Simple Poverty Scorecard® Rwanda

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Iki gitabo hamwe n'izindi nyandiko ziboneka mu Kinyarwanda kuri
`SimplePovertyScorecard.com`.
This document is available in English at `SimplePovertyScorecard.com`.

Abstract

The Simple Poverty Scorecard® uses ten low-cost indicators from Rwanda's 2010/11 Integrated Household Living Standards 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 bias and precision are reported for a range of poverty lines. The scorecard is a practical way for pro-poor programs in Rwanda to measure poverty rates, to track changes in poverty rates over time, and to segment clients for targeted services.

Version note

This paper uses 2010/11 data. It replaces Schreiner (2010a), which uses 2005/6 data. The new scorecard should be used from now on. The new and old scorecards use the same definition of *poverty*, so legacy users can still measure change over time with a baseline from the old scorecard and a follow-up from the new scorecard.

Acknowledgements

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Simple Poverty Scorecard®

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

Indicator	Response	Points	Score
1. How many household members are 18-years-old or less?	A. Five or more	0	
	B. Four	2	
	C. Three	6	
	D. Two	11	
	E. One	20	
	F. None	29	
2. In the last 12 months, how many household members carried out any agricultural activity (whether farming, livestock, fishing, or forestry) for salary, wages, or in-kind compensation?	A. Two or more	0	
	B. One	3	
	C. None	6	
3. In the last 12 months, how many household members ran or operated a non-farm business for cash or profit for themselves, like a small shop or other income-generating activity?	A. None	0	
	B. One	3	
	C. Two or more	5	
4. Can the (oldest) female head/spouse read a letter or a simple note (regardless of language), or has she completed at least Primary 1?	A. No	0	
	B. Yes	2	
	C. No female head/spouse	4	
5. What is the main construction material of the exterior walls?	A. Mud bricks, logs with mud, plastic sheeting, or other	0	
	B. Mud bricks with cement (stucco), oven-fired bricks, logs with mud and cement, stones, cement blocks, or wooden planks	5	
6. What is the main material used for roofing the main dwelling?	A. Thatch/leaves/grass, clay tiles, bamboo, plastic/plywood/non-permanent materials, or other	0	
	B. Metal sheets/corrugated iron, or concrete	3	
7. What is the main source of lighting in the residence of the household?	A. Firewood	0	
	B. Batteries and bulb, biogas, or other	5	
	C. Lantern (*agatadowa*)	7	
	D. Candle, or oil lamp	9	
	E. Electricity (from any source), generator, or solar panel	20	
8. How many beds does the household own?	A. None	0	
	B. One	3	
	C. Two	5	
	D. Three or more	9	
9. How many mobile telephones does the household own?	A. None	0	
	B. One	5	
	C. Two or more	12	
10. In the past 12 months, has any household member grown food or other agricultural produce to eat or sell or raised cattle or poultry? If so, then how many head of cattle does the household currently own?	A. Did not farm	0	
	B. Farmed, but no cattle	1	
	C. Farmed, one head	3	
	D. Farmed, two or more heads	7	

SimplePovertyScorecard.com **Score:**

Back-page Worksheet: Household Membership and Occupation

In the scorecard header, record a unique interview identifier, the interview date, and the participant's sampling weight. Then record the name and identification number of the participant, of yourself as the field agent, and of the participants' service point.

Then read to the respondent: *Please tell me the names and ages of all members of your household. A* household *is a person or group of persons, related or unrelated, who—for at least 6 of the last 12 months—normally live and eat together in the same dwelling unit.* Record names, ages, and presence. List the head of the household first, even if he/she is not the respondent, is not a participant in your organization, or is absent. For your own later use with the fourth scorecard indicator, note the name of the (oldest) female head/spouse (if she exists). Mark whether each person is a household member based on the full set of rules in the "Guidelines to the Interpretation of Indicators". Count the members, and record the total in the scorecard header next to "Number of household members:". Mark each member who is 18-years-old or younger, count them, and circle the response to the first scorecard indicator.

For each household member who is at least 6-years-old, ask: *In the last 12 months, did <name> carry out any agricultural activity (whether farming, livestock, fishing, or forestry) for salary, wages, or in-kind compensation?* Also ask: *In the last 12 months, did <name> run or operate a non-farm business for cash or profit for themselves, like a small shop or other income-generating activity?* Based on the responses, circle responses for the second and third scorecard indicators.

Keep in mind the full rules in the "Guidelines for the Interpretation of Indicators".

First name	Age	Present at least 6 of the last 12 months?	Is <name> a household member? (apply rules)	Is <name> a member and 18-years-old or younger)?	If <name> is 6-years-old or older, then in the last 12 months, did he/she . . .	
					Do any agricultural activity (whether farming, livestock, fishing, or forestry) for pay?	Run or operate a non-farm business for cash or profit for themselves?
1.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
2.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
3.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
4.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
5.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
6.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
7.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
8.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
9.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
10.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
11.		No Yes	No Yes	Not member >18 ≤18	Not member/<6 No Yes	No Yes
Members:			# Yes:	# ≤18:	# Yes:	# Yes:

Look-up table to convert scores to poverty likelihoods: National poverty lines

| Score | Poverty likelihood (%) | | | | Poorest half below 100% natl. |
| | National | | | | |
	Food	100%	150%	200%	
0–4	98.3	99.5	100.0	100.0	98.2
5–9	77.2	93.4	98.1	99.2	75.6
10–14	72.0	90.3	97.7	99.1	69.7
15–19	57.3	83.2	95.6	98.3	56.3
20–24	38.7	71.2	91.0	96.9	38.6
25–29	28.8	63.0	90.6	96.1	28.3
30–34	19.3	50.2	83.0	94.4	18.2
35–39	14.0	34.7	70.5	87.1	12.6
40–44	9.2	27.7	58.4	78.9	6.5
45–49	5.0	17.0	45.1	67.8	3.4
50–54	2.7	11.0	30.5	56.3	2.0
55–59	0.6	6.0	25.4	42.8	0.5
60–64	0.4	2.0	14.0	27.8	0.0
65–69	0.2	0.9	7.3	18.6	0.0
70–74	0.0	0.0	3.6	9.9	0.0
75–79	0.0	0.0	1.3	7.2	0.0
80–84	0.0	0.0	0.5	4.9	0.0
85–89	0.0	0.0	0.4	1.0	0.0
90–94	0.0	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0	0.0

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

	Poverty likelihood (%)				
	International 2005 PPP				
Score	$1.25	$2.00	$2.50	$5.00	$8.44
0–4	100.0	100.0	100.0	100.0	100.0
5–9	97.5	99.2	99.8	100.0	100.0
10–14	96.7	99.1	99.7	100.0	100.0
15–19	94.3	98.6	99.6	100.0	100.0
20–24	88.2	97.4	99.1	100.0	100.0
25–29	85.1	96.9	98.7	99.9	100.0
30–34	76.6	95.9	98.3	99.9	100.0
35–39	60.4	90.6	95.7	99.9	100.0
40–44	50.8	83.3	91.2	99.5	99.9
45–49	36.4	73.2	85.2	98.5	99.9
50–54	21.2	61.5	77.2	95.7	99.9
55–59	17.4	46.6	61.0	90.4	98.6
60–64	7.7	31.1	44.4	80.2	94.8
65–69	3.4	17.7	28.0	69.4	86.2
70–74	1.8	10.1	18.2	55.6	74.3
75–79	0.2	8.2	14.8	50.8	65.7
80–84	0.2	2.1	8.7	28.2	58.1
85–89	0.2	0.6	2.4	16.8	45.6
90–94	0.0	0.0	0.0	10.9	45.6
95–100	0.0	0.0	0.0	0.0	45.6

Note on measuring changes in poverty rates over time using the old 2005/6 and new 2010/11 scorecards

This paper uses data from Rwanda's 2010/11 *Enquête Intégrale sur les Conditions de Vie des Ménages* (Integrated Household Living Standards Survey, EICV). It replaces Schreiner (2010a), which uses data from the 2005/6 EICV. The new Simple Poverty Scorecard® here should be used from now on.

Some pro-poor programs in Rwanda already use the old 2005/6 scorecard. Even after switching to the new 2010/11 scorecard, these legacy users can still estimate changes in poverty rates over time with existing baseline estimates from the old 2005/6 scorecard and follow-up estimates from the new 2010/11 scorecard. This is possible because both the new and old scorecards are calibrated to the same definition of *poverty.* For a given poverty line supported for both scorecards, valid estimates of change can be found as the difference between estimated poverty rates from a baseline measure with the old 2005/6 scorecard and from a follow-up measure with the new 2010/11 scorecard.

In sum, both first-time and legacy users should use the new 2010/11 scorecard from now on. Looking forward, this establishes the best baseline. Looking backward, legacy users of Rwanda's old 2005/6 Simple Poverty Scorecard® can still use existing estimates when measuring change.

Simple Poverty Scorecard® Rwanda

1. Introduction

This paper presents the Simple Poverty Scorecard®. Pro-poor programs in

Rwanda can use it to estimate the likelihood that a household has consumption 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 new scorecard here uses data from Rwanda's 2010/11 *Enquête Intégrale sur*

les Conditions de Vie des Ménages (Integrated Household Living Standards Survey,

EICV); it replaces the old scorecard in Schreiner (2010a) that uses data from the

2005/6 EICV. The new 2010/11 scorecard is more accurate, so from now on, only it

should be used. Because both the new and old scorecards are calibrated to the same

definition of *poverty*, existing users of the old 2005/6 scorecard can still estimate

changes in poverty rates over time with a baseline from the old 2005/6 scorecard and a

follow-up from the new 2010/11 scorecard.

The direct approach to poverty measurement via consumption surveys is difficult

and costly. As a case in point, Rwanda's 2010/11 EICV has 78 pages and includes

many hundreds of items, many of which may be asked multiple times (for example, for

each household member, for each agricultural plot, or for each food item). According to the National Institute of Statistics of Rwanda (NISR, 2012, p. 31), an enumerator visited each sampled household 10 times over 20 to 30 days.

In comparison, the indirect approach via the scorecard is simple, quick, and low-cost. It uses ten verifiable indicators (such as "What is the main material used for roofing the main dwelling?" and "How many beds does the household own?") to get a score that is highly correlated with poverty status as measured by the exhaustive EICV survey.

The Simple Poverty Scorecard® differs from "proxy-means tests" (Coady, Grosh, and Hoddinott, 2004) in that it is transparent, it is freely available,[1] and it is tailored to the capabilities and purposes not of national governments but rather of local, pro-poor organizations. The feasible poverty-measurement options for local organizations are typically blunt (such as rules based on land-ownership or housing quality) or subjective and relative (such as participatory wealth ranking facilitated by skilled field workers). Poverty measures from these approaches may be costly, their accuracy is unknown, and they are not comparable across places, organizations, nor time.

The scorecard can be used to measure the share of a program's participants who are below a given poverty line, for example, the Millennium Development Goals' line of $1.25/day at 2005 purchase-power parity (PPP). USAID microenterprise partners in Rwanda can use scoring with the $1.25/day 2005 PPP line to report how many of their

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[1] The Simple Poverty Scorecard® is not, however, in the public domain. Copyright for Rwanda is held by the sponsor and by Microfinance Risk Management, L.L.C.

participants are "very poor".[2] Scoring can also be used to measure net movement across a poverty line over time. In all these applications, the scorecard provides a consumption-based, objective tool with known accuracy. While consumption surveys are costly even for governments, some local pro-poor organizations may be able to implement a low-cost scorecard to help with monitoring poverty and (if desired) segmenting clients for targeted services.

The statistical approach here aims to be understood by non-specialists. After all, if managers are to adopt the scorecard on their own and apply it to inform their decisions, then 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 by local, pro-poor organizations. This is not because they do not work, but because they are often presented (when they are presented at all) as tables of regression coefficients incomprehensible to non-specialists (with cryptic indicator names such as "`LGHHSZ_2`" and with points with negative values and many decimal places). Thanks to the predictive-modeling phenomenon known as the "flat maximum", simple, transparent scoring approaches can be about as accurate as complex, opaque ones (Schreiner, 2012a; Caire and Schreiner, 2012).

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[2] USAID defines a household as *very poor* if its daily per-capita consumption is less than the highest of the $1.25/day line—RWF480 on average in Rwanda as a whole from November 2010 to October 2011—or the line (RWF246) that marks the poorest half of people below 100% of the national line. USAID (2014, p. 8) has approved the Simple Poverty Scorecard® (branded as the Progress Out of Poverty Index®) for use by their microenterprise partners.

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

The scorecard is based on data from the 2010/11 EICV from Rwanda's NISR. 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
- Applicable in all regions of Rwanda

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 about ten minutes.

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

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

Third, the scorecard can estimate changes in the poverty rate for a group of households (or for two independent samples of households, both of which are representative of the same population) between two points in time. For households in the group(s), this estimate is the average follow-up poverty likelihood versus the average baseline likelihood (Schreiner, 2015a).

The scorecard can also be used to segment participants for targeted services. To help managers choose appropriate targeting cut-offs 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 with data from the 2010/11 EICV. Scores from this one scorecard are calibrated to poverty likelihoods for 10 poverty lines, four of which are also supported by the old 2009/10 scorecard.

The new scorecard is constructed using half of the data from the 2010/11 EICV. That same half of the data is also used to calibrate scores to poverty likelihoods. The other half of the data is used to validate the scorecard's accuracy for estimating households' poverty likelihoods, for estimating groups' poverty rates at a point in time, and for segmenting clients.[3]

All three scoring-based estimators (the poverty likelihood of a household, the poverty rate of households at a point in time, and the change in the poverty rate of

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[3] Several scorecard indicators or response options differ between 2005/6 and 2010/11 in the EICV. This precludes testing the accuracy of estimates of change over time by applying the new 2010/11 scorecard to 2005/6 data.

households over time) are *unbiased*. That is, they match the true value on average in repeated samples when constructed from (and applied to) a single, unchanging population in which the relationship between scorecard indicators and poverty is constant. Like all predictive models, the scorecard here is constructed from a single sample and so misses the mark when applied (in this paper) to a validation sample. Furthermore, it is biased to some unknown extent when applied (in practice) to a different population or when applied after 2010/11.[4]

Thus, while the indirect scoring approach is less costly than the direct survey approach, it is also biased when applied in practice. (The survey approach is unbiased by definition.) There is bias because the scorecard necessarily assumes that future relationships between indicators and poverty in all possible groups of households will be the same as in the construction data. Of course, this assumption—inevitable in predictive modeling—holds only partly.

On average across 1,000 bootstraps of $n = 16{,}384$ from the validation sample, the difference between scorecard estimates of groups' poverty rates versus the true rates at a point in time for 100% of the national poverty line is 0.4 percentage points. Across all 10 poverty lines, the average absolute difference is about 1.1 percentage points, and the maximum absolute difference is 2.2 percentage points. These differences reflect sampling variation, not bias; the average difference would be zero if the 2010/11 EICV

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[4] Important examples include nationally representative samples at a later point in time or sub-groups that are not nationally representative (Diamond *et al.*, 2016; Tarozzi and Deaton, 2009).

survey was to be repeatedly re-fielded and divided into sub-samples before repeating the entire process of constructing and validating scorecards.

The 90-percent confidence intervals with $n = 16{,}384$ are ± 0.8 percentage points or less. For $n = 1{,}024$, the 90-percent intervals are ± 3.0 percentage points or less.

Section 2 below documents data and poverty lines. Sections 3 and 4 describe scorecard construction and offer guidelines for use in practice. Sections 5 and 6 tell how to estimate households' poverty likelihoods and groups' poverty rates at a point in time. Section 7 discusses estimating changes in poverty rates over time. Section 8 covers targeting. Section 9 places the scorecard here in the context of related exercises for Rwanda. The last section is a summary.

The "Guidelines for the Interpretation of Scorecard Indicators" tells how to ask questions (and how to interpret responses) so as to mimic practice in the NISR as closely as possible. These "Guidelines" (and the "Back-page Worksheet") are integral parts of the Simple Poverty Scorecard®.

2. Data and definitions of poverty status

This section discusses the data used to construct and validate the Simple

Poverty Scorecard®. It also documents the 10 poverty lines to which scores are

calibrated.

2.1   Data

The new scorecard is based on data from 14,308 households in the 2010/11

EICV. This is Rwanda's most recent national consumption survey.

For the purposes of the scorecard, the households in the 2010/11 EICV are

randomly divided into two sub-samples:

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

Fieldwork for the 2010/11 EICV ran from November 2010 to October 2011.

Consumption is measured in Rwanda Francs (RWF) in average prices for the country

as a whole during fieldwork.

2.2 Poverty rates at the household, person, or participant level

A *poverty rate* is the share of units in households in which total household consumption (divided by the number of adult-equivalents in the household or by the number of household members) is below a given poverty line. The unit of analysis is either the household itself or a person in the household. Each household member has the same poverty status (or estimated poverty likelihood) as the other household members.

To illustrate, suppose a program serves two households. The first household is poor (its per-adult-equivalent or per-capita consumption is less than a given poverty line), and it has three members, one of whom is a program participant. The second household is non-poor and has four members, two of whom are program participants.

Poverty rates are in terms of either households or people. If the program defines its *participants* as households, then the household level is relevant. The estimated household-level poverty rate is the equal-weighted average of poverty statuses (or estimated poverty likelihoods) across households with participants.[5] In the example here, this is $\dfrac{1 \cdot 1 + 1 \cdot 0}{1 + 1} = \dfrac{1}{2} = 0.5 = 50$ percent. In the "$1 \cdot 1$" term in the numerator, the first "1" is the first household's weight, and the second "1" is the first household's poverty status (poor). In the "$1 \cdot 0$" term in the numerator, the "1" is the second household's weight, and the "0" is the second household's poverty status (non-poor).

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[5] The examples here assume simple random sampling at the household level.

The "$1 + 1$" in the denominator is the sum of the weights of the two households. Each household has a weight of one (1) because the unit of analysis is the household.

Alternatively, a person-level rate is relevant if a program defines all people in households that benefit from its services as *participants*. In the example here, the person-level rate is the household-size-weighted average of poverty statuses for households with participants, or $\frac{3 \cdot 1 + 4 \cdot 0}{3 + 4} = \frac{3}{7} = 0.43 = 43$ percent. In the "$3 \cdot 1$" term in the numerator, the "3" is the first household's weight because it has three members, and the "1" is its poverty status (poor). In the "$4 \cdot 0$" term in the numerator, the "4" is the second household's weight because it has four members, and the zero is its poverty status (non-poor). The "$3 + 4$" in the denominator is the sum of the weights of the two households. A household's weight is its number of members because the unit of analysis is the household member.

As a final example, a program might count as *participants* only those household members with whom it deals with directly. For the example here, this means that some—but not all—household members are counted. The person-level rate is now the participant-weighted average of the poverty statuses of households with participants, or $\frac{1 \cdot 1 + 2 \cdot 0}{1 + 2} = \frac{1}{3} = 0.33 = 33$ percent. The first "1" in the "$1 \cdot 1$" in the numerator is the first household's weight because it has one participant, and the second "1" is its poverty status (poor). In the "$2 \cdot 0$" term in the numerator, the "2" is the second household's weight because it has two participants, and the zero is its poverty status (non-poor).

The "1 + 2" in the denominator is the sum of the weights of the two households. Each household's weight is its number of participants because the unit of analysis is the participant.

To sum up, estimated poverty rates are weighted averages of households' poverty statuses (or estimated poverty likelihoods), where the weights are the number of relevant units in the household. When reporting, organizations should make explicit the unit of analysis—household, household member, or participant—and explain why that unit is relevant.

