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P4P Purchase for Progress

The Impact of P4P on FOs and Smallholder Farmers in El Salvador

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ACRONYMS

DiD	Difference in Differences
FO	Farmers' Organization
ha	hectares
LRP	Local and Regional Procurement
mt	metric tonnes
P4P	Purchase for Progress
USD	United States Dollars
WFP	World Food Programme

EXECUTIVE SUMMARY

The World Food Programme's (WFP) five-year Purchase for Progress (P4P) pilot initiative tests innovative approaches for linking some of the world's poorest farmers to formal commodity markets. If successful, P4P will transform smallholder low-income farmers from subsistence farming to business-oriented producers capable of delivering consistent surpluses to private sector buyers, government institutions, and international organizations. Remunerative participation in commodity markets should provide smallholder farmers the incentive and the means to invest in agricultural production thereby increasing their incomes and improving their wellbeing.

To accomplish this goal, WFP has committed about ten percent of its local and regional procurement (LRP) in 20 countries[1] to testing alternative approaches for procuring in a manner that more directly benefits smallholder low-income farmers. This commitment represents a substantial demand. In 2012, WFP purchased almost a half-million mt of food from the 20 pilot countries, transferring almost USD 204 million into the local economies.[2]

Each of the 20 P4P pilot countries developed its own strategy for engaging with smallholder farmers, taking into account the local environment, opportunities, and constraints. Building the capacities of smallholder farmers' organizations (FOs) to be active market participants lies at the center of all the strategies and WFP buys directly from FOs in almost all the countries. When the opportunities existed, some countries overlaid supporting structured market platforms (commodity exchanges and warehouse receipt systems), small and medium traders, and food processors onto the basic FO-centric model.

The P4P hypothesis describes a development progression that begins with building the capacities of FOs to aggregate commodities, add value (e.g., achieve WFP quality standards), and identify and sustainably access markets. To gain these capacities, FOs will necessarily need to engage their members; providing them with technical and financial services to support production and marketing, building trust and ownership, and promoting a business-oriented approach to farming. The progress individual countries are able to make along this progression will depend on the baseline capacities they find among FOs and smallholder farmers, the approach they take to capacity building, and characteristics of the enabling environment (e.g., partner support and policy).

P4P in El Salvador

El Salvador's Country Implementation Plan identified limited and inappropriate use of inputs as a key factor constraining smallholder productivity, limited access to credit as the primary barrier to accessing inputs, and ineffective extension services as a cause of inappropriate input use. To address these constraints El Salvador's P4P programme works with its partners to develop crop- and region-specific input packages (seed, fertilizer, pesticides, and technical assistance), improve the capacity of the extension services to train farmers in the appropriate use of the packages, and facilitate access to credit to finance purchase of the packages.

[1] Afghanistan, Burkina Faso, Democratic Republic of Congo, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Liberia, Malawi, Mali, Mozambique, Nicaragua, Rwanda, Sierra Leone, South Sudan, Tanzania, Uganda, and Zambia.
[2] WPF. (2012). Food Procurement Annual Report 2012. Rome. Accessed at: http://documents.wfp.org/stellent/groups/public/documents/communications/wfp255336.pdf

Assessing the Impact of P4P

The analysis in this report concludes that, by almost any objective measure, P4P-supported FOs and farmers are substantially better off at the end of the P4P pilot than at the beginning. For example, the 13 P4P-supported FOs reported receiving more external assistance in 2014 than in 2009, are able to offer a greater range of services to their members, and are more engaged in markets. At the household level, more P4P farmers have access to productivity-enhancing inputs, maize yields have improved, a greater percentage of households are producing larger surpluses of maize, and incomes and wealth have increased.

Trends in FO capacity and household production and welfare, however, do not constitute evidence that the observed changes are caused by participating in P4P. To credibly attribute changes to P4P it is necessary to compare these outcomes to those that *would have occurred had these same FOs and households not participated in P4P*. This report applies appropriate analytical techniques to the data to estimate the causal effects of P4P on key indicators of FO capacity and smallholder farmers' production and marketing of staple commodities and on their household income.

Data and Methods

The impact assessment analysis for FOs draws on the survey data collected from a panel of 13 P4P-supported FOs and 7 non-P4P FOs and WFP's detailed procurement data. The El Salvador country office collected data from FOs in 2009, 2012, and 2014. The household analysis draws on surveys of random samples of farmer members of both P4P and non-P4P FOs conducted at the baseline, midpoint, and final periods of the pilot (2009, 2012, and 2014). El Salvador experienced a very high attrition rate in the household sample between the 2009 baseline and the 2012 follow-up surveys. The survey contractor was not able to locate 67 percent of the P4P households interviewed during the baseline and failed to locate 59 percent of the non-P4P sample. The high attrition rate substantially reduced the size of the household panel and may also have introduced an unknown bias into the results. The analysis uses a stratification approach to correct for the attrition. The size of the panel, however, limits the power of hypothesis tests for the household analysis.

The very small number of observations on FOs precludes involved statistical analysis. The analysis of the causal effect of P4P on FOs therefore uses a simple non-parametric difference-in-differences (DiD) approach that does not control for differences between P4P and non-P4P FOs. The household impact assessment analysis also uses a DiD approach to estimate the causal effects of participating in P4P on household production, marketing, and welfare indicators. The larger size of the household sample, however, supports a regression-based estimation approach that controls for factors other than P4P that may have influenced household outcomes. Both analyses rely on comparing outcomes for P4P groups with those of non-P4P groups which represent the counterfactual of not having participated in P4P.

Finding and Conclusions

El Salvador initially purchased from first-level FOs that appeared, in the baseline survey, to be relatively low-capacity organizations. None of the P4P or non-P4P FOs reported selling maize prior to the 2009 baseline survey and only 2 of 13 (15 percent) P4P FOs reported having access to long-term storage facilities.

These basic conditions define the "baseline" for achieving the anticipated results laid out in the results framework of Figure 5 and Figure 6. The remainder of this section frames the conclusions in the context of

the results framework. It presents results in the sequence in which they are likely to occur; FO organizational capacity, FO marketing capacity, household marketing, household production, and household welfare.

In the results framework figures in this section, facilitating conditions are not necessarily outcomes of P4P, they merely represent conditions that may facilitate or enhance the potential for positive outcomes. The results framework figures therefore indicate whether the facilitating conditions are positive (+) or negative (-); attribution to P4P is not important. The columns of results attributable to P4P, however, indicate whether the facilitating conditions and participation in P4P caused a statistically significant change in the outcome indicator relative to non-P4P FOs and households.

Impact of P4P on FO Capacity

Figure 18 summarizes changes in facilitating conditions and anticipated results for FO capacity and serves to frame the conclusions presented in this section.

The facilitating conditions supporting increased FO organizational capacity generally improved over the course of the P4P pilot. The percentage of FOs reporting access to long-term storage facilities increased from 15 percent to 75 percent. P4P FOs also reported substantial improvements in access to supply-side support. By the end of the P4P pilot, 100 percent of P4P FOs reported receiving supply-side support for organizational strengthening, post-harvest handling, production, marketing, and inputs. The greatest changes were a 62 percentage point increase in the percentage of FOs receiving marketing support, a 54 percentage point increase in support for infrastructure, and a 38 percentage point increase in post-harvest handling support. The increases in post-harvest management, inputs, infrastructure, production, and marketing align with the particular areas on which the El Salvador P4P program focused.

WFP's procurement stimulus was relatively sizeable with the minimum quantity purchased from an FO in a given year at 40 mt, a maximum of 1,057 mt, and a mean of 342 mt.[3] However, procurement was inconsistent; WFP purchased in more than one year from only 3 of 10 P4P FOs registered as WFP suppliers.

