

# A Simple Poverty Scorecard for Nicaragua

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## Abstract

This study uses Nicaragua's 2005 Living Standard Measurement Survey to construct an easy-to-use scorecard that estimates the likelihood that a household has expenditure below a given poverty line. The scorecard uses ten simple indicators that field workers can quickly collect and verify. Poverty scores can be computed on paper in the field in five to ten minutes. The scorecard's accuracy and precision are reported for a range of poverty lines. The poverty scorecard is a practical way for pro-poor programs in Nicaragua to measure poverty rates, to track changes in poverty rates over time, and to target services.

## Acknowledgements

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## Figure 1: Simple poverty scorecard for Nicaragua

<u>Entity</u>	<u>Name</u>	<u>ID</u>	<u>Date</u> (DD/MM/YY)
Member:	_____	_____	Joined: _____
Loan officer:	_____	_____	Today: _____
Branch:	_____	_____	Household size: _____

  

<b>Indicator</b>	<b>Value</b>	<b>Points</b>	<b>Score</b>
1. How many household members are there?	A. Eight or more	0	
	B. Seven	10	
	C. Six	12	
	D. Five	13	
	E. Four	19	
	F. Three	26	
	G. One or two	37	
2. How many household members ages 7 to 12 are enrolled this year in the formal education system?	A. Not all	0	
	B. All, and all are in a non-autonomous public school, community school, or other	1	
	C. All, and one is in autonomous or private school	3	
	D. No children ages 7 to 12	3	
	E. All, and two or more in autonomous or private school	13	
3. Can the female head/spouse read and write?	A. No	0	
	B. Yes, or no female head/spouse	3	
4. What is the main material of the floor of the residence?	A. Earth, or other	0	
	B. Wooded planks, tiles or concrete, mud bricks, or cement bricks or tile (mosaic, ceramic, or glazed)	7	
5. What type of toilet arrangement does the household have?	A. None	0	
	B. Outhouse or latrine (with or without treatment), or flush toilet connected to cesspool, septic tank, river, or stream	3	
	C. Flush toilet connected to sewer	7	
6. What fuel does the household usually use for cooking?	A. Non-purchased firewood	0	
	B. Purchased firewood	2	
	C. Charcoal, butane or propane gas, kerosene, electricity, other, or does not cook	9	
7. Does the household have a refrigerator?	A. No	0	
	B. Yes	6	
8. Does the household have a blender?	A. No	0	
	B. Yes	4	
9. Does the household have an iron?	A. No	0	
	B. Yes	4	
10. Does the household have a radio, radio/tape player, or stereo system?	A. None	0	
	B. Only radio	1	
	C. Radio/tape player, regardless of radio, and no stereo	5	
	D. Stereo, regardless of radio and radio/tape player	10	

Microfinance Risk Management, L.L.C., <http://www.microfinance.com> **Score:**

**Figure 1: Simple poverty scorecard for Nicaragua (no points)**

<u>Entity</u>	<u>Name</u>	<u>ID</u>	<u>Date</u> (DD/MM/YY)
Member:	_____	_____	Joined: _____
Loan officer:	_____	_____	Today: _____
Branch:	_____	_____	Household size: _____

  

<u>Indicator</u>	<u>Value</u>
1. How many household members are there?	A. Eight or more B. Seven C. Six D. Five E. Four F. Three G. One or two
2. How many household members ages 7 to 12 are enrolled this year in the formal education system?	A. Not all B. All, and all in non-autonomous public school, community school, or other C. All, and one is in autonomous or private school D. No children ages 7 to 12 E. All, and two or more in autonomous or private school
3. Can the female head/spouse read and write?	A. No B. Yes, or no female head/spouse
4. What is the main material of the floor of the residence?	A. Earth, or other B. Wooded planks, tiles or concrete, mud bricks, or cement bricks or tile (mosaic, ceramic, or glazed)
5. What type of toilet arrangement does the household have?	A. None B. Outhouse or latrine (with or without treatment), or flush toilet connected to a cesspool, septic tank, river, or stream C. Flush toilet connected to sewer
6. What fuel does the household usually use for cooking?	A. Non-purchased firewood B. Purchased firewood C. Charcoal, butane or propane gas, kerosene, electricity, other, or does not cook
7. Does the household have a refrigerator?	A. No B. Yes
8. Does the household have a blender?	A. No B. Yes
9. Does the household have an iron?	A. No B. Yes
10. Does the household have a radio, radio/tape player, or stereo system?	A. None B. Only radio C. Radio/tape player, regardless of radio, and no stereo D. Stereo, regardless of radio and radio/tape player

# A Simple Poverty Scorecard for Nicaragua

## 1. Introduction

This paper presents an easy-to-use poverty scorecard that pro-poor programs in Nicaragua can use to estimate the likelihood that a household has expenditure below a given poverty line. This poverty likelihood can then be used to measure groups' poverty rates at a point in time, to track changes in groups' poverty rates between two points in time, and to target services to households.

The direct approach to poverty measurement via surveys is difficult and costly. As a case in point, Nicaragua's 2005 Living Standards Measurement Survey (EMNV, *Encuesta Nacional de Hogares sobre Medición de Nivel de Vida*) runs more than 50 pages. The expenditure module includes hundreds of questions such as "In the past 15 days, did any household member buy oatmeal or *pinolillo*?<sup>1</sup> If yes, how frequently did you buy it? How much was bought each time? How much did this amount cost? In the past 15 days, did the household consume any oatmeal or *pinolillo* that you grew yourself, received as a gift or as payment for services, or was taken from inventory of a store you own? How frequently did you consume oatmeal or *pinolillo* obtained in this way? How much was obtained each time? How much would you have paid for this, if you had to buy it? . . . Now, in the past 15 days, did anyone in the household buy tortillas? . . ."

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<sup>1</sup> *Pinolillo* is a traditional gritty Nicaraguan drink made of sweet cornmeal and cacao.

In contrast, the indirect approach via poverty scoring is simple, quick, and inexpensive. It uses ten verifiable indicators (such as “What fuel does the household usually use for cooking?” or “Does the household have an iron?”) to get a score that is highly correlated with poverty status as measured by expenditure from the exhaustive survey.

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

Poverty scorecards can serve several purposes. For example, a local pro-poor organization can use scoring to measure the share of its participants with expenditure below a poverty line such as the \$1.25/day line at 2005 purchase-power parity (PPP) used by the Millennium Development Goals. USAID microenterprise partners can use the scorecard to report how many of their participants are among the poorest half of people below the national poverty line. An organization could also use the scorecard to measure movement across a poverty line over time (for example, Daley-Harris, 2009). For all these uses, the poverty scorecard is an expenditure-based, objective tool with

known accuracy. While expenditure surveys are costly even for governments, many local pro-poor organizations can implement an inexpensive scorecard.

The statistical approach here aims to be understood by non-specialists. After all, if managers are to adopt poverty scoring on their own and apply it to inform their decisions, they must first trust that it works. Transparency and simplicity build trust. Getting “buy-in” matters; proxy means tests and regressions on the “determinants of poverty” have been around for three decades, but they are rarely used to inform decisions by local pro-poor organizations. This is not because these tools do not work, but rather because they are presented (when they are presented at all) as tables of regression coefficients incomprehensible to non-specialists (with indicator names such as “LGHHSZ\_2”, negative points, and points with many decimal places). Thanks to the predictive-modeling phenomenon known as the “flat maximum”, simple scorecards are about as accurate as complex ones.

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

The scorecard (Figure 1) is based on the 2005 EMNV conducted by Nicaragua's *Instituto Nacional de Información de Desarrollo* (INIDE.<sup>2</sup> Indicators are selected to be:

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

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

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

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

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

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<sup>2</sup> The 2005 EMNV data is exceptionally well-organized and documented (<http://www.inide.gob.ni/pobreza/pobreza.htm>, retrieved 1 June 2010).

Poverty scoring can also be used for targeting services to poorer households. To help managers choose a targeting cut-off, this paper reports several measures of targeting accuracy for a range of possible cut-offs.

This paper presents a single scorecard whose indicators and points are derived from household expenditure data and Nicaragua’s national poverty line. Scores from this scorecard are calibrated to poverty likelihoods for eight poverty lines.

The scorecard is constructed and calibrated using a sub-sample of the 2005 EMNV. Its accuracy is then validated on a different sub-sample from the 2005 EMNV. While all three scoring estimators are unbiased when applied to the population from which they are derived (that is, they match the true value on average in repeated samples from the same population from which the scorecard is built), they are—like all predictive models—biased to some extent when applied to a different population.<sup>3</sup>

Thus, while the indirect-scoring approach is less costly than the direct-survey approach, it is also biased in practice. (The direct-survey approach is unbiased by definition.) There is bias because scoring must assume that the relationships between indicators and poverty in the future will be the same as in the data used to build the scorecard. It must also assume that these relationships will be the same in all sub-

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<sup>3</sup> Important examples of “different populations” are nationally representative samples at another point in time or non-representative sub-groups (Tarozzi and Deaton, 2007).



groups as in the population as a whole.<sup>4</sup> Of course, these assumptions—ubiquitous and inevitable in predictive modeling—hold only partly.

When applied to the 2005 validation sample for Nicaragua with the national poverty line and  $n = 16,384$ , the difference between scorecard estimates of groups' poverty rates and the true rates at a point in time is +2.3 percentage points. Across all eight lines, the average absolute difference is 1.8 percentage points, and the maximum absolute difference is 3.4 percentage points. Because the 2005 validation sample is representative of the same population as the data that is used to construct the scorecard, and because all the data come from the same time frame, the scorecard estimators are unbiased and these observed differences are due to sampling variation; the average difference would be zero if the 2005 EMNV were to be repeatedly redrawn and divided into sub-samples before repeating the entire scorecard-building and accuracy-testing process.

For  $n = 16,384$ , the 90-percent confidence intervals for these estimates are  $\pm 0.6$  percentage points or less. For  $n = 1,024$ , these intervals are  $\pm 2.5$  percentage points or less.

Section 2 below documents data, poverty rates, and poverty lines for Nicaragua. Sections 3 and 4 describe scorecard construction and offer practical guidelines for use.

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<sup>4</sup> Bias may also result from changes over time in the quality of data collection, from changes in the real value of poverty lines, from imperfect adjustment of poverty lines to account for differences in cost-of-living across time or geographic regions, or from sampling variation across surveys.

Sections 5 and 6 detail the estimation of households' poverty likelihoods and of groups' poverty rates at a point in time. Section 7 discusses estimating changes in poverty rates, and Section 8 covers targeting. Section 9 places the new scorecard here in the context of similar existing exercises for Nicaragua. The final section is a summary.

## 2. Data and poverty lines

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

### 2.1 Data

The scorecard is based on data from 6,852 households in Nicaragua's 2005 EMNV.<sup>5</sup> This is the most recent national expenditure survey available for Nicaragua.

Households are randomly divided into three sub-samples (Figure 2):

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

### 2.2 Poverty rates and poverty lines

#### 2.2.1 Rates

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

Beyond this general definition, there two special cases, *household-level poverty rates* and *person-level poverty rates*. With household-level rates, each household is

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<sup>5</sup> This paper omits 30 households in the 2005 EMNV who completed the expenditure sections but did not complete some other sections. This omission leads to slight differences in the poverty lines and poverty rates here compared with INIDE (2007).

counted as if it had only one person, regardless of true household size, so all households are counted equally. With person-level rates (the “head-count index”), each household is weighted by the number of people in it, so larger households have greater weight.

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

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

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

The poverty scorecard here is constructed using Nicaragua’s 2005 EMNV and household-level lines, scores are calibrated to household-level poverty likelihoods, and

accuracy is measured for household-level rates. This use of household-level rates reflects the belief that they are the most relevant for most pro-poor organizations.

Organizations can estimate person-level poverty rates by taking a household-size-weighted average of the household-level poverty likelihoods. It is also possible to construct a scorecard based on person-level lines, to calibrate scores to person-level likelihoods, and to measure accuracy for person-level rates, but it is not done here.

### **2.2.2 Poverty lines**

Based on Nicaragua's 2005 EMNV, Figure 3 reports poverty rates and poverty lines for urban and rural areas in each department and for the country as a whole, at both the household- and person-level.

Nicaragua's official food poverty line (*línea de pobreza extrema*) is the average cost (NIO10.97<sup>6</sup>) of a food basket that provides 2,241 Calories. A deflator—derived from the 2005 EMNV—adjusts this average food line for price differences across Primary Sampling Units and time (*Instituto Nacional de Estadística y Censos*, 2006). The all-Nicaragua poverty rate for the food line is 12.4 percent for households and 17.3 percent for people (Figure 3).

The national poverty line (here sometimes called “100% of the national line”, corresponding to INIDE's *línea de pobreza general*) of NIO19.99 is the food line plus the cost of essential non-food goods and services (INIDE, 2007). The all-Nicaragua poverty

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<sup>6</sup> INIDE's (2007) figure of NIO10.76 includes 30 households with complete expenditure data but incomplete non-expenditure data.

rate for the national line is 39.2 percent for households and 48.4 percent for people (Figure 3).

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

- National
- Food
- 150% of national
- 200% of national
- USAID “extreme”
- \$1.25/day 2005 PPP
- \$2.50/day 2005 PPP
- \$3.75/day 2005 PPP

The 150-percent line and the 200-percent line are multiples of the national line.

The USAID “extreme” line is defined as the median expenditure of people (not households) below the national line (U.S. Congress, 2002). It is calculated separately for urban and rural areas in each department.

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

- 2005 PPP exchange rate for “individual consumption expenditure by households” (World Bank, 2008a): NIO7.297 per \$1.00
- Price deflators from the *Banco Central de Nicaragua*:<sup>7</sup> 150.3475 on average for July through October 2005 (the month when the 2005 EMNV was in the field), and 147.3883 on average for all of 2005

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<sup>7</sup> <http://www.bcn.gob.ni/estadisticas/inflacion/1008/8.pdf>, retrieved 10 December 2009.

Using the formula in Sillers (2006), the average \$1.25/day 2005 PPP line for Nicaragua as a whole in July through October 2005 is<sup>8</sup>:

$$\begin{aligned} & (\text{2005 PPP exchange rate}) \cdot \$1.25 \cdot \frac{\text{CPI}_{\text{Jul.-Oct. 2005}}}{\text{CPI}_{\text{Ave. 2005}}} = \\ & \left( \frac{\text{NIO}7.297}{\$1.00} \right) \cdot \$1.25 \cdot \frac{150.3475}{147.3883} = \text{NIO}9.30438. \end{aligned}$$

The \$2.50/day line and the \$3.75/day line are multiples of the \$1.25/day line.

The 2005 PPP lines above apply to Nicaragua as a whole. These are adjusted for differences in cost-of-living across time and geographic regions using the PSU-level deflators mentioned above.

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<sup>8</sup> This differs from the NIO9.49 reported in Figure 3 due to the omission of 30 households with incomplete non-expenditure data.

### 3. Scorecard construction

For the Nicaragua scorecard, about 120 potential indicators are initially prepared in the areas of:

- Family composition (such as household size)
- Education (such as school attendance of children)
- Employment (such as number of household members working in agriculture)
- Housing (such as the main construction material of the floor)
- Ownership of durable goods (such as refrigerators or irons)

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

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

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

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



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

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

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

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

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

## 4. Practical guidelines for scorecard use

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

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

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

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

The scorecard in Figure 1 is ready to be photocopied and can be used with a simple spreadsheet database (Microfinance Risk Management, L.L.C., 2010) that records identifying information, indicator values, scores, and poverty likelihoods.

A field worker using the paper scorecard would:

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

## 4.1 Quality control

Of course, field workers must be trained. The quality of outputs depends on the quality of inputs. If organizations or field workers gather their own data and if they believe that they have an incentive to exaggerate poverty rates (for example, if funders reward them for higher poverty rates), then it is wise to do on-going quality control via

data review and random audits (Matul and Kline, 2003).<sup>9</sup> IRIS Center (2007a) and Toohig (2008) are useful nuts-and-bolts guides for planning, 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 most alternatives, it is still absolutely difficult. Training and explicit definitions of terms and concepts in the scorecard are essential.<sup>10</sup> For the example of Nigeria, one study finds distressingly low inter-rater and test-retest correlations for indicators as seemingly simple and obvious as whether the household owns an automobile (Onwujekwe, Hanson, and Fox-Rushby, 2006).

For self-reports in the first stage of targeting in a Mexican program, Martinelli and Parker (2007) find that “underreporting [of asset ownership] is widespread but not overwhelming, except for a few goods . . . [and] overreporting is common for a few goods, which implies that self-reporting may lead to the exclusion of deserving households” (pp. 24–25). Still, as done in the second stage of the Mexican targeting process, field agents can verify responses with a home visit and correct false reports.

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<sup>9</sup> If an organization does not want field workers to know the points associated with indicators, then they can use the version of Figure 1 without points and apply the points later at the central office.

<sup>10</sup> Appendix A is a guide for interpreting indicators in Nicaragua’s poverty scorecard.

