.5:1
70–74	98.1	59.1	99.9	1.4:1
75–79	99.2	58.5	100.0	1.4:1
80–84	99.9	58.1	100.0	1.4:1
85–89	100.0	58.0	100.0	1.4:1
90–94	100.0	58.0	100.0	1.4:1
95–100	100.0	58.0	100.0	1.4:1

200% of the National Poverty Line Tables

Figure 4 (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	97.9
10–14	96.4
15–19	95.3
20–24	91.6
25–29	90.0
30–34	79.4
35–39	69.0
40–44	63.0
45–49	49.8
50–54	37.0
55–59	26.5
60–64	23.9
65–69	22.5
70–74	8.2
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 7 (200% of the national line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+4.8	2.5	3.0	3.8
5–9	–2.1	1.0	1.0	1.0
10–14	+0.2	0.9	1.1	1.4
15–19	+1.4	1.0	1.3	1.7
20–24	+0.5	1.0	1.2	1.5
25–29	+1.9	1.1	1.4	1.9
30–34	–1.2	1.6	1.8	2.4
35–39	–2.0	1.9	2.0	2.7
40–44	+1.9	2.4	2.9	3.7
45–49	–0.4	3.0	3.5	4.8
50–54	–3.1	3.5	4.2	5.5
55–59	+3.3	3.1	3.7	4.9
60–64	–1.2	4.0	4.7	5.9
65–69	+14.6	2.6	3.0	3.8
70–74	+0.8	2.5	3.1	4.0
75–79	–2.4	2.2	2.4	2.7
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 8 (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	+2.1	64.8	76.5	86.3
4	+1.2	29.6	35.1	47.1
8	+0.7	22.1	24.8	33.8
16	+0.2	14.9	17.6	22.7
32	+0.3	10.5	12.7	16.7
64	+0.4	7.5	9.0	11.9
128	+0.3	5.4	6.4	8.6
256	+0.4	3.7	4.4	6.0
512	+0.4	2.6	3.1	4.3
1,024	+0.5	1.9	2.2	3.0
2,048	+0.4	1.3	1.6	2.1
4,096	+0.4	0.9	1.1	1.5
8,192	+0.4	0.7	0.9	1.1
16,384	+0.4	0.5	0.6	0.8

Figure 11 (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	1.3	72.5	0.1	26.2	27.4	–96.5
5–9	3.7	70.0	0.1	26.2	29.9	–89.8
10–14	12.1	61.7	0.3	25.9	38.0	–66.8
15–19	20.6	53.2	0.9	25.3	45.9	–43.0
20–24	33.5	40.3	2.1	24.1	57.7	–6.4
25–29	45.5	28.3	3.7	22.5	68.0	+28.3
30–34	55.4	18.4	6.2	20.1	75.4	+58.4
35–39	64.2	9.6	9.8	16.5	80.6	+86.8
40–44	68.4	5.4	12.3	13.9	82.2	+83.3
45–49	70.8	3.0	14.7	11.5	82.2	+80.0
50–54	72.2	1.6	16.9	9.3	81.5	+77.1
55–59	72.9	0.9	19.2	7.0	79.9	+74.0
60–64	73.5	0.3	21.2	5.1	78.5	+71.3
65–69	73.6	0.2	22.9	3.3	76.9	+69.0
70–74	73.7	0.0	24.4	1.9	75.6	+67.0
75–79	73.8	0.0	25.4	0.8	74.6	+65.6
80–84	73.8	0.0	26.1	0.1	73.9	+64.6
85–89	73.8	0.0	26.2	0.0	73.8	+64.5
90–94	73.8	0.0	26.2	0.0	73.8	+64.5
95–100	73.8	0.0	26.2	0.0	73.8	+64.5

