Using the Progress Out of Poverty Index in Agricultural Value Chains

A Case Study in Kenyan Tea

The Progress Out of Poverty Index (PPI) developed by Mark Schreiner of Microfinance Risk Management L.L.C. and Grameen Foundation, is a simple poverty assessment tool that collects objective information to determine household poverty levels. The country-specific PPI scorecard measures economic poverty, by focusing on various non-financial indicator categories, including family, housing, education, and ownership of durable goods.

The PPI provides organizations with poverty information in terms of globally accepted international poverty lines and nationally recognized poverty lines. Organizations can understand if they are reaching populations living under the $1.25 day/PPP or national poverty lines. If users continue to track poverty status over time, they can understand whether they are moving out of poverty.

Like many organizations, the Sustainable Food Lab is excited about the prospect of the PPI as a simple and credible tool for estimating the likelihood of poverty in smallholder agricultural supply chains. In recent work to develop a shared approach to common indicators and metrics for measuring the sustainability of smallholder supply chains, the PPI is being carefully considered as an approach to estimating poverty likelihood. However, before unreservedly recommending the PPI as a suggested approach for measuring smallholder livelihoods—particularly if it replaces other measures of income and assets—the community engaged in developing these smallholder metrics wanted to build confidence that the PPI would be applicable for households in rural and strictly agricultural supply chains.

Why Test the PPI?
The PPI was built and tested on data from national censuses and is representative of the entire population of a country. Rural agriculturalists are not representative of the entire population, and as a subset, the PPI is

less likely to be an accurate indicator of their poverty status.

In 2012, the Sustainable Food Lab and a number of its member companies undertook a study of the sustainability of smallholder sugarcane production in Paraguay. As a part of this study, SFL worked with the Grameen Foundation to develop a Progress Out of Poverty Index specific for Paraguay. The experience developing and administering the PPI in Paraguay sugarcane production left the Food Lab with some questions. After analyzing the data collected, analysts found weaker than expected correlations between poverty likelihoods and other often related variables such as household income, farm size, and food security. There may be many reasons why this occurred in this particular case, but the experience illustrated a need for testing of the PPI against other data to build confidence that it is in fact appropriate for use in agricultural supply chains.

The Kenya Study
Throughout 2013, the Food Lab worked with Unilever to help develop an approach to tracking the livelihood status of the smallholder farmers in their supply chains. This goal, laid out in Unilever's Sustainable Living Plan, states that Unilever, "will work with suppliers as well as other key actors in the supply chain networks to help smallholder farmers improve their agricultural practices and thus enable them to become more competitive. By doing so [Unilever] will improve the quality of their livelihoods."

The Food Lab helped design a performance measurement survey that gathered farm level data to determine whether farmer productivity and livelihoods were, in fact, improving. Unilever piloted the survey among smallholder producers in three of their supply chains in late 2013. The first pilot study took place in Kenya with farmers selling to the Kenyan Tea Development Authority (KTDA). The Food Lab saw this pilot as an opportunity to test the PPI

alongside the metrics already included in the smallholder survey. The idea for the Kenya study was to gather income and asset data alongside the PPI in this rural agricultural supply chain in order to look for correlation between PPI poverty likelihoods, household income, and typical household assets. SFL believed this would reveal PPI's statistical significance in this distinctly rural agricultural supply chain.

The study was designed around two major hypotheses about the Progress Out of Poverty Index that needed to be tested in order to build confidence about its relevance for agricultural supply chains:

1. The PPI should correlate to the income[1] and assets of rural producers. Because PPI is based on asset and demographic questions from national level statistics, SFL wanted to ensure that it also worked for the kinds of asset investment choices made by rural households.

2. The PPI should correlate (at some point) with agricultural performance. If the general theory is that households that have more land, greater productivity, higher cash crop sales, and greater total farm production will be better off, one can also expect to see that reflected in PPI scores.

Data was collected in October of 2013 from 640 households representing approximately 8000 tea farmers from 8 Kenya Tea Development Agency tea factories.

The following questions were added to the Unilever household survey specifically in order to look for relationships to poverty likelihood.

- What was your gross income in the last 12 months from cash crops other than tea?
- What was your gross income from livestock and dairy last year?
- What is your estimate of your NET income in the last production year from crops other than tea?
- What was your gross income in the last production year from off-farm sources?
- Please estimate your overall net income for the household for the last production year
- How many cows do you own?
- Does your home have electricity?
- What is your source of drinking water?
- Which type of communication device do you own?

The survey already included *children in school, Months of Adequate Household Food Provisioning, kilograms of tea harvested in production year, land in production,* and *land planted to tea.*
The Food Lab and Mark Schreiner did the following data analysis in late 2013.