Figure 1 reports poverty lines and poverty rates for households and people in the 2010/11 EICV for Rwanda as a whole and for the construction/calibration and validation sub-samples. Figure 2 reports poverty lines and poverty rates for the country as a whole and for each of Rwanda's five provinces. Household-level poverty rates are reported because—as shown above—household-level poverty likelihoods can be straightforwardly converted into poverty rates for other units of analysis. This is also why the Simple Poverty Scorecard® is constructed, calibrated, and validated with household weights. Person-level poverty rates are also included in Figures 1 and 2 because these are the rates reported by the government of Rwanda and because person-level rates are usually used in policy discussions.

In Figure 1, the all-Rwanda person-level poverty rate by 100% of the national poverty line is 44.9 percent, and the person-level rate for the food line is 24.1 percent. These two figures match those in NISR (2012, p. 5).

2.3 Definition of *poverty*

Poverty is whether a household is poor or non-poor. In Rwanda, this is determined by whether per-adult-equivalent or per-capita aggregate household consumption is below a given poverty line. Thus, a definition of *poverty* has two aspects: a measure of aggregate household consumption, and a poverty line.

The definition of *poverty* is the same in the 2005/6 and 2010/11 EICV. Both surveys define *consumption* the same[6] and both define the national poverty lines and the 2005 PPP lines the same. This means that estimated poverty rates from the new 2010/11 scorecard are comparable with estimates from the old 2005/6 scorecard.[7] Thus, a legacy user of the old scorecard can estimate change over time as the difference between a follow-up estimate from the new scorecard and a baseline estimate from the old scorecard.

2.4 Poverty lines

McKay and Greenwell (2007) document Rwanda's national poverty line, which was originally developed for the 2000/1 EICV. It uses the concept of *adult equivalents* to adjust for the fact that consumption needs vary by age and sex. Poverty lines are then adjusted to average prices in all of Rwanda during the 2010/11 fieldwork using food

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[6] NISR (2014, pp. 5, 29) states that the measure of aggregate household consumption is comparable across the 2005/6 and 2010/11 EICV.

[7] This holds for the four poverty lines supported for both the new and old scorecards: 100% and 150% of the national line, and $1.25 and $2.50/day 2005 PPP.

and non-food deflators by month and province. The food-price deflator uses semi-monthly data "collected by the MINAGRI Mercuriale programme of price-data collection (previously PASAR: *Programme d'Appui à la Securité Alimentaire au Rwanda*)" (p. 5). Deflators for non-food consumption items come from Rwanda's official consumer price index for urban areas, again by month and province.

Using the cost-of-basic-needs approach (Observatoire de la Pauvreté, no date; Ravallion and Bidani, 1994), the food line is defined as the cost of 2,500 Calories from the average consumption basket observed in the 2000/1 EICV among the poorest 60 percent of people. For the 2010/11 EICV and with average prices for all of Rwanda over the course of the fieldwork, this translates to an average food poverty line of RWF282 per adult equivalent per day, giving all-Rwanda food-poverty rates of 20.6 percent at the household level and 24.1 percent at the person level (Figure 1).

The national poverty line (sometimes called here "100% of the national line") is defined as the average total consumption for households whose actual food consumption is within ±10 percent of the food line. For Rwanda on average during the 2010/11 EICV, this is RWF402 per adult equivalent per day, giving all-Rwanda poverty rates of 40.2 percent at the household level and 44.9 percent at the person level (Figure 1).

Because pro-poor organizations in Rwanda may want to use different or various poverty lines, this paper calibrates scores from its single scorecard to poverty likelihoods for 10 lines:

- Food
- 100% of national
- 150% of national
- 200% of national
- Line marking the poorest half of people below 100% of the national line
- $1.25/day 2005 PPP
- $2.00/day
- $2.50/day
- $5.00/day
- $8.44/day

Four of these lines are also supported for Rwanda's old 2005/6 scorecard: 100% and 150% of national, and $1.25 and $2.50/day 2005 PPP. These four lines can be used when measuring change over time with a baseline from the old 2005/6 scorecard and a follow-up from the new 2010/11 scorecard.

How are these poverty lines defined? The lines for 150% and 200% of national are multiples of the national line.

The line that marks the poorest half of people below 100% of the national line is defined—separately in each of Rwanda's five provinces—as the median aggregate household per-adult-equivalent consumption of people (not households nor adult equivalents) below 100% of the national line (U.S. Congress, 2004).

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

- Average all-Rwanda \$1.25/day 2005 PPP poverty line in January 2006 (Schreiner, 2010a): RWF303.506
- Urban Consumer Price Index in January 2006 (Schreiner, 2010a): 124.3
- Average urban CPI during 2010/11 EICV fieldwork: 196.7[8]
- All-Rwanda average national poverty line (Figure 1): RWF402
- National poverty lines in Rwanda's five provinces (Figure 2)

Given the \$1.25/day 2005 PPP line in January 2006 (Schreiner, 2010a) of

RWF303.506, the line in average prices in Rwanda overall during the 2010/11 EICV

fieldwork is (Sillers, 2006):

$$\text{RWF303.506} \cdot \left(\frac{\text{CPI}_{\text{Ave. Nov. 2010 to Oct. 2011}}}{\text{CPI}_{\text{Jan. 2006}}} \right) = \text{RWF303.506} \cdot \left(\frac{196.7}{124.3} \right) = \text{RWF480.29}.$$

The 2005 PPP lines are multiples of the \$1.25/day line. The \$8.44/day line is the

75th percentile of per-capita income (not consumption) worldwide as measured by

Hammond *et al.* (2007).

The 2005 PPP lines apply to Rwanda on average. In a given province, the

\$1.25/day line is the all-Rwanda \$1.25/day line, multiplied the national line in that

province, and divided by Rwanda's average national line.

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[8] This splices CPI series from `statistics.gov.rw/sites/default/files/ user_uploads/files/books/CPI_time_series_May_2015.xls` (retrieved 29 June 2015) and reports from `statistics.gov.rw/survey/consumer-price-index-cpi-survey`.

For example, the $1.25/day 2005 PPP line in Kigali is the all-Rwanda $1.25/day line of RWF480 (Figure 1), multiplied by the national line in Kigali of RWF458 (Figure 2), and divided by the average all-Rwanda national line of RWF402 (Figure 1). This gives a $1.25/day line in Kigali of 480 x 458 ÷ 402 = RWF547 (Figure 2).[9]

The person-level $1.25/day poverty rate reported by the World Bank's PovcalNet[10] for the 2010/11 EICV is 63.0 percent. Thus is not far from the 61.7 percent in Figure 1. The $1.25/day estimate here is to be preferred (Schreiner, 2014) because PovcalNet does not report:

- Its line(s) in RWF
- The time/place of its price units
- Whether/how it adjusts for regional differences in prices
- How it deflates 2005 PPP factors

USAID microenterprise partners in Rwanda who use the Simple Poverty Scorecard® to report poverty rates to USAID should use the $1.25/day 2005 PPP line. This is because USAID defines the "very poor" as those people in households whose daily per-capita consumption is below the highest of the following poverty lines:

- The line that marks the poorest half of people below 100% of the national line (RWF246, with a person-level poverty rate of 22.5 percent, Figure 1)
- $1.25/day 2005 PPP (RWF480, with a person-level poverty rate of 61.7 percent)

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[9] Due to rounding in the example in the text, Figure 2 displays 548, not 547.

[10] `iresearch.worldbank.org/PovcalNet/index.htm`, retrieved 7 July 2015.

3. Scorecard construction

For Rwanda, about 75 candidate indicators are initially prepared in the areas of:

- Household composition (such as the number of members)
- Education (such as the literacy of the (oldest) female head/spouse)
- Housing (such as the type of roof and walls)
- Ownership of durable assets (such as beds or mobile telephones)

Figure 3 lists the candidate indicators, ordered by the entropy-based "uncertainty coefficient" (Goodman and Kruskal, 1979) that measures how well a given indicator predicts poverty status on its own.[11]

One application of the scorecard is to measure *changes* in poverty through time. Thus, when selecting indicators and holding other considerations constant, preference is given to more sensitive indicators. For example, the ownership of a bed is probably more likely to change in response to changes in poverty than is the age of the male head/spouse.

The scorecard itself is built using poverty status based on 100% of 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 power to rank households by poverty status is measured as "c" (SAS Institute Inc., 2004).

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[11] The uncertainty coefficient is not used as a criterion when selecting scorecard indicators; it is just a way to order the candidate indicators in Figure 3.

One of these one-indicator scorecards is then selected based on several factors (Schreiner *et al.*, 2014; Zeller, 2004). These include improvement in accuracy, likelihood of acceptance by users (judged by simplicity, cost of collection, and "face validity" in terms of experience, theory, and common sense), sensitivity to changes in poverty, variety among indicators, applicability across regions, tendency to have a slow-changing relationship with poverty over time, relevance for distinguishing among households at the poorer end of the distribution of consumption, and verifiability.

A series of two-indicator scorecards are then built, each adding a second indicator to the one-indicator scorecard selected from the first round. The best two-indicator scorecard is then selected, again using judgment to balance "c" with the non-statistical criteria. These steps are repeated until the scorecard has 10 indicators that work well together.

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

This algorithm is similar to common R^2-based stepwise least-squares regression. It differs from naïve stepwise in that the selection of indicators considers both statistical[12] and non-statistical criteria. The use of non-statistical criteria can improve robustness through time and helps ensure that indicators are simple, sensible, and acceptable to users.

The single scorecard here applies to all of Rwanda. Tests for Indonesia (World Bank, 2012), Bangladesh (Sharif, 2009), India and Mexico (Schreiner, 2006 and 2005a), Sri Lanka (Narayan and Yoshida, 2005), and Jamaica (Grosh and Baker, 1995) suggest that segmenting scorecards by urban/rural does not improve targeting accuracy much. In general, segmentation may improve the accuracy of estimates of poverty rates (Diamond *et al.*, 2016; Tarozzi and Deaton, 2009), but it may also increase the risk of overfitting (Haslett, 2012).

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[12] The statistical criterion for selecting an indicator is not the p values of its coefficients but rather the indicator's contribution to the ranking of households by poverty status.

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 the scorecard is actually used (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 train and convince its employees to use the scorecard properly (Schreiner, 2002). After all, most reasonable scorecards have similar targeting accuracy, thanks to the empirical phenomenon known as the "flat maximum" (Caire and Schreiner, 2012; Hand, 2006; Baesens *et al.*, 2003; Lovie and Lovie, 1986; Kolesar and Showers, 1985; Stillwell, Barron, and Edwards, 1983; Dawes, 1979; Wainer, 1976; Myers and Forgy, 1963). The bottleneck is less technical and more human, not statistics but organizational-change management. Accuracy is easier to achieve than adoption.

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

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

- Only 10 indicators
- Only "multiple-choice" indicators
- Only simple points (non-negative integers, and no arithmetic beyond addition)

A field worker using Rwanda's new 2010/11 scorecard would:

- Record the interview identifier, the date of the interview, the county code ("RWA"), the scorecard code ("002") and the sampling weight assigned by the survey design to the household of the participant
- Record the names and identifiers of the participant (who is not necessarily the respondent), field agent, and relevant organizational service point
- Complete the back-page worksheet with each household member's:
  — First name
  — Age
  — Presence in the household for at least six of the last 12 months
  — Whether the person qualifies as a *household member*
  — Whether the person is a household member and is 18-years-old or younger
  — If the person is a household member who is 6-years-old or older, whether he/she did any agricultural activity (farming, livestock, fishing, or forestry) for pay in the past 12 months
  — If the person is a household member who is 6-years-old or older, whether he/she ran or operated a non-farm business for cash or profit for themselves in the past 12 months
- Record the total number of household members in the scorecard header next to "Number of household members:"
- Record the response to the first, second, and third scorecard indicators based on the responses recorded on the back-page worksheet
- Read each of the remaining seven questions one-by-one from the scorecard, drawing a circle around the relevant responses and their points, and writing each point value in the far right-hand column
- Add up the points to get a total score
- Implement targeting policy (if any)
- Deliver the paper scorecard to a central office for data entry and filing

Of course, field workers must be trained. The quality of outputs depends on the quality of inputs. Training is critical, and it should be based completely and only on the "Guidelines for the Interpretation of Indicators" in this paper.

If organizations or field workers gather their own data and believe that they have an incentive to exaggerate poverty rates (for example, if funders reward them for higher poverty rates), then it is wise to do on-going quality control via data review and random audits (Matul and Kline, 2003).[13] 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 alternative ways of measuring poverty, it is still absolutely difficult. Training and explicit definitions of terms and concepts in the scorecard are essential, and field workers should scrupulously study and follow the "Guidelines for the Interpretation of Scorecard Indicators" found at the end of this paper, as these "Guidelines"—along with the "Back-page Worksheet"—are integral parts of the Simple Poverty Scorecard®.[14]

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[13] If a program does not want field workers and respondents to know the points associated with responses, then it can use a version of the scorecard that does not display the points and then apply the points and compute scores later at a central office. Schreiner (2012b) argues that hiding points in Colombia (Camacho and Conover, 2011) did little to deter cheating and that, in any case, cheating by the user's central office was more damaging than cheating by field workers and respondents. And even if points are hidden, field workers and respondents can apply common sense to guess how response options are linked with poverty.

[14] The guidelines here are the only ones that organizations should give to field workers. All other issues of interpretation should be left to the judgment of field workers and respondents, as this seems to be what the NISR does in the EICV.

For the example of Nigeria, one study (Onwujekwe, Hanson, and Fox-Rushby, 2006) found distressingly low inter-rater and test-retest correlations for indicators as seemingly simple as whether the household owns an automobile. At the same time, Grosh and Baker (1995) suggest that gross underreporting of assets does not affect targeting. For the first stage of targeting in a conditional cash-transfer program in Mexico, Martinelli and Parker (2007, pp. 24–25) find that "underreporting [of asset ownership] is widespread but not overwhelming, except for a few goods . . . [and] overreporting is common for a few goods." Still, as is done in Mexico in the second stage of its targeting process, most false self-reports can be corrected (or avoided in the first place) by field workers who make a home visit. This is the recommended procedure for local, pro-poor organizations who use scoring for targeting in Rwanda.

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

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

In general, the sampling design should follow from the organization's goals for the exercise, the questions to be answered, and the budget. The main goal should be to make sure that the sample is representative of a well-defined population and that the scorecard will inform an issue that matters to the organization.

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

- Employees of the organization
- Third parties

Responses, scores, and poverty likelihoods can be recorded on:

- Paper in the field, and then filed at a central office
- Paper in the field, and then keyed into a database or spreadsheet at a central office
- Portable electronic devices in the field, and then uploaded to a database

Given a population of participants relevant for a particular business question, the participants to be scored can be:

- All relevant participants (a census)
- A representative sample of relevant participants
- All relevant participants in a representative sample of relevant field offices
- A representative sample of relevant participants in a representative sample of relevant field offices

If not determined by other factors, the number of participants to be scored can be derived from sample-size formulas (presented later) to achieve a desired confidence level and a desired confidence interval. The focus, however, should not be on having a sample size large enough to achieve some arbitrary level of statistical significance but rather to get a representative sample from a well-defined population so that the analysis of the results can have a chance to meaningfully inform questions that matter to the organization.

The frequency of application can be:

- As a once-off project (precluding measuring change)
- Every two years (or at any other fixed or variable time interval, allowing measuring change)
- Each time a field worker visits a participant at home (allowing measuring change)

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

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

An example set of choices is illustrated by BRAC and ASA, two microfinance organizations in Bangladesh who each have about 7 million participants and who declared their intention to apply the Simple Poverty Scorecard® (Schreiner, 2013a) with a sample of about 25,000. Their design is that all loan officers in a random sample of branches score all participants each time they visit a homestead (about once a year) as part of their standard due diligence prior to loan disbursement. They record responses on paper in the field before sending the forms to a central office to be entered into a database and converted to poverty likelihoods.

5. Estimates of household poverty likelihoods

The sum of scorecard points for a household is called the *score.* For Rwanda, 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 poor, the scores themselves have only relative units. For example, doubling the score decreases the likelihood of being below a given poverty line, but it does not cut it in half.

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 100% of the national line, scores of 30–34 have a poverty likelihood of 50.2 percent, and scores of 35–39 have a poverty likelihood of 34.7 percent (Figure 4).

The poverty likelihood associated with a score varies by poverty line. For example, scores of 30–34 are associated with a poverty likelihood of 50.2 percent for 100% of the national line but of 76.6 percent for the $1.25/day 2005 PPP line.[15]

5.1   Calibrating scores with poverty likelihoods

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

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[15] Starting with Figure 4, many figures have 10 versions, one for each poverty line. To keep them straight, figures are grouped by line. Single figures pertaining to all lines are placed with the figures for 100% of the national line.

For the example of 100% of the national line (Figure 5), there are 11,575 (normalized) households in the calibration sub-sample with a score of 30–34. Of these, 5,815 (normalized) are below the poverty line. The estimated poverty likelihood associated with a score of 30–34 is then 50.2 percent, because 5,815 ÷ 11,575 = 50.2 percent.

To illustrate with 100% of the national line and a score of 35–39, there are 12,381 (normalized) households in the calibration sample, of whom 4,298 (normalized) are below the line (Figure 5). The poverty likelihood for this score range is then 4,298 ÷ 12,381 = 34.7 percent.

The same method is used to calibrate scores with estimated poverty likelihoods for all 10 poverty lines.[16]

Even though the scorecard is constructed partly based on judgment related to non-statistical criteria, the calibration process produces poverty likelihoods that are objective, that is, derived from quantitative poverty lines and from survey data on consumption. The calibrated poverty likelihoods would be objective even if the process of selecting indicators and points did not use any data at all. In fact, objective scorecards of proven accuracy are often constructed using only expert judgment to select indicators and points (Fuller, 2006; Caire, 2004; Schreiner *et al.*, 2014). Of course,

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[16] To ensure that poverty likelihoods never increase as scores increase, likelihoods across series of adjacent scores are sometimes iteratively averaged before grouping scores into ranges. This preserves unbiasedness while keeping users from balking when sampling variation in score ranges with few households would otherwise lead to higher scores being linked with higher poverty likelihoods.

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 Rwanda scorecard are transformed coefficients from a Logit regression, (untransformed) scores are not converted to poverty likelihoods via the Logit formula of $2.718281828^{\text{score}}$ x $(1 + 2.718281828^{\text{score}})^{-1}$. 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. Going from scores to poverty likelihoods in this way requires no arithmetic at all, just a look-up table. This approach to calibration can also improve accuracy, especially with large samples.

5.2   Accuracy of estimates of households' poverty likelihoods

As long as the relationships between indicators and poverty do not change over time, and as long as the scorecard is applied to households that are representative of the same population from which the scorecard was originally 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 value in the population. Given the assumptions above, the scorecard also produces

unbiased estimates of poverty rates at a point in time and unbiased estimates of changes in poverty rates between two points in time.[17]

Of course, the relationships between indicators and poverty do change to some unknown extent over time and also across sub-national groups in Rwanda's population. Thus, the scorecard will generally be biased when applied after October 2011 (the last month of fieldwork for the 2010/11 EICV) or when applied with sub-groups that are not nationally representative.

How accurate are estimates of households' poverty likelihoods, given the assumption of unchanging relationships between indicators and poverty over time and the assumption of a sample that is representative of Rwanda as a whole? To find out, the scorecard is applied to 1,000 bootstrap samples of size $n = 16,384$ from the validation sample. Bootstrapping means to:

- Score each household in the validation sample
- Draw a 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 with consumption below a poverty line
- 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 intervals containing the central 900, 950, and 990 differences between estimated and true poverty likelihoods

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

For each score range and for $n = 16{,}384$, Figure 6 shows the average difference between estimated and true poverty likelihoods as well as confidence intervals for the differences.