The improvements in the facilitating environment prompted significant impacts in indicators of FO organizational capacity. In particular:

- Participating in P4P substantially increased P4P FOs' capacities to provide services to members relative to non-P4P FOs. The percentage of quality services offered increased by 49 percentage points, production services by 34 percentage points, and marketing services by 29 percentage points.
- Relative to non-P4P FOs, the percentage of P4P FOs facilitating members' access to inputs increased by 54 percentage points.
- The percentage of P4P FOs providing production training to members increased by 40 percentage points relative to non-P4P FOs.

The facilitating environment for marketing outcomes also generally improved for P4P FOs. The percentage of P4P FOs utilizing credit doubled from 31 percent to 62 percent between 2009 and 2014. WFP's procurement, although very inconsistent, was sizeable. These facilitating factors led to substantial increases in FO marketing capacity indicators. Although the indicator values increased substantially, only one could be attributed to P4P, probably because of the number of observations was too small to identify them as causal effects.

[3] WFP procurement records through May 2013.

FIGURE 1: SUMMARY OF IMPACT OF P4P ON FO CAPACITY

Maize Marketing

	Indicators	Results attributable to P4P		Facilitators	Status	
Organizational capacity	Planning	→	Percentage of P4P FOs planning for production and marketing increased by 32% relative to non-P4P but difference not statistically significant.	Infrastructure	+	Revolving loans and direct support from WFP contributed to increasing access to storage. P4P FOs reporting access to storage increased from 15% to 75%.
	Services	↑	Statistically significant increases in percentage of quality services (49%), production services (34%), and marketing services (29%) provided by P4P FOs relative to non-P4P FOs.	Procurement	-	Sizeable but inconsistent procurement stimulus
	Inputs	↑	54% increase in percentage of P4P FOs facilitating members' access to inputs relative to non-P4P FOs.	Supply-side support	+	Substantial increase in supply-side support for marketing (62% increase), infrastructure (54% increase), and post-harvest handling (38% increase)
	Training	↑	40% increase in percentage of P4P FOs providing production training to members relative to non-P4P FOs.			
Marketing capacity outcomes	Sales	↑	The percentage of P4P FOs reporting sales to any buyer increased by 29 percentage points relative to non-P4P FOs and average quantities sold increased by 262 mt.	Procurement	-	Sizeable but inconsistent procurement stimulus
	Market diversity	→	32 percentage point increase in percentage of P4P FOs selling to buyers other than WFP but not statistically different from non-P4P FOs.	Access to credit	+	Percentage of FOs utilizing credit doubled – from 31% to 62%.
	Financing for members	→	15 percentage point increase in percentage of P4P FOs providing post-harvest financing to members but not statistically different from non-P4P FOs.			
	Prices	↑	Price data at the FO level was too thin for inferences. However, P4P households reported receiving significantly higher prices than non-P4P households in 2012 (12% higher), the year when WFP purchased the most and from the greatest number of FOs.			
Impacts	Sustainable access to value-added staples markets (increasing trajectory of quantities sold, especially to formal buyers; declining dependence on WFP market, established relationship with financial institutions, access to permanent storage facilities of at least 500 mt capacity)					

Legend

↑	Statistically significant positive impact attributable to participating in P4P.
↓	Statistically significant negative impact attributable to participating in P4P.
→	No statistically significant impact associated with participating in P4P.
+	Favorable conditions/change.
-	Unfavorable conditions/change.

Specific marketing outcomes included:

- The percentage of P4P FOs reporting sales to any buyer increased by 29 percentage points relative to non-P4P FOs and average quantities sold increased by 262 mt.
- The percentage of P4P FOs reporting selling to buyers other than WFP rose from 0 percent to 54 percent – a 54 percentage point increase. However, probably because of the small number of observations, the result was not statistically significant relative to non-P4P FOs.
- Price data at the FO level was too thin for inferences. However, P4P households reported receiving significantly higher prices than non-P4P households in 2012 (12 percent higher), the year when WFP purchased the most and from the largest number of FOs.

Impact of P4P on Household Maize Marketing

The conditions facilitating change in household maize marketing behavior improved across the board in El Salvador during the P4P pilot (Figure 19). The percentage of P4P FOs selling maize increased as did the average quantities sold. The percentage of quality and marketing services available from the FO increased: quality services by 49 percentage points and marketing services by 29 percentage points. The percentage of P4P households using credit for agricultural and other purposes increased between 2009 and 2012; by 6 percentage points for agricultural loans and 8 percentage points for non-agricultural loans.

The improved facilitating conditions led to changes in household maize marketing behavior. Specifically:

- The percentage of P4P households that reported selling through the FO at some point during the pilot increased by 21 percentage points relative to non-P4P households and the average percentage of surpluses sold through the FO increased by 19 percentage points relative to non-P4P households.
- A 12 percentage point increase in the percentage of P4P households selling four weeks or more after harvest relative to non-P4P households was not statistically significant. However, the 13 percentage point increase, relative to non-P4P households, in the average percentage of maize surpluses sold was.

These behavioral changes, primarily the choice to sell through the FO in a year when WFP procurement was high, led to P4P households receiving significantly higher prices for maize than non-P4P households. The difference between the USD 396 reported by P4P households and the USD 355 obtained by non-P4P households represents an 11 percent higher price associated with being a member of a P4P FO.

Impact of P4P on Household Maize Production

The P4P development hypothesis suggests that positive outcomes in household maize marketing lead to positive production outcomes. For example, higher prices obtained from selling maize through the FOs are expected to provide the incentive to invest in increasing maize production. In addition to the incentive provided by better access to markets, facilitating factors for maize production include access to inputs and credit to resolve financial constraints to investing in agriculture. Specific changes in production facilitating conditions (documented in Figure 20) include:

- The percentage of P4P households reporting receiving subsidized inputs through their FO increased by 7 percentage point.
- The percentage of P4P households using credit for agricultural purposes increased by 6 percentage points between 2009 and 2012.
- The percentage of P4P households receiving production training increased by 23 percentage points.

FIGURE 2: SUMMARY OF IMPACT OF P4P ON HOUSEHOLD MAIZE MARKETING

Maize Marketing							
	Indicators	**Results attributable to P4P**			**Facilitators**	**Changes attributable to P4P**	
Behavioral change	Selling through the FO	↑	29 percentage point increase in percentage of households selling through the FO at any time during the pilot relative to non-P4P FOs.		Quantity sold by FO	+	The percentage of P4P FOs reporting sales to any buyer increased by 29 percentage points and average quantities sold increased by 262 mt.
					Quality and marketing services available from FO	+	Statistically significant increases in percentage of quality services (49%) and marketing services (29%) offered by P4P FOs.
	Selling more than 4 weeks after harvest	↑	Small but not statistically significant increase in percentage of P4P households selling maize 4 weeks or more after harvest relative to non-P4P households. Significant 13 percentage point increase in average percentage of surplus sold 4 weeks or more after harvest.		Access to credit	+	Slight increases in percentage of households utilizing credit for agriculture (up 6 percentage points) or for other purposes (up 8 percentage points).
Household marketing outcomes	Prices	→	Price data at the FO level was too thin for inferences. However, P4P households reported receiving significantly higher prices than non-P4P households in 2012 (12% higher), the year when WFP purchased the most and from the greatest number of FOs.		Quantity sold by FO	+	The percentage of P4P FOs reporting sales to any buyer increased by 29 percentage points and average quantities sold increased by 262 mt.