## 4.2 Implementation and sampling

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

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

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

- Employees of the organization
- Third-party contractors

Responses, scores, and poverty likelihoods can be recorded:

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

The subjects to be scored can be:

- All participants
- A representative sample of all participants
- All participants in a representative sample of branches
- A representative sample of all participants in a representative sample of branches
- A representative sample of participants in a sub-group relevant for a particular issue

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

Frequency of application can be:

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

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

- With different sets of participants, with each set representative of all participants
- With a single set of participants

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

## 5. Estimates of household poverty likelihoods

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

To get absolute units, scores must be converted to *poverty likelihoods*, that is, probabilities of being below a poverty line. This is done via simple look-up tables. For the example of the national line with the 2005 EMNV, scores of 30–34 have a poverty likelihood of 58.5 percent, and scores of 35–39 have a poverty likelihood of 54.1 percent (Figure 5).

The poverty likelihood associated with a score varies by poverty line. For example, scores of 30–34 are associated with a poverty likelihood of 58.5 percent for the national line but 12.3 percent for the food line.<sup>11</sup>

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<sup>11</sup> Starting with Figure 5, many figures have eight versions, one for each of the eight poverty lines. The tables are grouped by poverty line. Single tables that pertain to all poverty lines are placed with the tables for the national line.

## 5.1 Calibrating scores with poverty likelihoods

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

For the example of the national line (Figure 6), there are 6,738 (normalized) households in the calibration sub-sample with a score of 30–34, of whom 3,943 (normalized) are below the poverty line. The estimated poverty likelihood associated with a score of 30–34 is then 58.5 percent, as  $3,943 \div 6,738 = 58.5$  percent.

To illustrate further with the national line and a score of 35–39, there are 5,818 (normalized) households in the calibration sample, of whom 3,145 (normalized) are below the line (Figure 6). Thus, the poverty likelihood for this score is  $3,145 \div 5,818 = 54.1$  percent.

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



Figure 7 shows, for all scores, the likelihood that expenditure falls in a range demarcated by two adjacent poverty lines. For example, the daily expenditure of someone with a score of 30–34 falls in the following ranges with probability:

- 6.9 percent below the \$1.25/day 2005 PPP line
- 5.4 percent between the \$1.25/day 2005 PPP and the food lines
- 6.4 percent between the food and the USAID “extreme” lines
- 36.8 percent between the USAID “extreme” and the \$2.50/day 2005 PPP lines
- 3.1 percent between the \$2.50/day 2005 PPP and the national lines
- 27.8 percent between the national and the \$3.75/day 2005 PPP lines
- 1.3 percent between the \$3.75/day 2005 PPP and 150% of the national lines
- 10.2 percent between 150% and 200% of the national lines
- 2.2 percent above 200% of the national line

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

Although the points in Nicaragua’s poverty scorecard are transformed coefficients from a Logit regression, scores are not converted to poverty likelihoods via

the Logit formula of  $2.718281828^{\text{score}} \times (1 + 2.718281828^{\text{score}})^{-1}$ . 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. In the field, converting scores to poverty likelihoods requires no arithmetic at all, just a look-up table. This non-parametric calibration can also improve accuracy, especially with large calibration samples.

## 5.2 Accuracy of estimates of households' poverty likelihoods

As long as the relationship between indicators and poverty does not change and as long as the scorecard is applied to households who are representative of the same population from which the scorecard was constructed, this calibration process produces unbiased estimates of poverty likelihoods. *Unbiased* means that in repeated samples from the same population, the average estimate matches the true poverty likelihood. The scorecard also produces unbiased estimates of poverty rates at a point in time, as well as unbiased estimates of changes in poverty rates between two points in time.<sup>12</sup>

The relationship between indicators and poverty does change with time and also across sub-groups in Nicaragua's population, so the scorecard will generally be biased when applied after the end date of fieldwork for the 2005 EMNV (as it must be applied

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<sup>12</sup> This follows because these estimates of groups' poverty rates are linear functions of the unbiased estimates of households' poverty likelihoods.

in practice) or when applied with non-nationally representative groups (as it probably will be applied by local pro-poor organizations).

How accurate are estimates of households' poverty likelihoods, given the assumption of representativeness? To check, the scorecard is applied to 1,000 bootstrap samples of size  $n = 16,384$  from the 2005 validation sub-sample. Bootstrapping entails (Efron and Tibshirani, 1993):

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

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

For the national line in the 2005 validation sample, the average poverty likelihood across bootstrap samples for scores of 30–34 is too low by 0.6 percentage points (Figure 8). For scores of 35–39, the estimate is too high by 15.6 percentage points.<sup>13</sup>

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<sup>13</sup> These differences are not zero, despite the estimator's unbiasedness, because the scorecard comes from a single sample. The average difference by score would be zero if

The 90-percent confidence interval for the differences for scores of 30–34 is  $\pm 2.8$  percentage points (Figure 8). This means that in 900 of 1,000 bootstraps, the difference between the estimate and the true value is between  $-3.4$  and  $+2.2$  percentage points (because  $-0.6 - 2.8 = -3.4$ , and  $-0.6 + 2.8 = +2.2$ ). In 950 of 1,000 bootstraps (95 percent), the difference is  $-0.6 \pm 3.2$  percentage points, and in 990 of 1,000 bootstraps (99 percent), the difference is  $-0.6 \pm 4.5$  percentage points.

For many scores below 75, Figure 8 shows differences—some of them large—between estimated poverty likelihoods and true values. This is because the validation sub-sample is a single sample that—thanks to sampling variation—differs in distribution from the construction/calibration sub-samples and from Nicaragua’s population. For targeting, however, what matters is less the differences across all score ranges and more the differences in score ranges just above and below the targeting cut-off. This mitigates the effects of bias and sampling variation on targeting (Friedman, 1997). Section 8 below looks at targeting accuracy in detail.

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

Another possible source of bias is overfitting. By construction, the scorecard here is unbiased, but it may still be *overfit* when applied after the October 2005 end of field

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samples were repeatedly drawn from the population and split into sub-samples before repeating the entire construction and calibration process.

work for the 2005 EMNV. That is, the scorecard may fit the data from the 2005 EMNV so closely that it captures not only real patterns but also some random patterns that, due to sampling variation, show up only in the 2005 EMNV. Or the scorecard may be overfit in the sense that it is not robust to changes through time in the relationships between indicators and poverty. Finally, the scorecard could also be overfit if it is not robust when applied to samples from non-nationally representative sub-groups.

Overfitting can be mitigated by simplifying the scorecard and by not relying only on the 2005 EMNV data but rather also considering experience, judgment, and theory. Of course, the scorecard here does this. Bootstrapping scorecard construction—which is not done here—can also mitigate overfitting by reducing (but not eliminating) dependence on a single sampling instance. Combining scorecards can also help, at the cost of complexity.

In any case, most errors in individual households' likelihoods balance out in the estimates of groups' poverty rates (see later sections). Furthermore, much of the differences between scorecard estimates and true values may come from non-scorecard sources such as changes in the relationship between indicators and poverty over time, sampling variation, changes in poverty lines, inconsistencies in data quality across time, and inconsistencies/imperfections in cost-of-living adjustments across time and geographic regions. These factors can be addressed only by improving data quantity and quality (which is beyond the scope of the scorecard), by updating data, or by reducing overfitting (which likely has limited returns, given the scorecard's parsimony).

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

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

To illustrate, suppose a program samples three households on Jan. 1, 2010 and that they have scores of 20, 30, and 40, corresponding to poverty likelihoods of 80.7, 58.5, and 40.6 percent (national line, Figure 5). The group's estimated poverty rate is the households' average poverty likelihood of  $(80.7 + 58.5 + 40.6) \div 3 = 59.9$  percent.<sup>14</sup>

### 6.1 Accuracy of estimated poverty rates at a point in time

How accurate is this estimate? For a range of sample sizes, Figure 10 reports average differences between estimated and true poverty rates as well as precision (confidence intervals for the differences) for the Nicaragua scorecard applied to 1,000 bootstrap samples from the 2005 validation sample.

Summarizing Figure 10 across poverty lines and years for  $n = 16,384$ , Figure 9 shows that the absolute differences between the estimated poverty rate and the true rate for the 2005 scorecard applied to the 2005 validation sample are 3.4 percentage points or less. The average absolute difference across the eight poverty lines is 1.8 percentage points.

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<sup>14</sup> The group's poverty rate is *not* the poverty likelihood associated with the average score. Here, the average score is  $(20 + 30 + 40) \div 3 = 30$ , and the poverty likelihood associated with the average score is 58.5 percent. This is not the 59.9 percent found as the average of the three poverty likelihoods associated with each of the three scores.

In terms of precision, the 90-percent confidence interval for a group's estimated poverty rate at a point in time in 2005 with  $n = 16,384$  and for all poverty lines is  $\pm 0.6$  percentage points or less (Figure 9). This means that in 900 of 1,000 bootstraps of this size, the absolute difference between the estimate and the average estimate is 0.6 percentage points or less.

In the specific case of the national line, 90 percent of all samples of  $n = 16,384$  produce estimates that differ from the true value in the range of  $+2.3 + 0.4 = +2.7$  to  $+2.3 - 0.4 = +1.9$  percentage points. This is because  $+2.3$  is the average difference and  $\pm 0.4$  is its 90-percent confidence interval. The average difference is  $+2.3$  because the average scorecard estimate is too high by 2.3 percentage points; the scorecard tends to estimate a poverty rate of 41.0 percent for the 2005 validation sample, but the true value is 38.7 percent (Figure 2). Future accuracy will depend on how closely the time of application resembles 2005.

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

How precise are the point-in-time estimates? Because they are averages, the estimates have a Normal distribution and can be characterized by their average difference vis-à-vis true values, along with the standard error of the average difference.

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

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

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

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

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

$n$  is the sample size.

For example, with a sample  $n = 16,384$ , 90-percent confidence ( $z = 1.64$ ), and a poverty rate  $p$  of 38.7 percent (the true rate in the 2005 validation sample for the national line in Figure 2), the confidence interval  $c$  is

$$+/- z \cdot \sqrt{\frac{p \cdot (1 - p)}{n}} = +/- 1.64 \cdot \sqrt{\frac{0.387 \cdot (1 - 0.387)}{16,384}} = +/- 0.624 \text{ percentage points.}$$

Poverty scorecards, however, do not measure poverty directly, so this formula is not applicable. To derive a formula for the Nicaragua scorecard, consider Figure 10, which reports empirical confidence intervals  $c$  for the differences for the scorecard applied to 1,000 bootstrap samples of various sample sizes from the validation sample. For  $n = 16,384$ , the national line, and the 2005 validation sub-sample, the 90-percent



confidence interval is  $\pm 0.435$  percentage points.<sup>15</sup> Thus, the ratio of confidence intervals with poverty scoring and with direct measurement is  $0.435 \div 0.624 = 0.70$ .

Now consider the same case, but with  $n = 8,192$ . The confidence interval under direct measurement is  $\pm 1.64 \cdot \sqrt{\frac{0.387 \cdot (1 - 0.387)}{8,192}} = \pm 0.883$  percentage points. The empirical confidence interval with the Nicaragua scorecard for the national line (Figure 10) is  $\pm 0.630$  percentage points. Thus for  $n = 8,192$ , the ratio is  $0.630 \div 0.883 = 0.71$ .

This ratio of 0.71 for  $n = 8,192$  is not far from the ratio of 0.70 for  $n = 16,384$ . Indeed, across all sample sizes of 256 or more in Figure 10, the average ratio turns out to be 0.69, implying that confidence intervals for indirect estimates of poverty rates via the Nicaragua scorecard and the national poverty line are about 31 percent narrower than those for direct estimates. This 0.69 appears in Figure 9 as the “ $\alpha$  factor” because if  $\alpha = 0.69$ , then the formula relating confidence intervals  $c$  and standard errors  $\sigma$  for the Nicaragua scorecard is  $c = \pm z \cdot \alpha \cdot \sigma$ . The standard error for point-in-time estimates of poverty rates via scoring is  $\alpha \cdot \sqrt{\frac{p \cdot (1 - p)}{n}}$ .

In general,  $\alpha$  could be more or less than 1.00. When  $\alpha$  is less than 1.00, it means that the scorecard is more precise than direct measurement. This occurs in seven of eight cases in Figure 9.

The formula relating confidence intervals to standard errors for poverty scoring can be rearranged to give a formula for determining sample size  $n$  before measurement.<sup>16</sup>

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<sup>15</sup> Due to rounding, Figure 10 displays 0.4, not 0.435.

If  $\hat{p}$  is the expected poverty rate before measurement, then the formula for  $n$  based on the desired confidence level that corresponds to  $z$  and the desired confidence interval

$$+/-c \text{ under poverty scoring is } n = \left( \frac{\alpha \cdot z}{c} \right)^2 \cdot \hat{p} \cdot (1 - \hat{p}).$$

To illustrate how to use this, suppose  $c = 0.03410$  and  $z = 1.64$  (90-percent confidence), and  $\hat{p} = 0.395$  (the average poverty rate for the national line in the 2005 construction and calibration sub-samples, Figure 2). Then the formula gives

$$n = \left( \frac{0.69 \cdot 1.64}{0.03410} \right)^2 \cdot 0.395 \cdot (1 - 0.395) = 264, \text{ not far from the sample size of 256 observed}$$

for these parameters in Figure 10.

Of course, the  $\alpha$  factors in Figure 9 are specific to Nicaragua, its poverty lines, its poverty rates, and this scorecard. The method for deriving the formulas, however, is valid for any poverty scorecard following the approach in this paper.

In practice after the end of fieldwork in October 2005 for the EMNV, an organization would select a poverty line (say, the national line), select a desired confidence level (say, 90 percent, or  $z = 1.64$ ), select a desired confidence interval (say,  $+/-2.0$  percentage points, or  $c = 0.02$ ), make an assumption about  $\hat{p}$  (perhaps based on a previous measurement such as the 39.2 percent average for the national line in the

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<sup>16</sup> IRIS Center (2007a and 2007b) says that a sample size of  $n = 300$  is sufficient for reporting estimated poverty rates to USAID. If a scorecard is as precise as direct measurement, if the expected (before measurement) poverty rate is 50 percent, and if the confidence level is 90 percent, then  $n = 300$  implies a confidence interval of  $+/-2.2$  percentage points. In fact, USAID has not specified confidence levels or intervals. Furthermore, the expected poverty rate may not be 50 percent, and the scorecard could be more or less precise than direct measurement.

2005 EMNV in Figure 2), look up  $\alpha$  (here, 0.69), assume that the scorecard will still work in the future and/or for non-nationally representative sub-groups,<sup>17</sup> and then compute the required sample size. In this illustration,

$$n = \left( \frac{0.69 \cdot 1.64}{0.02} \right)^2 \cdot 0.392 \cdot (1 - 0.392) = 763.$$

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<sup>17</sup> This paper reports accuracy for the scorecard applied to the 2005 validation sample, but it cannot test accuracy for later years or other groups. Performance will deteriorate with time to the extent that the relationship between indicators and poverty changes.

## **7. Estimates of changes in group poverty rates over time**

The change in a group's poverty rate between two points in time is estimated as the change in the average poverty likelihood of the households in the group. With data only from the 2005 EMNV, this paper cannot test estimates of change over time for Nicaragua, and it can only suggest approximate formulas for standard errors.

Nevertheless, the relevant concepts are presented here because, in practice, pro-poor organizations can apply the scorecard to collect their own data and measure change through time.

### **7.1 Warning: Change is not impact**

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

## 7.2 Calculating estimated changes in poverty rates over time

Consider the illustration begun in the previous section. On Jan. 1, 2010, a program samples three households who score 20, 30, and 40 and so have poverty likelihoods of 80.7, 58.5, and 40.6 percent (national line, Figure 5). The group's baseline estimated poverty rate is the households' average poverty likelihood of  $(80.7 + 58.5 + 40.6) \div 3 = 59.9$  percent.

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

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

By way of illustration, suppose that a year later on Jan. 1, 2010, the program samples three additional households who are in the same cohort as the three households originally sampled (or suppose that the program scores the same three original households a second time) and finds that their scores are now 25, 35, and 45 (poverty likelihoods of 69.3, 54.1, and 25.5 percent, national line, Figure 5). Their average poverty likelihood at follow-up is  $(69.3 + 54.1 + 25.5) \div 3 = 49.6$  percent, an improvement of  $59.9 - 49.6 = 10.3$  percentage points.<sup>18</sup>

This suggests that about one of ten participants crossed the poverty line in 2009. (This is a net figure; some people start above the line and end below it, and vice versa.) Among those who started below the line, about one in six ( $10.3 \div 59.9 = 17.2$  percent)

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<sup>18</sup> Of course, such a huge reduction in poverty is unlikely in a year's time, but this is just an example to show how poverty scoring can be used to estimate change.

ended up above the line. Of course, poverty scoring does not reveal the reasons for this change.