For the example of 100% of the national line, the average poverty likelihood across bootstrap samples for scores of 30–34 in the validation sample is too low by 2.0 percentage points. For scores of 35–39, the estimate is too low by 2.2 percentage points.[18]

The 90-percent confidence interval for the differences for scores of 30–34 is ±2.4 percentage points (100% of the national line, Figure 6). This means that in 900 of 1,000 bootstraps, the difference between the estimate and the true value is between –4.4 and +0.4 percentage points (because –2.0 – 2.4 = –4.4, and –2.0 + 2.4 = +0.4). In 950 of 1,000 bootstraps (95 percent), the difference is –2.0 ± 3.0 percentage points, and in 990 of 1,000 bootstraps (99 percent), the difference is –2.0 ± 4.0 percentage points.

A couple of the differences between estimated poverty likelihoods and true values in Figure 6 are large. There are differences because the validation sample is a single sample that—thanks to sampling variation—differs in distribution from the construction/calibration sub-samples and from Rwanda's population. For targeting, however, what matters is less the difference in all score ranges and more the differences

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[18] These differences are not zero, despite the estimator's unbiasedness, because the scorecard comes from a single sample from the 2010/11 EICV. The average difference by score range would be zero if the EICV was repeatedly applied to samples of the population of Rwanda and then split into sub-samples before repeating the entire process of scorecard construction/calibration and validation.

in the 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.

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

Another possible source of differences between estimates and true values is overfitting. The scorecard here is unbiased, but it may still be *overfit* when applied after the end of the EICV fieldwork in October 2011. That is, the scorecard may fit the data from the 2010/11 EICV so closely that it captures not only some real patterns but also some random patterns that, due to sampling variation, show up only in the 2010/11 EICV but not in the overall population of Rwanda. Or the scorecard may be overfit in the sense that it is not robust when relationships between indicators and poverty change over time or when the scorecard is applied to samples that are not nationally representative.

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

Most errors in individual households' likelihoods do balance out in the estimates of groups' poverty rates for nationally representative samples (see the next section). Furthermore, at least some of the differences in change-through-time estimates may come from non-scorecard sources such as changes in the relationships between indicators and poverty, sampling variation, changes in poverty lines, inconsistencies in data quality across time, and imperfections in cost-of-living adjustments across time and across geographic regions. These factors can be addressed only by improving the availability, frequency, quantity, and quality of data from national consumption surveys (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 an organization samples three households on 1 January 2016 and that they have scores of 20, 30, and 40, corresponding to poverty likelihoods of 71.2, 50.2, and 27.7 percent (100% of the national line, Figure 4). The group's estimated poverty rate is the households' average poverty likelihood of (71.2 + 50.2 + 27.7) ÷ 3 = 49.7 percent.

Be careful; the group's poverty rate is *not* the poverty likelihood associated with the average score. Here, the average score is 30, which corresponds to a poverty likelihood of 50.2 percent. This differs from the 49.7 percent found as the average of the three individual poverty likelihoods associated with each of the three scores. Unlike poverty likelihoods, scores are ordinal symbols, like letters in the alphabet or colors in the spectrum. Because scores are not cardinal numbers, they cannot meaningfully be added up or averaged across households. Only three operations are valid for scores: conversion to poverty likelihoods, analysis of distributions (Schreiner, 2012a), or comparison—if desired—with a cut-off for targeting. The safest rule to follow is: Always use poverty likelihoods, never scores.

Existing users of the old 2005/6 scorecard who switch to the new 2010/11 scorecard and who want to salvage existing poverty-rate estimates for measuring

change over time can do so with a baseline from the old 2005/6 scorecard and a follow-up from the new 2010/11 scorecard.

6.1 Accuracy of estimated poverty rates at a point in time

For Rwanda's new 2010/11 scorecard applied to 1,000 bootstraps of $n = 16,384$ from the validation sample and 100% of the national poverty line, the average difference between the estimated poverty rate at a point in time versus the true rate is $+0.4$ percentage points (Figure 8, summarizing Figure 7 across poverty lines). Across all 10 poverty lines in the validation sample, the maximum absolute difference is 2.2 percentage points, and the average absolute difference is about 1.1 percentage points. At least part of these differences is due to sampling variation in the division of the 2010/11 EICV into two sub-samples.

When estimating poverty rates at a point in time, the bias reported in Figure 8 should be subtracted from the average poverty likelihood to make the estimate unbiased. For the example of Rwanda's new 2010/11 scorecard and 100% of the national line in the validation sample, bias is $+0.4$ percentage points, so the unbiased estimate in the three-household example above is 49.7 – (+0.4) = 49.3 percent.

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 ± 0.8 percentage points or better for all lines (Figure 8). This means that in 900 of 1,000 bootstraps of this size, the estimate (after subtracting off bias) is within 0.8 percentage points of the true value.

For example, suppose that the average poverty likelihood in a sample of $n =$ 16,384 with the Rwanda scorecard and 100% of the national line is 49.7 percent. Then estimates in 90 percent of such samples would be expected to fall in the range of 49.7 − (+0.4) − 0.8 = 48.5 percent to 49.7 − (+0.4) + 0.8 = 50.1 percent, with the most likely true value being the unbiased estimate in the middle of this range, that is, 49.7 − (+0.4) = 49.3 percent. This is because the original (biased) estimate is 49.7 percent, bias is +0.4 percentage points, and the 90-percent confidence interval for 100% of the national line in the validation sample with this sample size is ±0.8 percentage points (Figure 8).

6.2 Formula for standard errors for estimates of poverty rates

How precise are the point-in-time estimates? Because these estimates are averages, they have (in "large" samples) a Normal distribution and can be characterized by their average difference vis-à-vis true values (*bias*), together with their standard error (*precision*).

Schreiner (2008a) proposes an approach to deriving a formula for the standard errors of estimated poverty rates at a point in time from indirect measurement via the Simple Poverty Scorecard®. It starts with Cochran's (1977) textbook formula of $\pm c = \pm z \cdot \sigma$ that relates confidence intervals with standard errors in the case of the direct measurement of ratios, where:

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

z is from the Normal distribution and is $\begin{cases} 1.04 \text{ for confidence levels of 70 percent} \\ 1.28 \text{ for confidence levels of 80 percent} \\ 1.64 \text{ for confidence levels of 90 percent} \end{cases}$,

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

$\hat{p}$ is the estimated proportion of households below the poverty line in the sample,

ϕ is the finite population correction factor $\sqrt{\dfrac{N - n}{N - 1}}$,

N is the population size, and

n is the sample size.

For example, Rwanda's 2010/11 EICV gives a direct-measurement estimate of the household-level poverty rate for 100% of the national line in the validation sample of $\hat{p} = 40.2$ percent (Figure 1). If this estimate came from a sample of $n = 16,384$ households from a population N of 2,252,844 (the number of households in Rwanda in 2010/11 according to the EICV sampling weights), then the finite population correction ϕ is $\sqrt{\dfrac{2,252,844 - 16,384}{2,252,844 - 1}} = 0.9964$, which close to $\phi = 1$. If the desired confidence level is 90-percent ($z = 1.64$), then the confidence interval $\pm c$ is

$$\pm z \cdot \sqrt{\frac{\hat{p} \cdot (1 - \hat{p})}{n}} \cdot \sqrt{\frac{N - n}{N - 1}} = \pm 1.64 \cdot \sqrt{\frac{0.402 \cdot (1 - 0.402)}{16,384}} \cdot \sqrt{\frac{2,252,844 - 16,384}{2,252,844 - 1}} = \pm 0.624$$

percentage points. (If ϕ were taken as 1, then the interval would be ± 0.628 percentage points.)

Scorecards, however, do not measure poverty directly, so this formula is not applicable. To derive a formula for the Rwanda scorecard, consider Figure 7, which reports empirical confidence intervals $\pm c$ for the differences for the scorecard applied to 1,000 bootstraps of various sizes from the validation sample. For example, with $n = 16,384$ and 100% of the national line in the validation sample, the 90-percent confidence interval is ± 0.782 percentage points.[19]

Thus, the 90-percent confidence interval with $n = 16,384$ is ± 0.782 percentage points for the Rwanda scorecard and ± 0.624 percentage points for direct measurement. The ratio of the two intervals is $0.782 \div 0.624 = 1.25$.

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[19] Due to rounding, Figure 7 displays 0.8, not 0.756.

Now consider the same exercise, but with $n = 8{,}192$. The confidence interval under direct measurement and 100% of the national line in the validation sample is

$$\pm\, 1.64 \cdot \sqrt{\frac{0.402 \cdot (1 - 0.402)}{8{,}192}} \cdot \sqrt{\frac{2{,}252{,}844 - 8{,}192}{2{,}252{,}844 - 1}} = \pm 0.887 \text{ percentage points. The}$$

empirical confidence interval with the Rwanda scorecard (Figure 7) is ± 1.142 percentage points. Thus for $n = 8{,}192$, the ratio of the two intervals is $1.142 \div 0.887 = 1.29$.

This ratio of 1.29 for $n = 8{,}192$ is not far from the ratio of 1.25 for $n = 16{,}384$. Across all sample sizes of 256 or more in Figure 7, these ratios are generally close to each other, and the average ratio in the validation sample turns out to be 1.23 (Figure 8), implying that confidence intervals for indirect estimates of poverty rates via the Rwanda scorecard and 100% of the national poverty line are—for a given sample size— about 23-percent wider than confidence intervals for direct estimates via the 2010/11 EICV. This 1.23 appears in Figure 8 as the "α factor" because if $\alpha = 1.23$, then the formula for confidence intervals c for the Rwanda scorecard is $\pm c = \pm z \cdot \alpha \cdot \sigma$. That is, the formula for the standard error σ for point-in-time estimates of poverty rates via scoring is $\alpha \cdot \sqrt{\dfrac{\hat{p} \cdot (1 - \hat{p})}{n}} \cdot \sqrt{\dfrac{N - n}{N - 1}}$.

In general, α can be more or less than 1.00. When α is more than 1.00, it means that the scorecard is less precise than direct measurement. It turns out that α is more than 1.00 for all ten poverty lines in Figure 8.

The formula relating confidence intervals with standard errors for the scorecard can be rearranged to give a formula for determining sample size before measurement. If $\tilde{p}$ is the expected poverty rate before measurement, then the formula for sample size n from a population of size N that is based on the desired confidence level that corresponds to z and the desired confidence interval $\pm c$ is

$$n = N \cdot \left(\frac{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1 - \tilde{p})}{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1 - \tilde{p}) + c^2 \cdot (N - 1)} \right)$$. If the population N is "large" relative to the sample size n, then the finite population correction factor ϕ can be taken as one (1),

and the formula becomes $n = \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \tilde{p} \cdot (1 - \tilde{p})$.

To illustrate how to use this, suppose the population N is 2,252,844 (the number

of households in Rwanda in 2010/11), suppose $c = 0.06132$, $z = 1.64$ (90-percent

confidence), and the relevant poverty line is 100% of the national line so that the most

sensible expected poverty rate $\tilde{p}$ is Rwanda's overall poverty rate for that line in

2010/11 (40.2 percent at the household level, Figure 1). The α factor is 1.23 (Figure 8).

Then the sample-size formula gives

$$n = 2{,}252{,}844 \cdot \left(\frac{1.64^2 \cdot 1.23^2 \cdot 0.402 \cdot (1 - 0.402)}{1.64^2 \cdot 1.23^2 \cdot 0.402 \cdot (1 - 0.402) + 0.06132^2 \cdot (2{,}252{,}844 - 1)} \right) = 261, \text{ which}$$

is close to the sample size of 256 observed for these parameters in Figure 7 for 100% of

the national line. Taking the finite population correction factor ϕ as one (1) gives the

same result, as $n = \left(\dfrac{1.23 \cdot 1.64}{0.06132} \right)^2 \cdot 0.402 \cdot (1 - 0.402) = 261.$[20]

Of course, the α factors in Figure 8 are specific to Rwanda, its poverty lines, its

poverty rates, and its scorecard. The derivation of the formulas for standard errors

using the α factors, however, is valid for any scorecard following the approach in this

paper.

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[20] Although USAID has not specified confidence levels nor intervals, IRIS Center (2007a
and 2007b) says that a sample size of $n = 300$ is sufficient for USAID reporting. USAID
microenterprise partners in Rwanda should report using the $1.25/day line. Given the α
factor of 1.08 for this line in 2010/11 (Figure 8), an expected before-measurement
household-level poverty rate of 57.3 percent (the all-Rwanda rate in 2010/11, Figure 1),
and a confidence level of 90 percent ($z = 1.64$), then $n = 300$ implies a confidence
interval of $\pm 1.64 \cdot 1.08 \cdot \sqrt{\dfrac{0.573 \cdot (1 - 0.573)}{300}} = \pm 5.1$ percentage points.

In practice after the end of fieldwork for the EICV in October 2011, a program would select a poverty line (say, 100% of the national line), note its participants' population size (for example, $N = 10{,}000$ participants), select a desired confidence level (say, 90 percent, or $z = 1.64$), select a desired confidence interval (say, ± 2.0 percentage points, or $c = \pm 0.02$), make an assumption about $\tilde{p}$ (perhaps based on a previous measurement such as the household-level poverty rate for 100% of the national line for Rwanda of 40.2 percent in the 2010/11 EICV in Figure 1), look up α (here, 1.23 in Figure 8), assume that the scorecard will still work in the future and for sub-groups that are not nationally representative,[21] and then compute the required sample size. In

this illustration, $n = 10{,}000 \cdot \left(\dfrac{1.64^2 \cdot 1.23^2 \cdot 0.402 \cdot (1 - 0.402)}{1.64^2 \cdot 1.23^2 \cdot 0.402 \cdot (1 - 0.402) + 0.02^2 \cdot (10{,}000 - 1)} \right) =$

1,966.

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[21] This paper reports accuracy for the scorecard applied to its validation sample, but it cannot test accuracy for later years or for sub-groups. Performance after October 2011 will resemble that in the 2010/11 EICV with deterioration over time to the extent that the relationships between indicators and poverty status change.

7. Estimates of changes in 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.

For some indicators in the new scorecard, the wording or response options in the 2005/6 EICV differ from the 2010/11 EICV. This precludes applying the new 2010/11 scorecard to data from the 2005/6 EICV. Thus, this paper cannot test the accuracy of estimates of change over time for Rwanda, and it can only suggest approximate formulas for standard errors. Nonetheless, the relevant concepts are presented here because, in practice, local pro-poor organizations in Rwanda 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 scorecard simply estimates change, and it does not, in and of itself, indicate the reason for the change. In particular, estimating the impact of 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, the scorecard can help estimate the impact of participation only if there is some

way to know—or explicit assumptions about—what would have happened in the absence of participation. And that information must come from beyond the scorecard.

7.2 Estimating changes in poverty rates over time

Consider the illustration begun in the previous section. On 1 January 2016, an organization samples three households who score 20, 30, and 40 and so have poverty likelihoods of 71.2, 50.2, and 27.7 percent (100% of the national line, Figure 4). Adjusting for the known bias in the validation sample of +0.4 percentage points (Figure 8), the group's baseline estimated poverty rate is the households' average poverty likelihood of [(71.2 + 50.2 + 27.7) ÷ 3] – (+0.4) = 49.3 percent.

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

- Score a new, independent sample, measuring change across samples
- Score the same sample at both baseline and follow-up

By way of illustration, suppose that two years later on 1 January 2018, the organization samples three additional households who are in the same population as the three original households (or suppose that the same three original households are scored a second time) and finds that their scores are 25, 35, and 45 (poverty likelihoods of 63.0, 34.7, and 17.0 percent, 100% of the national line, Figure 4). Adjusting for the known bias, the average poverty likelihood at follow-up is [(63.0 + 34.7 + 17.0) ÷ 3] – (+0.4) = 37.8 percent, an improvement of 49.3 – 37.8 = 11.5 percentage points.[22]

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[22] Of course, such a huge reduction in poverty in two years is highly unlikely, but this is just an example to show how the scorecard can be used to estimate change.

Thus, about one in nine participants in this hypothetical example cross the poverty line in 2016/8.[23] Among those who start below the line, about one in four (11.5 ÷ 49.3 = 23.3 percent) on net end up above the line.[24]

7.3 Precision for estimates of change in two samples

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

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

Here, z, c, $\hat{p}$ and N are defined as above, n is the sample size at both baseline and follow-up,[25] and α is the average (across a range of bootstrap samples of various sample sizes) of the ratio of the observed confidence interval from a scorecard and the theoretical confidence interval under direct measurement.

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[23] This is a net figure; some start above the line and end below it, and vice versa.
[24] The scorecard does not reveal the reasons for this change.
[25] This means that—given precision—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 $\tilde{p}$ is based on previous measurements and is assumed equal at both baseline and follow-up:

$$n = 2 \cdot N \cdot \left(\frac{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1 - \tilde{p})}{z^2 \cdot \alpha^2 \cdot \tilde{p} \cdot (1 - \tilde{p}) + c^2 \cdot (N - 1)} \right).$$ If ϕ can be taken as one, then the

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

This α has been measured for 11 countries (Schreiner, 2015b, 2015c, 2013a, 2013b, 2012c, 2010b, 2009a, 2009b, 2009c, 2009d; and Chen and Schreiner, 2009). The simple average of α across countries—after averaging α across poverty lines and survey years within each country—is 1.04. This rough figure is as reasonable as any to use for Rwanda.

To illustrate the use of this formula 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 ($\pm c = \pm 0.02$), the poverty line is 100% of the national line, $\alpha = 1.04$, $\hat{p} = 0.402$ (the household-level poverty rate in 2010/11 for 100% of the national line in Figure 1), and the population N is large enough relative to the expected sample size n that the finite population correction ϕ can be taken as one. Then the baseline sample

size is $n = 2 \cdot \left(\frac{1.04 \cdot 1.64}{0.02} \right)^2 \cdot 0.402 \cdot (1 - 0.402) \cdot 1 = 3{,}497$, and the follow-up sample size is also 3,497.

7.4 Precision for estimated change for one sample, scored twice

Analogous to previous derivations, the general formula relating the confidence interval $\pm c$ 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:[26]

$$\pm c = \pm z \cdot \sigma = \pm z \cdot \alpha \cdot \sqrt{\frac{\hat{p}_{12} \cdot (1 - \hat{p}_{12}) + \hat{p}_{21} \cdot (1 - \hat{p}_{21}) + 2 \cdot \hat{p}_{12} \cdot \hat{p}_{21}}{n}} \cdot \sqrt{\frac{N - n}{n - 1}} \, ,$$

where z, c, α, N, and n are defined as usual, $\hat{p}_{12}$ is the share of all sampled households that move from below the poverty line to above it, and $\hat{p}_{21}$ is the share of all sampled households that move from above the line to below it.

The formula for confidence intervals 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 $\tilde{p}_{12}$ and $\tilde{p}_{21}$. Before measurement, a conservative assumption is that the change in the poverty rate will be zero, which implies $\tilde{p}_{12} = \tilde{p}_{21} = \tilde{p}_{*}$, giving:

$$n = 2 \cdot \left(\frac{\alpha \cdot z}{c} \right)^2 \cdot \tilde{p}_{*} \cdot \sqrt{\frac{N - n}{n - 1}} \, .$$

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

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

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

Given this, a sample-size formula for a group of households to whom the Rwanda scorecard is applied twice (once after October 2011 and then again later) is

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

In Peru (the only source of a data-based estimate, Schreiner, 2009e), 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 ($\pm c = \pm 0.02$), the poverty line is 100% of the national line, the sample will first be scored in 2016 and then again in 2019 ($y = 3$), and the population N is so large relative to the expected sample size n that the finite population correction ϕ can be taken as one. The pre-baseline poverty rate $p_{2010/11}$ is taken as 40.2 percent (Figure 1), and α is assumed to be 1.30. Then the baseline sample size is

$$n = 2 \cdot \left(\frac{1.30 \cdot 1.64}{0.02}\right)^2 \cdot \left\{-0.02 + 0.016 \cdot 3 + 0.47 \cdot \left[0.402 \cdot \left(1 - 0.402\right)\right]\right\} \cdot 1 = 3{,}205.$$ The same group of 3,205 households is scored at follow-up as well.