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[1] We understand that the accuracy of the income information collected in the comparison survey will be a factor in the quality of the comparison. Rough estimates of household income aren't always accurate of course, but we work within the limitations of a performance measurement household survey and we still expect to see some relationship between this data and the PPI poverty likelihood.

OVERVIEW OF RESULTS

Characteristics of Kenyan Tea Farmers Distributed by Farm Size

Graph 1.
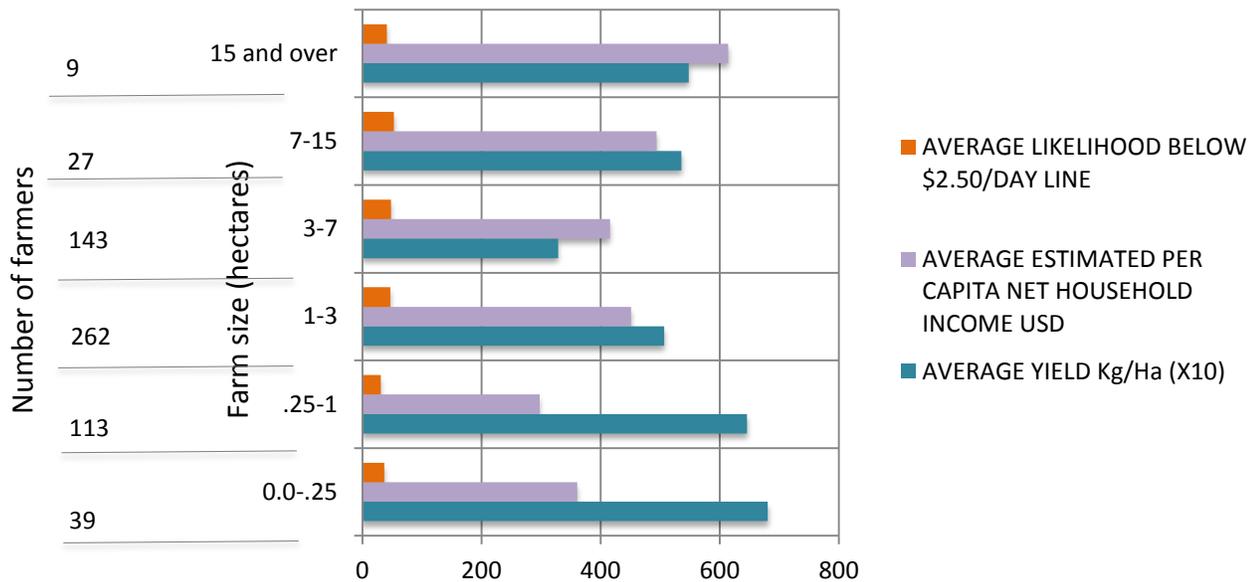
 As is evident from the distribution above and the table below, in this study yield and poverty likelihood do not change a great deal by farm size. And estimated per capita income seems to increase as farm sizes increase. The table below provides more detail that the chart format does not accommodate. Please note that this table reports averages.

Table 1.

FARM SIZE	AVERAGE YIELD	AVERAGE ESTIMATED NET HOUSEHOLD INCOME USD	AVERAGE LIKELIHOOD BELOW $2.50/DAY LINE (%)
0.0-.25	6815	361	37
.25-1	6460	298	31
1-3	5079	451	47
3-7	3295	416	48
7-15	5361	494	53
15 and over	5484	615	41
AVERAGE ALL	**5031**	**412**	**44**

Characteristics of Unilever Kenyan Tea Farmers by Factory

Table 2.

FACTORY	AVERAGE YIELD	AVERAGE OF REPORTED PER CAPITA NET	AVERAGE LIKELIHOOD BELOW $2.50/DAY LINE (%)

		HOUSEHOLD INCOME USD	
1	7177	166	46
2	3009	502	24
3	6174	769	33
4	4561	410	31
5	4846	216	65
6	3301	210	65
7	5900	139	63
8	5975	836	22
AVERAGE ALL	**5031**	**412**	**44**

POVERTY SCORECARD COMPARISONS

This review starts with the indicators that the analysis found to have a statistically significant correlation with the PPI. Those indicators that showed no relationship to the scorecard likelihoods follow.

Indicators with a Statistically Significant Correlation to the Poverty Scorecard Likelihood:

Summary:
The easy to measure proxy indicators with the most statistically significant correlation to the poverty scorecard were *source of drinking water* and *ownership of television.*

The indicators that had the most statistically significant correlation to the poverty scorecard were *estimated net household income per capita, kilograms of tea harvested, and Months of Adequate Household Food Provisioning.*

➔ **Source of Drinking Water**
As one would expect, there was a relationship between quality water sources and the poverty scorecard likelihood. According to Schreiner, "lower [PPI likelihood] scores and better water sources are both linked with lower poverty rates." The cross-tabs show that the magnitudes are large; for the national line, having a poor source (pond/river, or unprotected well) is linked with two-to-three-times the poverty risk as good sources (protected wells, or piped water to the house).