Legend

↑ Statistically significant positive impact attributable to participating in P4P.
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The positive facilitating environment coupled with a P4P program that provided customized technical packages of inputs and the training to use them correctly prompted P4P households to change their maize production behavior relative to non-P4P households. In particular:

- The percentage of P4P households choosing to cultivate maize increased by 19 percentage points relative to non-P4P households.
- P4P households allocated an average of 0.29 ha more to maize production than non-P4P households.
- The percentage of P4P households using certified maize seed increased by 18 percentage points relative to non-P4P households and the average percentage of maize seed used that was certified increased by 27 percentage points relative to non-P4P households.

Consistent with the increased focus on maize production and the increased use of certified seed, P4P households reported a significant increase in maize production parameters. Specifically:

- P4P households' maize yields increased by 0.87 mt/ha relative to non-P4P households.
- The average quantity of maize produced by P4P households was 1.08 mt higher than it would have been had the households not participated in P4P.
- P4P households reported selling an average of 2.42 mt more maize than non-P4P households.

Impacts of P4P on Household Welfare

Ultimately, better access to markets and increased production should boost household welfare. However, the well-known difficulties in measuring income and the relatively small change anticipated make it likely that even if P4P "caused" a change in income, it would not be detected through the noise of reporting error (recall) and variability. The analysis therefore also considered alternative measures of changes in welfare where the prospects for detecting change were more promising. These included a summary measure of household assets (the household asset score), an indicator of food security (the food consumption score), the value of household livestock, and characteristics of the households housing (flooring, wall, and roofing materials). Which of these will respond first to changes in income will probably depend to some extent on characteristics of a particular household. For example, a food insecure household may spend additional income on food before investing in housing or livestock.

P4P households were better off in 2014 than in 2009 by almost any measure of welfare.

- Average real incomes increased by 45 percent, from USD 870 in 2009 to USD 1,264 in 2014;
- The average household asset score increased from 12.30 in 2009 to 12.85 in 2014, an increase of 4 percent;
- The average real value of household livestock increased by 78 percent, from USD 435 to USD 774; and
- The average food consumption score increased by 9 percent, from 81.34 in 2009 to 85.22 in 2014.

However, non-P4P households experienced similar improvements and none of the changes observed with P4P households were significantly different from those experienced by non-P4P households.

FIGURE 3: SUMMARY OF IMPACT OF P4P ON HOUSEHOLD MAIZE PRODUCTION

Maize Production						
	Anticipated Results	**Results attributable to P4P**		**Facilitators**	**Changes attributable to P4P**	
Behavioral change	Planting maize	↑	Significant 19 percentage point increase in likelihood that P4P households plant maize relative to non-P4P households.	Access to inputs/credit	+	7 percentage point increase in percentage of P4P households receiving subsidized inputs through the FO. 6 percentage point increase in percentage of households receiving credit for agricultural purposes between 2009 and 2012.
	Area allocated to maize	↑	Significant 0.29 ha increase in average area allocated to maize production by P4P households relative to non-P4P households.			
	Use of inputs	↑	The percentage of P4P households using certified maize seed increased by 18 percentage points relative to non-P4P households and the average percentage of maize seed used that was certified increased by 27 percentage points relative to non-P4P households.	Production training	+	23 percentage point increase in percentage of P4P households receiving production training.
Intermediate outcomes	Yields	↑	Significant 0.87 mt/ha increase in maize yields relative to non-P4P households.	Access to inputs/credit	+	7 percentage point increase in percentage of P4P households receiving subsidized inputs through the FO. 6 percentage point increase in percentage of households receiving credit for agricultural purposes between 2009 and 2012.
	Quantity produced	↑	Significant 1.08 mt increase in quantity of maize produced relative to non-P4P households.			
	Quantity sold	↑	Significant 2.42 mt increase in quantity of maize sold relative to non-P4P households.			

Legend

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INTRODUCTION

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The P4P hypothesis describes a development progression that begins with building the capacities of FOs to aggregate commodities, add value (e.g., achieve WFP quality standards), and identify and sustainably access markets. To gain these capacities, FOs will necessarily need to engage their members; providing them with technical and financial services to support production and marketing, building trust and ownership, and promoting a business-oriented approach to farming. The progress individual countries are able to make along this progression will depend on the baseline capacities they find among FOs and smallholder farmers, the approach they take to capacity building, and characteristics of the enabling environment (e.g., partner support and policy).

DATA AND METHODS

The impact assessment is based on a quasi-experimental design that compares outcomes for two groups of FOs and households; one group that is participating in P4P and a group that is not. Participation at the FO level means that WFP has committed to buying from the FO. At the household level, participation means that the household is a member of a P4PP-supported FO. Comparison FOs were selected to be as similar to P4P FOs as practical in terms of FO capacity indicators and factors that could affect marketing and agricultural production. Survey data collected from these two groups at various points in time track changes in anticipated outcomes throughout the P4P implementation period. The El Salvador country office commissioned surveys of all P4P FOs and a sample of non-P4P FOs every year of the five-year pilot. It also

[4] Afghanistan, Burkina Faso, Democratic Republic of Congo, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Liberia, Malawi, Mali, Mozambique, Nicaragua, Rwanda, Sierra Leone, South Sudan, Tanzania, Uganda, and Zambia.
[5] WPF. (2012). Food Procurement Annual Report 2012. Rome. Accessed at: http://documents.wfp.org/stellent/groups/public/documents/communications/wfp255336.pdf

surveyed a panel of randomly selected members of the surveyed P4P and non-P4P FOs in year 1, the baseline, year 3, and year 5.[6] Table 1 and Table 2 summarize the FO and household samples, respectively. The attrition rate in the household sample was very high, particularly between the baseline and first follow-up surveys. In particular, only 115 of the 349 P4P households that participated in the baseline survey provided data in the 2012 follow-up survey, an attrition rate of 67 percent. The attrition rate among non-P4P households during the same time period was 59 percent (only 126 of 308 households that participated in the baseline responded to the first follow-up survey).[7] Consequently, the size of the household panel is relatively small.

The surveys collected data on a variety of FO capacity and household production, marketing, and welfare indicators. For FOs these included data on services provided to members, storage capacity, marketing activity, and credit utilization, among others. The household surveys collected data on household characteristics; production; production practices; marketing activity; credit utilization; and income from crops, livestock, and off-farm sources, among others. The data collection instruments are available from WFP.

TABLE 1: FO SAMPLE

	2009 (baseline)	2010	2012	2013	2014
Entire sample					
P4P FOs	13	13	13	13	13
Non-P4P FOs	7		9		8
Panel					
P4P FOs	13	13	13	13	13
Non-P4P FOs	7		7		7

TABLE 2: HOUSEHOLD SAMPLE

	2009 (baseline)	2012	2014
Entire sample			
P4P households	349	315	310
Non-P4P households	308	308	306
Panel			
P4P households	112	112	112
Non-P4P households	125	125	125

In the comparison group design, the outcomes for the non-P4P group represent the counterfactual, i.e., outcomes for the P4P groups had they not participated in P4P. Obviously, many factors other than P4P may affect outcomes of the two groups over time. The more similar the two groups, the less potential exists for other factors to differentially influence outcomes. It was not feasible, however, to randomly assign FOs to P4P and non-P4P groups (the best way to obtain comparable groups) and the EL Salvador country office matched them loosely on similarity of size, marketing experience, location, and organizational capacity.

Location may be an important determinant of all of the outcomes of importance to P4P. Therefore, it is important to match P4P groups to non-P4P groups in the same regions, or regions with similar access to

[6] Due to attrition, the size of the household panel (households interviewed in all three surveys) is smaller than the overall sample.
[7] The Country Office could not explain the cause of the high attrition rates.

markets and agricultural production environments. The relatively small number of FOs that met WFP's minimum requirements for participation made it difficult in El Salvador to find appropriate comparison FOs in some regions. The resulting sample is therefore somewhat unbalanced by region (Table 3). This has implications for the analysis as described in the next section.