8. Targeting

When an organization uses the scorecard for segmenting clients for targeted services, households with scores at or below a cut-off are labeled *targeted* and treated—for program purposes—as if they are below a given poverty line. Households with scores above a cut-off are labeled *non-targeted* and treated—for program purposes—as if they are above a given poverty line.

There is a distinction between *targeting status* (scoring at or below a targeting cut-off) and *poverty status* (having consumption below a poverty line). Poverty status is a fact that is defined by whether consumption is below a poverty line as directly measured by a survey. In contrast, targeting status is an organization'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 9 depicts these four possible targeting outcomes. Targeting accuracy varies by the cut-off score; a higher cut-off has better inclusion (but worse leakage), while a lower cut-off has better exclusion (but worse undercoverage).

Programs should weigh these trade-offs when setting a cut-off. A formal way to do this is to assign net benefits—based on a program's values and mission—to each of the four possible targeting outcomes and then to choose the cut-off that maximizes total net benefits (Adams and Hand, 2000; Hoadley and Oliver, 1998).

Figure 10 shows the distribution of households by targeting outcome for Rwanda. For an example cut-off of 34 or less, outcomes for 100% of the national line in the validation sample are:

- Inclusion: 30.4 percent are below the line and correctly targeted
- Undercoverage: 9.8 percent are below the line and mistakenly not targeted
- Leakage: 15.0 percent are above the line and mistakenly targeted
- Exclusion: 44.8 percent are above the line and correctly not targeted

Increasing the cut-off to 39 or less improves inclusion and undercoverage but worsens leakage and exclusion:

- Inclusion: 34.9 percent are below the line and correctly targeted
- Undercoverage: 5.3 percent are below the line and mistakenly not targeted
- Leakage: 22.9 percent are above the line and mistakenly targeted
- Exclusion: 36.9 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 10 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 and 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 the "hit rate", where total net benefit is the number of households correctly included or correctly excluded:

Hit rate = 1 x Households correctly included –
0 x Households mistakenly undercovered –
0 x Households mistakenly leaked +
1 x Households correctly excluded.

Figure 10 shows the hit rate for all cut-offs for the new 2010/11 scorecard for Rwanda. For 100% of the national line in the validation sample, total net benefit is greatest (75.4) for a cut-off of 29 or less, with about three in four households in Rwanda correctly classified.

The hit rate weighs successful inclusion of households below the line the same as successful exclusion of households above the line. If a program values inclusion more (say, twice as much) than exclusion, then it can reflect this by setting the benefit for

50

inclusion to 2 and the benefit for exclusion to 1. Then the chosen cut-off will maximize

(2 x Households correctly included) + (1 x Households correctly excluded).[27]

As an alternative to assigning benefits and costs to targeting outcomes and then choosing a cut-off to maximize total net benefits, a program could set a cut-off to achieve a desired poverty rate among targeted households. The third column of Figure 11 ("% targeted HHs who are poor") shows, for the Rwanda 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 100% of the national line, targeting households in the validation sample who score 34 or less would target 45.4 percent of all households (second column) and would be associated with a poverty rate among those targeted of 66.9 percent (third column).

Figure 11 also reports two other measures of targeting accuracy. The first is a version of coverage ("% poor HHs who are targeted"). For the example of 100% of the national line with the validation sample and a cut-off of 34 or less, 75.7 percent of all poor households are covered.

The final targeting measure in Figure 11 is the number of successfully targeted poor households for each non-poor household mistakenly targeted (right-most column). For 100% of the national line with the validation sample and a cut-off of 34 or less, covering 2.0 poor households means leaking to 1 non-poor household.

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[27] Figure 10 also reports BPAC, the Balanced Poverty Accuracy Criteria adopted by USAID for certifying poverty-assessment tools. BPAC is discussed in detail in Section 9.

9. Context for poverty-assessment tools in Rwanda

This section discusses 2 poverty-assessment tools for Rwanda in terms of their goals, methods, definitions of *poverty*, data, indicators, bias, precision, and cost. In general, the advantages of the scorecard here are its:

- Use of data from the most recent available nationally representative consumption survey
- Use of a consumption-based definition of *poverty* that is widely understood and that is used by the government of Rwanda
- Reporting bias and precision for estimates of poverty rates at a point in time from out-of-sample tests, including formulas for standard errors
- Targeting accuracy that is similar to that of alternative approaches
- Feasibility for local, pro-poor programs, due to its simplicity and transparency

9.1 Gwatkin *et al.*

Gwatkin *et al.* (2007) construct a poverty-assessment tool for Rwanda with an approach that they use in 56 countries with Demographic and Health Surveys (Rutstein and Johnson, 2004). They use Principal Components Analysis to make an asset index from simple, low-cost indicators available for the 9,696 households in Rwanda's 2003 DHS.[28] The PCA index is like the scorecard here except that, because the DHS does not collect data on consumption, the index is based on a different conception of *poverty*, its accuracy vis-à-vis consumption-based poverty is unknown, and it can only be assumed

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[28] All DHS datasets for Rwanda since 2000 include each household's score on the asset index (`dhsprogram.com/topics/wealth-index/`, retrieved 7 July 2015).

to be a proxy for long-term wealth/economic status.[29] Well-known examples of the PCA

asset-index approach include Stifel and Christiaensen (2007), Zeller *et al.* (2006), Sahn

and Stifel (2003 and 2000), Henry *et al.* (2003), and Filmer and Pritchett (2001).

The 12 indicators in Gwatkin *et al.* are similar to those in the Simple Poverty

Scorecard® in terms of their simplicity, low cost, and verifiability:

- Characteristics of the residence:
    — Presence of electricity
    — Type of floor
    — Type of cooking fuel
    — Source of drinking water
    — Type of toilet arrangement
- Ownership of consumer durables:
    — Radios
    — Televisions
    — Telephones
    — Refrigerators
    — Bicycles
    — Motorcycles
    — Cars or trucks

Gwatkin *et al.* suggest three possible uses for their index:

- Segmenting households by the quintile of their index value to see how health varies
  with socio-economic status
- Monitoring (via exit surveys) how well local health-service posts reach the poor
- Measuring local coverage of health services via small-scale surveys

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[29] Nevertheless, the indicators are similar and the "flat maximum" is important, so
carefully built PCA indexes and consumption-based poverty-assessment tools may pick
up the same underlying construct (perhaps "permanent income", see Bollen, Glanville,
and Stecklov, 2007), and they may rank households much the same. Comparisons of
rankings by PCA indexes and consumption-based poverty-assessment tools include
Filmer and Scott (2012), Lindelow (2006), Wagstaff and Watanabe (2003), and
Montgomery *et al.* (2000).

The first goal is akin to targeting, and the last two goals deal with performance monitoring, so the asset index would be used much like the scorecard here.

Still, the Gwatkin *et al.* index is more costly and difficult-to-use than the scorecard. While the scorecard requires adding up 10 integers (some of them usually zeroes), Gwatkin *et al.*'s index requires adding up 82 numbers, each with five decimal places and half with negative signs.

Unlike the asset index, the scorecard here is linked directly to a consumption-based poverty line. Thus, while both approaches can rank households, only the scorecard estimates consumption-based poverty status.

In essence, Gwatkin *et al.*—like all asset indexes—define *poverty* in terms of the indicators and the points in the index itself. Thus, the index is not a proxy standing in for something else (such as consumption); rather, it is a direct measure of a non-consumption-based definition of *poverty*. There is nothing wrong—and a lot right—about defining *poverty* in this way, but it is not as common as a consumption-based definition.

The asset-index approach defines people as *poor* if their assets (physical, human, financial, and social) fall below a threshold. Arguments for an asset-based view of development include Carter and Barrett (2006), Schreiner and Sherraden (2006), Sahn and Stifel (2003), and Sherraden (1991). The main advantages of the asset-based view are that:

- Asset ownership is easier to measure accurately than consumption
- Access to resources in the long term—and thus capacity to produce income and to consume—depends on the control of assets
- Assets get at capability more directly, the difference between, say, "Does income permit adequate sanitation?" versus "Does the toilet drain to a septic tank?"

While the asset view and the income/consumption view are distinct, they are also tightly linked. After all, income and consumption are flows of resources received/consumed from the use of stocks of assets. Both views are low-dimensional simplifications—due to practical limits on definitions and measurement—of a higher-dimensional and more complete conception of the production of human well-being.

9.2   IRIS Center

USAID commissioned IRIS Center (2011) to build a "Poverty Assessment Tool" (PAT) so that USAID's microenterprise partners in Rwanda could report the share of their participants who are "very poor" (in 2005/6, below \$1.25/day 2005 PPP). In general, the PAT for Rwanda is like the Simple Poverty Scorecard®, except that it:

- Estimates consumption itself (not whether a household's consumption is below a poverty line), and then converts estimated consumption to one of two poverty likelihoods (either 0 or 100 percent), rather than a poverty likelihood between 0 and 100
- Uses older EICV data (2005/6 rather than 2010/11)
- Has more indicators (17 rather than 10)
- Does not report standard errors

The PAT supports five 2005 PPP poverty lines:

- \$0.75/day
- \$1.00/day
- \$1.25/day
- \$2.00/day
- \$2.50/day

IRIS tests four regression-based approaches in both one-stage and two-stage versions (IRIS, 2005), settling on a one-step quantile regression that estimates the 64th percentile of the logarithm of per-capita household consumption. It uses 17 indicators (IRIS, 2011) that are simple and verifiable:

- Demographics:
    — Household size (and its square)
    — Age of the head (and its square)
    — Share of household members who are 5-years-old or younger
- Whether the head has gone to school
- Whether the head is employed
- Characteristics of the residence:
    — Type of floor
    — Type of roof
    — Type of toilet arrangement
    — Type of fuel for cooking
    — Source of lighting
    — Number of rooms
- Ownership of consumer durables:
    — Number of radios or cassette players
    — Number of bicycles
    — Number of hoes or shovels
    — Cattle
- Location:
    — Region
    — Urban/rural

Schreiner (2014) reports an apples-to-apple comparison of IRIS (2011) versus Schreiner (2010a).[30] In out-of-sample tests, the PAT has less bias (0.1 percentage points versus 1.0 percentage points for the scorecard).[31] The PAT is less precise (its α is 1.00 versus 0.77 for the scorecard). For targeting, the PAT classifies 0.2 more people per 100 correctly than does the scorecard. Thus, in terms of accuracy, the PAT and the scorecard are about tied.

IRIS also reports accuracy in terms of the Balanced Poverty Accuracy Criterion. IRIS Center (2005) introduced BPAC, and USAID adopted it as its criterion for approving poverty-assessment tools for use by its microenterprise partners. BPAC considers accuracy in terms of inclusion and in terms of the absolute difference between undercoverage and leakage (which, under the PAT's approach, is equal to the absolute value of the bias of the estimated poverty rate). The formula is:

$$\text{BPAC} = 100 \cdot \left(\frac{\text{Inclusion} - |\text{ Undercoverage} - \text{Leakage }|}{\text{Inclusion} + \text{Undercoverage}} \right).$$

Because bias (in the PAT approach) is the difference between undercoverage and leakage, and because the normalization term $\dfrac{100}{\text{Inclusion} + \text{Undercoverage}}$ may be relevant only when comparing poverty-assessment tools across populations with different poverty rates (but irrelevant when selecting among alternative tools for a given country in a given year for a given poverty line), the simpler formula

[30] Schreiner (2010a) replicates IRIS' incorrect deflation of the 2005 PPP factor and also makes an *ad hoc* adjustment to match the $1.25/day poverty rate reported by IRIS.
[31] When bias is known, it can be removed, so both the PAT and scorecard are unbiased.

BPAC = Inclusion − | Bias | ranks poverty-assessment tools the same as the more complex formula.

Expressing BPAC as Inclusion − | Bias | helps to show why BPAC is not useful for comparing the PAT with the Simple Poverty Scorecard® (Schreiner, 2014). Given the assumptions discussed earlier in this paper,[32] the Simple Poverty Scorecard® produces unbiased estimates of poverty rates, regardless of whether undercoverage differs from leakage. While BPAC can be used to compare alternative tools that all use the PAT's consumption-estimation approach, it does not make sense to apply BPAC to the scorecard's likelihood-estimation approach. This is because the scorecard does not use a single cut-off to classify households as either 100-percent poor or 0-percent poor. Instead, households have an estimated poverty likelihood somewhere between 0 to 100 percent. If a scorecard user sets a targeting cut-off, then that cut-off matters only for targeting, and it does not affect the estimation of poverty rates at all.

Although IRIS reports the PAT's targeting accuracy and although the BPAC formula considers targeting accuracy, IRIS says that the PAT should not be used for targeting.[33]

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[32] The unbiasedness of the PAT—or of any other scorecard—also requires these assumptions.

[33] `povertytools.org/faq/faq.html#11`, retrieved 19 February 2009.

IRIS also doubts that the PAT can be useful for measuring change, noting that "it is unclear that the tools will be able to identify real changes in poverty over time due to their inherent measurement errors. Unless the changes in the poverty rate are exceptionally large and unless the tools are exceptionally accurate, then the changes identified are likely to be contained within the margin of error."[34]

In contrast, targeting and estimating changes over time are possible uses that are supported for the Simple Poverty Scorecard®. In particular, this paper reports targeting accuracy so users can decide for themselves whether scoring targets adequately for their purposes.

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[34] `povertytools.org/faq/faq2.html`, retrieved 7 December 2012.

10. Conclusion

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

- Likelihood that a household has consumption below a given poverty line
- Poverty rate of a group of households at a point in time
- Change in the poverty rate of a group of households over in time[35]

The new scorecard here based on data from the 2010/11 EICV replaces the old scorecard in Schreiner (2010a) based on data from the 2005/6 EICV. The new scorecard should be used from now on. The new and old scorecards are based on the same definition of *poverty*, so legacy users can still measure change over time with a baseline from the old scorecard and a follow-up from the new scorecard.

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

The scorecard is constructed with half of the data from Rwanda's 2010/11 EICV, calibrated to 10 poverty lines, and tested on data from the other half of the 2010/11 EICV. Bias and precision are reported for estimates of households' poverty likelihoods and for estimates of groups' poverty rates at a point in time. Accuracy for targeting is also reported.

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[35] Scorecard estimates of change are not necessarily estimates of program impact.

When the scorecard is applied to the the validation sample, the maximum absolute difference between estimates versus true poverty rates for groups of households at a point in time is 2.2 percentage points. The average absolute bias across the 10 poverty lines is about 1.1 percentage points. Unbiased estimates may be had by subtracting the known bias for a given poverty line from the original estimates.

For $n = 16,384$ and 90-percent confidence, the precision of these differences is ± 0.8 percentage points or better.

If an organization wants to use the scorecard for targeting, then the results here provide useful information for selecting a cut-off that fits its values and mission.

Although the statistical technique is innovative, and although technical accuracy is important, the design of the scorecard focuses on transparency and ease-of-use. After all, accuracy is irrelevant if an organization feels so daunted by a scorecard's complexity or its cost that it does not even try to use it.

For this reason, the scorecard is kept simple, using ten indicators that are straightforward, low-cost, and verifiable. 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 converted to poverty likelihoods via simple look-up tables, and targeting cut-offs are likewise straightforward to apply. The design attempts to facilitate voluntary adoption by helping managers to understand and trust scoring and by allowing non-specialists to add up scores quickly in the field.

In summary, the Simple Poverty Scorecard® is a transparent, low-cost way for pro-poor programs in Rwanda to estimate consumption-based poverty rates, track changes in poverty rates over time, and target services. The same approach can be applied to any country with similar data.

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Guidelines for the Interpretation of Indicators

The following comes from:

National Institute of Statistics of Rwanda. (2010) *Enumerator Manual for the 2010/11 EICV*, Kigala (in Kinyarwanda), [the *Manual*], and

National Institute of Statistics of Rwanda. (2010) *Enquête Intégrale sur les Conditions de Vie des Ménages: 2010/11*, Kigala (in English and in Kinyarwanda), [the *Questionnaire*].

When an issue arises that is not addressed here, its resolution should be left to the unaided judgment of the enumerator, as that apparently was the practice in the 2010/11 EICV. That is, an organization using the Simple Poverty Scorecard® should not promulgate any definitions or rules (other than those in these "Guidelines") to be used by all its field agents. Anything not explicitly addressed in these "Guidelines" is to be left to the unaided judgment of the individual enumerator.

General Guidelines

Fill out the scorecard header and the "Back-page Worksheet" first, following the directions on the "Back-page Worksheet". In particular, do not ask the first, second, nor third scorecard indicators directly. Instead, use the information recorded on the "Back-page Worksheet" to determine the proper responses for the first, second, and third indicators.

Do not read the response options to the respondent. Unless instructed otherwise here, read the question, and then stop; wait for a response. If the respondent asks for clarification or otherwise hesitates or seems confused, then read the question again or provide additional assistance based on these "Guidelines" or as you, the enumerator, deem appropriate.

In general, you should accept the responses given by the respondent. Nevertheless, if the respondent says something—or if you see or sense something—that suggests that the response may not be accurate, that the respondent is uncertain, or that the respondent desires assistance in figuring out how to respond, then you should read the question again and provide whatever assistance you deem appropriate based on these "Guidelines".

While most indicators in the Simple Poverty Scorecard® are verifiable, you do not—in general—need to verify responses unless something suggests to you that the response may not be accurate and thus that verification might improve data quality. For example, you might choose to verify if the respondent hesitates, seems nervous, or otherwise gives signals that he/she may be lying or be confused. Likewise, verification is probably appropriate if a child in the household or neighbor says something that does not square with the respondent's answer. Verification is also a good idea if you can see something yourself—such as a consumer durable that the respondent avers not to have, or a child eating in the room who has not been counted as a member of the household—that suggests that the response may not be accurate.

In general, the application of the Simple Poverty Scorecard® should mimic as closely as possible the application of the 2010/11 EICV. For example, the poverty-scoring interview should take place in the respondent's homestead because the 2010/11 EICV took place in respondents' homesteads.

According to the *Manual*, "As the enumerator, you have a key role in the survey because, of course, you are the one collecting the data. There are some guidelines that you would be wise to follow to put the respondent at ease. You must always follow [these 'Guidelines'] and refer to them when necessary. . . . Do not stray from [these 'Guidelines'].
     "Always read the questions word-for-word exactly as they appear in the [scorecard]. After you read the question out loud, stop; wait for a response. If the respondent hesitates or takes his/her time to answer, it may be because he/she:

- Has not heard the question
- Does not understand the question
- Does not know how to respond, or does not know the appropriate response"

Confidentiality:
According to the *Manual*, "Keep in mind that you must always maintain all information received from an interviewed household in strict confidentiality.
     "In addition, remember that the interview should be conducted in private, as that is an essential factor in maintaining confidentiality. If third parties who are not members of the interviewed household at present, the respondent may be tempted to give inaccurate responses. Thus, do your best to make sure that you do the interview in private."