### **7.3 Estimated changes in poverty rates in Nicaragua**

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

### **7.4 Accuracy for estimated change in two independent samples**

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

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

$z$ ,  $c$ , and  $p$  are defined as above,  $n$  is the sample size at both baseline and follow-up,<sup>19</sup> and  $\alpha$  is the average (across a range of bootstrapped sample sizes) of the ratio of the observed confidence intervals from a poverty scorecard and the theoretical confidence intervals from the textbook formula for direct measurement for two equal-sized independent samples.

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

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

For the countries for which this  $\alpha$  has been measured (Schreiner 2010, 2009a, 2009b, 2009c, 2009d, 2009e, 2008a, 2008b; Schreiner and Woller, 2010a, 2010b; Chen and Schreiner, 2009a and 2009b), the average  $\alpha$  (averaged across poverty lines and years and then across countries) is 1.19. This is as reasonable a figure as any for Nicaragua.

To illustrate the use of the formula above to determine sample size for estimating changes in poverty rates across two independent samples, suppose the desired confidence level is 90 percent ( $z = 1.64$ ), the desired confidence interval is 2 percentage points ( $c = 0.02$ ), the poverty line is the national line,  $\alpha = 1.19$ , and  $\hat{p} = 0.392$  (from

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<sup>19</sup> This means that, for a given precision and with direct measurement, estimating the change in a poverty rate over time requires four times as many measurements (not twice as many) as does estimating a poverty rate at a point in time.

Figure 2). Then the baseline sample size is  $n = 2 \cdot \left( \frac{1.19 \cdot 1.64}{0.02} \right)^2 \cdot 0.392 \cdot (1 - 0.392) = 4,539$ , and the follow-up sample size is also 4,539.

## 7.5 Accuracy for estimated change for one sample, scored twice

The general formula relating the confidence interval  $c$  to the standard error  $\sigma$  when using scoring to estimate change for a single group of households, all of whom are scored at two points in time, is:<sup>20</sup>

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

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

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

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

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<sup>20</sup> See McNemar (1947) and Johnson (2007). John Pezzullo helped find this formula.



$\hat{p}_*$  could be anything between 0–0,5, so more information is needed before applying this formula. Suppose that the observed relationship between  $\hat{p}_*$ , the number of years  $y$  between baseline and follow-up, and  $p_{\text{baseline}} \cdot (1 - p_{\text{baseline}})$  is—as in Peru (Schreiner, 2009a)—close to:

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

Given this, a sample-size formula for a group of households to whom the Nicaragua poverty scorecard is applied twice (once after the end of field work for the 2005 EMNV and then again later) is:

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

In Peru (the only other country for which there is a data-based estimate, Schreiner 2009a), the average  $\alpha$  across years and poverty lines is about 1.30.

To illustrate the use of this formula, suppose the desired confidence level is 90 percent ( $z = 1.64$ ), the desired confidence interval is 2.0 percentage points ( $c = 0.02$ ), the poverty line is the national line, and the sample will be scored first in 2010 and then again in 2013 ( $y = 3$ ). The before-baseline poverty rate is 39.2 percent ( $p_{2005} = 0.392$ , Figure 2), and suppose  $\alpha = 1.30$ . Then the baseline sample size is

$$n = 2 \cdot \left( \frac{1.30 \cdot 1.64}{0.02} \right)^2 \cdot \{ -0.02 + 0.016 \cdot 3 + 0.47 \cdot [0.392 \cdot (1 - 0.392)] \} = 3,183. \text{ The same}$$

group of 3,183 households is scored at follow-up as well.

## 8. Targeting

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

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

Targeting is successful when households truly below a poverty line are targeted (*inclusion*) and when households truly above a poverty line are not targeted (*exclusion*). Of course, no scorecard is perfect, and targeting is unsuccessful when households truly below a poverty line are not targeted (*undercoverage*) or when households truly above a poverty line are targeted (*leakage*).

Figure 11 depicts these four possible targeting outcomes. Targeting accuracy varies by cut-off; a higher cut-off has better inclusion (but worse leakage), while a lower cut-off has better exclusion (but worse undercoverage).

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

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

Figure 12 shows the distribution of households by targeting outcome. For an example cut-off of 34 or less and the 2005 scorecard applied to the 2005 validation sample, outcomes for the national line are:

- Inclusion: 29.6 percent are below the line and correctly targeted
- Undercoverage: 9.1 percent are below the line and mistakenly not targeted
- Leakage: 7.7 percent are above the line and mistakenly targeted
- Exclusion: 53.6 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: 32.0 percent are below the line and correctly targeted
- Undercoverage: 6.7 percent are below the line and mistakenly not targeted
- Leakage: 11.1 percent are above the line and mistakenly targeted
- Exclusion: 50.2 percent are above the line and correctly not targeted

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

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

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

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

The most difficult step is assigning benefits and costs to targeting outcomes. Any program that uses targeting—with or without scoring—should thoughtfully consider

how it values successful inclusion or exclusion versus errors of undercoverage and leakage. It is healthy to go through a process of thinking explicitly and intentionally about how possible targeting outcomes are valued.

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

$$\begin{array}{rcll}
 \text{Total Accuracy} = & 1 & \times & \text{Households correctly included} & - \\
 & 0 & \times & \text{Households mistakenly undercovered} & - \\
 & 0 & \times & \text{Households mistakenly leaked} & + \\
 & 1 & \times & \text{Households correctly excluded.} & 
 \end{array}$$

Figure 12 shows “Total Accuracy” for all cut-offs for Nicaragua’s scorecard. For the national line in the 2005 validation sample, total net benefit is greatest (83.2) for a cut-off of 34 or less, with about four in five Nicaraguan households correctly classified.

“Total Accuracy” weighs successful inclusion of households below the line the same as successful exclusion of households above the line. If a program valued inclusion more (say, twice as much) than exclusion, it could reflect this by setting the benefit for inclusion to 2 and the benefit for exclusion to 1. Then the chosen cut-off would maximize  $(2 \times \text{Households correctly included}) + (1 \times \text{Households correctly excluded})$ .<sup>21</sup>

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<sup>21</sup> Figure 12 also reports the Balanced Poverty Accuracy Criteria adopted by USAID as its criterion for certifying poverty scorecards. IRIS Center (2005) says that BPAC considers accuracy both in terms of the estimated poverty rate and in terms of targeting inclusion. After normalizing by the number of people below the poverty line:  
 $\text{BPAC} = (\text{Inclusion} + |\text{Undercoverage} - \text{Leakage}|) \times [100 \div (\text{Inclusion} + \text{Undercoverage})]$ .

As an alternative to assigning benefits and costs to targeting outcomes and then choosing a cut-off to maximize total net benefit, a program could set a cut-off to achieve a desired poverty rate among targeted households. The third column of Figure 13 (“% targeted who are poor”) shows the expected poverty rate among Nicaraguan households who score at or below a given cut-off. For the example of the national line and the 2005 validation sample, targeting households who score 34 or less would target 37.3 percent of all households (second column) and produce a poverty rate among those targeted of 79.4 percent (third column).

Figure 13 also reports two other measures of targeting accuracy. The first is a version of inclusion (“% of poor who are targeted”). For the example of the national line and the 2005 validation sample with a cut-off of 34 or less, 76.5 percent of all poor households are covered.

The final targeting measure in Figure 13 is the number of successfully targeted poor households for each non-poor household mistakenly targeted (right-most column). For the national line, the 2005 validation sample, and a cut-off of 34 or less, covering 3.9 poor households means leaking to 1 non-poor household.

## 9. The context of poverty scorecards for Nicaragua

This section discusses five existing Nicaragua scorecards in terms of their goals, data, methods, poverty lines, indicators, accuracy, and precision. The relative strengths of the new scorecard here are that it uses the latest nationally representative data, it uses simpler and fewer indicators and so costs less to implement, it reports accuracy and precision out-of-sample, and it provides formulas for standard errors.

### 9.1 Gwatkin *et al.*

Gwatkin *et al.* (2007) apply to Nicaragua an approach used in 56 countries with Demographic and Health Surveys (Rutstein and Johnson, 2004). Principal Components Analysis is used to make an asset index from simple, low-cost indicators available for the 11,328 households in Nicaragua’s 2001 DHS. The PCA index is like the poverty scorecard here except that, because the DHS does not collect data on income nor expenditure, it is based on a relative definition of poverty, its accuracy vis-à-vis expenditure-based poverty is unknown, and can only be assumed to be a proxy for long-term wealth/economic status.<sup>22</sup> Well-known examples of the PCA asset-index approach

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<sup>22</sup> Still, because the indicators are similar and because the “flat maximum” is important, carefully built PCA indices and expenditure-based poverty scorecards seem to pick up the same underlying construct (perhaps “permanent income”, see Bollen, Glanville, and Stecklov, 2007), and they rank households much the same. Tests of how well rankings by PCA indices correspond with rankings by expenditure include Lindelow (2006), Wagstaff and Watanabe (2003), and Montgomery *et al.* (2000).

include Stifel and Christiaensen (2007), Sahn and Stifle (2000 and 2003), and Filmer and Pritchett (2001).

The 25 indicators in Gwatkin *et al.* are similar to those in the new scorecard here in terms of their simplicity, low cost, and verifiability:

- Characteristics of the residence:
  - Type of residence
  - Tenancy status
  - Type of floors
  - Type of walls
  - Type of roof
  - Electrical connection
  - Source of energy for lighting
  - Source of water for drinking
  - Source of water for washing
  - Type of water receptacle
  - Means of water disposal
  - Type of toilet arrangement
  - Whether the toilet arrangement is shared with other households
  - Type of sewer connection
  - Means of trash disposal
  - Type of fuel used for cooking
- Whether any household member works agricultural land
- Ownership of consumer durables:
  - Radio
  - Television
  - Refrigerator
  - Telephone
  - Bicycle
  - Motorcycle or scooter
  - Car or truck
- Number of people per sleeping room

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

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

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

Still, the Gwatkin *et al.* index is more difficult and costly to use: it has 25 indicators, it cannot easily be put on a single page and photocopied, and it cannot be computed by hand in the field, as it has 220 point values, some of them negative, and all of them with five decimal places.

Finally, the scorecard here—unlike the PCA index—is linked directly to an absolute, expenditure-based poverty line. Thus, while both approaches can rank households, only the poverty scorecard can estimate expenditure-based poverty status. Furthermore, relative accuracy (that is, ability to rank or target by expenditure) is tested here in other ways than in Gwatkin *et al.*, who report how well their index ranks or targets by a wide range of health outcomes.

## 9.2 Filmer and Scott

Filmer and Scott (2008) test how well different approaches to constructing asset indices produce ranks that correlate with ranks from other asset indices, with expenditure as directly measured by a survey, and with expenditure as predicted by a regression. They run tests on 11 countries, one of which is Nicaragua.



Filmer and Scott find that different approaches to constructing asset indices (such as PCA) generally lead to similar—albeit not identical—rankings vis-à-vis the benchmarks of directly measured expenditure and predicted expenditure. Furthermore, this rough equivalence is most robust in countries where regression models work well for predicting expenditure and in less-poor countries where total expenditure is not dominated by food.

For Nicaragua, Filmer and Scott use the 2001 EMNV to select 32 indicators that—as in Gwatkin *et al.* and in this paper—are simple, low-cost, and verifiable:

- Characteristics of the residence:
  - Type of walls
  - Type of roof
  - Type of floor
  - Type of toilet arrangement
  - Source of water
  - Source of energy for lighting
  - Type of fuel used for cooking

- Ownership of consumer durables:
  - Radio
  - Radio/tape player
  - Stereo system
  - Telephone
  - Black-and-white television
  - Color television
  - VCR
  - Personal computer
  - Bicycle
  - Motorcycle
  - Boat
  - Car
  - Blender
  - Toaster
  - Rice cooker
  - Oven
  - Microwave oven
  - Iron
  - Mill
  - Sewing machine
  - Typewriter
  - Fan
  - Washing machine
  - Air conditioner
- Rooms per household member

As Filmer and Scott aim to establish general properties of approaches to constructing asset indices (rather than provide asset indices that local pro-poor organizations can use), they do not report scorecard points. And because their indices are constructed without explicit links to expenditure-based poverty status, they cannot be used—even if the scorecard points were available—for anything but targeting.

### 9.3 Zeller, Sharma, Henry, and Lapenu

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

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

Zeller *et al.* start the construction process with a long list of potential indicators and narrow it down based on their correlation with expenditure on clothing, eventually selecting 16 indicators that are statistically significant in the PCA analysis:

- Characteristics of the residence:
  - Value of residence
  - Type of residence
  - Type of fuel used for cooking
  - Type of toilet arrangement
  - Number of rooms per person
- Education of the household head
- Ownership of consumer durables:
  - Number of televisions
  - Number of VCRs
  - Value of electrical devices
  - Value of vehicles
  - Value of assets per adult

- Food security:
  - Number of meals served in the past two days
  - Episodes of hunger in the past 30 days
  - Episodes of hunger in the past twelve months
  - Frequency of purchase of a staple food
  - Food stock in the house
- Per-capita expenditure on clothing

Like all asset indices (and like the scorecard here), Zeller *et al.*'s index can rank households and be applied in diverse contexts. Its weakness is its relative definition of poverty, as well as its small, non-nationally representative sample. Most important, the specific indicators in Nicaragua's index are difficult and costly to collect. For example, most households cannot easily estimate the value of their residence, let alone the value of their electrical devices, the per-adult value of their assets, or their per-capita spending on clothing. Furthermore, the food-security indicators relate to historical events and so are inherently non-verifiable. Even if all these indicators could be collected accurately, they would probably not rank households much better—thanks to the “flat maximum”—than indices with simpler, less-costly indicators.

## 9.4 IFPRI

Maluccio (2009) describes the use of a scorecard documented in IFPRI (2002) for targeting conditional cash transfers in Nicaragua's *Red de Protección Social* (RPS, social safety net). The RPS was inspired by Mexico's *PROGRESA/Oportunidades* and was meant to alleviate short-term poverty via cash transfers conditional on participants' reducing their long-term poverty by developing and maintaining the long-

term human capital of children through school attendance and regular preventative health care.

The RSP pilot used a poverty scorecard to target some of its beneficiaries. In 2000, a baseline expenditure survey similar to the 1998 EMNV was administered to all of about 6,000 eligible households in 42 rural localities in six municipalities. The localities themselves had been selected partly via a geographic targeting tool and had poverty rates (by the national line) of about 80 percent.

IFPRI constructed the scorecard using data on expenditure and indicators from this baseline survey and stepwise regression on the natural logarithm of per-capita household expenditure for 1,570 households. There were about 50 indicators:

- Household demographics:
  - Number of members (and its logarithm)
  - Number of members (and its square) multiplied by average education of members older than 13
  - Number of members (and its logarithm and its square) multiplied by the age of the head (and its square)
  - Number of members (and its square) in households with a female head
  - Number of members less than four-years-old
  - Age of the head squared
- Characteristics of the residence:
  - Tenancy status
  - Type of walls
  - Type of roof
  - Type of toilet arrangement
  - Number of rooms in the residence (and its logarithm and square)
  - Number of rooms used by the household (squared)
  - People per sleeping room (squared)
  - Type of electrical connection
- Ownership of assets:
  - Fan
  - Pesticide sprayer

- Employment:
  - Presence of agricultural casual laborers
  - Presence of self-employed farmers
  - Number of non-agricultural wage and salaried workers
  - Number of non-agricultural casual laborers
  - Number of non-agricultural self-employed people
  - Number of non-paid family workers
  - Whether anyone in the household older than six does not work
- Agriculture:
  - Use of chemical fertilizers in the past twelve months
  - Whether livestock were raised in the past twelve months
  - Area of agricultural land owned
- Characteristics of the census block in which the household lives:
  - Median age of household heads
  - Median age of heads multiplied by median household size
  - Median education of household heads
  - Median education of heads multiplied by median household size
  - Median education of heads multiplied by share of female heads
  - Standard deviation of ages of heads
  - Standard deviation of ages of heads multiplied by median household size
  - Share of households with tile (*embaldosado*) floors
  - Share of households with a radio/tape player
  - Average hours to walk to the nearest school (and its logarithm)
  - Share of households who kept cows in the past twelve months
  - Share of households receiving some type of subsidy

This scorecard is meant for use by government agencies, not local organizations.

It is lengthy and complex, and requires data at the level of census blocks as well as household data. Although the basic indicators themselves are few and straightforward, scoring requires software to combine basic indicators and to compute ratios, logarithms, medians, and standard deviations. Also, the scorecard is tailored to a few, very poor, rural localities in the departments of Madriz and Matagalpa.

Maluccio reports that the RPS scorecard’s targeting is effective, pointing to undercoverage of less than 8 percent and leakage of less than 11 percent.<sup>23</sup> As a benchmark for the improvements due to the RPS’ scorecard, note that selecting 75 percent of households in these localities at random would give undercoverage of 20 percent and leakage of 5 percent. Comparison with the targeting accuracy of the poverty scorecard here is not straightforward because the RPS focused on a specific, high-poverty area in Nicaragua.