TABLE 3: DISTRIBUTION OF FO AND HOUSEHOLD SAMPLES BY REGION

Region	Number of FOs		Number of households	
	P4P	Non-P4P	P4P	Non-P4P
Ahuachapán	5	2	117	72
Santa Ana	1		10	
Sonsonate	2	1	19	68
La Libertad		2		29
San Vicente	1	1	29	54
Usulután	2	1	78	85
Morazán	1		50	
La Unión	1		46	

Data Limitations

The most troublesome aspect of the El Salvador data is the potential bias resulting from the high attrition rates in the household sample between the 2009 baseline and the first follow-up survey in 2012. Even analyses based only on the household panel (which excludes the households selected to replace those dropped from the second follow-up survey) may produce biased results if the dropped households are systematically different than retained households. Comparison of the baseline characteristics of dropped and retained households suggests that they are indeed different with respect to many of the key P4P outcome indicators. The analysis addresses this limitation by using only panel households, stratifying on an index of P4P outcomes, and weighting the analyses to account for disproportionate representation in each stratum relative to proportions in the full baseline sample. The ability of this approach to eliminate potential biases in estimates of causal effects depends on the extent to which the stratification variable reflects household characteristics that are relevant to defining household responses to P4P. See Annex A for more information on the stratification approach.

In the FO data, the fact that only three of the five surveys collected data on non-P4P FOs severely restricts the scope of the analysis and probably biases some results. The missing observations for non-P4P FOs makes it impossible to fully compare temporal trends in outcome variables between the two groups. The limitation is particularly acute for variables formulated in cumulative terms, e.g., total quantity sold to date. In fact, in these instances, even a comparison of P4P and non-P4P FOs in the final year must ignore the 2010 and 2013 data for P4P FOs or values will not be comparable. Consequently, when necessary, comparisons of P4P and non-P4P FOs use data only for the years in which data from both groups exist. The missing data may also bias results for outcomes that exhibit considerable variability over time, especially if the causes of the variability are different for P4P and non-P4P FOs.

The very small number of observations on non-P4P FOs also limits the power of tests of impacts on FO capacity. Low power means that the chance of identifying an effect that does in fact exist is relatively small. In other words, an effect will have to be relatively large to be detected as a significant difference.

Analysis of Impacts on FO Capacity Indicators

As country offices designed their P4P programs, they had to match the number of FOs selected to participate with the anticipated level of procurement in order to provide a meaningful and consistent level of procurement throughout the pilot. El Salvador elected to work with 13 FOs. This number of FOs is too small to expect reliable results from rigorous approaches to estimating causal effects. Consequently, the analysis of the effects on FOs of participating in P4P relies on simple difference-in-differences (DiD) comparisons without controlling for other factors that might affect FO outcomes. The simple DiD estimator is the difference in average outcomes for the P4P group over time minus the difference in average outcomes for the non-P4P group. The impact of P4P on an outcome Y at time *t* is:

$$Impact_t = \left(\bar{Y}_{pt} - \bar{Y}_{p(t-k)}\right) - \left(\bar{Y}_{nt} - \bar{Y}_{n(t-k)}\right)$$

where $\bar{Y}$ indicates the group mean of outcome Y, the subscript *t* refers to time (surveys periods), *k* is the number of years prior to *t* from which to evaluate impact, *p* indicates P4P groups, and *n* is non-P4P groups.

Analysis of Impacts on Households

Analysis of the household data employs a DiD approach to estimate the causal effects of P4P on anticipated outcomes. The DiD estimator defines the impact of a program on an anticipated outcome as the relative change in the average outcome measure over time between a "treatment" group affected by the program and a "control" group that is not affected, or:

$$Impact = \left(\bar{Y}_{1t_1} - \bar{Y}_{1t_0}\right) - \left(\bar{Y}_{0t_1} - \bar{Y}_{0t_0}\right) \quad (1)$$

where $\bar{Y}$ indicates the group mean of outcome measure Y; the subscripts *0* and *1* refer to control and treatment groups, respectively, and the subscript *t* refers to time with the subscripts 0 and 1 on *t* referring to pre- and post- program time periods respectively.

The non-parametric DiD estimator in equation (1) is appropriate only if the treatment and control groups are statistically equivalent, that is, that differences are due only to chance. Statistical equivalence implies that the DiD impact estimate derived from equation (1) is due only to the treatment and not to other factors. Random assignment of experimental units (e.g., FOs or households) to treatment and control groups is the best way to ensure statistical equivalence. Except for Ghana, however, it was not possible to randomly assign FOs, or by implication, households, to P4P and non-P4P groups. Therefore, the simple estimator of equation (1) is not appropriate for El Salvador.

A generalization of the DiD estimator in a regression framework is more appropriate for cases where treatment and control groups are not equivalent. When the two groups are not statistically equivalent, the analysis needs to control for the differences to obtain reliable estimates of causal effects. One useful feature of the DiD estimator is that it completely controls for time-invariant differences between the two groups leaving only time-variant differences as possible confounders. The regression equivalent of the DiD estimator is:

$$Y_{it} = \alpha + \beta D_{it_0} + \delta\tau + \gamma D_{it} + \theta X_{it} + \epsilon_{it} \quad (2)$$

where Y_{it} is the observed outcome for household i at time (survey) t, D_{it_0} is a vector of indicators of whether household i is in the treatment group at time $t=0$, τ is a vector of indicators for each time period except $t=0$, D_{it} is an indicator of household i being in the treatment group for all $t\neq 0$, X_{it} is a set of control variables which may include interactions, and ε_{it} is the error term. The elements of the coefficient vector γ are the average impacts of the treatment on Y at time t.

With panel data the regression equation becomes:

$$Y_{it} - Y_{it-1} = \alpha + \delta\tau + \gamma D_{it} + \theta X_{it} + \epsilon_{it} \quad (3)$$

where parameters are the same as those defined for equation (2).

Given the limitations of the data caused by high attrition rates, the analysis applies equation (3) to the small panel of households.

Comparability of P4P and Non-P4P Groups

The reliability of the DiD estimates of impact in the case of non-equivalent groups depends in part on their similarity. Therefore, prior to assessing the impacts of P4P on FO capacity and farmers' productivity and welfare, the analysis examines the differences between the two groups and the significance of observed differences.

Comparability of FOs

Side-by-side tests of differences in means and proportions of 31 FO characteristics served to assess the baseline comparability of P4P and non-P4P FOs. There were very few statistically significant differences between the two groups. However, the samples were too small for powerful tests of differences. The three significant differences that did emerge were:

- P4P FOs were significantly **more likely** than non-P4P FOs to report having received external assistance for marketing – 38 percent versus 0 percent.
- P4P FOs were significantly **less likely** to report providing any services to members – 69 percent versus 100 percent.
- P4P FOs were **more likely** than non-P4P FOs to report providing marketing services – 21 percent versus 0 percent.

Table 15 in Annex B provides the full details of the tests for similarity between P4P and non-P4P FOs.