Role of interviewer:

According to the *Manual*, in your role as the enumerator, you should behave as follows:

- Be polite with everyone (local authorities, the respondent, and all other members of the responding household). Take the high road, so that regardless of how anyone treats you, you know that you have done the right thing to the best of your abilities. Do not drink alcohol nor act unprofessionally in other ways
- Avoid upsetting the respondent, regardless of what happens
- Dress appropriately so as to inspire the respondent to trust that you know what you are doing and that you are honest
- Respect the respondent's time, keeping in mind that you are keeping him/her from his/her normal business. If you expect to arrive to a scheduled interview late for reasons beyond your control, then let the household know ahead of time, and ask them to reschedule at another time that works for them
- Stay calm and be aware of what is happening in this moment in this time and place so that you do not annoy the respondent, as that could lead to careless or inaccurate responses

"Some questions [in the scorecard] are easier to ask and to answer than others. . . . Some difficult questions will give the respondent pause. . . . For this reason, it is important to do the interview in private. If some third parties do not want to leave you and the responding household alone, then politely explain they the interview is none of their business and that you would like to be alone with the responding household."

Asking questions:

According to the *Manual*, "When you interview, you must read the questions word-for-word exactly as they are written in the questionnaire, following [these 'Guidelines']. Fill out the survey instrument as your go through the interview [not afterwards when it is all over].

"Be sure to:

- Keep an even keel. Some people are shy with new acquaintances and so they may try to give responses that they think the visitor (you) will approve of
- Do not show surprise, dissatisfaction, or approval with any responses you hear, and do not tell the respondent what you think about a response. If the respondent asks for your opinion, simply say that you will be happy to discuss your views once the interview is over
- Do not argue with the respondent. If he/she digresses or rambles on, do not brusquely shut him/her up; rather, listen patiently and then gently bring him/her back on-topic. Remember, you are the one who controls the interview"

<u>Check questionnaires for completeness</u>:
According to the *Manual*, "Once the interview is done, check that you have clearly marked a response for each question. Also make sure that you asked all the questions. Do this right away, [before you take your leave from the household.

   "If you have not clearly marked a response, then be sure to ask the question of the responding household again. Do not trust your memory of what was said before."

<u>Who to interview</u>:
According to p. 1 of the *Questionnaire*, the *respondent* is "preferably the head of household. If he/she unavailable, then the wife or husband of the head,—or any other knowledgeable adult member of the household—can provide information."

The respondent need not be a participant with your organization.

According to the *Manual*, "The preferred respondent is the head of the household. If the head is absent at the time of the interview or if he/she must leave before the interview is finished, then you should choose a replacement [from among the other adult household members]. The replacement should be able to provide all the information required about the household and its members. Other household members can help the respondent if they happen to be the most knowledgable member on a certain topic."

According to the *Manual*, the *head of the household* is "that person who is recognized as the head by the other household members. It is the person who the household members name when they are asked, 'Who is the head of the household?' Often—but not always—the head is the person who makes the largest contribution to meeting the basic needs of the members of the household and who has the best knowledge of the household's activities. The head may be male or female."

Guidelines for specific scorecard indicators

1. How many household members are 18-years-old or less?
   - A. Five or more
   - B. Four
   - C. Three
   - D. Two
   - E. One
   - F. None

Do not read this question directly to the respondent. Instead, mark the relevant response based on the data that you collect on the "Back-page Worksheet".

According to the *Manual*, a *household* is "a group of people who have lived together and shared meals for at least six of the last 12 months.
    "The following special cases are part of the definition of *household*:

- Lodgers or visitors who live and share meals with the household are *not* counted as household members
- People who are dead as of the day of the interview are not counted as household members, even if, before their death, they lived with the household for at least six of the past 12 months
- Newborns and newly-weds who currently live and eat with the household count as household members, even if they have not yet lived with the household for at least six months
- The head of the household always is counted as a household member, even if he/she has not lived and eaten with the household for at least six of the past 12 months
- Family members (and non-family members) who have been absent but who currently live and eat with the household and who intend to stay should be counted as household members, even if they have not been present for at least six of the past 12 months
- Anyone else—for example, students or apprentices—who have not been living with the household for at least six of the past 12 months but who have not been part of another household during their absence and who intend to return to the household are to be counted as household members

"Examples of households include:

- A head, his/her spouse(s) and their children, the father of the head, nephews/nieces of the head, and others (regardless of whether they have a blood or marital reslationship with the head) who have slept under the same roof and shared meals with the other household members for at least six of the past 12 months
- A household made up of a single adult
- A household of a man and his wife, a man and his wives, andor several men and their wives, regardless of whether any of them have any children

You should "fill up the household roster carefully. List the household members in this order:

- Head of the household (even if he/she is absent)
- Children of the head of the household whose mother/father is not a member of the household
- Spouse(s) of the head of the household
- If head has more than one spouse, then list them in the order in which they became members of the household of the head, and list after each spouse the children of that spouse. Then go on to list the other spouses and their children
- The parents (father and/or mother) of the head of the household
- Other blood relatives of the head of the household and his/her spouse(s) (for example, brothers, sisters, brothers-in-law, sisters-in-law, grandparents, etc.)
- Other household members who are not related to the head of the household by blood nor marriage

"For each household member, ask about the number of months in the past 12 in which the person did not live and eat with the household. Of course, the person may have had several absences in the kast 12 months; you want to know the total months he/she was absent. If a person has one or more absences, ask whether he/she lived with another household (unless the person is the household head). This line of questioning will tell to you whether to count the person as a member of the household. In particular, if a person's total absence(s) are six months or less and if the person was not part of another household during the absence(s), then he/she counts as a household member. Examples include people who were hospitalized, students or apprentices, members of the armed forces, drivers, etc.

"In contrast, a student who rented his/her own lodgings—even if he/she did so alone and without roommates and even if he/she ate with outside of the rented lodgings—counts as a distinct household and is not counted as a member of the interviewed household.

"The head of the household is always counted as a member of the household, regardless of the duration of his absence(s) from the household, and regardless of whether he/she has other spouses.

"New-borns or newly-weds who are now members of the household count as household members, even if they joined the household less than six months ago."

2. In the last 12 months, how many household members carried out any agricultural activity (whether farming, livestock, fishing, or forestry) for salary, wages, or in-kind compensation?
   A. Two or more
   B. One
   C. None

Do not read this question directly to the respondent. Instead, mark the relevant response based on the data that you collect on the "Back-page Worksheet".

See the "Guidelines" for the previous indicator for the definitions of *household* and of *household member*.

According to the *Manual,* "This question only concerns household members who are 6-years-old or older. Also, do not count work done by students."

According to the *Manual,* "An *economic activity* is something that household members do that directly leads to monetary income. Before starting the interview, it is a good idea to have an informal discussion of the different ways in which members of the household earn money. These ways directly correspond with the household's economic activities."

According to the *Manual*, you should "explain to the respondent that *the last 12 months* refers the 365 days that ended the day before the interview. For example, if the interview is on 6 November 2010, then the last twelve months started on 6 November 2009 [and ended on 5 November 2010]."

According to the *Manual*, "Keep in mind that, from the point of view of most respondents, "time is in terms of agricultural seasons which, in general, do not coincide with the 12 months that are relevant for [the scorecard]. . . . Make it clear that *the last 12 months* refers to the 365 days immediately preceding the day of the interview, and not the agricultural seasons."

3. In the last 12 months, how many household members ran or operated a non-farm business for cash or profit for themselves, like a small shop or other income-generating activity?
    A. None
    B. One
    C. Two or more

Do not read this question directly to the respondent. Instead, mark the relevant response based on the data that you collect on the "Back-page Worksheet".

See the "Guidelines" for the previous indicator for the definitions of *household* and of *household member.*

According to the *Manual,* "This question only concerns household members who are 6-years-old or older. Also, do not count work done by students."

According to the *Manual,* "An *economic activity* is something that household members do that directly leads to monetary income. Before starting the interview, it is a good idea to have an informal discussion of the different ways in which members of the household earn money. These ways directly correspond with the household's economic activities."

According to the *Manual*, you should "explain to the respondent that *the last 12 months* refers the 365 days that ended the day before the interview. For example, if the interview is on 6 November 2010, then the last twelve months started on 6 November 2009 [and ended on 5 November 2010]."

4. Can the (oldest) female head/spouse read a letter or a simple note (regardless of language), or has she completed at least Primary 1?
    A. No
    B. Yes
    C. No female head/spouse

According to the *Manual*, "Ask the respondent whether the (oldest) female head/spouse can read a short letter or simple note (regardless of language) or if she has completed at least primary 1."

When asking this question, use the actual name of the (oldest) female head/spouse, who—if she exists—you will have identified while completing the "Back-page Worksheet". That is, do not read this question to the respondent as "Can the (oldest) female head/spouse read a letter or a simple note (regardless of language), or has she completed at least Primary 1?" Instead, read it as "Can <name> read a letter or a simple note (regardless of language), or has she completed at least Primary 1?"

    Any language means any language and so includes not only English or French but also any other language. For example, if the (oldest) female head/spouse cannot read and write in English nor in French, but she can read and write in Kinyarwanda, then the response marked should be "B. Yes".

    If there is no female head/spouse in the household (a fact which you will know after completing the "Back-page worksheet"), then do not read the question at all; mark "No female head/spouse", and then go on to the next question.

For the purposes of the Simple Poverty Scorecard®, the *(oldest) female head/spouse* is:

- The household head, if the head is female
- The (oldest) spouse/conjugal partner of the household head, if the head is male
- Non-existent, if the head is male and if he does not have a spouse/conjugal partner who is also a member of the household

If there is more than one female head/spouse, then ask this question of the oldest one.

According to the *Manual*, the *head of the household* is "that person who is recognized as the head by the other household members. It is the person who the household members name when they are asked, 'Who is the head of the household?' Often—but not always—the head is the person who makes the largest contribution to meeting the basic needs of the members of the household and who has the best knowledge of the household's activities. The head may be male or female."

5. What is the main construction material of the exterior walls?
    A. Mud bricks, logs with mud, plastic sheeting, or other
    B. Mud bricks with cement (stucco), oven-fired bricks, logs with mud and cement, stones, cement blocks, or wooden planks

According to the *Manual*, a *dwelling unit* "is made up of one or more separate buildings (all within the same compound) inhabited by a single household."

According to the *Manual*, "If the respondent's answer does not clearly correspond with one of the listed options, then mark the response correspoding with 'Other'.

6. What is the main material used for roofing the main dwelling?
   A. Thatch/leaves/grass, clay tiles, bamboo, plastic/plywood/non-permanent materials, or other
   B. Metal sheets/corrugated iron, or concrete

According to the *Manual*, a *dwelling unit* "is made up of one or more separate buildings (all within the same compound) inhabited by a single household."

According to the *Manual*, "If the respondent's answer does not clearly correspond with one of the listed options, then mark the response correspoding with 'Other'.

7. What is the main source of lighting in the residence of the household?
   A. Firewood
   B. Batteries and bulb, biogas, or other
   C. Lantern (*agatadowa*)
   D. Candle, or oil lamp
   E. Electricity (from any source), generator, or solar panel

According to the *Manual*, "This question seeks the household's main source of lighting at night."

According to the *Manual*, a *dwelling unit* "is made up of one or more separate buildings (all within the same compound) inhabited by a single household."

According to the *Manual*, "If the respondent's answer does not clearly correspond with one of the listed options, then mark the response correspoding with 'Other'.

8. How many beds does the household own?
    A. None
    B. One
    C. Two
    D. Three or more

The *Manual* has no additional information related to this indicator.

9. How many mobile telephones does the household own?
    A. None
    B. One
    C. Two or more

The *Manual* has no additional information related to this indicator.

10. In the past 12 months, has any household member grown food or other agricultural produce to eat or sell or raised cattle or poultry? If so, then how many head of cattle does the household currently own?

    A. Did not farm

    B. Farmed, but no cattle

    C. Farmed, one head

    D. Farmed, two or more head

This indicator should be asked in two parts. First, ask: "Has any household member grown food or other agricultural produce to eat or sell in the past 12 months?" If the answer is No, then mark "A. Did not farm", and do not ask the second part of the question.

    If the response to the first part of the question is "Yes", then ask the second part of the question: "How many head of cattle does the household currently own?" Mark the response as follows:

- If the household does not own any cattle, then mark "B. Farmed, but no cattle"
- If the household owns one head of cattle, then mark "C. Farmed, one head"
- If the household owns two or more head of cattle, mark "D. Farmed, two or more head"

Does the household farm?	Number of cattle	Response
No	None	A
No	One	A
No	Two or more	A
Yes	None	B
Yes	One	C
Yes	Two or more	D

Figure 1: National poverty lines (and the line marking the poorest half of people below 100% of the national line) and poverty rates for all of Rwanda and for construction/validation samples, by households and people, for 2010/11

Sample	Line or Rate	Households or people	Households surveyed	% with consumption below a poverty line				
					National			Poorest half
				Food	100%	150%	200%	below 100% natl.
All Rwanda	Line			282	402	602	803	246
	Rate	Households	14,308	20.6	40.2	63.3	75.8	19.3
	Rate	People		24.1	44.9	67.7	79.0	22.5
Construction and calibration (Selecting indicators and weights, and associating scores with likelihoods)								
	Rate	Households	7,195	20.5	40.2	63.3	75.8	19.5
Validation (Measuring accuracy)								
	Rate	Households	7,113	20.7	40.2	63.3	75.8	19.2

Source: Rwanda's 2010/11 EICV

Poverty lines are in RWF in average prices for all of Rwanda from November 2010 to October 2011.

National lines are per-adult-equivalent per day.

The line marking the poorest half of people below 100% of the national line is per-capita per day.

Figure 1: International 2005 PPP poverty lines and poverty rates for all of Rwanda and for construction/validation samples, by households and people, for 2010/11

| Sample | Line or Rate | Households or people | Households surveyed | International 2005 PPP | | | | |
				$1.25	$2.00	$2.50	$5.00	$8.44
All Rwanda	Line			480	768	961	1,921	3,243
	Rate	Households	14,308	57.3	78.0	84.3	94.1	97.3
	Rate	People		61.7	80.9	86.4	95.1	97.9
Construction and calibration (Selecting indicators and weights, and associating scores with likelihoo								
	Rate	Households	7,195	57.3	78.1	84.2	94.2	97.4
Validation (Measuring accuracy)								
	Rate	Households	7,113	57.3	77.9	84.4	94.0	97.2

Source: Rwanda's 2010/11 EICV

Poverty lines are per-person per day in RWF in average prices for all of Rwanda from Nov. 2010 to Oct. 2011.

Figure 2: Poverty poverty lines and poverty rates for all of Rwanda and by province, by households and people, for 2010/11

Poverty line region	Line or Rate	HHs or people	n	Poverty line									
				National				Poorest half below 100% natl.	International 2005 PPP				
				Food	100%	150%	200%		$1.25	$2.00	$2.50	$5.00	$8.44
All Rwanda	Line			282	402	602	803	246	480	768	961	1,921	3,243
	Rate	HHs	14,308	20.6	40.2	63.3	75.8	19.3	57.3	78.0	84.3	94.1	97.3
	Rate	People		24.1	44.9	67.7	79.0	22.5	61.7	80.9	86.4	95.1	97.9
Kigali	Line			322	458	687	916	293	548	877	1,096	2,192	3,700
	Rate	HHs	1,348	6.1	14.0	27.1	36.3	6.7	24.0	38.8	47.7	70.3	83.9
	Rate	People		7.8	16.8	30.9	40.0	8.4	27.7	42.9	51.7	73.3	86.7
South	Line			285	405	607	810	243	484	775	969	1,937	3,270
	Rate	HHs	3,840	26.8	50.5	74.9	86.1	24.4	69.0	87.7	91.8	97.7	99.1
	Rate	People		31.1	56.5	79.5	89.3	28.3	73.9	90.5	93.7	98.1	99.3
West	Line			277	394	591	788	235	471	754	943	1,886	3,183
	Rate	HHs	3,360	23.3	43.9	67.4	79.7	20.8	61.7	81.9	88.8	97.0	99.0
	Rate	People		27.4	48.4	71.1	82.0	24.2	65.5	83.7	90.0	97.4	99.2
North	Line			258	367	550	733	228	438	701	877	1,753	2,960
	Rate	HHs	2,400	20.0	38.7	62.7	76.9	18.5	56.1	79.1	85.6	96.0	98.0
	Rate	People		23.5	42.8	66.6	79.3	21.4	60.3	81.1	86.5	96.0	98.1
East	Line			289	410	616	821	257	491	786	982	1,964	3,315
	Rate	HHs	3,360	18.0	38.2	62.8	77.0	18.5	55.8	79.8	86.5	96.1	98.9
	Rate	People		20.8	42.6	67.8	80.9	21.3	60.4	83.4	89.1	97.4	99.4

Source: Rwanda's 2010/11 EICV.

Figure 3: Poverty indicators by uncertainty coefficient

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
1,051	How many mobile telephones does the household own? (None; One; Two or more)
1,002	What is the main source of lighting in the residence of the household? (Firewood; Batteries and bulb, biogas, or other; Lantern (*agatadowa*); Candle; Oil lamp; Electricity (from any source), generator, or solar panel)
941	In the last 12 months, how many household members carried out any agricultural activity (whether farming, livestock, fishing, or forestry) for salary, wages, or in-kind compensation? (Two or more; One; None)
807	What is the main construction material of the exterior walls? (Mud bricks, logs with mud, plastic sheeting, or other; Mud bricks with cement (stucco), oven-fired bricks, logs with mud and cement, stones, cement blocks, or wooden planks)
776	Does the household own a living-room suite? (No; Yes)
716	What is the main material used for the floors of the dwelling? (Packed earth, or other; Hardened dung, cement, bricks, planks, clay tiles)
686	How many beds does the household own? (None; One; Two; Three or more)
663	How many household members are 18-years-old or less? (Five or more; Four; Three; Two; One; None)
651	How many household members are 17-years-old or less? (Five or more; Four; Three; Two; One; None)
640	What is the main source of drinking water for the household? (Unprotected spring; Protected spring; Tube well or borehole, surface water (river/lake/pond/stream/irrigation channel), rainwater, or tanker truck; Protected or unprotected well; Public tap/standpipe; Piped into dwelling, piped to yard/plot, or other)
637	How many household members are 16-years-old or less? (Five or more; Four; Three; Two; One; None)
624	How many household members are 15-years-old or less? (Five or more; Four; Three; Two; One; None)
584	What is the primary source of cooking fuel? (Firewood, crop waste, animal dung, biogas, other; Charcoal, LPG, electricity, oil/kerosene, or solar power)

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

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
578	How many household members are 14-years-old or less? (Five or more; Four; Three; Two; One; None)
507	What is the highest class that the (oldest) female head/spouse has successfully attained? (None; Primary 1; Primary 2; Primary 3; Primary 4; Primary 5; Primary 6; At least one year in a technical or vocational training school; No female head/spouse; Secondary 1 or higher)
501	How many household members are 13-years-old or less? (Five or more; Four; Three; Two; One; None)
500	What is the floor area of the dwelling in m^2? (1 to 19; 20 to 24; 25 to 29; 30 to 34; 35 to 39; 40 to 49; 50 to 59; 60 or more)
495	Have all household members ages 7 to 15 gone to school in the past 12 months? (No; Yes; No children ages 7 to 15)
492	How many household members are there? (Eight or more; Seven; Six; Five; Four; Three; Two; One)
485	How many household members are 14-years-old or less? (Four or more; Three; Two; One; None)
480	Have all household members ages 7 to 16 gone to school in the past 12 months? (No; Yes; No children ages 7 to 16)
474	Have all household members ages 7 to 14 gone to school in the past 12 months? (No; Yes; No children ages 7 to 14)
472	How many household members are 11-years-old or less? (Four or more; Three; Two; One; None)
470	How many ares of agricultural land does the household own or cultivate? (None; 0.01 to 4.99; 5 to 9.99; 10 to 14.99; 15 to 24.99; 25 to 34.99; 35 to 39.99; 40 to 54.99; 55 to 74.99; 75 to 99.99; 100 or more)
469	During the last 12 months, how many household members worked on their own farm or worked on a farm belonging to a household member without being paid or carried out any agricultural activity (whether farming, livestock, fishing, or forestry) for salary, wages, or in-kind compensation (excluding VUP)? (Four or more; Three; Two; One; None)
466	Does the household own a TV set, a radio-cassette, or a sewing machine? (No; Yes)