## 9.5 Sobrado and Rocha

As part of the World Bank’s *Nicaragua Poverty Assessment* (2008b), Sobrado and Rocha use the 2005 EMNV and the 2005 Census to build poverty scorecards that feed into a “poverty map” (Elbers, Lanjouw, and Lanjouw, 2003; Hentschel *et al.*, 2000) that estimates poverty status for Nicaragua’s municipalities. This is the latest in a series of poverty maps for Nicaragua. According to Snel and Henninger (2002), the earlier maps were widely used and helped make planning and policy-making more transparent and thus more pro-poor. For example, the map based on the 1998 EMNV and 1995 Census was used to help select municipalities for the RPS pilot.

Sobrado and Rocha build seven scorecards for the regions of Managua, urban and rural Pacific, urban and rural Central, and urban and rural Atlantic. They use

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<sup>23</sup> These figures use the definitions in this paper and assume an 80-percent poverty rate in the pilot localities.

stepwise ordinary least squares on the logarithm of per-capita expenditure, using only indicators found both in the 2005 EMNV and the 2005 Census.

They apply the scorecards to households in the 2005 Census to estimate poverty rates by municipality for both the food and national lines. At the municipal level, the poverty-mapping estimates are more precise than direct estimates based on the EMNV. Finally, Sobrado and Rocha make “poverty maps” that quickly show—in a way that is clear for non-specialists—how poverty rates vary across municipalities and how poverty changes between 1998 and 2005 vary by municipality.

Poverty mapping in Sobrado and Rocha and poverty scoring in this paper are similar in that they both:

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

Strengths of poverty mapping include that it:

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



Strengths of poverty scoring include that it:

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

The basic difference between the two approaches is that poverty mapping seeks to help governments design and target pro-poor policies, while poverty scoring seeks to help small, local pro-poor organizations to manage their outreach when implementing policies.<sup>24</sup>

Sobrado and Rocha use the following indicators in their Nicaragua scorecards:

- Demographics of the household:
  - Number of members ages:
    - 0 to 5
    - 6 to 15
    - 16 to 59
    - 60 or more
    - Of any age
  - Average age of household members
  - Ethnicity of the household head
- Emigration:
  - Whether the household head was born in a different municipality
  - Whether any household member has emigrated
  - Number of household members who have emigrated in the past five years
  - Share of male members who have emigrated

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<sup>24</sup> Another apparent difference is that the developers of the poverty-mapping approach (Elbers, Lanjouw, and Lanjouw, 2003; Demombynes *et al.*, 2002) say that it is too inaccurate to be used for targeting individual households, while Schreiner (2008c) supports such targeting as a legitimate, potentially useful application of poverty scoring. Recently, the developers of poverty mapping seem to have taken a small step away from their original position (Elbers *et al.*, 2007).

- Years of education of emigrants
- Destination of emigrants
- Education:
  - Share of household members 10-years-old or older who are literate
  - Whether the household head is literate
  - Whether the household head has a college degree
  - Average years of education for members 16-years-old or older
  - Share of children 15-years-old or younger who attend school
- Employment:
  - Average hours worked by members 16-years-old or older
  - Occupation of the household head
  - Sector of work of the household head
- Characteristics of the residence:
  - Type of structure
  - Tenancy status
  - Length of residence
  - Type of walls
  - Type of floors
  - Type of roof
  - Type of electrical connection
  - Source of water
  - Type of toilet arrangement
  - Type of fuel for cooking
  - Means of garbage disposal
  - Type of kitchen
- Ownership of durable assets:
  - Stereo system
  - Radio/tape player
  - Small equipment
  - Medium and large equipment
  - Telephone, cable television, and internet
- Characteristics of the census segment (average):
  - Distance to travel to nearest health center:
    - Hours
    - Kilometers
  - Literacy rate for people 10-years-old or older
  - Birth rate in past five years
  - Households with a member who works in agriculture
  - Share of people 16-years-old or older who work
  - Share of household heads who are female
  - Source of water

- Ownership of durable assets:
  - Fan
  - Radio
  - Bicycle
  - Cellular telephone
- Identity of the department

The average regional scorecard uses about 19 of these 51 indicators and is based on about 1,000 households. The seven regional scorecards are built with stepwise regression, so they may be overfit. The possibility of overfitting matters, for example, when comparing the bias of Sobrado and Rocha’s scorecard for all-Nicaragua poverty rates (−0.9 percentage points for the food line, −2.1 percentage points for the national line) to those here (+0.3 for the food line and +2.3 for the national line, Figure 9) because Sobrado and Rocha’s test is in-sample, which—when coupled with overfitting—is known to overstate accuracy.

Although Sobrado and Rocha note that “the correct calculation of the standard error is key to any poverty map” (p. 194), they do not report standard errors, so the precision of their estimates cannot be compared with those in this paper.

## 10. Conclusion

This paper presents a simple poverty scorecard for Nicaragua that can be used to estimate the likelihood that a household has expenditure below a given poverty line, to estimate the poverty rate of a group of households at a point in time, and to estimate changes in the poverty rate of a group of households between two points in time. The scorecard can also be used for targeting.

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

The scorecard is built with a sub-sample of data from the 2005 EMNV, tested on a different sub-sample from the 2005 EMNV, and calibrated to eight poverty lines.

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

When the scorecard is applied to the 2005 validation sample with  $n = 16,384$ , the absolute difference between estimates and true poverty rates at a point in time is 3.4 percentage points or less and averages—across the eight poverty lines—1.8 percentage points. With 90-percent confidence and  $n = 16,384$ , the precision of these

differences is  $\pm 0.6$  percentage points or less. The scorecard is usually more precise than direct measurement.

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

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

In sum, the simple poverty scorecard is a practical, objective way for pro-poor programs in Nicaragua to measure poverty rates, track changes in poverty rates over time, and target services, provided that it is applied during a period similar to that of the second half of 2005, the period of time when the data used to construct the scorecard was collected. The same approach can be applied to any country with similar data from a national income or expenditure survey.

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**Figure 2: Sample sizes and household poverty rates by sub-sample, survey round and poverty line**

Sub-sample	Households	% with expenditure below a poverty line							
		National				USAID	International 2005 PPP		
		100%	Food	150%	200%	'Extreme'	\$1.25/day	\$2.50/day	\$3.75/day
<b>All Nicaragua</b>	6,852	39.2	12.4	60.5	74.6	17.5	8.3	36.3	58.1
<b>Construction</b>									
Selecting indicators and points	2,268	39.5	12.3	61.5	75.1	17.4	8.3	36.4	58.6
<b>Calibration</b>									
Associating scores with likelihoods	2,242	39.5	12.4	60.8	75.4	17.6	8.0	36.4	58.8
<b>Validation</b>									
Measuring accuracy	2,342	38.7	12.5	59.4	73.3	17.5	8.6	36.2	56.9
<b>Change in poverty rate (percentage points)</b>									
From construction/calibration to validation		+0.8	-0.2	+1.7	+1.9	+0.0	-0.4	+0.2	+1.9

Source: ENMV 2005.

**Figure 3: Poverty lines and poverty rates, by department and for all Nicaragua, by urban/rural and at household- and person-level**

Department	Urban or rural	Line or rate	Household or person	Average poverty line (NIO/person/day) and poverty rate (%)							
				National				USAID		International 2005 PPP	
				100%	Food	150%	200%	'Extreme'	\$1.25/day	\$2.50/day	\$3.75/day
Nueva Segovia	Urban	Line	Both	18.94	10.40	28.41	37.88	11.80	8.99	17.98	26.97
		Rate	Household	43.3	18.6	62.8	80.1	21.2	13.2	41.3	60.8
		Rate	Person	49.7	21.4	69.1	84.9	24.6	15.3	47.9	67.3
	Rural	Line	Both	18.03	9.90	27.04	36.05	9.90	8.56	17.11	25.67
		Rate	Household	79.9	35.2	91.6	94.7	35.2	21.1	77.0	89.8
		Rate	Person	85.8	42.8	95.1	97.1	42.8	26.2	83.4	93.9
Jinotega	Urban	Line	Both	18.62	10.22	27.94	37.25	13.03	8.84	17.68	26.52
		Rate	Household	35.9	9.6	51.8	73.3	15.8	5.0	33.8	45.9
		Rate	Person	44.8	13.4	61.6	79.3	22.0	8.1	42.9	54.0
	Rural	Line	Both	17.79	9.77	26.69	35.58	9.94	8.44	16.89	25.33
		Rate	Household	69.2	26.5	84.9	92.0	27.9	19.6	64.0	84.9
		Rate	Person	76.3	35.7	90.7	94.9	38.1	26.8	71.3	90.7
Madriz	Urban	Line	Both	19.47	10.69	29.20	38.93	10.77	9.24	18.48	27.72
		Rate	Household	40.2	15.3	61.4	70.7	15.3	8.5	36.4	58.8
		Rate	Person	48.0	21.9	68.6	79.4	21.9	14.5	43.2	66.7
	Rural	Line	Both	18.02	9.89	27.04	36.05	8.63	8.56	17.11	25.67
		Rate	Household	74.5	39.9	88.6	97.3	32.0	31.1	72.6	87.7
		Rate	Person	82.0	47.8	92.4	98.6	40.6	39.7	80.8	91.9
Estelí	Urban	Line	Both	19.55	10.73	29.32	39.10	14.80	9.28	18.56	27.84
		Rate	Household	27.6	6.3	48.8	62.8	12.9	3.9	25.6	45.3
		Rate	Person	35.4	8.1	58.6	71.2	16.9	5.8	33.5	54.6
	Rural	Line	Both	18.30	10.04	27.45	36.60	10.07	8.69	17.37	26.06
		Rate	Household	66.8	27.3	83.2	91.6	27.3	13.9	62.6	81.5
		Rate	Person	73.9	35.1	87.6	94.3	35.1	17.7	68.9	86.1
Chinandega	Urban	Line	Both	20.30	11.14	30.45	40.60	15.17	9.64	19.27	28.91
		Rate	Household	29.7	2.4	51.7	68.9	12.1	1.3	27.0	49.5
		Rate	Person	41.4	4.4	62.8	77.9	19.6	1.9	38.3	60.1
	Rural	Line	Both	19.58	10.75	29.37	39.15	12.00	9.29	18.58	27.88
		Rate	Household	67.0	19.2	83.7	89.7	29.8	12.9	62.9	81.6
		Rate	Person	79.4	27.4	93.1	96.3	38.9	18.8	75.7	91.8
León	Urban	Line	Both	20.82	11.43	31.24	41.65	16.73	9.88	19.77	29.65
		Rate	Household	32.6	3.9	58.7	72.8	15.5	2.1	29.8	57.0
		Rate	Person	43.6	7.4	68.0	81.5	21.3	3.1	40.3	66.4
	Rural	Line	Both	19.20	10.54	28.80	38.40	11.12	9.11	18.23	27.34
		Rate	Household	52.5	21.6	77.9	85.4	23.8	13.3	49.3	75.2
		Rate	Person	65.7	29.4	87.4	93.6	32.5	16.5	61.8	84.7
Matagalpa	Urban	Line	Both	19.72	10.82	29.57	39.43	12.61	9.36	18.72	28.08
		Rate	Household	31.8	9.5	55.6	65.4	13.9	5.3	29.6	54.5
		Rate	Person	42.3	15.4	64.8	74.5	21.1	8.4	40.7	64.1
	Rural	Line	Both	18.17	9.97	27.25	36.33	9.13	8.62	17.25	25.87
		Rate	Household	71.1	36.1	80.8	93.5	30.7	27.9	68.2	79.7
		Rate	Person	80.2	45.9	89.0	96.8	39.6	36.5	78.1	88.3
Boaco	Urban	Line	Both	20.09	11.03	30.14	40.19	12.64	9.54	19.08	28.61
		Rate	Household	10.7	3.3	33.1	52.1	4.4	1.2	10.2	29.9
		Rate	Person	15.7	4.9	41.5	62.2	6.2	2.2	14.6	37.0
	Rural	Line	Both	18.20	9.99	27.29	36.39	12.01	8.64	17.27	25.91
		Rate	Household	64.2	17.3	87.8	94.6	32.3	11.5	60.7	82.6
		Rate	Person	68.6	18.6	91.4	96.0	33.9	12.9	65.5	86.8
Managua	Urban	Line	Both	21.88	12.01	32.82	43.76	16.83	10.39	20.77	31.16
		Rate	Household	13.9	1.5	34.7	54.8	6.5	0.8	11.5	31.5
		Rate	Person	19.7	2.9	44.0	63.3	9.9	1.9	16.6	40.8
	Rural	Line	Both	20.41	11.21	30.62	40.83	15.24	9.69	19.38	29.07
		Rate	Household	29.3	6.9	58.3	74.9	13.5	3.6	29.3	55.9
		Rate	Person	35.4	10.8	67.8	81.0	16.9	5.1	35.4	64.7
Masaya	Urban	Line	Both	20.57	11.29	30.85	41.14	16.20	9.76	19.53	29.29
		Rate	Household	25.2	4.5	54.2	70.1	12.1	1.1	21.7	49.6
		Rate	Person	29.9	5.6	61.8	76.1	14.8	1.7	26.7	55.3
	Rural	Line	Both	20.60	11.31	30.90	41.20	15.28	9.78	19.55	29.33
		Rate	Household	34.8	5.9	68.1	87.7	16.2	2.4	29.5	66.3
		Rate	Person	44.2	9.0	75.9	91.3	21.0	3.1	37.6	74.4



**Figure 3 (cont): Poverty lines and poverty rates, by department and for all Nicaragua, by urban/rural and at household- and person-level**

Department	Urban or rural	Line or rate	Household or person	Average poverty line (NIO/person/day) and poverty rate (%)							
				National				USAID	International 2005 PPP		
				100%	Food	150%	200%	'Extreme'	\$1.25/day	\$2.50/day	\$3.75/day
Chontales	Urban	Line	Both	20.00	10.98	30.00	40.00	14.47	9.49	18.99	28.48
		Rate	Household	26.6	4.2	50.4	62.7	11.0	2.1	23.6	45.4
		Rate	Person	33.3	6.1	57.7	69.7	16.0	3.5	30.0	53.8
	Rural	Line	Both	18.37	10.08	27.56	36.74	12.47	8.72	17.44	26.16
		Rate	Household	48.7	9.5	75.7	84.4	21.7	4.9	45.1	72.4
		Rate	Person	59.5	14.1	87.3	94.0	29.4	7.1	53.9	85.5
Granada	Urban	Line	Both	20.36	11.17	30.53	40.71	14.53	9.66	19.32	28.99
		Rate	Household	27.9	4.2	52.4	70.7	12.4	2.9	25.7	51.3
		Rate	Person	37.2	6.3	62.3	79.4	17.0	4.6	35.0	61.4
	Rural	Line	Both	19.35	10.62	29.02	38.70	15.41	9.18	18.37	27.55
		Rate	Household	38.3	2.7	70.1	90.8	18.4	2.7	33.6	65.7
		Rate	Person	43.2	2.1	80.5	95.7	19.3	2.1	39.2	75.0
Carazo	Urban	Line	Both	21.00	11.53	31.50	42.00	14.97	9.97	19.94	29.91
		Rate	Household	25.0	6.1	51.6	69.0	10.9	5.1	21.6	49.6
		Rate	Person	29.5	8.3	59.4	75.6	14.4	7.1	25.7	55.5
	Rural	Line	Both	19.81	10.87	29.71	39.62	12.12	9.40	18.81	28.21
		Rate	Household	56.4	18.2	82.8	90.7	23.1	9.8	53.4	78.4
		Rate	Person	61.3	24.4	88.8	93.6	30.2	13.9	58.5	86.2
Rivas	Urban	Line	Both	20.66	11.34	30.99	41.32	15.23	9.81	19.61	29.42
		Rate	Household	31.4	5.5	55.3	75.5	13.8	4.6	30.5	50.7
		Rate	Person	40.2	9.7	62.3	82.6	19.5	7.7	39.1	57.8
	Rural	Line	Both	19.60	10.76	29.40	39.19	12.56	9.30	18.60	27.91
		Rate	Household	54.3	18.6	76.9	85.4	25.0	10.8	48.0	75.4
		Rate	Person	63.2	23.3	84.5	90.5	30.9	14.1	56.1	81.2
Río San Juan	Urban	Line	Both	20.19	11.08	30.28	40.38	14.01	9.58	19.17	28.75
		Rate	Household	32.6	7.1	57.5	73.9	13.0	5.8	31.4	55.0
		Rate	Person	44.5	11.4	67.4	81.1	21.5	9.3	43.0	65.4
	Rural	Line	Both	18.57	10.19	27.86	37.14	11.79	8.81	17.63	26.44
		Rate	Household	57.7	16.0	78.7	88.5	26.6	9.2	55.4	76.4
		Rate	Person	67.1	20.5	87.7	95.0	33.4	12.6	65.0	85.8
RAAN	Urban	Line	Both	21.47	11.79	32.21	42.94	15.22	10.19	20.38	30.57
		Rate	Household	32.9	9.6	57.6	70.6	15.4	5.2	29.3	55.6
		Rate	Person	40.8	12.0	68.1	79.7	20.3	6.2	37.0	65.2
	Rural	Line	Both	19.10	10.48	28.65	38.20	10.17	9.07	18.13	27.20
		Rate	Household	76.4	35.9	89.0	95.1	33.8	27.8	73.4	87.9
		Rate	Person	82.7	43.6	93.4	97.2	41.0	34.3	80.2	92.7
RAAS	Urban	Line	Both	21.11	11.59	31.67	42.23	15.66	10.02	20.04	30.06
		Rate	Household	26.6	5.5	51.6	67.9	12.3	2.4	23.5	49.4
		Rate	Person	34.2	7.7	60.9	76.7	17.1	3.6	29.7	58.7
	Rural	Line	Both	18.63	10.23	27.95	37.27	11.72	8.84	17.69	26.53
		Rate	Household	66.9	24.2	88.2	93.5	31.7	18.7	63.0	87.2
		Rate	Person	73.3	28.8	92.4	97.3	36.6	21.9	70.0	91.9
Nicaragua	Urban	Line	Both	20.91	11.48	31.37	41.82	15.53	9.93	19.85	29.78
		Rate	Household	23.3	4.4	46.0	63.3	10.5	2.5	20.9	43.0
		Rate	Person	30.9	6.7	55.3	71.6	15.1	4.0	28.0	52.2
	Rural	Line	Both	18.82	10.33	28.23	37.64	11.30	8.93	17.86	26.80
		Rate	Household	61.6	23.5	81.0	90.4	27.2	16.4	58.0	79.2
		Rate	Person	70.4	30.6	88.2	94.7	34.7	21.7	67.0	86.7
	All	Line	Both	19.99	10.97	29.98	39.98	13.66	9.49	18.97	28.46
		Rate	Household	39.2	12.4	60.5	74.6	17.5	8.3	36.3	58.1
		Rate	Person	48.4	17.3	69.8	81.8	23.8	11.8	45.2	67.4