Comparability of Households

Similarly, the comparison of P4P and non-P4P households relied on testing for differences between the two groups on the basis of 76 variables extracted from the household survey. The two groups of households differed significantly (i.e., p-value<=0.10) on 35 of the 76 variables. The most meaningful differences included:

- In terms of household characteristics:
    - P4P households were significantly **more likely** than non-P4P households to have a female household head – 73 percent compared to 54 percent.
    - P4P households were significantly **more likely** than non-P4P households to obtain water from an improved source – 96 percent versus 79 percent.
    - P4P households were significantly **less likely** than non-P4P households to have a concrete or wood floor (as opposed to dirt) – 59 percent compared to 70 percent.
- In terms agricultural production:
    - P4P households reported owning significantly **more** land than non-P4P households – an average of 1.79 ha compared to 0.97 ha.
    - P4P households reported cultivating significantly **more** land than non-P4P households – an average of 2.21 ha compared to 1.37 ha.
    - P4P households reported allocating significantly **more** land to maize production than non-P4P households – an average of 1.33 ha compared to 0.86 ha.
    - P4P households reported harvesting significantly **larger** quantities of maize (3.43 mt on average compared to 1.93 mt), producing a larger surplus of maize (2.28 mt versus 0.99 mt), and selling larger quantities of maize (4.92 mt compared to 2.43 mt).
    - P4P households were significantly **more likely** than non-P4P households to have received inputs through their FO – 80 percent versus 61 percent.
    - P4P household were significantly **more likely** than non-P4P households to use fertilizer – 42 percent compared to 29 percent.
    - P4P households reported spending significantly **more** than non-P4P households on producing crops – an average of USD 529 annually compared to USD 321.
    - P4P households earned significantly **more** from farming than non-P4P households – an average of USD 826 per year compared to USD 384.
- In terms of marketing, P4P households were significantly **more likely** than non-P4P households to report selling maize four weeks or more after harvest – 47 percent compared to 34 percent.
- In terms of income and expenditure:
    - P4P households reported significantly **larger** total household incomes – USD 1,083 per year versus USD 653. P4P households also reported higher income from all crop-related activities.
    - P4P households reported earning a significantly **smaller** share of total income from off-farm sources than non-P4P households – 19 percent compared to 39 percent.
    - P4P households reported spending significantly **less** than P4P households on household items (USD 573 compared to USD 443) and on "other" items (USD 2,768 versus 4,646).

Taken together these differences seem to imply that P4P households were significantly more involved in agriculture than non-P4P households. The discrepancy between income and expenditure makes it difficult to determine if one group is better off than the other.

Table 16 in Annex B provides the details of the comparisons.

THE P4P "TREATMENT"

An impact assessment determines the causal effect of a *treatment* on anticipated outcomes. For P4P this is the impact on FO capacity and household agricultural productivity and welfare associated with participating in

P4P. The P4P logframe defines a number of indicators of FO capacity and household productivity and welfare outcomes.[8]

The P4P development hypothesis expects WFP's commitment to buy from FOs during the pilot phase will catalyze the support of development partners to help build the capacities of participating FOs to capitalize on the opportunity to sell to WFP and of individual farmers to increase agricultural productivity and 2) provide individual farmers the financial incentive to invest in increasing agricultural productivity. In this context, the P4P *treatment* is merely WFP's procurement and the capacity building activities of partners are outcomes of the treatment.

However, many P4P programs purposely selected FOs based in part on the presence of development partners working to build the capacities of the FOs. Furthermore, country programs often directly supported capacity building activities, e.g., conducted training, provided infrastructure and equipment. The El Salvador program, for instance, focused on providing technical packages of inputs and associated training aimed at increasing production. In this context, access to inputs may be a component of the treatment rather than an outcome.

Impact assessments often carefully design treatments/interventions to vary the treatment elements and/or their intensity across subjects (e.g., FOs). With P4P, however, country offices had a great deal of latitude to design and implement their own programs. The P4P Rome-based coordination unit, which designed and managed the monitoring and evaluation system and the impact assessment framework, had little direct control over specific implementation decisions at the country level. The impact assessment therefore has to take the types and intensities of treatments as given.

The remainder of this section documents characteristics of the P4P treatment for individual FOs in El Salvador. These data will define the dimensions and intensity of the P4P *treatment* applied to individual FOs and help identify the characteristics of the treatment that influence particular outcomes. In the El Salvador context, the broad dimensions of the treatment are WFP procurement, establishing revolving funds to facilitate FO access to credit, distributing technical packages and training to improve agricultural productivity, and training. Because, in most cases, WFP's development partners were already working with participating FOs, coordinated their activities closely with WFP, and were often funded by WFP, the impact assessment considers their activities to be part of the P4P treatment rather than an outcome of the treatment.

WFP Procurement

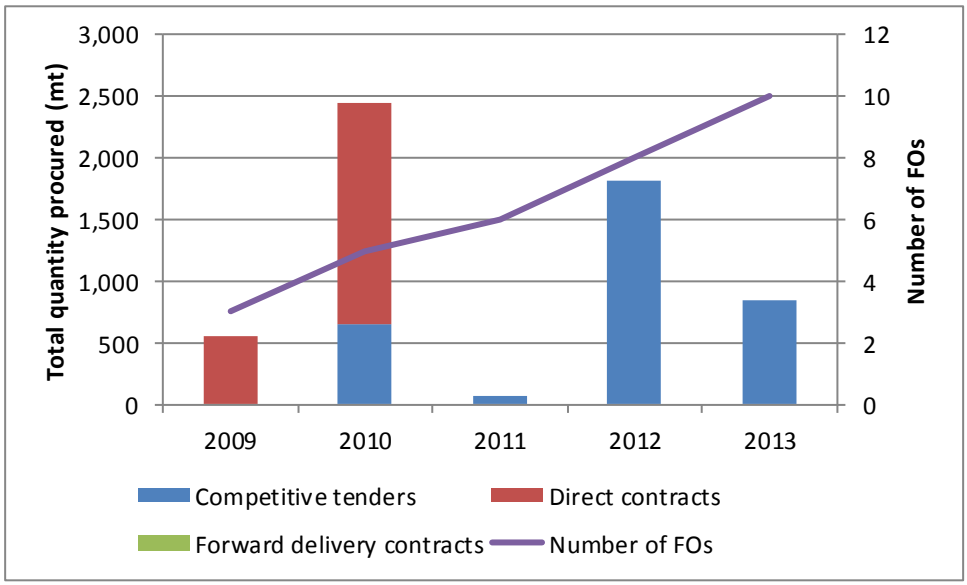
Between P4P's inception in 2009 and May 2014, WFP took purchased 5,758 mt of maize and beans from P4P FOs in El Salvador.[9] The quantities WFP procured varied throughout the course of the pilot, largely due to programmatic requirements external to the P4P program (Figure 4). Aspects of the treatment as they relate to procurement that the country office could control were the procurement modality; the number of FOs from which it purchased; the number of contracts (excluding competitive tenders where WFP could not control the outcome) awarded to each FO; and by implication, the quantities contracted from each FO.[10]

[8] P4P Global Logframe, Internal WFP document.
[9] Source: WFP procurement records. The most recent available data cover the period from inception (2009) to December 2013. The fourth quarter data from 2013 (i.e., October-December) had not been verified by the P4P Coordination Unit at the time of this analysis.
[10] With competitive tenders, the CO could control only the number of tenders it issued, and their size, but could not directly control the individual FOs that won tenders.

Figure 4 also illustrates that, over the course of the five-year pilot WFP switched from relying exclusively on direct contracts in 2009 to using only competitive tenders from 2011 onward. By the end of the pilot, WFP had executed 48 separate contracts and purchased from 10 of the 13 FOs participating in P4P

The P4P development hypothesis implies that the size and consistency of procurement matters. WFP's commitment to purchase from a FO is expected to provide the FO the space to build capacity with a patient buyer. The stimulus should also be large enough to provide member farmers with the incentive to invest in increasing production. This implies a consistent level of procurement large enough to represent a meaningful sale volume for individual farmers.