Water source	n	PPI Natl. line	PPI 150% natl. line
Pond/river	194	30.3	56.8
Unprotected well	27	30.2	58.5
Protected well	91	16.6	39.1
Piped water to house	251	8.4	25.1

➔ **Ownership of Television / Access to Electricity**

Electrified?	n	PPI Natl. line	PPI 150% natl. line
Yes	213	8.1	23.4
No	330	23.9	49.7

Poverty is less for tea farmers with electricity or a television.

Owns a TV?	N	PPI Natl. line	PPI 150% natl. line
No	314	26.2	52.6
Yes	248	7.7	23.6

According to Schreiner's analysis, "scoring's estimates are strongly and logically linked with these two non-scoring indicators of well-being." It is worth noting that ownership of a television and access to electricity are two data points that can be collected with a fair amount of confidence.

Schreiner adds that tea farmers without electricity are three times more likely to be under the national poverty line than farmers with electricity. And tea farmers without a television are four times more likely to be below the national line than tea farmers who own a television.

➔**Household Income per Capita**

Income / capita	n	PPI Natl.	PPI 150% natl.	Electricity?	TV?	All in school?	Good H_2O?
0–5,999	93	27	53	21	20	66	40
6,000–11,999	99	27	54	22	23	53	45
12,000–19,999	91	23	48	47	36	47	55
20,000–39,999	114	11	30	52	57	55	70
≥40,000	117	6	21	62	71	51	88

According to Schreiner's analysis, the poverty scorecard likelihood of poverty "consistently decreases as estimated per-capita net income increases." This makes sense. He adds, "The pattern is clear and logical, suggesting that both [the scorecard] and this single-question measure of income work as indicators of well-being."

The pattern for electrification, television, and source of water fits that of the PPI scorecard; higher income is linked with better well-being.

➔**Kilograms of Tea Harvested**

Kg. tea	n	PPI Natl.	PPI 150% natl.	Electricity?	TV?	All in school?	Good H_2O?
0–600	119	24	47	31	25	55	44
601–1,199	109	20	44	25	26	60	54
1,200–1,999	107	18	40	43	45	57	62
2,000–3,999	110	17	38	45	53	44	74
≥4,000	116	12	31	67	71	63	75

Kilograms of tea harvested is the most reliable measure of (partial) income, and it corresponds with the scorecard and the other simple, easily-measured non-scoring indicators of well-being (except school attendance). More harvest links with lower poverty likelihoods.

➔ Months of Adequate Household Food Provisioning

Experiences food insecurity	n	PPI Natl.	PPI 150% natl.	Electricity?	TV?	Kids in school?	Good H$_2$O?
Yes	113	33	57	25	22	29	29
No	451	14	35	47	51	64	71

From the table above one can see that those who experienced food insecurity were more than twice as likely to have expenditure under the national poverty line as those who did not. The same pattern holds for the other four non-scoring indicators.

According to Schreiner, the Months of Adequate Household Food Provisioning "is a good, blunt indicator, giving sensible results that accord with the other indicators that generally accord with expectations."

Indicators with No Statistically Significant Correlation to the Poverty Scorecard Likelihood:

Summary:
The indicators that had little or no statistically significant correlation to the poverty scorecard likelihood were *land in production, land in tea, gross income from crops other than tea, net income from crops other than tea,* and *gross income from off-farm sources.*

The indicators that had the most statistically significant correlation to the poverty scorecard were

➔ Land in Production
Schreiner states, "For farmers, land is probably the main productive asset, other than household labor. Although not all land is created equal, this question understandably ignores land quality, irrigation, age of plants, etc. Nevertheless, land is a concrete thing, is central in farming, and tends to change slowly (if at all) year to year, so it may be measured reliably. On the other hand, farmers may not know their land quantity in hectares. Unexpectedly, poverty rates increase with more land (up to 1 Ha), and then they level out."

Ha. ag. land	n	PPI Natl. line	PPI 150% Natl. line
0 to 0.50	102	11.2	29.8
0.51 to 1.00	147	17.1	37.5
1.01 to 2.00	124	21.2	44.4

2.01 to 4.00	120	20.3	44.7
4.01 or more	71	21.0	42.0

➔ Land in Tea

Data for land in tea was collected from farmers and crosschecked with tea factory data.

Ha. of tea	n	PPI Natl.	PPI 150% natl.	Electricity?	TV?	All in school?	Good H_2O?
0–0.20	117	20	41	42	42	39	56
0.21–0.49	114	15	36	32	34	62	67
0.50–0.99	145	19	40	42	44	56	61
1–1.99	111	21	44	44	46	59	56
≥2.00	76	16	39	58	63	67	78

The poverty score is roughly constant across tea-land categories. "In broad terms, scoring and the other indicators show little consistent relationship with hectares in green-leaf tea, other than that the largest decile of tea farms (≥2.0 Ha) are better-off." reports Schreiner.