**Figure 4: Poverty indicators by uncertainty coefficient**

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly indicative of poverty)</u>
2104	What fuel does the household usually use for cooking? (Non-purchased firewood; Purchased firewood; Charcoal, butane or propane gas, kerosene, electricity, other, or does not cook)
1733	Does the household have a stove? (No; Yes)
1669	How many color or black-and-white televisions does the household have? (None; Only black and white; One color, regardless of ownership of black and white; Two or more color, regardless of ownership of black and white)
1640	How many household members work in a business in agriculture, animal husbandry, hunting, fishing, and forestry? (Two or more; One; None)
1626	How many color televisions does the household have? (None; One; Two or more)
1601	What type of telephone service does the household have? (None; Cellular only; Land-line only; Both land-line and cellular)
1491	What is the educational level and the highest grade or year that the female head/spouse passed? (None, pre-school, or special education; Adult education or first grade; Second to fourth grade; Fifth grade; Sixth grade; There is no female head/spouse; Seventh to eleventh grade; Basic, middle, or upper technical school, teacher's college, college, master's or doctoral degree)
1458	Does the household have a radio, radio/tape player, or stereo system? (None; Only radio; Radio/tape player, regardless of radio, and no stereo; Stereo, regardless of radio and radio/tape player)
1435	What the main source of water for the household? (Spring or artesian well; Public standpipe; River, stream, or brook, water truck, lake or pond, another household/neighbor/business, or other; Public or private well; Piped into the residence, or piped into the yard of the residence, but not into the residence itself)
1389	What is the main source of lighting for the household? (Kerosene lamp or lantern, candle, torch, other, or none; Electrical generator, solar panel, car battery, or electrical grid)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
1347	What is the main material of the floor of the residence? (Earth, or other; Wooded planks, tiles or concrete, mud bricks, or cement bricks or tile (mosaic, ceramic or glazed))
1340	How many fans does the household have? (None; One; Two or more)
1306	What is the educational level and the highest grade or year that a household member has passed? (None, pre-school, special education, adult education, or first grade; Second to fifth grade; Sixth or seventh grade; Eighth to tenth grade; Eleventh grade; Basic or middle technical school, or teacher's college; Upper technical school, college, master's or doctoral degree)
1283	How many household members ages 7 to 15 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 15)
1237	How many household members ages 7 to 16 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 16)
1214	What is the educational level and the highest grade or year that the male head/spouse has passed? (None, pre-school, special education, or adult education; First to third grade; Fourth or fifth grade; There is no male head/spouse; Sixth to eighth grade; Ninth to eleventh grade; Basic, middle, or upper technical school, teacher's college, college, master's or doctoral degree)
1213	How many household members ages 7 to 14 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 14)
1189	How many household members are 18 years old or younger? (Five or more; Four; Three; Two; One; None)
1185	Does the household have a blender? (No; Yes)
1171	How many household members are 16 years old or younger? (Five or more; Four; Three; Two; One; None)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
1163	Does the household have a land-line telephone, a clothes washer, a microwave oven, an air conditioner, a personal computer, or a video-game machine? (No; Yes)
1162	How many household members ages 7 to 17 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 17)
1155	How many household members are 17 years old or younger? (Five or more; Four; Three; Two; One; None)
1152	How many household members ages 7 to 12 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 12)
1146	How many household members ages 7 to 13 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 13)
1146	Does the household have a refrigerator? (No; Yes)
1139	How many household members ages 7 to 18 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 18)
1133	Does the household have an iron? (No; Yes)
1130	How many household members are 15 years old or younger? (Five or more; Four; Three; Two; One; None)
1104	What is the main material of the external walls of the residence? (Adobe or mixed timber/bamboo/mud; Wood, tin sheets, bamboo, <i>barul</i> , cane, palm leaves, scrap materials, or other; Mud blocks or bricks; Concrete and some other material, quarried stone, reinforced concrete, concrete slabs, COVINTEC prefabricated panels, drywall, fiberglass cement, asbestos, or wood with a concrete base (miniskirt); Cement or concrete blocks)
1091	What type of toilet arrangement does the household have? (None; Outhouse or latrine (with or without treatment), or flush toilet connected to cesspool, septic tank, river, or stream; Flush toilet connected to sewer)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
1088	In the past 12 months, has any household member worked (or is working) land of any size, as a farmer, or do any household members have land for agricultural or animal husbandry use, for commercial ends or for subsistence, be they owned, rented, borrowed, sharecropped, or squatted? (Yes; No)
1076	What is the economic activity of the place where the male head/spouse works? (Agriculture, animal husbandry, hunting, fishing, and forestry; Other activities, not otherwise specified, or does not work; Electricity, gas, water, and construction; Public administration, defense, and Social Security, education, or domestic service; There is no male head/spouse; Manufacturing, health care, social work, and other community service and personal service; Retail and wholesale trade, repair of automobiles and motorcycles, personal effects, and household appliances, food service and lodging; Logistics, storage, and communications, financial intermediation, real estate and rental, or international organizations)
1049	How many household members are there? (Eight or more; Seven; Six; Five; Four; Three; One or two)
1044	How many household members are 14 years old or younger? (Four or more; Three; Two; One; None)
1018	Does the household have a stereo system? (No; Yes)
1000	What is the main occupation of the male head/spouse? (Farmers and skilled workers in agriculture and fishing; Unskilled laborers; Does not work; Managers, operators, and craftspeople in manufacturing; There is no male head/spouse; Armed forces, lawmakers and policymakers and executives in public and private administration, professionals, scientists, and intellectuals, technicians and para-professionals, clerks and other office workers, service workers and salespeople in stores and markets, factory workers, or no data)
975	How many household members are 13 years old or younger? (Four or more; Three; Two; One; None)
972	How many household members ages 7 to 11 are enrolled this year in the formal education system? (Not all; All, and all are in a non-autonomous public school, community school, or other; All, and at least some are in an autonomous or private school; No children ages 7 to 11)
916	How many household members are 12 years old or younger? (Four or more; Three; Two; One; None)
894	How many household members are unskilled laborers? (Two or more; One; None)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
873	Does the household have a mill? (Yes; No)
867	Can the female head/spouse read and write? (No; Yes, or no female head/spouse)
828	How many household members are 11 years old or younger? (Four or more; Three; Two; One; None)
749	In the past 12 months, has any household member worked (or is working) land of any size, as a farmer, or do any household members have land for agricultural or animal husbandry use, for commercial ends or for subsistence, be it owned, rented, borrowed, sharecropped, or squatted, or has anyone harvested anything from the yard of the residence, be it basic grains, fruits, vegetables, or other, or raised animals such as chickens, pigs, goats, etc. in the yard? (Yes; No)
731	Are any household members farmers or skilled workers in agriculture and fishing? (Yes; None)
724	What does the male head/spouse do in his main line of work? (Casual laborer, or other; Self-employed, or member of a cooperative; Does not work, unpaid worker, or unpaid family worker; There is no male head/spouse; Wage or salary workers; Employer/boss)
721	What is the main occupation of the female head/spouse? (Farmers and skilled workers in agriculture and fishing; Does not work; Unskilled laborers; Managers, operators, and craftspeople in manufacturing; There is no female head/spouse; Service workers and salespeople in stores and markets, and factory workers; Technicians and para-professionals; Armed forces, lawmakers and policymakers and executives in public and private administration, professionals, scientists, and intellectuals, clerks and other office workers, or no data)
706	How many household members ages 7 to 15 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 15)
689	How many household members ages 7 to 16 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 16)
677	Does the household have cable television? (No; Yes)
665	How many household members ages 7 to 14 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 14)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
654	Does the household have a radio or a radio/tape player? (Only radio; None; Radio/tape player, regardless of ownership of radio)
639	Can the male head/spouse read and write? (No; Yes, or no male head/spouse)
634	How many household members ages 7 to 18 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 18)
628	How many household members ages 7 to 17 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 17)
609	In the past 12 months, has the household raised animals such as chickens, pigs, goats, etc. in the yard of the residence? (Yes; No)
588	How many household members ages 7 to 12 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 12)
576	How many household members ages 7 to 13 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 13)
569	What is the economic activity of the place where the female head/spouse works? (Agriculture, animal husbandry, hunting, fishing, and forestry, other activities not otherwise specified, or does not work; Domestic service; Manufacturing; Health care, social work, and other community service and personal service; There is no female head/spouse; Electricity, gas, water, and construction, or retail and wholesale trade, repair of automobiles and motorcycles, personal effects, and household appliances, or food service and lodging; Public administration, defense, and Social Security, education, logistics, storage, and communications, financial intermediation, real estate and rental, or international organizations)
525	How many household members are 6 years old or younger? (Two or more; One; None)
515	What does the female head/spouse do in her main line of work? (Casual laborer, unpaid worker, or unpaid family worker; Member of a cooperative, does not work, or other; Self-employed; There is no female head/spouse; Wage or salary workers; Employer/boss)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
504	Do any household members work as professionals, scientists, and intellectuals, technicians and para-professionals, clerks and other office workers, or lawmakers, and policymakers, and executives in public and private administration? (No; Yes)
499	In their main line of work, are any household members casual laborers? (Yes; No)
482	How many household members ages 7 to 11 are enrolled this year in the formal education system? (All; Not all; There are no members ages 7 to 11)
470	Does the household have a radio? (Yes; No)
457	In their main line of work, how many household members are wage or salary workers? (None; One; Two or more)
449	Does the household have a VCR, CD player, DVD player, or home-theatre system? (No; Yes)
449	How many rooms does the household use (excluding kitchen, bathrooms, hallways, and garages)? (One or none; Two; Three; Four; Five or more)
402	Does the household have a bicycle, boat, motorcycle, or automobile? (None; One or more bicycles or boats, but no motorcycles nor automobiles; One or more motorcycles and no automobiles, regardless of ownership of bicycles or boats; One or more automobiles, regardless of ownership of bicycles, boats, or motorcycles)
400	How many rooms does the household use only for sleeping? (One or none; Two; Three; Four or more)
360	Does the household have a vehicle? (No; Yes)
357	Does the household have a microwave oven? (No; Yes)
314	What is the tenancy status of the household in the residence? (Owned free-and-clear without title; Given as payment for services; Given as a gift or lent; Owned free-and-clear with title; Rented, owned with mortgage outstanding, squatted, or other)
299	What is the marital status of the female head/spouse? (Cohabiting; Widowed; Married; Separated; There is no female head/spouse, divorced, or single/never-married)
281	Does the household have a CD player, DVD player, or home theatre? (No; Yes)



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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
268	What is the main material of the roof of the residence? (Cement or mud shingles, reinforced concrete slab, straw, palm leaves, and the like, scrap materials, or other; Tin sheets; Fiberglass cement or asbestos)
258	What is the marital status of the male head/spouse? (Cohabiting; Widowed; Married; There is no male head/spouse; Separated, divorced, or single/never-married)
256	Are any household members service workers or salespeople in stores and markets? (No; Yes)
235	Does the household have a personal computer? (No; Yes)
233	In the past 12 months, has the household harvested anything from the yard of the residence, be it basic grains, fruits, vegetables, or other, or has it raised animals such as chickens, pigs, goats, etc. in the yard? (Yes; No)
222	Does the household have a VCR? (No; Yes)
212	Does the household have a radio/tape player? (No; Yes)
208	Does the household have a toaster? (No; Yes)
191	Did the female head/spouse work in the past week? (No; Yes; There is no female head/spouse)
189	Does the household have a clothes washer? (No; Yes)
186	Does the household have a rice cooker? (No; Yes)
181	What is the structure of household headship? (Both male and female heads/spouses; Female head/spouse only; Male head/spouse only;)
179	Does the household have a video-game machine? (No; Yes)
176	How many rooms does the household use for sleeping, even if they are put to another use during the day? (One or none; Two; Three; Four or more)
157	How many household members worked in the past week? (Three or more; Two; One; None)
144	How old is the male head/spouse? (51 to 60; 61 or more; 50 or younger; There is no male head/spouse)
137	Does the household have a lawn mower? (No; Yes)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
118	Does the household have a sewing machine? (No; Yes)
110	Is Spanish the mother tongue of the male head/spouse? (No; Yes; There is no male head/spouse)
101	Does the male head/spouse consider himself to be a member of an indigenous or ethnic group? (Yes; No; There is no male head/spouse)
100	Does the male head/spouse consider himself to be a member of an indigenous or ethnic group, or is his mother tongue not Spanish? (Yes; No; There is no male head/spouse)
98	Did the male head/spouse work in the past week? (No; Yes; There is no male head/spouse)
87	What type of residence does the household live in? (Other; Detached house)
86	In their main line of work, are any household members employers/bosses or self-employed? (Yes; No)
83	Does any household member know how to read and write? (No; Yes)
77	How old is the female head/spouse? (40 to 49; 28 to 39; 58 or more; 27 or younger; 50 to 57; There is no female head/spouse)
77	Does the household have a typewriter? (No; Yes)
74	Does the household have an oven? (No; Yes)
64	Is Spanish the mother tongue of the female head/spouse? (No; Yes; There is no female head/spouse)
58	Does the female head/spouse consider herself to be a member of an indigenous or ethnic group? (Yes; No; There is no female head/spouse)
58	Does the female head/spouse consider herself to be a member of an indigenous or ethnic group, or is her mother tongue not Spanish? (Yes; No; There is no female head/spouse)
51	Does the household have a video camera or a digital camera? (No; Yes)
48	Does the household have an air conditioner? (No; Yes)
48	Where in the residence does the household prepare food? (In a room that is also used for sleeping; In the yard or somewhere else outside of the residence; In a room used only for cooking; In the living or dining room, or does not cook)
45	Does the household have a bicycle, boat, or motorcycle? (None; One or more bicycles or boats, but no motorcycles; One or more motorcycles, regardless of ownership of bicycles or boats)

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

<u>Uncertainty coefficient</u>	<u>Indicator (Answers ordered starting with those most strongly associated with poverty)</u>
44	In the past 12 months, has the household harvested anything from the yard of the residence, be it basic grains, fruits, vegetables, or other? (Yes; No)
29	Does the household have a motorcycle? (No; Yes)
18	Does the household have a bicycle? (No; Yes)
18	Does the household have a bicycle or boat? (No; Yes)
17	Does the household have a black and white television? (Yes; No)
12	Do all household members speak Spanish as their mother tongue? (No; Yes)
2	Does any household member consider him/herself to be a member of an indigenous or ethnic group? (Yes; No)
2	Does any household member consider him/herself to be a member of an indigenous or ethnic group or have as his/her mother tongue a language that is not Spanish? (Yes; No)
0	Does the household have a boat? (No; Yes)

Source: 2005 EMNV and the national poverty line.