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

Figure 12 (200% of the national line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	95.6	1.7	21.6:1
5–9	3.8	98.4	5.1	63.1:1
10–14	12.4	97.3	16.4	36.2:1
15–19	21.5	95.9	27.9	23.4:1
20–24	35.6	94.2	45.4	16.2:1
25–29	49.2	92.4	61.6	12.2:1
30–34	61.5	90.0	75.0	9.0:1
35–39	73.9	86.8	87.0	6.6:1
40–44	80.7	84.7	92.6	5.5:1
45–49	85.5	82.8	95.9	4.8:1
50–54	89.0	81.0	97.8	4.3:1
55–59	92.1	79.2	98.8	3.8:1
60–64	94.6	77.6	99.5	3.5:1
65–69	96.5	76.3	99.8	3.2:1
70–74	98.1	75.2	99.9	3.0:1
75–79	99.2	74.4	100.0	2.9:1
80–84	99.9	73.9	100.0	2.8:1
85–89	100.0	73.8	100.0	2.8:1
90–94	100.0	73.8	100.0	2.8:1
95–100	100.0	73.8	100.0	2.8:1

USAID "Extreme" Poverty Line Tables

Figure 4 (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	75.4
5–9	44.7
10–14	44.3
15–19	27.8
20–24	19.3
25–29	12.7
30–34	7.6
35–39	4.3
40–44	2.7
45–49	0.0
50–54	0.7
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 7 (USAID 'extreme' line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–5.3	4.7	5.1	6.9
5–9	–14.4	9.2	9.6	10.4
10–14	+1.8	2.2	2.6	3.5
15–19	–2.9	2.4	2.6	3.1
20–24	–0.2	1.4	1.7	2.2
25–29	–2.0	1.6	1.7	2.0
30–34	+1.6	0.9	1.1	1.4
35–39	+0.7	0.7	0.8	1.1
40–44	+1.0	0.6	0.7	1.0
45–49	–0.8	0.7	0.8	0.9
50–54	+0.7	0.0	0.0	0.0
55–59	–0.5	0.5	0.5	0.7
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 8 (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	–1.6	62.5	65.8	68.5
4	–0.6	26.5	30.8	38.1
8	+0.0	18.5	21.7	28.4
16	–0.5	14.1	16.6	21.6
32	–0.5	9.7	11.2	13.9
64	–0.5	7.2	8.4	10.8
128	–0.5	5.2	5.9	8.1
256	–0.5	3.5	4.2	5.9
512	–0.5	2.5	3.0	3.9
1,024	–0.5	1.7	2.0	2.7
2,048	–0.5	1.2	1.4	1.8
4,096	–0.6	0.9	1.0	1.3
8,192	–0.6	0.6	0.7	0.9
16,384	–0.5	0.4	0.5	0.7

Figure 11 (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	1.1	14.1	0.3	84.6	85.6	–84.2
5–9	2.5	12.6	1.3	83.6	86.1	–58.1
10–14	6.2	9.0	6.2	78.6	84.8	+22.7
15–19	9.0	6.2	12.5	72.4	81.3	+17.5
20–24	11.7	3.4	23.8	61.0	72.7	–57.4
25–29	13.8	1.4	35.4	49.4	63.2	–133.9
30–34	14.5	0.7	47.0	37.8	52.3	–210.3
35–39	15.0	0.2	58.9	25.9	40.9	–289.0
40–44	15.1	0.1	65.6	19.2	34.3	–332.9
45–49	15.1	0.0	70.4	14.5	29.6	–364.4
50–54	15.1	0.0	73.9	10.9	26.1	–387.8
55–59	15.2	0.0	76.9	7.9	23.1	–407.5
60–64	15.2	0.0	79.5	5.4	20.5	–424.3
65–69	15.2	0.0	81.4	3.5	18.6	–436.9
70–74	15.2	0.0	82.9	1.9	17.1	–447.4
75–79	15.2	0.0	84.0	0.8	16.0	–454.5
80–84	15.2	0.0	84.7	0.1	15.3	–459.1
85–89	15.2	0.0	84.8	0.0	15.2	–459.7
90–94	15.2	0.0	84.8	0.0	15.2	–459.7
95–100	15.2	0.0	84.8	0.0	15.2	–459.9