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

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
460	What is the highest class that the male head/spouse has successfully attained? (None; Primary 1; Primary 2; Primary 3; No male head/spouse; Primary 4; Primary 5; Primary 6; At least one year in a technical or vocational training school; Secondary 1, or higher)
451	Does the household own a cupboard or bookcase? (No; Yes)
440	Have all household members ages 7 to 17 gone to school in the past 12 months? (No; Yes; No children ages 7 to 17)
421	Have all household members ages 7 to 11 gone to school in the past 12 months? (No; Yes; No children ages 7 to 11)
420	Have all household members ages 7 to 12 gone to school in the past 12 months? (No; Yes; No children ages 7 to 12)
418	Have all household members ages 7 to 18 gone to school in the past 12 months? (No; Yes; No children ages 7 to 18)
417	Have all household members ages 7 to 13 gone to school in the past 12 months? (No; Yes; No children ages 7 to 13)
390	During the last 12 months, how many household members worked on their own farm or worked on a farm belonging to a household member without being paid? (Four or more; Three; Two; One; None)
347	In the last 12 months, how many household members carried out any agricultural activity (whether farming, livestock, fishing, or forestry) for salary, wages, or in-kind compensation? (Two or more; One; None)
329	How many tables does the household own? (None; One; Two or more)
309	How many rooms does the household occupy (excluding bathroom, toilet, kitchen, and barns)? (One; Two; Three; Four; Five; Six or more)
277	How many chairs does the household own? (None; One; Two; Three or more)

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

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
277	How does the household dispose of its garbage? (Thrown in the fields or bushes on own property, dumped in river/lake/ditch, or other; Compost heap on own property, or burned; Rubbish collection service, or publicly managed refuse area)
265	What is the main material used for roofing the main dwelling? (Thatch/leaves/grass, clay tiles, bamboo, plastic/plywood/non-permanent materials, or other; Metal sheets/corrugated iron, or concrete)
237	How many sleeping rooms does the household have? (One; Two; Three; Four or more)
231	How many household members are 14-years-old or less? (Three or more; Two; One; None)
182	Can the (oldest) female head/spouse read a letter or a simple note (regardless of language), or has she completed at least Primary 1? (No; Yes; No female head/spouse)
176	What is the current tenancy status of the household in its residence? (Provided free of charge, temporary camp or settlement, appropriated/squatting, or other; Owner-occupier (no loan or mortgage); Renter, owned with loan or mortgage, or provided by employer)
165	What type of toilet does the household use? (No toilet; Pit latrine without constructed floor slab; Pit latrine with constructed floor slab; Flush toilet, or other)
161	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then how many cattle does the household currently own? (Non-agricultural household; Agricultural household with no cattle; Agricultural household with one head of cattle; Agricultural household with two or more head of cattle)
161	What is the marital status of the (oldest) female head/spouse? (Separated; Divorced; Widow; Single, never-married; No female head/spouse; Married, polygamously; Married monogamously; Living together)
135	Does the household own a radio? (No; Yes)
123	During the last 12 months, did the male head/spouse or the (oldest) female head/spouse run or operate a non-farm business for cash or profit for themselves, like a small shop or other income-generating activity? (No; Yes)

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

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
120	What is the structure of household headship? (Both male and female heads/spouses; Female head/spouse only; Male head/spouse only)
116	In the last 12 months, how many household members ran or operated a non-farm business for cash or profit for themselves, like a small shop or other income-generating activity? (None; One; Two or more)
104	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any crop sprayers? (Agricultural household without sprayers; Agricultural household with sprayers; Non-agricultural household)
92	Can the male head/spouse read a letter or a simple note (regardless of language), or has he completed at least Primary 1? (No; No male head/spouse; Yes)
88	Does the household currently own any wheel barrows, sprinklers, or sprayers? (Agricultural household without wheel barrows, sprinklers, or sprayers; Agricultural household with wheel barrows, sprinklers, or sprayers; Non-agricultural household)
87	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any rakes or spades? (Agricultural household without rakes or spades; Agricultural household with rakes or spades; Non-agricultural household)
74	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any wheel barrows? (Agricultural household without wheel barrows; Agricultural household with wheel barrows; Non-agricultural household)
60	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any cattle or pigs? (Non-agricultural household; Agricultural household without cattle or pigs; Agricultural household with cattle or pigs)
58	Has any household member grown food or other agricultural produce to eat or sell in the past 12 months? If so, then how many machetes does the household currently own? (Agricultural household with no machetes; Non-agricultural household; Agricultural household with one machete; Agricultural household with two or more machetes)

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

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
57	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then how many hoes or shovels does the household currently own? (Non-agricultural household; Agricultural household with no hoes or shovels; Agricultural household with one hoe or shovel; Agricultural household with two hoe or shovel; Agricultural household with three hoes or shovels; Agricultural household with four or more hoes or shovels)
54	What is the marital status of the male head/spouse? (Married, polygamously; Married monogamously; No male head/spouse; Living together, divorced, separated, single, never-married, or widower)
39	Does the household currently own any sprinklers? (Agricultural household without sprinklers; Agricultural household with sprinklers; Non-agricultural household)
39	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then how many sickles or scythes does the household currently own? (Agricultural household with no sickles or scythes; Agricultural household with one sickle or scythe; Agricultural household with two or more sickles or scythes; Non-agricultural household)
38	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any picks? (Agricultural household without picks; Agricultural household with picks; Non-agricultural household)
34	During the last 12 months, how many household members worked for salary, wages, or any in-kind compensation in a non-farm business owned by someone else? (None; One; Two or more)
33	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then how many goats does the household currently own? (Agricultural household with no goats; Agricultural household with one goat; Agricultural household with two goats; Agricultural household with three goats; Agricultural household with four or more goats; Non-agricultural household)
33	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any chickens? (Agricultural household without chickens; Agricultural household with chickens; Non-agricultural household)

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

Uncertainty coefficient	Indicator (Responses ordered starting with those linked with higher poverty likelihoods)
21	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the housheold own any hatchets or axes? (Agricultural household with no hatchets or axes; Agricultural household with one hatchet or ax; Agricultural household with two or more hatchets or axes; Non-agricultural household)
14	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any sheep? (Agricultural household without sheep; Non-agricultural household; Agricultural household with sheep)
10	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any rabbits? (Agricultural household with rabbits; Agricultural household without rabbits; Non-agricultural household)
9	If any household member has grown food or other agricultural produce to eat or sell in the past 12 months, then does the household currently own any pigs? (Agricultural household with pigs; Agricultural household without pigs; Non-agricultural household)
4	Over the last 12 months, has any household member grown food or other agricultural products to eat or sell, or raised livestock? (Yes; No)

Source: 2010/11 EICV questionnaire and 100% of the national poverty line

Figures for
100% of the National Poverty Line

(and Figures Pertaining to all Poverty Lines)

Figure 4 (100% 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	99.5
5–9	93.4
10–14	90.3
15–19	83.2
20–24	71.2
25–29	63.0
30–34	50.2
35–39	34.7
40–44	27.7
45–49	17.0
50–54	11.0
55–59	6.0
60–64	2.0
65–69	0.9
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 (100% of the national line): Derivation of estimated poverty likelihoods associated with scores

Score	Households in range and < poverty line		All households in range		Poverty likelihood (%)
0–4	349	÷	350	=	99.5
5–9	1,368	÷	1,465	=	93.4
10–14	3,749	÷	4,153	=	90.3
15–19	5,955	÷	7,155	=	83.2
20–24	6,820	÷	9,584	=	71.2
25–29	7,024	÷	11,141	=	63.0
30–34	5,815	÷	11,575	=	50.2
35–39	4,298	÷	12,381	=	34.7
40–44	2,893	÷	10,445	=	27.7
45–49	1,461	÷	8,571	=	17.0
50–54	746	÷	6,777	=	11.0
55–59	270	÷	4,518	=	6.0
60–64	79	÷	4,037	=	2.0
65–69	26	÷	2,796	=	0.9
70–74	0	÷	1,518	=	0.0
75–79	0	÷	1,510	=	0.0
80–84	0	÷	1,246	=	0.0
85–89	0	÷	603	=	0.0
90–94	0	÷	69	=	0.0
95–100	0	÷	107	=	0.0

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

Figure 6 (100% of the national line): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16,384$, 2010/11 scorecard applied to the validation sample

| Score | Diff. | Difference between estimate and true value | | |
| | | Confidence interval (±percentage points) | | |
		90-percent	95-percent	99-percent
0–4	−0.5	0.2	0.2	0.2
5–9	+0.9	2.9	3.5	4.5
10–14	+1.1	2.0	2.2	3.1
15–19	+3.2	2.2	2.6	3.6
20–24	+3.4	2.6	3.1	4.4
25–29	+8.7	2.6	3.2	4.3
30–34	−2.0	2.4	3.0	4.0
35–39	−2.2	2.4	2.9	3.8
40–44	−2.9	2.8	3.4	4.3
45–49	+0.2	1.8	2.2	2.7
50–54	−7.8	5.8	6.2	7.3
55–59	+1.8	1.1	1.4	1.8
60–64	+0.2	0.8	1.0	1.2
65–69	−0.4	0.8	1.0	1.3
70–74	−0.6	0.7	0.8	0.9
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 7 (100% of the national line): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

| Sample Size | Difference between estimate and true value | | | |
| | | Confidence interval (±percentage points) | | |
n	Diff.	90-percent	95-percent	99-percent
1	+1.1	64.2	71.7	90.9
4	+1.6	37.0	44.2	60.0
8	+1.5	28.0	34.2	45.4
16	+1.3	20.4	25.1	33.1
32	+1.0	16.2	19.6	24.9
64	+0.5	11.7	14.5	18.5
128	+0.3	8.6	10.0	13.6
256	+0.4	6.1	7.6	9.3
512	+0.4	4.1	5.0	6.7
1,024	+0.4	3.0	3.5	4.5
2,048	+0.3	2.2	2.6	3.4
4,096	+0.4	1.6	1.9	2.5
8,192	+0.4	1.1	1.3	1.7
16,384	+0.4	0.8	0.9	1.2

Figure 8 (National poverty lines and the line that marks the poorest half of people below 100% of the national line): Average differences between estimates and true values for poverty rates of a group of households at a point in time, precision, and the α factor for precision, 2010/11 scorecard applied to the validation sample

| | | Poverty line | | | |
| | | National | | | Poorest half |
	Food	100%	150%	200%	below 100% natl.
Estimate minus true value	+0.2	+0.4	+1.5	+2.2	+0.3
Precision of difference	0.7	0.8	0.7	0.6	0.7
α factor for precision	1.31	1.23	1.07	1.08	1.35

Results pertain to the 2010/11 scorecard applied to the validation sample.

Differences between estimates and true values are displayed in units of percentage points.

Precision is measured as 90-percent confidence intervals in units of $\pm$ percentage points.

Differences and precision estimated from 1,000 bootstraps with $n = 16{,}384$.

α is estimated from 1,000 bootstrap samples of $n = 256, 512, 1{,}024, 2{,}048, 4{,}096, 8{,}192$, and 16,384.

Figure 8 (International 2005 PPP poverty lines): Average differences between estimates and true values for poverty rates of a group of households at a point in time, precision, and the α factor for precision, 2010/11 scorecard applied to the validation sample

| | International 2005 PPP poverty lines | | | | |
	$1.25	**$2.00**	**$2.50**	**$5.00**	**$8.44**
Estimate minus true value	+1.1	+2.0	+1.8	+1.0	+0.2
Precision of difference	0.7	0.6	0.5	0.3	0.3
α factor for precision	1.08	1.03	1.14	1.12	1.20

Results pertain to the 2010/11 scorecard applied to the validation sample.

Differences between estimates and true values are displayed in units of percentage points.

Precision is measured as 90-percent confidence intervals in units of ± percentage points.

Differences and precision estimated from 1,000 bootstraps with n = 16,384.

α is estimated from 1,000 bootstrap samples of n = 256, 512, 1,024, 2,048, 4,096, 8,192, and 16,384.

Figure 9 (All poverty lines): Possible targeting outcomes

		Targeting segment	
		Targeted	**Non-targeted**
True poverty status	**Below poverty line**	**Inclusion** Below poverty line correctly targeted	**Undercoverage** Below poverty line mistakenly non-targeted
	Above poverty line	**Leakage** Above poverty line mistakenly targeted	**Exclusion** Above poverty line correctly non-targeted

Figure 10 (100% of the national line): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	39.8	0.0	59.8	60.2	−98.3
≤9	1.7	38.5	0.1	59.7	61.4	−91.2
≤14	5.3	34.9	0.7	59.1	64.4	−72.0
≤19	11.0	29.2	2.1	57.7	68.7	−39.9
≤24	17.8	22.4	4.9	54.9	72.6	+0.7
≤29	24.7	15.5	9.1	50.7	75.4	+45.7
≤34	30.4	9.8	15.0	44.8	75.2	+62.6
≤39	34.9	5.3	22.9	36.9	71.7	+42.9
≤44	37.6	2.6	30.7	29.2	66.8	+23.7
≤49	39.0	1.2	37.8	22.0	61.0	+5.9
≤54	39.8	0.4	43.8	16.0	55.8	−9.0
≤59	40.0	0.1	48.1	11.7	51.8	−19.6
≤64	40.1	0.1	52.0	7.8	47.9	−29.5
≤69	40.2	0.0	54.8	5.0	45.2	−36.3
≤74	40.2	0.0	56.3	3.5	43.7	−40.0
≤79	40.2	0.0	57.8	2.0	42.2	−43.8
≤84	40.2	0.0	59.0	0.8	41.0	−46.9
≤89	40.2	0.0	59.6	0.2	40.4	−48.4
≤94	40.2	0.0	59.7	0.1	40.3	−48.6
≤100	40.2	0.0	59.8	0.0	40.2	−48.8

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

Figure 11 (100% of the national line): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.9	Only poor targeted
≤9	1.8	94.0	4.2	15.7:1
≤14	6.0	88.5	13.1	7.7:1
≤19	13.1	83.9	27.4	5.2:1
≤24	22.7	78.2	44.2	3.6:1
≤29	33.8	73.0	61.5	2.7:1
≤34	45.4	66.9	75.7	2.0:1
≤39	57.8	60.3	86.7	1.5:1
≤44	68.2	55.1	93.6	1.2:1
≤49	76.8	50.8	97.1	1.0:1
≤54	83.6	47.6	99.0	0.9:1
≤59	88.1	45.4	99.6	0.8:1
≤64	92.2	43.5	99.9	0.8:1
≤69	94.9	42.3	100.0	0.7:1
≤74	96.5	41.7	100.0	0.7:1
≤79	98.0	41.0	100.0	0.7:1
≤84	99.2	40.5	100.0	0.7:1
≤89	99.8	40.3	100.0	0.7:1
≤94	99.9	40.2	100.0	0.7:1
≤100	100.0	40.2	100.0	0.7:1

Tables for
the Food Poverty Line

Figure 4 (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	98.3
5–9	77.2
10–14	72.0
15–19	57.3
20–24	38.7
25–29	28.8
30–34	19.3
35–39	14.0
40–44	9.2
45–49	5.0
50–54	2.7
55–59	0.6
60–64	0.4
65–69	0.2
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (Food line): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16{,}384$, 2010/11 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	4.4	4.9	6.1
5–9	+3.2	5.0	5.9	7.7
10–14	+8.8	4.4	5.1	7.0
15–19	+0.6	2.6	3.2	4.1
20–24	+5.6	2.6	3.1	4.1
25–29	+1.9	2.1	2.5	3.3
30–34	–3.3	2.9	3.1	3.7
35–39	–4.6	3.5	3.8	4.1
40–44	–2.5	2.4	2.7	3.5
45–49	+2.0	0.8	0.9	1.2
50–54	+0.8	0.6	0.7	0.9
55–59	–0.2	0.6	0.7	0.9
60–64	+0.3	0.2	0.2	0.3
65–69	–0.6	0.7	0.9	1.1
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 7 (Food line): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
	Diff.	Confidence interval (±percentage points)		
n		90-percent	95-percent	99-percent
1	+1.1	55.0	71.6	84.0
4	+1.8	31.8	39.8	53.8
8	+1.5	22.9	29.9	40.6
16	+1.2	18.0	21.9	29.3
32	+0.5	13.7	16.0	20.9
64	+0.3	9.9	11.8	15.1
128	+0.2	7.2	8.8	12.2
256	+0.2	5.5	6.6	8.5
512	+0.2	3.8	4.5	6.1
1,024	+0.2	2.7	3.1	4.2
2,048	+0.2	1.9	2.3	2.9
4,096	+0.2	1.3	1.5	2.1
8,192	+0.2	1.0	1.1	1.5
16,384	+0.2	0.7	0.8	1.1

Figure 10 (Food line): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.3	20.3	0.0	79.3	79.7	−96.7
≤9	1.4	19.2	0.4	78.9	80.4	−84.4
≤14	4.2	16.5	1.8	77.5	81.7	−50.9
≤19	8.1	12.6	5.0	74.3	82.4	+2.7
≤24	11.6	9.0	11.1	68.3	79.9	+46.4
≤29	15.0	5.7	18.9	60.5	75.5	+8.7
≤34	17.4	3.3	28.0	51.3	68.7	−35.7
≤39	19.2	1.4	38.6	40.8	60.0	−86.7
≤44	20.2	0.5	48.1	31.3	51.4	−132.8
≤49	20.4	0.2	56.4	23.0	43.4	−173.0
≤54	20.6	0.1	63.0	16.3	36.9	−205.1
≤59	20.6	0.0	67.5	11.9	32.5	−226.8
≤64	20.6	0.0	71.5	7.8	28.5	−246.3
≤69	20.7	0.0	74.3	5.1	25.7	−259.7
≤74	20.7	0.0	75.8	3.5	24.2	−267.0
≤79	20.7	0.0	77.3	2.0	22.7	−274.4
≤84	20.7	0.0	78.6	0.8	21.4	−280.4
≤89	20.7	0.0	79.2	0.2	20.8	−283.3
≤94	20.7	0.0	79.2	0.1	20.8	−283.7
≤100	20.7	0.0	79.3	0.0	20.7	−284.2

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

Figure 11 (Food line): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	96.1	1.6	24.7:1
≤9	1.8	77.7	6.8	3.5:1
≤14	6.0	69.7	20.2	2.3:1
≤19	13.1	61.6	39.1	1.6:1
≤24	22.7	51.2	56.3	1.0:1
≤29	33.8	44.3	72.6	0.8:1
≤34	45.4	38.3	84.2	0.6:1
≤39	57.8	33.3	93.2	0.5:1
≤44	68.2	29.5	97.6	0.4:1
≤49	76.8	26.6	98.9	0.4:1
≤54	83.6	24.6	99.7	0.3:1
≤59	88.1	23.4	99.9	0.3:1
≤64	92.2	22.4	99.9	0.3:1
≤69	94.9	21.8	100.0	0.3:1
≤74	96.5	21.4	100.0	0.3:1
≤79	98.0	21.1	100.0	0.3:1
≤84	99.2	20.8	100.0	0.3:1
≤89	99.8	20.7	100.0	0.3:1
≤94	99.9	20.7	100.0	0.3:1
≤100	100.0	20.7	100.0	0.3:1

Tables for
150% of the National Poverty Line

Figure 4 (150% of national line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	98.1
10–14	97.7
15–19	95.6
20–24	91.0
25–29	90.6
30–34	83.0
35–39	70.5
40–44	58.4
45–49	45.1
50–54	30.5
55–59	25.4
60–64	14.0
65–69	7.3
70–74	3.6
75–79	1.3
80–84	0.5
85–89	0.4
90–94	0.0
95–100	0.0