## **National Poverty Line**

**2007 Scorecard Applied to 2007 Validation Sample**

**(and tables pertaining to all poverty lines)**

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

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	92.0
5-9	87.5
10-14	96.7
15-19	87.3
20-24	80.7
25-29	69.3
30-34	58.5
35-39	54.1
40-44	40.6
45-49	25.5
50-54	10.1
55-59	10.2
60-64	1.2
65-69	2.4
70-74	3.8
75-79	0.0
80-84	0.0
85-89	0.0
90-94	0.0
95-100	0.0

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

Score	Households below poverty line		All households at score		Poverty likelihood (estimated, %)
0-4	1,418	÷	1,541	=	92.0
5-9	2,489	÷	2,844	=	87.5
10-14	3,515	÷	3,634	=	96.7
15-19	5,991	÷	6,861	=	87.3
20-24	5,797	÷	7,181	=	80.7
25-29	5,894	÷	8,506	=	69.3
30-34	3,943	÷	6,738	=	58.5
35-39	3,145	÷	5,818	=	54.1
40-44	3,760	÷	9,263	=	40.6
45-49	1,772	÷	6,963	=	25.5
50-54	692	÷	6,871	=	10.1
55-59	733	÷	7,196	=	10.2
60-64	99	÷	8,083	=	1.2
65-69	146	÷	5,969	=	2.4
70-74	182	÷	4,766	=	3.8
75-79	0	÷	4,089	=	0.0
80-84	0	÷	1,898	=	0.0
85-89	0	÷	999	=	0.0
90-94	0	÷	744	=	0.0
95-100	0	÷	34	=	0.0

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

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

Score	Likelihood of having expenditure in range demarcated by poverty lines per day per capita												
	<\$1.25/day	=>\$1.25/day	=>Food	=>USAID	=>\$2.50/day	=>National	=>\$3.75/day	=>150% Natl.	=>200% Natl.				
		and	and	and	and	and	and	and					
	<Food	<Food	<USAID	<USAID	<\$2.50/day	<National	<\$3.75/day	<150% Natl.	<200% Natl.				
	=>NIO9.49	=>NIO9.49	=>NIO13.66	=>NIO13.66	=>NIO18.97	=>NIO18.97	=>NIO19.99	=>NIO19.99	=>NIO28.46	=>NIO28.46			
	and	and	and	and	and	and	and	and	and	=>NIO39.98			
	<NIO9.49	<NIO10.97	<NIO13.66	<NIO13.66	<NIO18.97	<NIO18.97	<NIO19.99	<NIO19.99	<NIO28.46	<NIO28.46	<NIO29.98	<NIO29.98	<NIO39.98
0-4	61.3	17.1	0.8	9.8	3.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-9	40.5	14.2	5.6	27.3	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-14	37.3	8.1	16.5	34.5	0.3	3.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
15-19	27.8	14.5	11.7	30.7	2.6	9.1	1.0	2.6	2.6	2.6	0.0	0.0	0.0
20-24	13.9	16.1	6.2	37.1	7.4	17.0	0.0	2.1	2.1	2.1	0.0	0.2	0.2
25-29	14.1	7.9	12.3	30.1	5.0	20.7	0.6	6.6	6.6	6.6	2.9	2.9	2.9
30-34	6.9	5.4	6.4	36.8	3.1	27.8	1.3	10.2	10.2	10.2	2.2	2.2	2.2
35-39	1.8	0.8	14.9	31.9	4.7	29.9	1.6	11.9	11.9	11.9	2.5	2.5	2.5
40-44	0.5	1.5	6.4	27.8	4.5	30.6	2.8	20.2	20.2	20.2	5.8	5.8	5.8
45-49	0.9	0.0	3.1	17.0	4.5	35.3	3.9	23.4	23.4	23.4	12.0	12.0	12.0
50-54	0.0	0.2	1.9	5.9	2.1	30.7	4.7	24.1	24.1	24.1	30.4	30.4	30.4
55-59	0.0	0.0	0.0	3.9	6.2	15.2	3.8	25.2	25.2	25.2	45.7	45.7	45.7
60-64	0.0	0.0	0.0	1.2	0.0	15.4	3.1	26.6	26.6	26.6	53.8	53.8	53.8
65-69	0.0	0.0	0.0	2.2	0.2	10.8	1.4	19.1	19.1	19.1	66.3	66.3	66.3
70-74	0.0	0.0	0.0	3.8	0.0	8.6	2.8	22.6	22.6	22.6	62.2	62.2	62.2
75-79	0.0	0.0	0.0	0.0	0.0	4.3	1.0	12.6	12.6	12.6	82.2	82.2	82.2
80-84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	13.7	13.7	86.3	86.3	86.3
85-89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7	6.7	93.3	93.3	93.3
90-94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0
95-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0

Note: All poverty likelihoods in percentage units.

**Figure 8 (National line): Bootstrapped differences between estimated and true household poverty likelihoods with confidence intervals in a large sample ( $n = 16,384$ ), 2005 scorecard applied to the 2005 validation sample**

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	-4.5	3.2	3.3	3.6
5-9	-10.0	5.5	5.6	5.7
10-14	-0.6	1.1	1.3	1.6
15-19	-3.7	2.5	2.6	2.8
20-24	-1.1	2.1	2.5	3.2
25-29	+0.8	2.5	2.9	3.8
30-34	-0.6	2.8	3.2	4.5
35-39	+15.6	2.9	3.5	4.7
40-44	+11.1	2.2	2.5	3.1
45-49	+3.3	2.2	2.7	3.4
50-54	+1.1	1.3	1.5	2.0
55-59	+3.6	1.3	1.5	2.1
60-64	+0.3	0.4	0.5	0.6
65-69	+1.0	0.6	0.7	0.9
70-74	+3.8	0.0	0.0	0.0
75-79	+0.0	0.0	0.0	0.0
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0



**Figure 9 (All poverty lines): Differences, precision of differences, and the  $\alpha$  factor for bootstrapped estimates of poverty rates for groups of households at a point in time, 2005 scorecard applied to the 2005 validation sample**

	Poverty line								
	National				USAID	International 2005 PPP			
	100%	Food	150%	200%	'Extreme'	\$1.25/day	\$2.50/day	\$3.75/day	
<b>Estimate minus true value</b>									
2005 scorecard applied to 2005 validation	+2.3	+0.3	+3.2	+2.7	-0.5	+0.0	+1.7	+3.4	
<b>Precision of difference</b>									
2005 scorecard applied to 2005 validation	0.4	0.3	0.6	0.6	0.4	0.2	0.4	0.6	
<b><math>\alpha</math> factor for sample size</b>									
2005 scorecard applied to 2005 validation	0.69	0.69	0.95	1.01	0.79	0.70	0.69	0.94	
Precision is measured as 90-percent confidence intervals in units of +/- percentage points.									
Differences and precision estimated from 500 bootstraps of size $n = 16,384$ .									
$\alpha$ is estimated from 1,000 bootstrap samples of $n = 256, 512, 1,024, 2,048, 4,096, 8,192, \text{ and } 16,384$ .									

**Figure 10 (National line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	+0.2	64.4	77.6	88.6
4	+1.4	29.5	36.3	51.6
8	+1.9	19.0	24.3	33.9
16	+2.2	14.6	17.4	23.2
32	+2.2	10.2	12.1	16.2
64	+2.3	7.3	8.9	11.0
128	+2.3	4.8	5.7	7.4
256	+2.3	3.4	3.9	5.5
512	+2.4	2.4	2.9	3.7
1,024	+2.4	1.7	2.2	2.7
2,048	+2.3	1.2	1.4	1.8
4,096	+2.3	0.9	1.0	1.4
8,192	+2.3	0.6	0.8	0.9
16,384	+2.3	0.4	0.5	0.7

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

		Targeting segment	
		<u>Targeted</u>	<u>Non-targeted</u>
<b>True poverty status</b>	<b><u>Below</u></b> poverty <b><u>line</u></b>	<b>Inclusion</b> Under poverty line Correctly Targeted	<b>Undercoverage</b> Under poverty line Mistakenly Non-targeted
	<b><u>Above</u></b> poverty <b><u>line</u></b>	<b>Leakage</b> Above poverty line Mistakenly Targeted	<b>Exclusion</b> Above poverty line Correctly Non-targeted

**Figure 12 (National line): Households by targeting classification and score, along with “Total Accuracy” and BPAC, 2005 scorecard applied to the 2005 validation sample**

Score	Inclusion:	Undercoverage:	Leakage:	Exclusion:	Total Accuracy	BPAC
	< poverty line correctly targeted	< poverty line mistakenly non-targeted	=> poverty line mistakenly targeted	=> poverty line correctly non-targeted	Inclusion + Exclusion	See text
0-4	1.5	37.2	0.0	61.2	62.7	-92.2
5-9	4.2	34.5	0.2	61.1	65.3	-77.8
10-14	7.7	31.0	0.3	61.0	68.7	-59.4
15-19	13.7	25.0	1.1	60.1	73.9	-26.1
20-24	19.5	19.2	2.5	58.7	78.3	+7.4
25-29	25.5	13.3	5.1	56.2	81.6	+44.7
30-34	29.6	9.1	7.7	53.6	83.2	+72.8
35-39	32.0	6.7	11.1	50.2	82.2	+71.3
40-44	35.1	3.6	17.3	44.0	79.1	+55.3
45-49	37.0	1.7	22.3	38.9	76.0	+42.3
50-54	37.9	0.8	28.3	33.0	70.9	+26.9
55-59	38.5	0.2	34.9	26.4	64.9	+9.8
60-64	38.6	0.1	42.9	18.4	57.0	-10.7
65-69	38.7	0.0	48.7	12.5	51.3	-25.9
70-74	38.7	0.0	53.5	7.8	46.5	-38.2
75-79	38.7	0.0	57.6	3.7	42.4	-48.7
80-84	38.7	0.0	59.5	1.8	40.5	-53.6
85-89	38.7	0.0	60.5	0.8	39.5	-56.2
90-94	38.7	0.0	61.2	0.0	38.8	-58.1
95-100	38.7	0.0	61.3	0.0	38.7	-58.2

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

**Figure 13 (National line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	96.8	3.9	30.7:1
5-9	4.4	96.0	10.9	23.8:1
10-14	8.0	96.2	19.9	25.3:1
15-19	14.9	92.4	35.5	12.1:1
20-24	22.1	88.5	50.4	7.7:1
25-29	30.6	83.3	65.7	5.0:1
30-34	37.3	79.4	76.5	3.9:1
35-39	43.1	74.2	82.7	2.9:1
40-44	52.4	67.0	90.6	2.0:1
45-49	59.3	62.4	95.6	1.7:1
50-54	66.2	57.3	97.9	1.3:1
55-59	73.4	52.4	99.4	1.1:1
60-64	81.5	47.4	99.7	0.9:1
65-69	87.5	44.3	100.0	0.8:1
70-74	92.2	42.0	100.0	0.7:1
75-79	96.3	40.2	100.0	0.7:1
80-84	98.2	39.4	100.0	0.7:1
85-89	99.2	39.0	100.0	0.6:1
90-94	100.0	38.7	100.0	0.6:1
95-100	100.0	38.7	100.0	0.6:1

## **Food Poverty Line**

**2005 Scorecard Applied to 2005 Validation Sample**

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

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	78.5
5-9	54.7
10-14	45.5
15-19	42.3
20-24	30.0
25-29	21.9
30-34	12.3
35-39	2.6
40-44	2.0
45-49	0.9
50-54	0.2
55-59	0.0
60-64	0.0
65-69	0.0
70-74	0.0
75-79	0.0
80-84	0.0
85-89	0.0
90-94	0.0
95-100	0.0

**Figure 8 (Food line): Bootstrapped differences between estimated and true household poverty likelihoods with confidence intervals in a large sample ( $n = 16,384$ ), 2005 scorecard applied to the 2005 validation sample**

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	+11.2	5.1	6.0	8.1
5-9	+21.0	4.0	4.7	5.8
10-14	-8.8	6.2	6.6	7.1
15-19	-8.4	5.7	5.9	6.5
20-24	+6.7	2.2	2.6	3.2
25-29	-1.4	2.1	2.5	3.2
30-34	+6.8	1.0	1.2	1.6
35-39	-4.6	3.1	3.3	3.6
40-44	+0.6	0.4	0.5	0.6
45-49	+0.9	0.0	0.0	0.0
50-54	-0.1	0.2	0.2	0.3
55-59	+0.0	0.0	0.0	0.0
60-64	+0.0	0.0	0.0	0.0
65-69	+0.0	0.0	0.0	0.0
70-74	+0.0	0.0	0.0	0.0
75-79	+0.0	0.0	0.0	0.0
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0



**Figure 10 (Food line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	-0.7	56.2	61.8	73.6
4	-0.2	22.9	27.8	36.7
8	+0.1	14.3	17.9	25.9
16	+0.4	9.5	12.1	17.1
32	+0.3	6.9	8.4	11.5
64	+0.3	4.9	5.9	8.0
128	+0.3	3.3	4.0	5.4
256	+0.4	2.3	2.8	3.5
512	+0.4	1.6	2.0	2.7
1,024	+0.3	1.2	1.5	2.0
2,048	+0.3	0.8	1.0	1.3
4,096	+0.3	0.6	0.7	0.9
8,192	+0.3	0.4	0.5	0.7
16,384	+0.3	0.3	0.3	0.4

**Figure 12 (Food line): Households by targeting classification and score, along with “Total Accuracy” and BPAC, 2005 scorecard applied to the 2005 validation sample**

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
	0-4	1.0	11.4	0.5	87.0	88.0
5-9	2.2	10.3	2.2	85.3	87.5	-47.4
10-14	4.2	8.3	3.8	83.7	87.9	-2.1
15-19	7.3	5.2	7.6	79.9	87.2	+39.1
20-24	9.2	3.3	12.9	74.6	83.8	-3.4
25-29	11.2	1.2	19.3	68.2	79.5	-55.0
30-34	11.8	0.7	25.5	62.0	73.8	-104.8
35-39	12.2	0.3	30.9	56.6	68.8	-148.3
40-44	12.4	0.0	40.0	47.6	60.0	-220.6
45-49	12.4	0.0	46.9	40.6	53.0	-276.5
50-54	12.5	0.0	53.8	33.8	46.2	-331.3
55-59	12.5	0.0	61.0	26.6	39.0	-389.1
60-64	12.5	0.0	69.0	18.5	31.0	-453.9
65-69	12.5	0.0	75.0	12.5	25.0	-501.8
70-74	12.5	0.0	79.8	7.8	20.2	-540.1
75-79	12.5	0.0	83.9	3.7	16.1	-572.9
80-84	12.5	0.0	85.8	1.8	14.2	-588.1
85-89	12.5	0.0	86.8	0.8	13.2	-596.1
90-94	12.5	0.0	87.5	0.0	12.5	-602.1
95-100	12.5	0.0	87.5	0.0	12.5	-602.4

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

**Figure 13 (Food line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	66.2	8.2	2.0:1
5-9	4.4	49.4	17.4	1.0:1
10-14	8.0	52.1	33.5	1.1:1
15-19	14.9	49.0	58.5	1.0:1
20-24	22.1	41.6	73.6	0.7:1
25-29	30.6	36.8	90.2	0.6:1
30-34	37.3	31.6	94.5	0.5:1
35-39	43.1	28.2	97.7	0.4:1
40-44	52.4	23.7	99.7	0.3:1
45-49	59.3	20.9	99.7	0.3:1
50-54	66.2	18.8	100.0	0.2:1
55-59	73.4	17.0	100.0	0.2:1
60-64	81.5	15.3	100.0	0.2:1
65-69	87.5	14.2	100.0	0.2:1
70-74	92.2	13.5	100.0	0.2:1
75-79	96.3	12.9	100.0	0.1:1
80-84	98.2	12.7	100.0	0.1:1
85-89	99.2	12.6	100.0	0.1:1
90-94	100.0	12.5	100.0	0.1:1
95-100	100.0	12.5	100.0	0.1:1

**150% of the National Poverty Line Tables**

**2005 Scorecard Applied to 2005 Validation Sample**

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

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	100.0
5-9	100.0
10-14	99.9
15-19	97.4
20-24	97.8
25-29	90.6
30-34	87.6
35-39	85.6
40-44	74.0
45-49	64.6
50-54	45.5
55-59	29.2
60-64	19.7
65-69	14.6
70-74	15.2
75-79	5.3
80-84	0.0
85-89	0.0
90-94	0.0
95-100	0.0

**Figure 8 (150% of the national line): Bootstrapped differences between estimated and true household poverty likelihoods with confidence intervals in a large sample ( $n = 16,384$ ), 2005 scorecard applied to the 2005 validation sample**