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

Figure 12 (USAID 'extreme' line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	79.5	7.0	3.9:1
5–9	3.8	67.0	16.8	2.0:1
10–14	12.4	49.8	40.8	1.0:1
15–19	21.5	41.8	59.1	0.7:1
20–24	35.6	33.0	77.4	0.5:1
25–29	49.2	28.0	90.9	0.4:1
30–34	61.5	23.6	95.7	0.3:1
35–39	73.9	20.3	98.8	0.3:1
40–44	80.7	18.7	99.6	0.2:1
45–49	85.5	17.7	99.9	0.2:1
50–54	89.0	17.0	99.9	0.2:1
55–59	92.1	16.5	100.0	0.2:1
60–64	94.6	16.0	100.0	0.2:1
65–69	96.5	15.7	100.0	0.2:1
70–74	98.1	15.4	100.0	0.2:1
75–79	99.2	15.3	100.0	0.2:1
80–84	99.9	15.2	100.0	0.2:1
85–89	100.0	15.2	100.0	0.2:1
90–94	100.0	15.2	100.0	0.2:1
95–100	100.0	15.2	100.0	0.2:1

$1.25/day 2005 PPP Poverty Line Tables

Figure 4 ($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	85.8
5–9	76.3
10–14	71.3
15–19	62.1
20–24	50.4
25–29	39.8
30–34	25.9
35–39	16.1
40–44	12.3
45–49	4.5
50–54	4.5
55–59	2.4
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 7 ($1.25/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	–5.5	4.2	4.5	5.0
5–9	–9.7	6.3	6.5	7.2
10–14	–2.0	2.0	2.3	3.0
15–19	+2.0	2.2	2.5	3.3
20–24	–0.4	1.7	2.0	2.8
25–29	+0.8	1.7	2.0	2.6
30–34	+4.2	1.5	1.8	2.4
35–39	–1.5	1.5	1.7	2.2
40–44	+3.0	1.4	1.7	2.2
45–49	–1.2	1.4	1.6	2.1
50–54	+0.7	1.4	1.7	2.2
55–59	+1.0	0.9	1.0	1.4
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	–1.6	1.6	1.8	2.1
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 8 ($1.25/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+1.9	61.2	68.1	84.6
4	+0.2	33.3	38.8	47.8
8	+0.8	24.5	29.0	35.8
16	+0.3	18.5	22.2	27.6
32	+0.4	12.1	14.9	18.5
64	+0.3	8.9	10.8	13.3
128	+0.2	6.6	7.7	9.9
256	+0.3	4.6	5.3	6.8
512	+0.3	3.0	3.8	5.1
1,024	+0.3	2.2	2.5	3.4
2,048	+0.3	1.5	1.8	2.4
4,096	+0.3	1.1	1.3	1.7
8,192	+0.3	0.7	0.9	1.1
16,384	+0.3	0.5	0.6	0.8

Figure 11 ($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	1.2	32.3	0.1	66.3	67.5	–92.4
5–9	3.3	30.2	0.5	66.0	69.3	–78.8
10–14	9.7	23.9	2.8	63.7	73.4	–34.2
15–19	15.1	18.5	6.4	60.0	75.1	+8.8
20–24	22.3	11.3	13.3	53.1	75.4	+60.3
25–29	27.5	6.0	21.7	44.8	72.3	+35.4
30–34	30.3	3.3	31.3	35.2	65.4	+6.9
35–39	32.4	1.1	41.5	25.0	57.4	–23.6
40–44	33.1	0.5	47.6	18.8	51.9	–41.8
45–49	33.4	0.2	52.1	14.3	47.7	–55.4
50–54	33.5	0.1	55.6	10.9	44.4	–65.5
55–59	33.5	0.0	58.5	7.9	41.5	–74.4
60–64	33.5	0.0	61.1	5.4	38.9	–82.0
65–69	33.5	0.0	63.0	3.5	37.0	–87.6
70–74	33.5	0.0	64.6	1.9	35.4	–92.4
75–79	33.6	0.0	65.6	0.8	34.4	–95.5
80–84	33.6	0.0	66.3	0.1	33.7	–97.6
85–89	33.6	0.0	66.4	0.0	33.6	–97.8
90–94	33.6	0.0	66.4	0.0	33.6	–97.8
95–100	33.6	0.0	66.4	0.0	33.6	–98.0