➔ Gross and Net Income from Crops other than Tea

Gross income from crops other than tea did not correlate with the poverty scorecard's likelihood.

Gross non-tea income/ capita	n	PPI Natl.	PPI 150% natl.	Electricity?	TV?	All in school?	Good H_2O?
Missing	117	16	35	55	62	62	70
Zero	245	16	38	40	40	56	64
1 to 19	73	20	43	38	39	57	53
20 to 50	62	28	50	40	37	45	43
≥60	67	18	40	38	42	48	66

➔ Gross Income from Off-farm Sources

Off-farm income/ capita	n	PPI Natl.	PPI 150% natl.	Electricity?	TV?	All in school?	Good H_2O?
Missing	91	13	31	61	68	63	77
Zero	237	19	41	41	41	58	58
1 to 6,000	69	26	50	30	40	45	51
6,001 to 19,999	75	21	43	37	38	47	61
≥20,000	92	13	35	38	35	55	67

Schreiner found that, "The pattern for scoring is that having a little off-farm income is associated with more poverty than having no off-farm income (possibly due to poorer farmers hiring themselves out as day laborers), but having more off-farm income—given that there is off-farm income—is linked with less poverty (probably because these are households that do not depend solely on tea because a member has a non-agricultural job)."

➔**Gender of Head of Household**

Sex of farmer	n	PPI Natl. line	PPI 150% natl. line
Male	404	18.5	39.6
Female	160	17.3	40.4

In the Kenya survey we found that female tea farmers had nearly the same poverty rate as male farmers. The gender of the tea farmer is not linked with the scorecard's estimate of poverty, and the gender of the tea farmer does not seem like a useful indicator of well-being.

Analysis Lessons

In working with the data, a few key lessons around analysis became clear:

- **Normalize data for household needs like income**. When Schreiner normalized the data—distributed things like income over the number of household member—for the comparisons, we found much stronger relationships with the poverty likelihood than we did by comparing it to overall household income.
- **Use the PPI poverty likelihood for comparison not the PPI score.** Guidance from Schreiner states that, "Unlike poverty likelihoods, scores are ordinal symbols, like letters in the alphabet or colors in the spectrum. Because scores are not cardinal numbers, they cannot be added up or averaged across households. Only three operations are valid for scores: conversion to poverty likelihoods, analysis of distributions, or comparison—if desired—with a cut-off for targeting. The safest rule to follow is: Always use poverty likelihoods, never scores."
- **Cross tabs are a useful way to make sense of relationships** between data when correlation can't tell a great story. Correlation coefficients assume continuous values and linear relationships and so obscure things when one or both indicators are categorical or if relationships are non-linear. They do not impose the assumption that the data is correlated.
- **Check, and double check scoring and analysis.** It is very easily for simple mistakes in scoring and analysis to cascade through the lead to erroneous results. With ICT systems for automatic scoring and multiple people conducting analysis, it is easy to end of up mistakes on coding scores for responses.

Remaining Questions and Conclusions

The PPI comparison test in tea increased the Sustainable Food Lab's confidence in the use of the PPI in agricultural value chains. In Kenya, the study found the PPI had a statistically significant correlation with more of the indicators that—like the questions in the PPI—are typically linked to poverty. These included *source of drinking water* and *ownership of television.* The indicators that had the most statistically significant correlation to the poverty scorecard were *estimated net household income per capita, kilograms of tea harvested, and Months of Adequate Household Food Provisioning.*

The learning from this pilot—together with other experiences from other crops and contexts— will help inform the agricultural value chain partners about how to best use PPI with agricultural supply chain projects.

Some questions remain, however:
- Can the PPI replace household income and asset questions in performance measurement surveys?
- Is it best used as a complement to the other metrics?
- How useful is the poverty likelihood data by itself?
- Is it the case that the PPI is useful for categorizing farmers but does not provide information that is actionable for a company looking to better understand and perhaps invest in their supply chain?

The Sustainable Food Lab and the Grameen Foundation plan to form a learning community focused on the use of the PPI in agricultural value chains in order to create a space for users of the PPI to come together to begin to answer some of these questions, and share additional questions, learning, and successes with one anther to improve the tool for new adopters.

Grameen and the Food Lab also hope to compile more studies like this one into a meta-analysis to be made publicly available. In future studies comparing the PPI to other indicators of poverty, it would be useful to include a greater number of simple measures like *access to electricity* or *water source*. The results of this would allow for greater confidence in the usefulness of the PPI for agricultural value chains.