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	+0.0	0.0	0.0	0.0
5-9	+0.2	0.1	0.2	0.2
10-14	-0.1	0.1	0.1	0.1
15-19	-1.4	0.9	1.0	1.0
20-24	-0.6	0.6	0.7	0.8
25-29	-4.7	2.9	3.0	3.2
30-34	+1.5	1.9	2.2	2.9
35-39	+2.5	2.3	2.7	3.7
40-44	+15.9	2.6	3.2	4.2
45-49	+14.7	3.3	4.0	5.5
50-54	-6.9	4.8	5.1	5.8
55-59	+5.1	2.3	2.7	3.3
60-64	+0.1	2.1	2.6	3.3
65-69	-2.0	2.0	2.5	3.1
70-74	+9.1	1.6	1.9	2.5
75-79	+5.2	0.1	0.1	0.1
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0

**Figure 10 (150% of the national line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	-0.1	64.3	83.0	88.0
4	+2.4	36.0	42.8	56.4
8	+3.0	26.0	30.9	41.7
16	+3.0	18.5	22.2	29.3
32	+3.2	13.5	16.3	20.2
64	+3.1	9.5	11.1	15.3
128	+3.2	6.5	8.1	10.8
256	+3.2	4.9	5.7	7.1
512	+3.3	3.3	4.0	5.6
1,024	+3.2	2.4	2.8	3.6
2,048	+3.2	1.7	2.0	2.6
4,096	+3.2	1.2	1.4	2.0
8,192	+3.2	0.8	1.0	1.5
16,384	+3.2	0.6	0.7	1.0

**Figure 12 (150% of the national line): Households by targeting classification and score, along with “Total Accuracy” and BPAC, 2005 scorecard applied to the 2005 validation sample**

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
	0-4	1.5	57.9	0.0	40.6	42.1
5-9	4.4	55.1	0.0	40.6	44.9	-85.3
10-14	8.0	51.4	0.0	40.6	48.6	-73.0
15-19	14.7	44.7	0.2	40.4	55.1	-50.2
20-24	21.7	37.7	0.3	40.2	62.0	-26.3
25-29	29.8	29.6	0.7	39.8	69.7	+1.6
30-34	35.6	23.8	1.7	38.9	74.6	+22.8
35-39	40.6	18.9	2.6	38.0	78.6	+40.8
40-44	46.5	12.9	5.9	34.7	81.3	+66.5
45-49	50.9	8.6	8.5	32.1	82.9	+85.5
50-54	54.4	5.0	11.8	28.8	83.2	+80.1
55-59	56.5	2.9	16.9	23.6	80.1	+71.5
60-64	57.9	1.5	23.6	17.0	74.9	+60.3
65-69	59.1	0.3	28.3	12.2	71.4	+52.3
70-74	59.4	0.0	32.8	7.7	67.1	+44.7
75-79	59.4	0.0	36.9	3.7	63.1	+37.9
80-84	59.4	0.0	38.8	1.8	61.2	+34.7
85-89	59.4	0.0	39.8	0.8	60.2	+33.0
90-94	59.4	0.0	40.5	0.0	59.5	+31.8
95-100	59.4	0.0	40.6	0.0	59.4	+31.7

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



**Figure 13 (150% of the national line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	100.0	2.6	Only poor targeted
5-9	4.4	99.5	7.3	199.3:1
10-14	8.0	99.7	13.5	365.3:1
15-19	14.9	98.9	24.8	92.5:1
20-24	22.1	98.5	36.6	64.8:1
25-29	30.6	97.6	50.2	40.2:1
30-34	37.3	95.5	60.0	21.4:1
35-39	43.1	94.0	68.3	15.8:1
40-44	52.4	88.8	78.3	7.9:1
45-49	59.3	85.7	85.6	6.0:1
50-54	66.2	82.1	91.6	4.6:1
55-59	73.4	76.9	95.1	3.3:1
60-64	81.5	71.1	97.5	2.5:1
65-69	87.5	67.6	99.5	2.1:1
70-74	92.2	64.4	100.0	1.8:1
75-79	96.3	61.7	100.0	1.6:1
80-84	98.2	60.5	100.0	1.5:1
85-89	99.2	59.9	100.0	1.5:1
90-94	100.0	59.4	100.0	1.5:1
95-100	100.0	59.4	100.0	1.5:1

**200% of the National Poverty Line Tables**

**2005 Scorecard Applied to 2005 Validation Sample**

**Figure 5 (200% of the national line): Estimated poverty likelihoods associated with scores**

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	100.0
5-9	100.0
10-14	100.0
15-19	100.0
20-24	99.8
25-29	97.1
30-34	97.8
35-39	97.5
40-44	94.2
45-49	88.0
50-54	69.6
55-59	54.4
60-64	46.3
65-69	33.7
70-74	37.8
75-79	17.8
80-84	13.7
85-89	6.7
90-94	0.0
95-100	0.0

**Figure 8 (200% of the national line): Bootstrapped differences between estimated and true household poverty likelihoods with confidence intervals in a large sample ( $n = 16,384$ ), 2005 scorecard applied to the 2005 validation sample**

Score	Difference between estimate and true value			
	Diff.	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	+0.5	0.3	0.4	0.5
20-24	+0.3	0.3	0.3	0.4
25-29	-2.1	1.2	1.2	1.3
30-34	+0.6	0.8	0.9	1.3
35-39	+1.1	1.1	1.3	1.7
40-44	+16.2	2.4	3.0	3.9
45-49	+3.1	2.0	2.4	3.2
50-54	-11.6	6.8	7.0	7.4
55-59	-7.6	5.2	5.5	6.1
60-64	+5.3	2.6	3.1	4.2
65-69	+2.3	2.6	3.1	3.9
70-74	+10.4	2.9	3.4	4.5
75-79	+15.7	0.6	0.7	0.9
80-84	-0.3	3.9	4.7	6.2
85-89	+6.5	0.2	0.2	0.3
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0

**Figure 10 (200% of the national line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	+0.9	54.1	75.1	82.0
4	+2.4	34.2	42.1	54.1
8	+2.4	25.3	29.9	40.2
16	+2.5	18.1	22.1	27.0
32	+2.8	12.6	14.8	20.7
64	+2.7	9.0	10.5	13.9
128	+2.6	6.3	7.3	9.7
256	+2.7	4.5	5.2	7.0
512	+2.7	3.3	4.0	4.9
1,024	+2.7	2.2	2.7	3.6
2,048	+2.8	1.6	1.9	2.6
4,096	+2.8	1.2	1.4	1.8
8,192	+2.7	0.8	1.0	1.3
16,384	+2.7	0.6	0.7	0.9

**Figure 12 (200% of the national line): Households by targeting classification and score, along with “Total Accuracy” and BPAC, 2005 scorecard applied to the 2005 validation sample**

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
	0-4	1.5	71.8	0.0	26.7	28.2
5-9	4.4	68.9	0.0	26.7	31.1	-88.0
10-14	8.0	65.3	0.0	26.7	34.7	-78.1
15-19	14.8	58.5	0.1	26.6	41.4	-59.5
20-24	21.9	51.4	0.1	26.6	48.5	-40.0
25-29	30.3	43.0	0.2	26.4	56.8	-16.9
30-34	36.8	36.5	0.5	26.2	63.0	+1.1
35-39	42.4	30.9	0.7	26.0	68.4	+16.7
40-44	50.3	23.0	2.1	24.6	75.0	+40.1
45-49	56.2	17.2	3.2	23.5	79.6	+57.5
50-54	61.5	11.8	4.7	22.0	83.5	+74.2
55-59	66.0	7.3	7.4	19.3	85.3	+89.9
60-64	69.4	3.9	12.1	14.6	84.1	+83.6
65-69	71.6	1.7	15.8	10.8	82.5	+78.4
70-74	72.9	0.5	19.4	7.3	80.2	+73.6
75-79	73.1	0.2	23.2	3.4	76.5	+68.3
80-84	73.3	0.0	24.9	1.8	75.1	+66.0
85-89	73.3	0.0	25.9	0.8	74.1	+64.7
90-94	73.3	0.0	26.6	0.0	73.4	+63.7
95-100	73.3	0.0	26.7	0.0	73.3	+63.6

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

**Figure 13 (200% of the national line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	100.0	2.1	Only poor targeted
5-9	4.4	100.0	6.0	Only poor targeted
10-14	8.0	100.0	10.9	Only poor targeted
15-19	14.9	99.6	20.2	260.1:1
20-24	22.1	99.5	29.9	186.4:1
25-29	30.6	99.3	41.4	133.3:1
30-34	37.3	98.7	50.2	76.6:1
35-39	43.1	98.4	57.8	59.8:1
40-44	52.4	96.1	68.6	24.5:1
45-49	59.3	94.6	76.6	17.6:1
50-54	66.2	92.9	83.9	13.0:1
55-59	73.4	89.9	90.0	8.9:1
60-64	81.5	85.2	94.7	5.8:1
65-69	87.5	81.9	97.7	4.5:1
70-74	92.2	79.0	99.4	3.8:1
75-79	96.3	75.9	99.7	3.1:1
80-84	98.2	74.6	100.0	2.9:1
85-89	99.2	73.9	100.0	2.8:1
90-94	100.0	73.4	100.0	2.8:1
95-100	100.0	73.3	100.0	2.7:1

## **USAID “Extreme” Poverty Line**

**2005 Scorecard Applied to 2005 Validation Sample**



**Figure 5 (USAID “extreme” line): Estimated poverty likelihoods associated with scores**

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0–4	79.2
5–9	60.3
10–14	61.9
15–19	54.0
20–24	36.2
25–29	34.2
30–34	18.6
35–39	17.5
40–44	8.3
45–49	4.0
50–54	2.1
55–59	0.0
60–64	0.0
65–69	0.0
70–74	0.0
75–79	0.0
80–84	0.0
85–89	0.0
90–94	0.0
95–100	0.0

**Figure 8 (USAID “extreme” line): Bootstrapped differences between estimated and true household poverty likelihoods with confidence intervals in a large sample ( $n = 16,384$ ), 2005 scorecard applied to the 2005 validation sample**

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	+6.6	4.9	5.9	8.0
5-9	+20.7	4.1	5.0	6.3
10-14	-13.9	8.5	8.8	9.1
15-19	+1.6	2.9	3.4	4.5
20-24	-7.4	5.1	5.4	5.8
25-29	+3.5	2.3	2.7	3.5
30-34	-2.4	2.4	2.7	3.7
35-39	+1.6	2.4	3.0	3.9
40-44	-4.4	3.1	3.2	3.6
45-49	+0.1	1.2	1.4	1.8
50-54	-2.1	1.5	1.6	1.8
55-59	+0.0	0.0	0.0	0.0
60-64	+0.0	0.0	0.0	0.0
65-69	+0.0	0.0	0.0	0.0
70-74	+0.0	0.0	0.0	0.0
75-79	+0.0	0.0	0.0	0.0
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0

**Figure 10 (USAID “extreme” line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	-0.4	59.9	67.7	77.9
4	-1.1	25.9	32.6	46.0
8	-0.9	18.2	20.8	28.7
16	-0.7	12.0	14.3	20.6
32	-0.8	8.6	10.9	15.6
64	-0.7	6.6	7.9	10.5
128	-0.5	4.5	5.3	7.3
256	-0.5	3.1	3.6	4.6
512	-0.5	2.1	2.5	3.2
1,024	-0.5	1.5	1.8	2.5
2,048	-0.5	1.2	1.3	1.7
4,096	-0.5	0.8	0.9	1.2
8,192	-0.5	0.5	0.6	0.8
16,384	-0.5	0.4	0.5	0.6

**Figure 12 (USAID “extreme” line): Households by targeting classification and score, along with “Total Accuracy” and BPAC, 2005 scorecard applied to the 2005 validation sample**

Score	Inclusion:	Undercoverage:	Leakage:	Exclusion:	Total Accuracy	BPAC
	< poverty line correctly targeted	< poverty line mistakenly non-targeted	=> poverty line mistakenly targeted	=> poverty line correctly non-targeted	Inclusion + Exclusion	See text
0–4	1.1	16.3	0.4	82.1	83.2	–84.8
5–9	2.4	15.0	2.0	80.6	83.0	–61.0
10–14	5.1	12.4	3.0	79.6	84.7	–25.0
15–19	8.4	9.1	6.5	76.0	84.4	+33.2
20–24	11.1	6.4	11.0	71.6	82.7	+37.2
25–29	13.8	3.7	16.8	65.8	79.5	+3.9
30–34	15.1	2.4	22.2	60.3	75.4	–27.2
35–39	15.9	1.6	27.3	55.3	71.1	–56.2
40–44	16.9	0.6	35.5	47.0	63.9	–103.5
45–49	17.1	0.4	42.3	40.3	57.3	–142.2
50–54	17.5	0.0	48.8	33.8	51.2	–179.3
55–59	17.5	0.0	56.0	26.6	44.0	–220.6
60–64	17.5	0.0	64.0	18.5	36.0	–266.9
65–69	17.5	0.0	70.0	12.5	30.0	–301.1
70–74	17.5	0.0	74.8	7.8	25.2	–328.4
75–79	17.5	0.0	78.9	3.7	21.1	–351.8
80–84	17.5	0.0	80.8	1.8	19.2	–362.7
85–89	17.5	0.0	81.8	0.8	18.2	–368.4
90–94	17.5	0.0	82.5	0.0	17.5	–372.7
95–100	17.5	0.0	82.5	0.0	17.5	–372.9

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

**Figure 13 (USAID “extreme” line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	72.1	6.4	2.6:1
5-9	4.4	55.1	13.8	1.2:1
10-14	8.0	63.2	29.0	1.7:1
15-19	14.9	56.3	48.0	1.3:1
20-24	22.1	50.3	63.6	1.0:1
25-29	30.6	45.1	79.0	0.8:1
30-34	37.3	40.5	86.5	0.7:1
35-39	43.1	36.8	90.8	0.6:1
40-44	52.4	32.2	96.6	0.5:1
45-49	59.3	28.8	97.8	0.4:1
50-54	66.2	26.4	100.0	0.4:1
55-59	73.4	23.8	100.0	0.3:1
60-64	81.5	21.4	100.0	0.3:1
65-69	87.5	20.0	100.0	0.2:1
70-74	92.2	18.9	100.0	0.2:1
75-79	96.3	18.1	100.0	0.2:1
80-84	98.2	17.8	100.0	0.2:1
85-89	99.2	17.6	100.0	0.2:1
90-94	100.0	17.5	100.0	0.2:1
95-100	100.0	17.5	100.0	0.2:1

**\$1.25/day 2005 PPP Poverty Line**

**2005 Scorecard Applied to 2005 Validation Sample**

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

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	61.3
5-9	40.5
10-14	37.3
15-19	27.8
20-24	13.9
25-29	14.1
30-34	6.9
35-39	1.8
40-44	0.5
45-49	0.9
50-54	0.0
55-59	0.0
60-64	0.0
65-69	0.0
70-74	0.0
75-79	0.0
80-84	0.0
85-89	0.0
90-94	0.0
95-100	0.0

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

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	+5.8	5.8	6.9	8.4
5-9	+20.4	3.0	3.7	5.3
10-14	-7.0	5.3	5.6	6.4
15-19	+0.6	2.4	2.9	3.7
20-24	-2.7	2.3	2.5	3.1
25-29	-3.3	2.6	2.8	3.1
30-34	+3.7	0.8	1.0	1.2
35-39	-2.1	1.7	1.8	2.0
40-44	-0.3	0.3	0.3	0.4
45-49	+0.9	0.0	0.0	0.0
50-54	-0.3	0.2	0.3	0.3
55-59	+0.0	0.0	0.0	0.0
60-64	+0.0	0.0	0.0	0.0
65-69	+0.0	0.0	0.0	0.0
70-74	+0.0	0.0	0.0	0.0
75-79	+0.0	0.0	0.0	0.0
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0



**Figure 10 (\$1.25/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	-1.0	50.0	62.4	72.0
4	-0.4	19.4	25.9	33.9
8	-0.3	12.5	15.1	21.9
16	-0.1	8.7	10.7	15.6
32	-0.1	5.9	7.2	9.9
64	-0.0	4.2	5.0	6.4
128	+0.0	3.0	3.5	4.7
256	+0.1	2.0	2.4	3.1
512	+0.1	1.4	1.7	2.4
1,024	+0.1	1.0	1.2	1.7
2,048	+0.1	0.7	0.8	1.2
4,096	+0.1	0.5	0.6	0.8
8,192	+0.0	0.4	0.4	0.5
16,384	+0.0	0.2	0.3	0.4

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

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
	0-4	0.8	7.8	0.7	90.7	91.5
5-9	1.6	7.0	2.8	88.6	90.1	-30.9
10-14	3.2	5.4	4.9	86.5	89.7	+30.1
15-19	5.1	3.5	9.8	81.6	86.7	-13.9
20-24	6.4	2.2	15.6	75.8	82.2	-82.0
25-29	7.9	0.7	22.7	68.7	76.6	-163.9
30-34	8.2	0.4	29.1	62.3	70.5	-238.7
35-39	8.4	0.2	34.7	56.7	65.1	-304.1
40-44	8.6	0.0	43.8	47.6	56.1	-410.2
45-49	8.6	0.0	50.8	40.6	49.2	-491.2
50-54	8.6	0.0	57.6	33.8	42.4	-570.7
55-59	8.6	0.0	64.8	26.6	35.2	-654.5
60-64	8.6	0.0	72.9	18.5	27.1	-748.6
65-69	8.6	0.0	78.9	12.5	21.1	-818.0
70-74	8.6	0.0	83.6	7.8	16.4	-873.5
75-79	8.6	0.0	87.7	3.7	12.3	-921.1
80-84	8.6	0.0	89.6	1.8	10.4	-943.2
85-89	8.6	0.0	90.6	0.8	9.4	-954.8
90-94	8.6	0.0	91.4	0.0	8.6	-963.5
95-100	8.6	0.0	91.4	0.0	8.6	-963.9