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

Figure 12 ($1.25/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	90.6	3.6	9.7:1
5–9	3.8	87.5	9.9	7.0:1
10–14	12.4	77.8	28.8	3.5:1
15–19	21.5	70.2	44.8	2.4:1
20–24	35.6	62.6	66.4	1.7:1
25–29	49.2	55.9	82.0	1.3:1
30–34	61.5	49.2	90.2	1.0:1
35–39	73.9	43.9	96.7	0.8:1
40–44	80.7	41.0	98.6	0.7:1
45–49	85.5	39.0	99.4	0.6:1
50–54	89.0	37.6	99.8	0.6:1
55–59	92.1	36.4	99.9	0.6:1
60–64	94.6	35.5	99.9	0.5:1
65–69	96.5	34.8	99.9	0.5:1
70–74	98.1	34.2	99.9	0.5:1
75–79	99.2	33.8	100.0	0.5:1
80–84	99.9	33.6	100.0	0.5:1
85–89	100.0	33.6	100.0	0.5:1
90–94	100.0	33.6	100.0	0.5:1
95–100	100.0	33.6	100.0	0.5:1

$2.50/day 2005 PPP Poverty Line Tables

Figure 4 ($2.50/day 2005 PPP line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	97.9
10–14	96.7
15–19	96.5
20–24	91.8
25–29	91.7
30–34	82.4
35–39	72.5
40–44	66.1
45–49	53.9
50–54	37.6
55–59	29.9
60–64	27.6
65–69	24.9
70–74	11.9
75–79	1.9
80–84	9.5
85–89	0.0
90–94	0.0
95–100	0.0

Figure 7 ($2.50/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+4.8	2.5	3.0	3.8
5–9	–2.1	1.0	1.0	1.0
10–14	–0.3	0.9	1.0	1.3
15–19	+2.6	1.0	1.3	1.7
20–24	–1.0	1.0	1.1	1.4
25–29	+3.2	1.1	1.4	1.8
30–34	–0.7	1.5	1.7	2.2
35–39	–1.0	1.7	1.9	2.6
40–44	+3.2	2.5	2.9	3.8
45–49	+1.1	2.9	3.5	4.4
50–54	–8.0	5.7	6.1	6.9
55–59	+2.9	3.3	3.9	5.0
60–64	+0.8	4.0	4.7	6.1
65–69	+8.2	3.8	4.4	5.7
70–74	+2.1	2.9	3.5	4.6
75–79	–1.1	1.8	2.2	2.8
80–84	+9.5	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 8 ($2.50/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (+/− percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+2.0	64.3	77.1	84.0
4	+1.1	29.2	35.0	48.0
8	+0.7	21.1	24.8	34.2
16	+0.2	14.6	17.3	22.8
32	+0.5	10.3	12.5	16.1
64	+0.5	7.4	9.0	11.8
128	+0.5	5.2	6.4	8.3
256	+0.6	3.7	4.4	5.9
512	+0.7	2.5	3.1	4.3
1,024	+0.7	1.8	2.2	3.0
2,048	+0.6	1.3	1.5	2.1
4,096	+0.6	0.9	1.1	1.5
8,192	+0.6	0.7	0.8	1.1
16,384	+0.6	0.5	0.5	0.8