FIGURE 4: WFP PROCUREMENT FROM P4P FOS BY YEAR AND MODALITY



Source: WFP procurement records.

Over the course of the pilot El Salvador purchased at least once from 10 of the 13 FOs that participated in P4P at some stage during the pilot. It purchased in more than one year from 3 of the 10 FOs (30 percent) from which it purchased. Contract sizes ranged from 4.65 to 497.00 mt with an overall average of 120 mt. The average contracted per FO (considering multiple contracts in a year) ranged from 97.30 to 1,941.36 mt with an overall average of 576 mt (Table 4). These results suggest a reasonably large but inconsistent procurement stimulus. Table 17 in Annex C documents sales to WFP by FO and year and clearly illustrates the characteristics of the procurement stimulus for individual FOs.

TABLE 4: DISTRIBUTION OF CONTRACTED QUANTITIES

	Number of observations	Mean	Median	Minimum	Maximum	Standard deviation
Quantity per contract (mt)	48	120	100	4.65	497.00	99.7958
Quantity per FO (mt)	10	576	328	97.30	1,941.36	615.3211

Source: WFP procurement records.

RESULTS FRAMEWORK

The results framework articulated in this section illustrates the interdependent, and often sequential, nature of P4P results and provides a context within which to interpret the findings. It is relevant at this juncture as context for the quantitative findings presented in the following two sections.

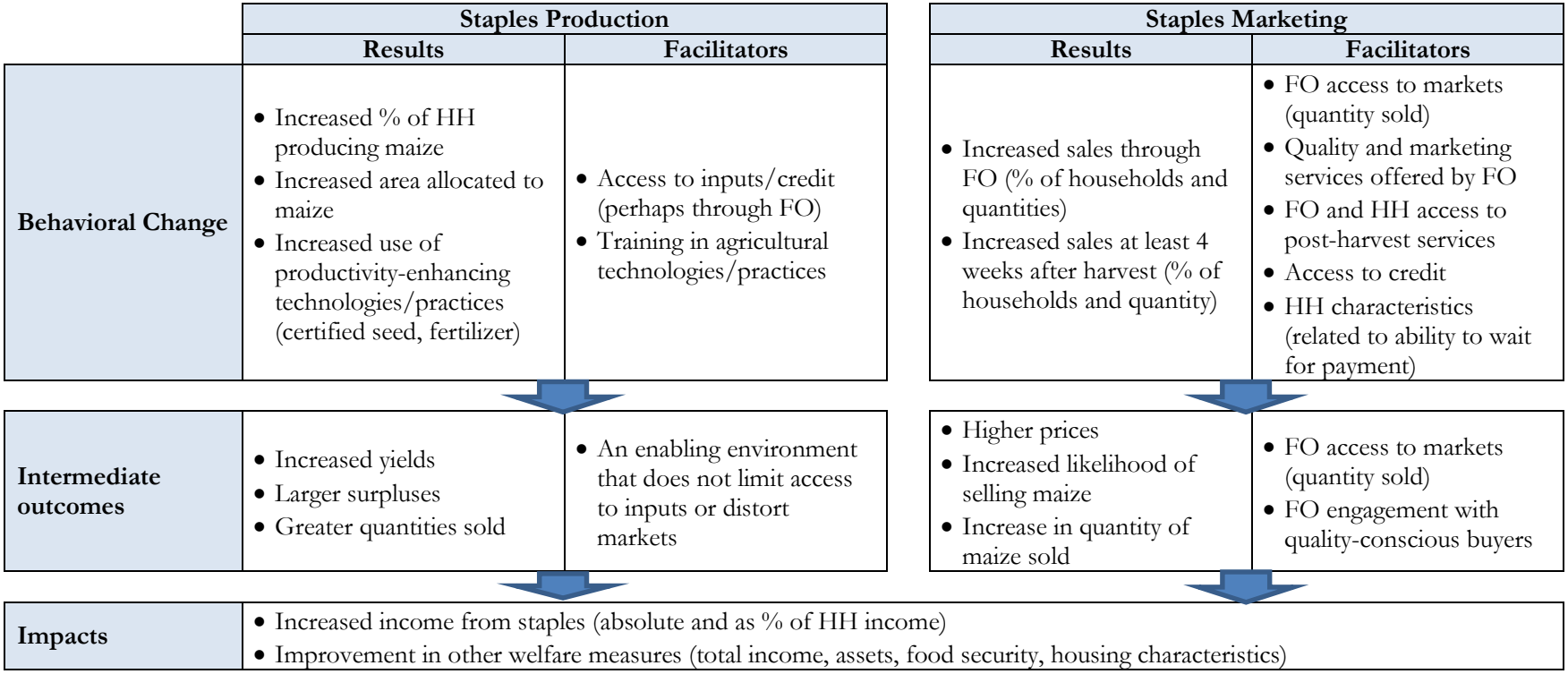
P4P is a capacity building program. By committing to buy a high-value (quality) product more directly from smallholder farmers, usually through FOs, WFP expects to catalyze the efforts of other development actors working to build the capacities of FOs. Stronger FOs will be more effective marketing entities able to aggregate larger quantities and add value to staple commodities by selling in bulk, improving quality, or transforming the product through processing. As FOs gain capacity, their smallholder farmer members benefit from enhanced access to markets enabling them to sell larger quantities through the FO at, perhaps, higher prices reflecting value addition. Increasing returns to agriculture, coupled with productivity-enhancing support from WFP and its partners, may begin to change farmers' perspectives on agriculture from a primarily subsistence activity to a viable business opportunity. As farmers recognize the potential of agriculture, they may begin to invest in productivity-enhancing technologies and practices, extending farm-level benefits beyond food security to increased incomes.

This is an obviously simplistic summary of a much more complex and nuanced development hypothesis. It does, however, illustrate the sequential and interdependent aspects of the pathway through which P4P expects to produce results. At both the FO and household levels, results progress from behavioral change to intermediate outcomes to higher level impacts. For example, at the FO level (illustrated in Figure 5), adopting a business orientation and increasing services provided to members (behavioral change) lead to increased quantities aggregated and sold and higher prices (intermediate outcomes) and then to sustainable access to value-added markets (impacts). At the household level (Figure 6), choosing to sell through the FO (behavioral change) will increase returns to agriculture (intermediate marketing outcomes) which should increase investments in agricultural production such as adopting productivity-enhancing technologies and practices (behavioral change) which should then lead to the intermediate production outcomes of increasing yields, quantities produced, and quantities sold. Producing and selling larger quantities at higher prices will have an impact on household welfare.

FIGURE 5: PROGRESSION OF FO RESULTS

	Staples Marketing	
	Results	**Facilitators**
Behavioral Change	• Acquiring a business orientation • Planning for production and marketing • Increased services/training offered to members	• Access to post-harvest facilities and equipment • WFP procurement (catalyst) • Supply-side support (capacity building, infrastructure)
Intermediate outcomes	• Increased quantities aggregated and sold • Increased range of markets (including quality-conscious buyers) • Able to facilitate financing for members • Obtaining higher prices	• Consistent and sizeable WFP procurement • Trust of membership, transparency • Improved access to credit
Impacts	• Sustainable access to value-added staples markets (increasing trajectory of quantities sold, especially to formal buyers; declining dependence on WFP market, established relationship with financial institutions, access to permanent storage facilities of at least 500 mt capacity)	

FIGURE 6: PROGRESSION OF HOUSEHOLD RESULTS



There are several important things to note about the progression of results in Figure 5 and Figure 6.