Figure 6 (150% of national line): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16,384$, 2010/11 scorecard applied to the validation sample

| Score | Diff. | Difference between estimate and true value Confidence interval ($\pm$percentage points) | | |
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	−1.9	0.9	0.9	0.9
10–14	0.0	0.8	1.0	1.4
15–19	+1.7	1.2	1.5	1.9
20–24	−1.8	1.4	1.5	1.8
25–29	+3.4	1.9	2.2	3.0
30–34	+7.8	2.0	2.4	3.1
35–39	−0.1	2.4	2.9	3.7
40–44	+5.3	2.8	3.3	3.9
45–49	−2.3	2.4	2.8	3.6
50–54	−7.7	5.6	6.1	6.9
55–59	+5.7	2.4	2.9	4.0
60–64	+4.5	1.9	2.2	2.9
65–69	+1.2	1.7	2.0	2.5
70–74	−2.7	2.5	2.8	3.8
75–79	−1.6	1.8	2.2	2.8
80–84	−2.5	2.4	2.6	3.2
85–89	+0.4	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 7 (150% of national line): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (±percentage points)		
		90-percent	95-percent	99-percent
1	+0.8	68.9	82.6	90.2
4	+1.5	33.9	40.9	52.1
8	+1.8	26.4	30.9	41.3
16	+1.4	18.1	23.1	30.4
32	+1.9	14.3	18.0	22.5
64	+1.6	10.3	11.8	15.5
128	+1.4	7.5	8.8	11.2
256	+1.5	5.2	6.2	7.6
512	+1.6	3.7	4.4	5.4
1,024	+1.6	2.6	3.0	4.2
2,048	+1.5	1.9	2.4	3.1
4,096	+1.5	1.3	1.7	2.1
8,192	+1.5	1.0	1.1	1.5
16,384	+1.5	0.7	0.8	1.0

Figure 10 (150% of national line): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	62.9	0.0	36.7	37.1	−98.9
≤9	1.8	61.5	0.0	36.7	38.5	−94.3
≤14	5.8	57.4	0.1	36.6	42.4	−81.3
≤19	12.5	50.8	0.6	36.1	48.6	−59.5
≤24	21.3	42.0	1.4	35.3	56.5	−30.5
≤29	31.1	32.2	2.8	33.9	65.0	+2.6
≤34	40.0	23.3	5.4	31.3	71.3	+35.0
≤39	48.9	14.3	8.9	27.9	76.8	+68.7
≤44	54.9	8.4	13.4	23.3	78.2	+78.8
≤49	59.0	4.3	17.9	18.9	77.8	+71.8
≤54	61.4	1.9	22.2	14.5	75.8	+64.9
≤59	62.4	0.9	25.7	11.0	73.3	+59.3
≤64	62.9	0.4	29.3	7.4	70.3	+53.7
≤69	63.1	0.2	31.9	4.9	67.9	+49.7
≤74	63.2	0.1	33.3	3.5	66.7	+47.4
≤79	63.2	0.0	34.7	2.0	65.2	+45.1
≤84	63.3	0.0	35.9	0.8	64.1	+43.2
≤89	63.3	0.0	36.5	0.2	63.5	+42.3
≤94	63.3	0.0	36.6	0.1	63.4	+42.2
≤100	63.3	0.0	36.7	0.0	63.3	+42.0

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

Figure 11 (150% of national line): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.6	Only poor targeted
≤9	1.8	100.0	2.9	Only poor targeted
≤14	6.0	97.9	9.2	46.7:1
≤19	13.1	95.4	19.8	20.8:1
≤24	22.7	93.6	33.6	14.7:1
≤29	33.8	91.8	49.1	11.2:1
≤34	45.4	88.0	63.2	7.4:1
≤39	57.8	84.7	77.3	5.5:1
≤44	68.2	80.4	86.7	4.1:1
≤49	76.8	76.8	93.2	3.3:1
≤54	83.6	73.4	97.0	2.8:1
≤59	88.1	70.8	98.6	2.4:1
≤64	92.2	68.2	99.4	2.1:1
≤69	94.9	66.4	99.7	2.0:1
≤74	96.5	65.5	99.9	1.9:1
≤79	98.0	64.6	99.9	1.8:1
≤84	99.2	63.8	100.0	1.8:1
≤89	99.8	63.4	100.0	1.7:1
≤94	99.9	63.4	100.0	1.7:1
≤100	100.0	63.3	100.0	1.7:1

Tables for
200% of the National Poverty Line

Figure 4 (200% of national line): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	99.2
10–14	99.1
15–19	98.3
20–24	96.9
25–29	96.1
30–34	94.4
35–39	87.1
40–44	78.9
45–49	67.8
50–54	56.3
55–59	42.8
60–64	27.8
65–69	18.6
70–74	9.9
75–79	7.2
80–84	4.9
85–89	1.0
90–94	0.0
95–100	0.0

Figure 6 (200% of national line): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16{,}384$, 2010/11 scorecard applied to the validation sample

Score	Diff.	Difference between estimate and true value		
		Confidence interval ($\pm$percentage points)		
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	−0.8	0.4	0.4	0.4
10–14	−0.3	0.4	0.5	0.6
15–19	−0.4	0.5	0.6	0.8
20–24	−0.7	0.6	0.7	1.0
25–29	−1.0	0.8	0.9	1.0
30–34	+5.9	1.7	2.0	2.5
35–39	+2.9	2.4	2.8	3.8
40–44	+6.7	2.7	3.1	4.0
45–49	+1.5	2.2	2.7	3.4
50–54	−4.4	3.8	4.1	4.7
55–59	+7.4	3.2	3.9	5.2
60–64	+6.2	2.8	3.3	4.3
65–69	+5.6	2.5	2.9	3.7
70–74	−3.5	3.9	4.6	5.8
75–79	+1.2	2.5	3.0	3.7
80–84	+1.9	2.1	2.4	3.2
85–89	−0.3	1.6	1.7	2.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 7 (200% of national line): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size n	Diff.	Difference between estimate and true value		
		Confidence interval (±percentage points)		
		90-percent	95-percent	99-percent
1	+2.5	65.4	75.8	86.4
4	+2.1	32.5	39.3	49.2
8	+2.1	24.9	29.9	38.4
16	+2.0	17.9	21.6	27.1
32	+2.3	12.9	15.7	20.5
64	+2.3	9.4	11.5	15.1
128	+2.1	7.0	8.1	11.3
256	+2.1	4.7	5.6	7.9
512	+2.2	3.5	4.0	5.1
1,024	+2.2	2.4	2.7	3.5
2,048	+2.2	1.7	2.0	2.5
4,096	+2.1	1.2	1.4	1.8
8,192	+2.2	0.9	1.0	1.4
16,384	+2.2	0.6	0.7	0.9

Figure 10 (200% of national line): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	75.5	0.0	24.2	24.5	−99.1
≤9	1.8	74.0	0.0	24.2	26.0	−95.2
≤14	5.9	69.9	0.0	24.1	30.1	−84.3
≤19	13.0	62.8	0.1	24.0	37.0	−65.6
≤24	22.3	53.6	0.4	23.7	46.0	−40.7
≤29	33.0	42.9	0.9	23.3	56.3	−11.9
≤34	43.5	32.4	2.0	22.2	65.7	+17.2
≤39	54.4	21.5	3.4	20.7	75.1	+47.9
≤44	62.3	13.5	5.9	18.3	80.6	+72.2
≤49	68.2	7.6	8.6	15.5	83.7	+88.6
≤54	72.2	3.6	11.4	12.8	84.9	+84.9
≤59	73.9	1.9	14.2	10.0	83.9	+81.3
≤64	75.0	0.8	17.2	7.0	82.0	+77.4
≤69	75.5	0.4	19.5	4.7	80.2	+74.3
≤74	75.7	0.1	20.8	3.4	79.1	+72.6
≤79	75.8	0.0	22.2	2.0	77.7	+70.7
≤84	75.8	0.0	23.4	0.8	76.6	+69.1
≤89	75.8	0.0	24.0	0.2	76.0	+68.3
≤94	75.8	0.0	24.1	0.1	75.9	+68.3
≤100	75.8	0.0	24.2	0.0	75.8	+68.1

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

Figure 11 (200% of national line): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.5	Only poor targeted
≤9	1.8	100.0	2.4	Only poor targeted
≤14	6.0	99.4	7.8	158.7:1
≤19	13.1	98.9	17.1	91.3:1
≤24	22.7	98.0	29.4	49.8:1
≤29	33.8	97.4	43.5	37.3:1
≤34	45.4	95.7	57.3	22.1:1
≤39	57.8	94.0	71.7	15.8:1
≤44	68.2	91.3	82.2	10.5:1
≤49	76.8	88.7	89.9	7.9:1
≤54	83.6	86.3	95.2	6.3:1
≤59	88.1	83.9	97.5	5.2:1
≤64	92.2	81.4	98.9	4.4:1
≤69	94.9	79.5	99.5	3.9:1
≤74	96.5	78.5	99.8	3.6:1
≤79	98.0	77.3	99.9	3.4:1
≤84	99.2	76.4	100.0	3.2:1
≤89	99.8	76.0	100.0	3.2:1
≤94	99.9	75.9	100.0	3.1:1
≤100	100.0	75.8	100.0	3.1:1

Tables for
the Line that Marks the Poorest Half of People below
100% of the National Poverty Line

Figure 4 (Poorest half below 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	98.2
5–9	75.6
10–14	69.7
15–19	56.3
20–24	38.6
25–29	28.3
30–34	18.2
35–39	12.6
40–44	6.5
45–49	3.4
50–54	2.0
55–59	0.5
60–64	0.0
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

Figure 6 (Poorest half below the national line): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16,384$, 2010/11 scorecard applied to the validation sample

Score	Diff.	Difference between estimate and true value		
		Confidence interval ($\pm$percentage points)		
		90-percent	95-percent	99-percent
0–4	+5.9	5.7	6.7	8.9
5–9	+3.7	5.1	6.0	7.6
10–14	+8.5	4.3	5.1	6.8
15–19	+3.4	2.5	3.1	4.5
20–24	+7.6	2.4	2.9	4.0
25–29	+2.7	2.0	2.5	3.3
30–34	−3.8	3.2	3.3	3.8
35–39	−4.3	3.4	3.6	4.1
40–44	−4.3	3.3	3.5	4.0
45–49	+0.5	0.8	1.0	1.2
50–54	+0.9	0.4	0.5	0.6
55–59	+0.1	0.3	0.4	0.5
60–64	0.0	0.0	0.0	0.0
65–69	−0.8	0.8	0.9	1.1
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 7 (Poorest half below the national line): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size n	Diff.	Difference between estimate and true value		
		Confidence interval (±percentage points)		
		90-percent	95-percent	99-percent
1	+2.5	64.0	69.0	84.6
4	+1.8	30.1	36.6	52.6
8	+1.7	21.8	29.7	41.7
16	+1.4	17.2	22.1	30.6
32	+0.7	13.9	16.4	21.4
64	+0.5	9.8	11.6	16.1
128	+0.4	7.3	8.6	11.7
256	+0.4	5.5	6.5	8.2
512	+0.3	3.8	4.6	6.4
1,024	+0.3	2.7	3.2	4.1
2,048	+0.3	1.9	2.3	2.9
4,096	+0.3	1.3	1.6	2.1
8,192	+0.3	0.9	1.1	1.5
16,384	+0.3	0.7	0.8	1.0

Figure 10 (Poorest half below the national line): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.3	18.8	0.0	80.8	81.1	−96.5
≤9	1.4	17.8	0.5	80.4	81.7	−83.4
≤14	4.0	15.1	2.0	78.9	82.9	−47.9
≤19	7.6	11.5	5.5	75.3	83.0	+8.5
≤24	10.9	8.2	11.8	69.1	80.0	+38.5
≤29	14.1	5.0	19.7	61.1	75.2	−3.2
≤34	16.4	2.8	29.0	51.8	68.2	−51.7
≤39	18.0	1.1	39.8	41.0	59.0	−108.0
≤44	18.8	0.4	49.5	31.4	50.1	−158.5
≤49	19.0	0.1	57.8	23.0	42.1	−202.0
≤54	19.1	0.0	64.5	16.4	35.5	−236.9
≤59	19.1	0.0	69.0	11.9	31.0	−260.3
≤64	19.1	0.0	73.0	7.8	26.9	−281.4
≤69	19.1	0.0	75.8	5.1	24.2	−295.9
≤74	19.1	0.0	77.3	3.5	22.7	−303.9
≤79	19.1	0.0	78.8	2.0	21.2	−311.8
≤84	19.1	0.0	80.0	0.8	19.9	−318.3
≤89	19.1	0.0	80.7	0.2	19.3	−321.4
≤94	19.1	0.0	80.7	0.1	19.2	−321.8
≤100	19.1	0.0	80.8	0.0	19.1	−322.4

Figure 11 (Poorest half below the national line): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	92.3	1.7	12.0:1
≤9	1.8	75.2	7.1	3.0:1
≤14	6.0	67.2	21.0	2.0:1
≤19	13.1	58.2	39.9	1.4:1
≤24	22.7	48.1	57.1	0.9:1
≤29	33.8	41.6	73.6	0.7:1
≤34	45.4	36.1	85.6	0.6:1
≤39	57.8	31.1	94.0	0.5:1
≤44	68.2	27.5	98.1	0.4:1
≤49	76.8	24.7	99.3	0.3:1
≤54	83.6	22.8	99.8	0.3:1
≤59	88.1	21.7	99.9	0.3:1
≤64	92.2	20.7	99.9	0.3:1
≤69	94.9	20.2	100.0	0.3:1
≤74	96.5	19.8	100.0	0.2:1
≤79	98.0	19.5	100.0	0.2:1
≤84	99.2	19.3	100.0	0.2:1
≤89	99.8	19.2	100.0	0.2:1
≤94	99.9	19.2	100.0	0.2:1
≤100	100.0	19.1	100.0	0.2:1

Tables for
The $1.25/day 2005 PPP Poverty Line

Figure 4 ($1.25/day): 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	97.5
10–14	96.7
15–19	94.3
20–24	88.2
25–29	85.1
30–34	76.6
35–39	60.4
40–44	50.8
45–49	36.4
50–54	21.2
55–59	17.4
60–64	7.7
65–69	3.4
70–74	1.8
75–79	0.2
80–84	0.2
85–89	0.2
90–94	0.0
95–100	0.0

Figure 6 ($1.25/day): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16,384$, 2010/11 scorecard applied to the validation sample

| Score | Diff. | Difference between estimate and true value | | |
| | | Confidence interval (±percentage points) | | |
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	−0.4	1.7	1.9	2.5
10–14	−0.2	1.0	1.2	1.5
15–19	+1.7	1.3	1.6	2.1
20–24	+1.6	2.0	2.2	2.8
25–29	+3.2	2.0	2.4	3.2
30–34	+5.3	2.1	2.4	3.2
35–39	−0.9	2.5	3.0	3.8
40–44	+4.0	2.8	3.3	4.3
45–49	−0.9	2.2	2.6	3.3
50–54	−9.9	6.8	7.2	8.2
55–59	+5.4	2.0	2.4	3.0
60–64	+1.2	1.6	1.9	2.5
65–69	−1.9	1.8	1.9	2.5
70–74	−0.6	1.4	1.7	2.1
75–79	−0.5	0.8	1.0	1.2
80–84	+0.2	0.0	0.0	0.0
85–89	+0.2	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 7 ($1.25/day): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+1.4	70.1	82.0	93.3
4	+2.0	33.9	42.7	54.9
8	+1.7	26.7	31.8	41.6
16	+1.5	18.8	23.6	30.9
32	+1.6	14.9	18.2	24.8
64	+1.3	10.7	13.1	17.1
128	+1.0	7.9	9.1	12.8
256	+1.1	5.3	6.6	8.4
512	+1.2	3.9	4.5	5.6
1,024	+1.1	2.6	3.0	4.3
2,048	+1.1	2.0	2.3	3.2
4,096	+1.1	1.4	1.7	2.2
8,192	+1.1	1.0	1.2	1.5
16,384	+1.1	0.7	0.8	1.1

Figure 10 ($1.25/day): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	56.9	0.0	42.7	43.1	−98.8
≤9	1.8	55.5	0.0	42.7	44.5	−93.7
≤14	5.8	51.5	0.2	42.5	48.3	−79.5
≤19	12.3	44.9	0.8	41.9	54.3	−55.5
≤24	20.7	36.6	2.0	40.7	61.4	−24.2
≤29	29.9	27.4	3.9	38.8	68.7	+11.3
≤34	38.3	19.0	7.2	35.6	73.8	+46.1
≤39	46.0	11.2	11.8	31.0	77.0	+79.5
≤44	51.0	6.2	17.2	25.5	76.6	+70.0
≤49	54.3	3.0	22.6	20.2	74.4	+60.6
≤54	56.1	1.2	27.5	15.2	71.3	+51.9
≤59	56.7	0.6	31.4	11.3	68.0	+45.1
≤64	57.0	0.2	35.1	7.6	64.6	+38.7
≤69	57.2	0.1	37.7	5.0	62.2	+34.1
≤74	57.3	0.0	39.2	3.5	60.8	+31.6
≤79	57.3	0.0	40.7	2.0	59.3	+28.9
≤84	57.3	0.0	41.9	0.8	58.1	+26.8
≤89	57.3	0.0	42.5	0.2	57.5	+25.7
≤94	57.3	0.0	42.6	0.1	57.4	+25.6
≤100	57.3	0.0	42.7	0.0	57.3	+25.4

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

Figure 11 ($1.25/day): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.6	Only poor targeted
≤9	1.8	98.4	3.1	61.7:1
≤14	6.0	96.6	10.1	28.7:1
≤19	13.1	94.0	21.5	15.8:1
≤24	22.7	91.1	36.1	10.2:1
≤29	33.8	88.4	52.2	7.6:1
≤34	45.4	84.2	66.8	5.3:1
≤39	57.8	79.6	80.4	3.9:1
≤44	68.2	74.8	89.1	3.0:1
≤49	76.8	70.6	94.7	2.4:1
≤54	83.6	67.1	97.9	2.0:1
≤59	88.1	64.3	99.0	1.8:1
≤64	92.2	61.9	99.6	1.6:1
≤69	94.9	60.3	99.9	1.5:1
≤74	96.5	59.4	100.0	1.5:1
≤79	98.0	58.5	100.0	1.4:1
≤84	99.2	57.7	100.0	1.4:1
≤89	99.8	57.4	100.0	1.3:1
≤94	99.9	57.3	100.0	1.3:1
≤100	100.0	57.3	100.0	1.3:1

Tables for
The $2.00/Day 2005 PPP Poverty Line

Figure 4 ($2.00/day): 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	99.2
10–14	99.1
15–19	98.6
20–24	97.4
25–29	96.9
30–34	95.9
35–39	90.6
40–44	83.3
45–49	73.2
50–54	61.5
55–59	46.6
60–64	31.1
65–69	17.7
70–74	10.1
75–79	8.2
80–84	2.1
85–89	0.6
90–94	0.0
95–100	0.0