Figure 11 ($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	1.3	74.3	0.1	24.3	25.6	–96.5
5–9	3.7	71.9	0.1	24.3	28.1	–90.0
10–14	12.2	63.5	0.3	24.1	36.3	–67.5
15–19	20.7	55.0	0.8	23.6	44.2	–44.3
20–24	33.8	41.8	1.7	22.6	56.5	–8.2
25–29	45.9	29.8	3.4	21.0	66.9	+25.7
30–34	56.1	19.6	5.4	18.9	75.0	+55.5
35–39	65.2	10.4	8.7	15.6	80.8	+83.9
40–44	69.5	6.1	11.2	13.2	82.7	+85.2
45–49	72.1	3.6	13.4	10.9	83.0	+82.2
50–54	73.6	2.0	15.4	9.0	82.6	+79.6
55–59	74.5	1.2	17.6	6.8	81.2	+76.7
60–64	75.1	0.5	19.5	4.9	80.0	+74.2
65–69	75.4	0.2	21.1	3.3	78.6	+72.1
70–74	75.6	0.1	22.5	1.8	77.4	+70.2
75–79	75.6	0.0	23.6	0.8	76.4	+68.9
80–84	75.6	0.0	24.2	0.1	75.8	+67.9
85–89	75.6	0.0	24.3	0.0	75.7	+67.8
90–94	75.6	0.0	24.3	0.0	75.7	+67.8
95–100	75.6	0.0	24.4	0.0	75.6	+67.8

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

Figure 12 ($2.50/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	95.6	1.7	21.6:1
5–9	3.8	98.4	4.9	63.1:1
10–14	12.4	97.9	16.1	47.7:1
15–19	21.5	96.3	27.3	25.8:1
20–24	35.6	95.1	44.7	19.3:1
25–29	49.2	93.2	60.6	13.7:1
30–34	61.5	91.2	74.1	10.3:1
35–39	73.9	88.2	86.2	7.5:1
40–44	80.7	86.1	91.9	6.2:1
45–49	85.5	84.3	95.3	5.4:1
50–54	89.0	82.7	97.4	4.8:1
55–59	92.1	80.9	98.5	4.2:1
60–64	94.6	79.4	99.3	3.8:1
65–69	96.5	78.1	99.7	3.6:1
70–74	98.1	77.0	99.9	3.4:1
75–79	99.2	76.3	100.0	3.2:1
80–84	99.9	75.7	100.0	3.1:1
85–89	100.0	75.7	100.0	3.1:1
90–94	100.0	75.7	100.0	3.1:1
95–100	100.0	75.6	100.0	3.1:1

$3.75/day 2005 PPP Poverty Line Tables

Figure 4 ($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	100.0
10–14	99.3
15–19	97.7
20–24	98.2
25–29	98.6
30–34	93.8
35–39	91.8
40–44	85.3
45–49	83.4
50–54	67.6
55–59	57.9
60–64	55.1
65–69	52.3
70–74	37.8
75–79	21.6
80–84	34.9
85–89	0.0
90–94	0.0
95–100	0.0

Figure 7 ($3.75/day 2005 PPP line): Bootstrapped differences between estimated and true poverty likelihoods for households in a large sample (n = 16,384) with confidence intervals, scorecard applied to the validation sample