1. Household results can be classified as production-oriented and marketing-oriented. However, these categories are not necessarily independent. For example, the development hypothesis posits that higher prices associated with selling through the FO (an intermediate outcome in the marketing column) will provide an incentive to invest in productivity-enhancing technologies and practices (a behavioral change in the production column). The interdependence of results therefore works horizontally and vertically in the household figure.
2. Results often depend on "facilitators", conditions that contribute to achieving results. Some facilitators are elements of the P4P program and some fall within the remit of development partners' or governments.
3. Many FO results appear as facilitators in the household results progression. This implies that household results are, in some cases, dependent on FO results. The FO and household frameworks are therefore interdependent and household results may lag FO results. It is also possible that FO results lag household results. For example, an FO may find it difficult to aggregate large quantities before achieving a level of trust with its members that will encourage them to sell through the FO.

The following two sections present the quantitative findings on FO capacity building and household production and welfare with little interpretation. The conclusions section returns to the framework articulated in this section to draw the quantitative and qualitative evidence together into a coherent story of the impact of P4P in El Salvador.

IMPACT OF P4P ON FO CAPACITY

The El Salvador follow up report shows substantial improvements in many measures of FO capacity. However, these results do not reflect the impact of P4P because they do not consider what would have happened had the FOs not participated in P4P. This report determines which of the observed changes in FO capacity can be attributed to participating in P4P.

Because El Salvador collected data for non-P4P FOs only in 2009, 2012, and 2014, it is possible to compare P4P and non-P4P groups only in these three years (see the Data Limitations section on page 3 for more detail). The missing data can lead to substantially biased impact estimates, especially for highly variable outcomes such as quantities sold or outcomes measured in a cumulative form such as services provided. To avoid bias associated with missing data, the analysis ignores the data on P4P FOs in 2010 and 2013 and compares the P4P and non-P4P groups only on the basis of the years for which data exist for both groups of FOs.

Impact of P4P on Organizational Capacity

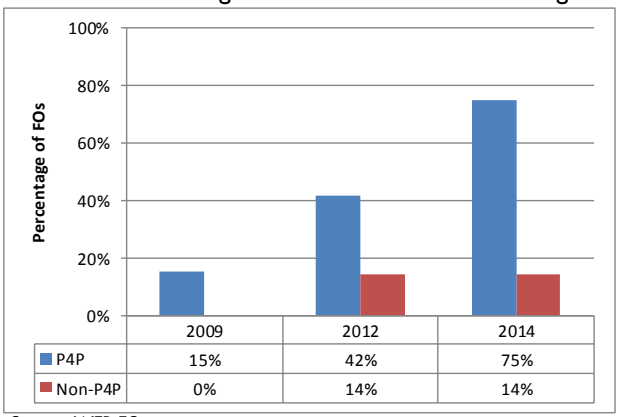
Organizational capacity refers to the human and physical capacity of an organization to effectively manage commodity aggregation, value addition, and marketing. The results framework of Figure 5 postulates that access to post-harvest infrastructure, WFP's procurement, and other supply-side support are important factors facilitating improvements in organizational capacity. At the time of the baseline, only 2 of the 13 P4P FOs reported having access to long-term storage and none of the non-P4P FOs reported access to storage (Panel 1 of Figure 7). WFP established revolving funds with P4P FOs and many used the funds to construct storage facilities. By 2014, 9 P4P FOs reported having access to storage while only one non-P4P FO gained access to storage during the same time period. Data on the capacity of storage facilities were inconsistent, i.e., showing declines in owned capacity, and are not reported.

Over the course of the P4P pilot, the percentage of P4P FOs receiving supply-side support also increased substantially, particularly support focused on marketing and infrastructure, two P4P focus areas (Panel 2 of Figure 7). Non-P4P FOs experienced similar growth in the percentage receiving supply-side support, particularly support related to post-harvest handling and marketing (Panel 3 of Figure 7). However, growth in the percentage of P4P FOs receiving assistance with marketing, inputs, tools, and infrastructure was substantially higher than for non-P4P FOs.

Finally, the consistency and size of WFP's procurement is also an important facilitating factor contributing to building organizational capacity. The "WFP Procurement" section on page 7 summarized WFP's procurement from P4P FOs and concluded that WFP provided a sizeable but inconsistent procurement stimulus.

FIGURE 7: ORGANIZATIONAL CAPACITY FACILITATORS

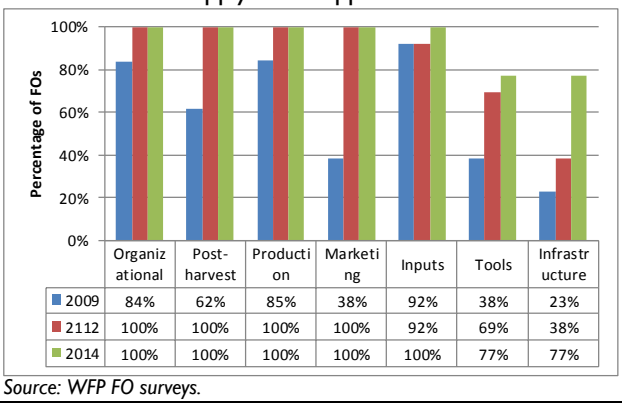
Panel 1: Percentage of FOs with Access to Storage



	2009	2012	2014
P4P	15%	42%	75%
Non-P4P	0%	14%	14%

Source: WFP FO surveys.

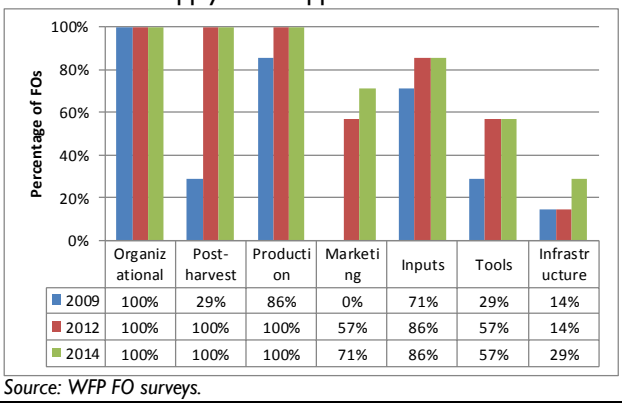
Panel 2: Supply-Side Support to P4P FOs



	Organizational	Post-harvest	Production	Marketing	Inputs	Tools	Infrastructure
2009	84%	62%	85%	38%	92%	38%	23%
2112	100%	100%	100%	100%	92%	69%	38%
2014	100%	100%	100%	100%	100%	77%	77%

Source: WFP FO surveys.

Panel 3: Supply-Side Support to Non-P4P FOs



	Organizational	Post-harvest	Production	Marketing	Inputs	Tools	Infrastructure
2009	100%	29%	86%	0%	71%	29%	14%
2012	100%	100%	100%	57%	86%	57%	14%
2014	100%	100%	100%	71%	86%	57%	29%

Source: WFP FO surveys.

WFP's procurement, its direct and indirect (through revolving funds) investments in warehouses, and the external assistance it brought to bear on the FOs significantly improved the facilitating conditions necessary to support improvements in organizational capacity. Except for the inconsistent procurement stimulus from WFP, by 2014, facilitating conditions for P4P FOs were generally supportive of improved organizational capacity. Indicators of organizational capacity include the range of services offered to members, ability to facilitate members' access to production inputs and provide production training to members, and planning for production and marketing.

The FO survey asked whether FOs provided a range of 18 different services; too many to examine individually. The services fall into four categories; value addition, quality, production, and marketing.[11] The analysis aggregates the services into these four categories and defines four service capacity indicators as the percentage of the services within a category the FO provides. Panels 1 and 2 of Figure 8 illustrate trends in the average percentage of services offered by P4P and non-P4P FOs, respectively.