Figure 6 ($2.00/day): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16{,}384$, 2010/11 scorecard applied to the validation sample

| Score | Diff. | Difference between estimate and true value | | |
| | | Confidence interval (±percentage points) | | |
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	−0.8	0.4	0.4	0.4
10–14	−0.3	0.4	0.5	0.6
15–19	−0.5	0.4	0.5	0.7
20–24	−0.4	0.6	0.7	0.9
25–29	−0.8	0.7	0.7	0.8
30–34	+2.9	1.1	1.3	1.7
35–39	+4.1	2.3	2.9	4.0
40–44	+4.3	2.3	2.8	3.7
45–49	+3.5	2.2	2.6	3.4
50–54	−2.4	3.0	3.4	4.6
55–59	+8.9	3.3	3.9	5.2
60–64	+7.6	3.0	3.7	4.7
65–69	+4.9	2.5	2.9	3.6
70–74	−5.9	5.1	5.5	6.3
75–79	+2.2	2.5	3.0	3.7
80–84	−0.9	2.1	2.4	3.2
85–89	−0.7	1.6	1.7	2.0
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 7 ($2.00/day): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size n	Diff.	Difference between estimate and true value		
		Confidence interval (±percentage points)		
		90-percent	95-percent	99-percent
1	+2.2	60.9	72.0	86.2
4	+2.1	30.8	36.4	47.4
8	+2.2	21.6	28.2	36.9
16	+2.0	17.0	19.8	24.7
32	+2.2	12.0	14.6	19.6
64	+2.2	9.1	10.6	13.5
128	+2.0	6.2	7.2	9.6
256	+2.0	4.3	5.1	6.7
512	+2.1	3.0	3.6	5.0
1,024	+2.1	2.1	2.6	3.4
2,048	+2.1	1.6	1.9	2.4
4,096	+2.0	1.1	1.3	1.6
8,192	+2.0	0.8	1.0	1.2
16,384	+2.0	0.6	0.7	0.9

Figure 10 ($2.00/day): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	77.5	0.0	22.1	22.5	−99.1
≤9	1.8	76.1	0.0	22.1	23.9	−95.3
≤14	5.9	72.0	0.0	22.1	28.0	−84.7
≤19	13.0	64.9	0.1	22.0	35.0	−66.4
≤24	22.3	55.6	0.4	21.7	44.1	−42.2
≤29	33.1	44.8	0.7	21.4	54.5	−14.0
≤34	43.9	34.0	1.5	20.6	64.5	+14.7
≤39	55.2	22.7	2.6	19.5	74.6	+45.0
≤44	63.6	14.3	4.7	17.4	81.0	+69.3
≤49	69.7	8.1	7.1	15.0	84.8	+88.2
≤54	74.0	3.9	9.6	12.5	86.5	+87.7
≤59	75.9	2.0	12.2	9.9	85.7	+84.3
≤64	77.0	0.9	15.1	7.0	84.0	+80.6
≤69	77.5	0.4	17.5	4.7	82.1	+77.6
≤74	77.7	0.1	18.7	3.4	81.1	+76.0
≤79	77.8	0.0	20.1	2.0	79.8	+74.2
≤84	77.9	0.0	21.3	0.8	78.6	+72.6
≤89	77.9	0.0	21.9	0.2	78.1	+71.8
≤94	77.9	0.0	22.0	0.1	78.0	+71.8
≤100	77.9	0.0	22.1	0.0	77.9	+71.6

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

Figure 11 ($2.00/day): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.4	Only poor targeted
≤9	1.8	100.0	2.3	Only poor targeted
≤14	6.0	99.4	7.6	158.7:1
≤19	13.1	99.1	16.7	115.5:1
≤24	22.7	98.3	28.7	58.6:1
≤29	33.8	97.8	42.5	45.1:1
≤34	45.4	96.7	56.4	29.1:1
≤39	57.8	95.4	70.8	20.9:1
≤44	68.2	93.2	81.6	13.6:1
≤49	76.8	90.8	89.5	9.9:1
≤54	83.6	88.5	95.0	7.7:1
≤59	88.1	86.1	97.4	6.2:1
≤64	92.2	83.6	98.9	5.1:1
≤69	94.9	81.6	99.5	4.4:1
≤74	96.5	80.6	99.8	4.2:1
≤79	98.0	79.4	99.9	3.9:1
≤84	99.2	78.5	100.0	3.6:1
≤89	99.8	78.0	100.0	3.6:1
≤94	99.9	78.0	100.0	3.5:1
≤100	100.0	77.9	100.0	3.5:1

Tables for
the $2.50/Day 2005 PPP Poverty Line

Figure 4 ($2.50/day): 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	99.8
10–14	99.7
15–19	99.6
20–24	99.1
25–29	98.7
30–34	98.3
35–39	95.7
40–44	91.2
45–49	85.2
50–54	77.2
55–59	61.0
60–64	44.4
65–69	28.0
70–74	18.2
75–79	14.8
80–84	8.7
85–89	2.4
90–94	0.0
95–100	0.0

Figure 6 ($2.50/day): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16,384$, 2010/11 scorecard applied to the validation sample

| Score | Diff. | Difference between estimate and true value | | |
| | | Confidence interval ($\pm$percentage points) | | |
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	−0.2	0.1	0.1	0.1
10–14	+0.1	0.4	0.4	0.5
15–19	+0.5	0.4	0.5	0.7
20–24	+0.1	0.4	0.5	0.6
25–29	−0.2	0.4	0.4	0.6
30–34	+0.2	0.5	0.6	0.7
35–39	+4.9	2.4	2.9	3.7
40–44	+4.6	2.1	2.6	3.4
45–49	+3.9	2.1	2.5	3.2
50–54	−2.6	2.5	2.8	3.6
55–59	+6.2	3.7	4.4	5.8
60–64	+1.7	4.0	4.7	6.1
65–69	+6.9	3.1	3.8	5.1
70–74	−7.6	6.4	6.9	7.8
75–79	+2.6	3.5	4.2	5.7
80–84	+4.2	2.5	2.9	3.5
85–89	−1.8	2.9	3.2	4.3
90–94	0.0	0.0	0.0	0.0
95–100	0.0	0.0	0.0	0.0

Figure 7 ($2.50/day): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size n	Difference between estimate and true value			
		Confidence interval (±percentage points)		
	Diff.	90-percent	95-percent	99-percent
1	+0.6	50.0	70.4	90.0
4	+1.3	26.8	34.0	50.5
8	+1.5	19.3	25.8	39.9
16	+1.6	15.8	19.6	25.2
32	+1.8	11.7	14.6	18.8
64	+2.0	8.3	9.9	13.3
128	+1.8	5.7	7.1	9.2
256	+1.8	4.2	4.9	6.5
512	+1.8	2.8	3.5	4.8
1,024	+1.8	1.9	2.4	3.4
2,048	+1.8	1.4	1.7	2.4
4,096	+1.8	1.0	1.2	1.6
8,192	+1.8	0.7	0.9	1.2
16,384	+1.8	0.5	0.7	0.8

Figure 10 ($2.50/day): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	84.0	0.0	15.6	16.0	−99.2
≤9	1.8	82.6	0.0	15.6	17.4	−95.7
≤14	5.9	78.4	0.0	15.6	21.5	−85.9
≤19	13.0	71.4	0.1	15.5	28.5	−69.0
≤24	22.5	61.9	0.2	15.4	37.9	−46.4
≤29	33.4	50.9	0.4	15.2	48.7	−20.2
≤34	44.8	39.6	0.7	15.0	59.7	+6.9
≤39	56.6	27.8	1.2	14.4	71.0	+35.6
≤44	66.0	18.4	2.2	13.4	79.4	+59.1
≤49	73.2	11.2	3.6	12.0	85.2	+77.8
≤54	78.5	5.9	5.1	10.5	89.1	+92.1
≤59	81.2	3.2	6.9	8.7	89.9	+91.8
≤64	82.9	1.4	9.2	6.4	89.3	+89.1
≤69	83.7	0.7	11.3	4.4	88.1	+86.7
≤74	84.1	0.3	12.4	3.3	87.4	+85.4
≤79	84.3	0.1	13.7	1.9	86.2	+83.8
≤84	84.3	0.0	14.9	0.7	85.1	+82.4
≤89	84.4	0.0	15.4	0.2	84.6	+81.7
≤94	84.4	0.0	15.5	0.1	84.5	+81.6
≤100	84.4	0.0	15.6	0.0	84.4	+81.5

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

Figure 11 ($2.50/day): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.4	Only poor targeted
≤9	1.8	100.0	2.2	Only poor targeted
≤14	6.0	99.6	7.0	241.2:1
≤19	13.1	99.2	15.4	130.4:1
≤24	22.7	99.0	26.6	100.3:1
≤29	33.8	98.8	39.6	83.2:1
≤34	45.4	98.5	53.0	67.3:1
≤39	57.8	97.9	67.1	47.3:1
≤44	68.2	96.7	78.3	29.8:1
≤49	76.8	95.3	86.8	20.3:1
≤54	83.6	93.9	93.1	15.5:1
≤59	88.1	92.1	96.2	11.7:1
≤64	92.2	90.0	98.3	9.0:1
≤69	94.9	88.2	99.2	7.4:1
≤74	96.5	87.2	99.7	6.8:1
≤79	98.0	86.0	99.9	6.2:1
≤84	99.2	85.0	100.0	5.7:1
≤89	99.8	84.5	100.0	5.5:1
≤94	99.9	84.5	100.0	5.4:1
≤100	100.0	84.4	100.0	5.4:1

Tables for
the $5.00/Day 2005 PPP Poverty Line

Figure 4 ($5.00/day): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	100.0
15–19	100.0
20–24	100.0
25–29	99.9
30–34	99.9
35–39	99.9
40–44	99.5
45–49	98.5
50–54	95.7
55–59	90.4
60–64	80.2
65–69	69.4
70–74	55.6
75–79	50.8
80–84	28.2
85–89	16.8
90–94	10.9
95–100	0.0

Figure 6 ($5.00/day): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16{,}384$, 2010/11 scorecard applied to the validation sample

| Score | Diff. | Difference between estimate and true value Confidence interval (±percentage points) | | |
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0
10–14	0.0	0.0	0.0	0.0
15–19	0.0	0.0	0.0	0.0
20–24	0.0	0.0	0.0	0.0
25–29	+0.1	0.1	0.1	0.2
30–34	0.0	0.1	0.1	0.2
35–39	+0.2	0.2	0.2	0.3
40–44	+0.1	0.3	0.3	0.4
45–49	−0.4	0.5	0.6	0.7
50–54	−0.6	1.1	1.2	1.6
55–59	+6.6	3.6	4.2	5.8
60–64	+8.1	3.8	4.3	5.8
65–69	+8.9	4.8	5.8	7.5
70–74	+1.2	5.5	6.7	8.5
75–79	+17.1	5.0	6.1	7.5
80–84	+0.7	6.1	7.0	9.2
85–89	−21.1	15.1	15.8	18.1
90–94	−11.0	22.5	25.3	31.7
95–100	−31.3	26.0	28.5	31.3

Figure 7 ($5.00/day): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size	Difference between estimate and true value			
		Confidence interval (±percentage points)		
n	Diff.	90-percent	95-percent	99-percent
1	+0.8	24.0	55.4	85.1
4	+0.7	17.6	22.9	38.5
8	+0.7	12.8	16.7	25.2
16	+0.9	9.2	12.7	18.1
32	+0.9	7.5	9.4	12.0
64	+1.0	5.3	6.5	9.0
128	+1.0	3.9	4.7	6.2
256	+1.0	2.8	3.3	4.3
512	+0.9	2.0	2.4	3.0
1,024	+1.0	1.4	1.6	2.2
2,048	+1.0	1.0	1.2	1.6
4,096	+1.0	0.7	0.8	1.0
8,192	+1.0	0.5	0.6	0.7
16,384	+1.0	0.3	0.4	0.5

Figure 10 ($5.00/day): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: ≥ poverty line mistakenly targeted	Exclusion: ≥ poverty line correctly non-targeted	Hit rate Inclusion + Exclusion	BPAC See text
≤4	0.4	93.7	0.0	6.0	6.3	−99.3
≤9	1.8	92.2	0.0	6.0	7.8	−96.1
≤14	6.0	88.1	0.0	6.0	11.9	−87.3
≤19	13.1	80.9	0.0	6.0	19.1	−72.1
≤24	22.7	71.3	0.0	6.0	28.7	−51.7
≤29	33.8	60.2	0.0	5.9	39.8	−28.0
≤34	45.4	48.7	0.0	5.9	51.3	−3.4
≤39	57.7	36.3	0.1	5.9	63.6	+22.9
≤44	68.1	25.9	0.2	5.8	73.9	+45.0
≤49	76.6	17.5	0.3	5.7	82.3	+63.1
≤54	83.1	10.9	0.5	5.5	88.6	+77.3
≤59	87.2	6.9	1.0	5.0	92.1	+86.4
≤64	90.2	3.9	2.0	4.0	94.2	+93.9
≤69	92.0	2.0	2.9	3.0	95.0	+96.9
≤74	92.9	1.2	3.6	2.4	95.2	+96.2
≤79	93.4	0.6	4.6	1.4	94.8	+95.1
≤84	93.8	0.3	5.4	0.5	94.3	+94.2
≤89	94.0	0.0	5.8	0.1	94.1	+93.8
≤94	94.0	0.0	5.9	0.1	94.1	+93.8
≤100	94.0	0.0	6.0	0.0	94.0	+93.7

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

Figure 11 ($5.00/day): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.4	Only poor targeted
≤9	1.8	100.0	1.9	Only poor targeted
≤14	6.0	100.0	6.3	Only poor targeted
≤19	13.1	100.0	14.0	Only poor targeted
≤24	22.7	100.0	24.1	Only poor targeted
≤29	33.8	99.9	36.0	1,420.1:1
≤34	45.4	99.9	48.3	1,210.3:1
≤39	57.8	99.9	61.4	723.1:1
≤44	68.2	99.8	72.4	442.5:1
≤49	76.8	99.7	81.4	302.3:1
≤54	83.6	99.4	88.4	165.1:1
≤59	88.1	98.9	92.7	90.5:1
≤64	92.2	97.9	95.9	45.7:1
≤69	94.9	96.9	97.8	31.3:1
≤74	96.5	96.3	98.8	25.9:1
≤79	98.0	95.3	99.3	20.4:1
≤84	99.2	94.5	99.7	17.3:1
≤89	99.8	94.2	100.0	16.1:1
≤94	99.9	94.1	100.0	16.0:1
≤100	100.0	94.0	100.0	15.8:1

Tables for
the $8.44/Day 2005 PPP Poverty Line

Figure 4 ($8.44/day): Estimated poverty likelihoods associated with scores

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	100.0
5–9	100.0
10–14	100.0
15–19	100.0
20–24	100.0
25–29	100.0
30–34	100.0
35–39	100.0
40–44	99.9
45–49	99.9
50–54	99.9
55–59	98.6
60–64	94.8
65–69	86.2
70–74	74.3
75–79	65.7
80–84	58.1
85–89	45.6
90–94	45.6
95–100	45.6

Figure 6 ($8.44/day): For each score range, average differences between estimated and true poverty likelihoods for households, with confidence intervals, from 1,000 bootstraps of $n = 16{,}384$, 2010/11 scorecard applied to the validation sample

Score	Diff.	Difference between estimate and true value		
		Confidence interval ($\pm$percentage points)		
		90-percent	95-percent	99-percent
0–4	0.0	0.0	0.0	0.0
5–9	0.0	0.0	0.0	0.0
10–14	0.0	0.0	0.0	0.0
15–19	0.0	0.0	0.0	0.0
20–24	0.0	0.0	0.0	0.0
25–29	+0.1	0.1	0.1	0.1
30–34	0.0	0.0	0.0	0.0
35–39	0.0	0.1	0.1	0.1
40–44	−0.1	0.0	0.0	0.0
45–49	−0.1	0.0	0.0	0.0
50–54	0.0	0.1	0.1	0.1
55–59	+2.6	1.4	1.6	2.1
60–64	+11.6	3.8	4.5	5.9
65–69	−0.3	2.8	3.4	4.4
70–74	−15.8	9.4	9.7	10.3
75–79	+5.2	5.2	6.3	8.3
80–84	−14.2	9.7	10.1	11.0
85–89	−5.7	8.9	10.9	14.7
90–94	−26.8	22.6	24.4	37.1
95–100	+14.3	20.7	24.4	31.3

Figure 7 ($8.44/day): Average differences between estimated poverty rates and true values for a group at a point in time, with confidence intervals, for 1,000 bootstraps of various sample sizes, 2010/11 scorecard applied to the validation sample

Sample Size n	Diff.	Difference between estimate and true value		
		Confidence interval (±percentage points)		
		90-percent	95-percent	99-percent
1	+0.1	6.9	35.7	68.4
4	−0.1	12.7	17.5	29.5
8	−0.2	8.9	11.7	21.2
16	0.0	6.4	9.0	16.8
32	0.0	4.7	6.6	11.2
64	+0.1	3.9	5.0	7.3
128	+0.2	2.7	3.3	4.9
256	+0.2	2.0	2.4	3.4
512	+0.2	1.5	1.7	2.3
1,024	+0.2	1.0	1.2	1.6
2,048	+0.2	0.7	0.8	1.2
4,096	+0.2	0.5	0.6	0.8
8,192	+0.2	0.4	0.4	0.6
16,384	+0.2	0.3	0.3	0.4

Figure 10 ($8.44/day): Percentages of households by cut-off score and targeting classification, along with the hit rate and BPAC, 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.4	Only poor targeted
≤9	1.8	100.0	1.9	Only poor targeted
≤14	6.0	100.0	6.1	Only poor targeted
≤19	13.1	100.0	13.5	Only poor targeted
≤24	22.7	100.0	23.4	Only poor targeted
≤29	33.8	100.0	34.8	2,563.7:1
≤34	45.4	100.0	46.7	3,440.7:1
≤39	57.8	100.0	59.4	2,266.5:1
≤44	68.2	100.0	70.2	2,676.2:1
≤49	76.8	100.0	79.0	3,012.4:1
≤54	83.6	100.0	85.9	2,609.5:1
≤59	88.1	99.8	90.4	417.2:1
≤64	92.2	99.3	94.1	132.9:1
≤69	94.9	98.8	96.5	83.8:1
≤74	96.5	98.7	97.9	73.9:1
≤79	98.0	98.1	98.8	51.6:1
≤84	99.2	97.6	99.6	41.2:1
≤89	99.8	97.4	99.9	36.8:1
≤94	99.9	97.3	100.0	36.4:1
≤100	100.0	97.2	100.0	35.3:1

Figure 11 ($8.44/day): Share of all households who are targeted (that is, score at or below a cut-off), the share of targeted households who are poor (that is, have consumption below the poverty line), the share of poor households who are targeted, and the number of poor households who are successfully targeted (inclusion) per non-poor household mistakenly targeted (leakage), 2010/11 scorecard applied to the validation sample

Targeting cut-off	% all HHs who are targeted	% targeted HHs who are poor	% poor HHs who are targeted	Poor HHs targeted per non-poor HH targeted
≤4	0.4	100.0	0.4	Only poor targeted
≤9	1.8	100.0	1.9	Only poor targeted
≤14	6.0	100.0	6.1	Only poor targeted
≤19	13.1	100.0	13.5	Only poor targeted
≤24	22.7	100.0	23.4	Only poor targeted
≤29	33.8	100.0	34.8	2,563.7:1
≤34	45.4	100.0	46.7	3,440.7:1
≤39	57.8	100.0	59.4	2,266.5:1
≤44	68.2	100.0	70.2	2,676.2:1
≤49	76.8	100.0	79.0	3,012.4:1
≤54	83.6	100.0	85.9	2,609.5:1
≤59	88.1	99.8	90.4	417.2:1
≤64	92.2	99.3	94.1	132.9:1
≤69	94.9	98.8	96.5	83.8:1
≤74	96.5	98.7	97.9	73.9:1
≤79	98.0	98.1	98.8	51.6:1
≤84	99.2	97.6	99.6	41.2:1
≤89	99.8	97.4	99.9	36.8:1
≤94	99.9	97.3	100.0	36.4:1
≤100	100.0	97.2	100.0	35.3:1