	Difference between estimate and true value			
		Confidence interval (+/– percentage points)		
Score	Diff.	90-percent	95-percent	99-percent
0–4	+1.9	1.6	1.8	2.4
5–9	+0.0	0.0	0.0	0.0
10–14	–0.7	0.3	0.3	0.3
15–19	–0.5	0.6	0.7	0.9
20–24	+1.1	0.6	0.7	0.9
25–29	+2.1	0.6	0.7	1.0
30–34	–2.0	1.3	1.4	1.5
35–39	+0.4	1.0	1.2	1.5
40–44	–1.8	1.7	2.0	2.8
45–49	+3.7	2.4	2.8	3.8
50–54	–12.6	7.7	7.9	8.6
55–59	–6.8	5.1	5.6	6.3
60–64	–0.6	4.1	4.9	6.3
65–69	+7.5	4.9	5.6	7.6
70–74	+5.4	4.7	5.5	7.2
75–79	–8.5	7.6	8.4	10.5
80–84	+12.2	7.0	8.6	10.9
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 8 ($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	+0.7	50.0	68.4	80.2
4	+0.1	20.8	26.9	38.2
8	–0.2	15.0	18.9	26.3
16	–0.2	10.9	13.2	16.5
32	–0.3	7.9	9.4	12.1
64	–0.2	5.5	6.6	8.8
128	–0.3	3.7	4.8	6.0
256	–0.3	2.7	3.2	4.2
512	–0.3	1.9	2.4	3.4
1,024	–0.2	1.4	1.6	2.1
2,048	–0.2	1.0	1.2	1.5
4,096	–0.2	0.7	0.8	1.0
8,192	–0.2	0.5	0.6	0.8
16,384	–0.2	0.4	0.4	0.6

Figure 11 ($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	1.3	87.7	0.0	11.0	12.3	–97.0
5–9	3.8	85.2	0.0	11.0	14.7	–91.5
10–14	12.4	76.6	0.0	11.0	23.4	–72.1
15–19	21.3	67.7	0.2	10.8	32.1	–52.0
20–24	35.0	54.0	0.6	10.4	45.4	–20.7
25–29	48.1	40.9	1.1	9.9	58.1	+9.4
30–34	59.9	29.1	1.6	9.4	69.3	+36.4
35–39	71.3	17.7	2.6	8.4	79.6	+63.1
40–44	77.2	11.8	3.5	7.5	84.7	+77.4
45–49	81.1	7.9	4.4	6.6	87.6	+87.2
50–54	83.9	5.1	5.2	5.8	89.7	+94.2
55–59	85.8	3.2	6.3	4.7	90.6	+93.0
60–64	87.2	1.8	7.4	3.6	90.8	+91.7
65–69	88.0	1.0	8.5	2.5	90.5	+90.5
70–74	88.6	0.4	9.5	1.5	90.1	+89.3
75–79	88.9	0.1	10.3	0.7	89.6	+88.4
80–84	89.0	0.0	10.9	0.1	89.1	+87.8
85–89	89.0	0.0	11.0	0.0	89.0	+87.7
90–94	89.0	0.0	11.0	0.0	89.0	+87.7
95–100	89.0	0.0	11.0	0.0	89.0	+87.6

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

Figure 12 ($3.75/day 2005 PPP line): For a given score cut-off, the percentage of all households who are targeted (that is, have a score equal to or less than the cut-off), the percentage of targeted households who are poor (that is, below the poverty line), the percentage of poor households who are targeted, and the number of poor households who are successful targeted (coverage) per non-poor household mistakenly targeted (leakage), scorecard applied to the validation sample

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0–4	1.3	98.0	1.5	49.3:1
5–9	3.8	99.3	4.2	141.9:1
10–14	12.4	99.8	13.9	466.0:1
15–19	21.5	99.1	23.9	113.0:1
20–24	35.6	98.4	39.3	61.0:1
25–29	49.2	97.9	54.1	45.6:1
30–34	61.5	97.4	67.3	37.9:1
35–39	73.9	96.4	80.1	27.0:1
40–44	80.7	95.7	86.8	22.2:1
45–49	85.5	94.8	91.1	18.3:1
50–54	89.0	94.2	94.2	16.2:1
55–59	92.1	93.2	96.4	13.7:1
60–64	94.6	92.2	98.0	11.7:1
65–69	96.5	91.2	98.9	10.4:1
70–74	98.1	90.3	99.5	9.3:1
75–79	99.2	89.6	99.9	8.6:1
80–84	99.9	89.1	100.0	8.2:1
85–89	100.0	89.0	100.0	8.1:1
90–94	100.0	89.0	100.0	8.1:1
95–100	100.0	89.0	100.0	8.1:1