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

**Figure 13 (\$1.25/day 2005 PPP line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	53.6	9.6	1.2:1
5-9	4.4	35.4	18.0	0.5:1
10-14	8.0	39.4	36.8	0.7:1
15-19	14.9	34.2	59.3	0.5:1
20-24	22.1	29.1	74.8	0.4:1
25-29	30.6	25.8	91.9	0.3:1
30-34	37.3	22.0	95.5	0.3:1
35-39	43.1	19.5	97.8	0.2:1
40-44	52.4	16.3	99.5	0.2:1
45-49	59.3	14.4	99.5	0.2:1
50-54	66.2	13.0	100.0	0.1:1
55-59	73.4	11.7	100.0	0.1:1
60-64	81.5	10.5	100.0	0.1:1
65-69	87.5	9.8	100.0	0.1:1
70-74	92.2	9.3	100.0	0.1:1
75-79	96.3	8.9	100.0	0.1:1
80-84	98.2	8.7	100.0	0.1:1
85-89	99.2	8.7	100.0	0.1:1
90-94	100.0	8.6	100.0	0.1:1
95-100	100.0	8.6	100.0	0.1:1

**\$2.50/day 2005 PPP Poverty Line**

**2005 Scorecard Applied to 2005 Validation Sample**

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

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	89.0
5-9	87.5
10-14	96.4
15-19	84.7
20-24	73.3
25-29	64.4
30-34	55.4
35-39	49.4
40-44	36.1
45-49	20.9
50-54	8.0
55-59	3.9
60-64	1.2
65-69	2.2
70-74	3.8
75-79	0.0
80-84	0.0
85-89	0.0
90-94	0.0
95-100	0.0

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

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	-4.9	3.6	3.9	4.4
5-9	-9.9	5.5	5.5	5.7
10-14	+4.1	1.9	2.1	3.0
15-19	-1.0	1.8	2.2	2.8
20-24	-5.6	3.9	4.1	4.4
25-29	+0.9	2.5	3.0	4.2
30-34	+2.1	2.9	3.3	4.3
35-39	+13.5	2.8	3.4	4.4
40-44	+9.0	2.1	2.4	3.0
45-49	+4.0	2.1	2.4	3.3
50-54	-0.6	1.3	1.5	2.0
55-59	-1.5	1.3	1.4	1.9
60-64	+0.3	0.4	0.5	0.6
65-69	+2.0	0.1	0.2	0.2
70-74	+3.8	0.0	0.0	0.0
75-79	+0.0	0.0	0.0	0.0
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0

**Figure 10 (\$2.50/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	+0.1	64.1	76.2	90.4
4	+0.6	29.5	36.9	52.0
8	+1.2	19.2	24.3	32.7
16	+1.6	14.1	16.8	23.4
32	+1.5	10.1	11.7	16.1
64	+1.7	7.1	8.4	11.1
128	+1.7	4.9	5.8	7.6
256	+1.8	3.5	4.3	5.4
512	+1.8	2.4	2.9	3.6
1,024	+1.7	1.7	2.0	2.7
2,048	+1.7	1.2	1.4	1.9
4,096	+1.8	0.8	1.0	1.4
8,192	+1.7	0.6	0.7	0.9
16,384	+1.7	0.4	0.5	0.6

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

Score	Inclusion:	Undercoverage:	Leakage:	Exclusion:	Total Accuracy	BPAC
	< poverty line correctly targeted	< poverty line mistakenly non-targeted	=> poverty line mistakenly targeted	=> poverty line correctly non-targeted	Inclusion + Exclusion	See text
0-4	1.5	34.7	0.1	63.7	65.2	-91.7
5-9	4.2	32.0	0.2	63.6	67.8	-76.4
10-14	7.5	28.7	0.6	63.3	70.8	-57.2
15-19	13.3	22.9	1.6	62.2	75.5	-22.2
20-24	18.8	17.4	3.3	60.6	79.4	+13.0
25-29	24.5	11.7	6.1	57.8	82.2	+52.2
30-34	28.3	7.9	9.0	54.8	83.1	+75.1
35-39	30.5	5.6	12.6	51.3	81.8	+65.2
40-44	33.3	2.9	19.1	44.8	78.1	+47.3
45-49	34.7	1.4	24.6	39.2	74.0	+32.0
50-54	35.6	0.6	30.6	33.2	68.8	+15.3
55-59	36.0	0.1	37.4	26.4	62.4	-3.4
60-64	36.1	0.0	45.4	18.5	54.6	-25.4
65-69	36.2	0.0	51.3	12.5	48.7	-41.9
70-74	36.2	0.0	56.1	7.8	43.9	-55.0
75-79	36.2	0.0	60.2	3.7	39.8	-66.3
80-84	36.2	0.0	62.1	1.8	37.9	-71.6
85-89	36.2	0.0	63.1	0.8	36.9	-74.4
90-94	36.2	0.0	63.8	0.0	36.2	-76.4
95-100	36.2	0.0	63.8	0.0	36.2	-76.5

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



**Figure 13 (\$2.50/day 2005 PPP line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	94.1	4.0	16.0:1
5-9	4.4	94.7	11.5	18.0:1
10-14	8.0	93.1	20.7	13.5:1
15-19	14.9	89.1	36.7	8.2:1
20-24	22.1	85.2	52.0	5.7:1
25-29	30.6	80.1	67.7	4.0:1
30-34	37.3	75.9	78.2	3.1:1
35-39	43.1	70.8	84.5	2.4:1
40-44	52.4	63.6	92.1	1.7:1
45-49	59.3	58.5	96.1	1.4:1
50-54	66.2	53.7	98.4	1.2:1
55-59	73.4	49.1	99.6	1.0:1
60-64	81.5	44.3	99.9	0.8:1
65-69	87.5	41.3	100.0	0.7:1
70-74	92.2	39.2	100.0	0.6:1
75-79	96.3	37.5	100.0	0.6:1
80-84	98.2	36.8	100.0	0.6:1
85-89	99.2	36.4	100.0	0.6:1
90-94	100.0	36.2	100.0	0.6:1
95-100	100.0	36.2	100.0	0.6:1

**\$3.75/day 2005 PPP Poverty Line**

**2005 Scorecard Applied to 2005 Validation Sample**

**Figure 5 (\$3.75/day 2005 PPP line): Estimated poverty likelihoods associated with scores**

If a household's score is . . .	. . . then the likelihood (%) of being below the poverty line is:
0-4	100.0
5-9	100.0
10-14	99.9
15-19	96.4
20-24	97.8
25-29	90.0
30-34	86.3
35-39	83.9
40-44	71.2
45-49	60.7
50-54	40.8
55-59	25.4
60-64	16.6
65-69	13.2
70-74	12.5
75-79	4.3
80-84	0.0
85-89	0.0
90-94	0.0
95-100	0.0

**Figure 8 (\$3.75/day 2005 PPP line): Bootstrapped differences between estimated and true household poverty likelihoods with confidence intervals in a large sample ( $n = 16,384$ ), 2005 scorecard applied to the 2005 validation sample**

Score	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
0-4	+0.0	0.0	0.0	0.0
5-9	+0.2	0.1	0.2	0.2
10-14	-0.1	0.1	0.1	0.1
15-19	-2.0	1.2	1.3	1.4
20-24	+1.5	0.8	1.0	1.3
25-29	+0.6	1.9	2.2	2.9
30-34	+1.5	2.0	2.3	3.0
35-39	+5.5	2.5	2.9	4.1
40-44	+16.8	2.6	3.1	4.2
45-49	+16.5	3.1	3.7	4.8
50-54	-8.7	5.8	6.1	6.4
55-59	+2.4	2.3	2.6	3.4
60-64	-2.5	2.3	2.6	3.3
65-69	-2.8	2.4	2.7	3.0
70-74	+11.4	0.5	0.6	0.8
75-79	+4.2	0.1	0.1	0.1
80-84	+0.0	0.0	0.0	0.0
85-89	+0.0	0.0	0.0	0.0
90-94	+0.0	0.0	0.0	0.0
95-100	+0.0	0.0	0.0	0.0

**Figure 10 (\$3.75/day 2005 PPP line): Differences and precision of differences for bootstrapped estimates of poverty rates for groups of households at a point in time, by sample size, 2005 scorecard applied to the 2005 validation sample**

Sample Size n	Difference between estimate and true value			
	Diff.	Confidence interval (+/- percentage points)		
		90-percent	95-percent	99-percent
1	+0.7	65.2	79.9	91.6
4	+2.4	36.8	43.3	55.0
8	+2.9	25.8	32.4	42.0
16	+3.1	18.9	22.8	29.0
32	+3.3	13.3	16.0	20.5
64	+3.2	9.5	10.9	15.3
128	+3.3	6.7	8.1	10.7
256	+3.4	4.9	5.6	7.1
512	+3.4	3.4	4.0	5.3
1,024	+3.4	2.5	2.8	3.7
2,048	+3.4	1.6	2.0	2.6
4,096	+3.4	1.2	1.4	1.9
8,192	+3.4	0.9	1.0	1.4
16,384	+3.4	0.6	0.7	1.0

**Figure 12 (\$3.75/day 2005 PPP line): Households by targeting classification and score, along with “Total Accuracy” and BPAC, 2005 scorecard applied to the 2005 validation sample**

Score	Inclusion: < poverty line correctly targeted	Undercoverage: < poverty line mistakenly non-targeted	Leakage: => poverty line mistakenly targeted	Exclusion: => poverty line correctly non-targeted	Total Accuracy Inclusion + Exclusion	BPAC See text
	0-4	1.5	55.3	0.0	43.1	44.7
5-9	4.4	52.5	0.0	43.1	47.5	-84.6
10-14	8.0	48.9	0.0	43.1	51.1	-71.8
15-19	14.7	42.2	0.2	42.9	57.6	-48.0
20-24	21.5	35.4	0.6	42.6	64.1	-23.4
25-29	29.3	27.5	1.2	41.9	71.2	+5.3
30-34	35.0	21.8	2.3	40.9	75.9	+27.2
35-39	39.6	17.2	3.5	39.6	79.3	+45.5
40-44	45.3	11.6	7.1	36.0	81.3	+71.8
45-49	49.2	7.7	10.2	33.0	82.2	+82.1
50-54	52.4	4.5	13.8	29.3	81.7	+75.7
55-59	54.3	2.6	19.1	24.0	78.3	+66.4
60-64	55.7	1.2	25.8	17.3	73.0	+54.6
65-69	56.8	0.1	30.7	12.4	69.2	+46.0
70-74	56.8	0.0	35.4	7.7	64.6	+37.7
75-79	56.9	0.0	39.5	3.7	60.5	+30.6
80-84	56.9	0.0	41.4	1.8	58.6	+27.2
85-89	56.9	0.0	42.4	0.8	57.6	+25.5
90-94	56.9	0.0	43.1	0.0	56.9	+24.2
95-100	56.9	0.0	43.1	0.0	56.9	+24.1

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

**Figure 13 (\$3.75/day 2005 PPP line): Households below the poverty line and all households at a given score or at or below a given score cut-off, 2005 scorecard applied to the 2005 validation sample**

Targeting cut-off	% all households who are targeted	% targeted who are poor	% of poor who are targeted	Poor households targeted per non-poor household targeted
0-4	1.5	100.0	2.7	Only poor targeted
5-9	4.4	99.5	7.7	199.3:1
10-14	8.0	99.7	14.1	365.3:1
15-19	14.9	98.7	25.8	74.1:1
20-24	22.1	97.5	37.8	38.5:1
25-29	30.6	95.9	51.6	23.6:1
30-34	37.3	93.9	61.6	15.4:1
35-39	43.1	91.9	69.7	11.3:1
40-44	52.4	86.4	79.6	6.4:1
45-49	59.3	82.9	86.5	4.8:1
50-54	66.2	79.1	92.2	3.8:1
55-59	73.4	74.0	95.5	2.8:1
60-64	81.5	68.3	97.9	2.2:1
65-69	87.5	64.9	99.8	1.8:1
70-74	92.2	61.6	100.0	1.6:1
75-79	96.3	59.0	100.0	1.4:1
80-84	98.2	57.9	100.0	1.4:1
85-89	99.2	57.3	100.0	1.3:1
90-94	100.0	56.9	100.0	1.3:1
95-100	100.0	56.9	100.0	1.3:1

## Appendix A: Guidance for Interpreting Scorecard Indicators

This appendix refers to information in the following documents:

Instituto Nacional de Estadísticas y Censos. (2005) “Boleta de la Encuesta Nacional de Hogares Sobre la Medición de Nivel de Vida 2005”, Managua: República de Nicaragua, <http://www.inide.gob.ni/pobreza/emnv/emnv05/Boleta.pdf>, retrieved 9 December 2009. (“the questionnaire”)

----- (2001) “Manual del Encuestador, EMNV 2001”, Managua: República de Nicaragua, <http://www.inide.gob.ni/pobreza/emnv/manenc.pdf>, retrieved 9 December 2009. (“the manual”)

### 1. How many household members are there?

According to Section 2 of the questionnaire and p. 43 of the manual, a *household* is made up of those people who regularly live in the same residence and who share eating arrangements. Domestic workers and lodgers (and their family members) do not count as members of the household. Likewise, people who have been absent from the residence for more than 9 of the past 12 months do not count as members of the household.

### 2. How many household members ages 7 to 12 are enrolled this year in the formal education system?

According to pp. 66–67 of the manual, the possible responses make use of the following definitions:

The manual does not define *community school*. It does, however, define a *community infant development center* and a *community preschool* as “pre-school centers that serve boys and girls in urban and rural communities. They rely on the management and participation of the community, and in some cases they are located in residences, community centers, or churches.”

A *non-autonomous public school* is a “school financed and administered directly by the Ministry of Education by a director who is assisted by a school board made up of teachers, parents, and students.”



An *autonomous school* is one where “the board, led by a director and composed of teachers, parents, and students, is solely responsible for the management of the educational institution, within the limits set by the Nicaraguan Constitution.”

A *private school* is owned by people, private companies, or other legal entities, and it is run by its owners. It may or may not receive subsidies from the government.

### 3. Can the female head/spouse read and write?

For the purposes of the scorecard, the *female head/spouse* is defined as the head of the household (if the head is a woman) or as the spouse of the head of household (if the head is a man). If the head of the household is a man who does not have a spouse, then there is no female head/spouse.

### 4. What is the main material of the floor of the residence?

According to p. 29 in the manual, the question aims to “determine the materials used in the most of the floors in the residence. If more than one material has been used, ask which is the one that has been used the most. If the response does not correspond to any of the available alternatives, record ‘Other’.”

The *main material of the floor* “refers to the material covering the floor of the residence. Do not base this only on the floor of the front room, as in some houses this may be made of a different material than the floors in the other rooms.”

### 5. What type of toilet arrangement does the household have?

According to p. 29 of the manual:

An *outhouse* or *latrine* is “an installation whose purpose is the elimination of human waste. It does not flush the waste away using water pressure nor drainpipes. It is not connected to a sewer network; rather, the waste is collected in a fixed location and stays there. It is constructed of wood or concrete mounted on a base above a hole, river, stream, or ocean.”

A *flush toilet* is a “sanitary installation made of cement or ceramic that uses water under pressure to eliminate human waste via drainpipes connected to the public sewer system or to some other system.”

According to p. 37 of the manual:

An *outhouse or latrine without treatment* “is one for which there are no practical ways to maintain and disinfect it”.

An *outhouse or latrine with treatment* “is one that is maintained and disinfected using lime, ash, or other materials.”

6. What fuel does the household usually use for cooking?

According to p. 39 of the manual: “If the household uses more than one kind of fuel for cooking, record the one that is used in the greatest quantity.”

7. Does the household have a refrigerator?

The manual does not provide any addition information.

8. Does the household have a blender?

The manual does not provide any addition information.

9. Does the household have an iron?

According to p. 140 of the manual, the section “Household Appliances” “pertains to the type and number of electrical apparatuses, household appliances, and vehicles that the household has.”

Page 124 states that “*household appliances* includes expenditures on electronic appliances such as stoves, refrigerators, washers, irons, vacuums, radios, and the like.”

This seems to imply that “iron” refers to electric irons, not irons heated over a fire.

10. Does the household have a radio, radio/tape player, or stereo system?

The manual does not provide any addition information.