Between 2009 and 2014, P4P FOs reported substantial increases in the percentage of quality, production, and marketing services they offered while non-P4P FOs reported virtually no change. In fact, the average percentage of quality services provided by P4P FOs increased by 49 percentage points relative to non-P4P FOs, production services increased by 34 percentage points, and marketing services by 29 percentage points. The non-parametric DiD results reported in Table 5 strongly suggest that these changes are attributable to participating in P4P.

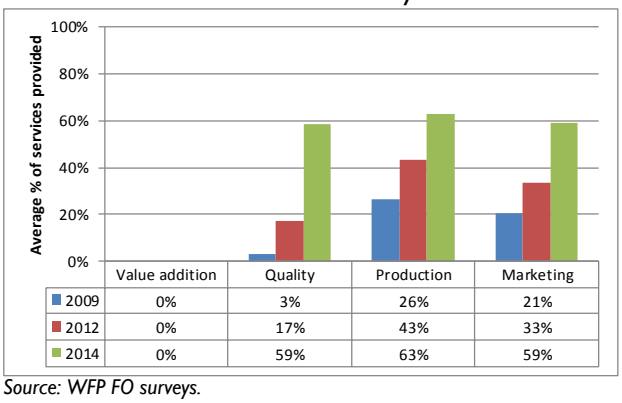
Panels 3 and 4 of Figure 8 show substantial increases in the percentages of P4P FOs that reported, respectively, facilitating access to inputs for their members and providing production training. In both cases, non-P4P FOs were significantly more likely than P4P FOs to provide these services in 2009 but P4P FOs surpassed non-P4P FOs by 2014. Non-parametric DiD analysis (Table 5) estimated a statistically significant 54 percentage point increase in the percentage of P4P FOs facilitating access to inputs relative to non-P4P FOs – a result that is consistent with the P4P focus on providing technical input packages. Similarly, the analysis concludes that the 40 percentage point increase in the percentage of P4P FOs providing production training relative to non-P4P FOs is attributable to participating in P4P.

The percentage of P4P FOs that reported planning for production and marketing also increased markedly between 2009 and 2014 while non-P4P FOs reported little change. The 32 percentage point growth among P4P FOs relative to non-P4P FOs was not statistically significant however so it cannot be attributed to P4P (Table 5).

[11] The value addition category includes two services; small-scale food processing and milling. The quality category includes eight services; drying commodities, cleaning commodities, removing small/broken grains, removing discolored grains, use of storage facilities, use of cleaning facilities, use of drying equipment, and fumigation. Production includes five services; technical assistance in agricultural technologies and practices, supplying agricultural inputs, facilitating access to inputs, maize threshing/shelling, and draft power. Marketing includes the three services of transporting good to buyers/markets, weighing and bagging, and aggregating commodities for sale.

FIGURE 8: TRENDS IN FO ORGANIZATIONAL CAPACITY INDICATORS

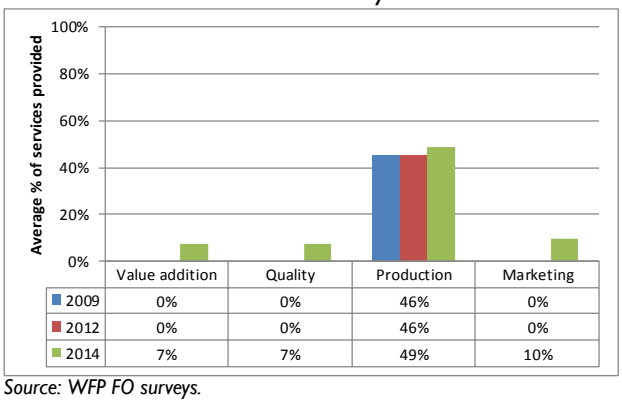
Panel 1: Services Provided by P4P FOs



	Value addition	Quality	Production	Marketing
2009	0%	3%	26%	21%
2012	0%	17%	43%	33%
2014	0%	59%	63%	59%

Source: WFP FO surveys.

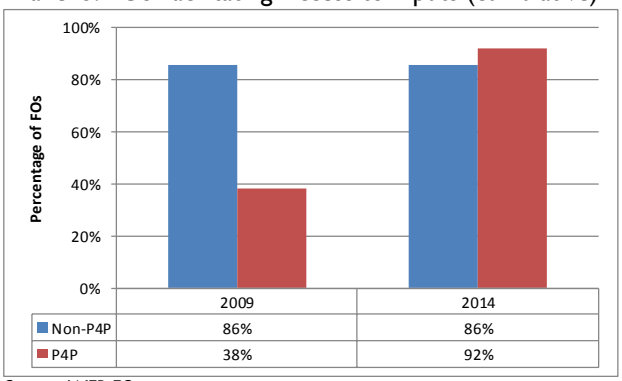
Panel 2: Services Provided by Non-P4P FOs



	Value addition	Quality	Production	Marketing
2009	0%	0%	46%	0%
2012	0%	0%	46%	0%
2014	7%	7%	49%	10%

Source: WFP FO surveys.

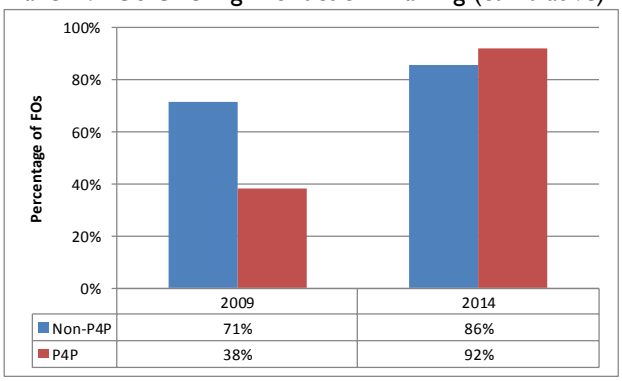
Panel 3: FOs Facilitating Access to Inputs (cumulative)



	2009	2014
Non-P4P	86%	86%
P4P	38%	92%

Source: WFP FO surveys.

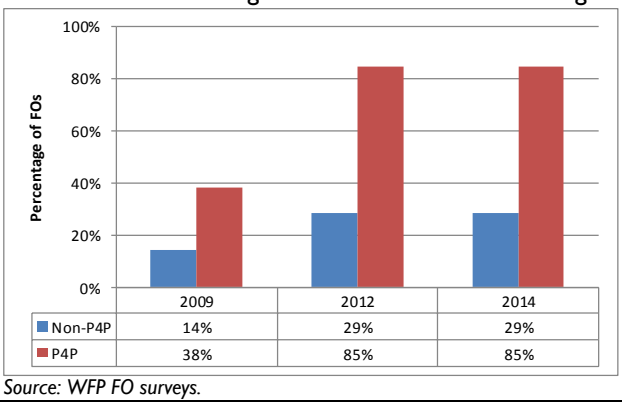
Panel 4: FOs Offering Production Training (cumulative)



	2009	2014
Non-P4P	71%	86%
P4P	38%	92%

Source: WFP FO surveys.

Panel 5: FOs Planning for Production and Marketing



	2009	2012	2014
Non-P4P	14%	29%	29%
P4P	38%	85%	85%

Source: WFP FO surveys.

TABLE 5: NON-PARAMETRIC DID ESTIMATES OF THE IMPACT OF P4P ON ORGANIZATIONAL CAPACITY

Model	Impact (coefficient/p-value)		
	2009-2012	2012-2014	2009-2014
Percentage of value addition services provided (cumulative %)	0% (---)	-7% (0.1800)	-7% (0.1800)
Percentage of quality services provided (cumulative %)	14% (0.1480)	34%*** (0.0030)	49%*** (0.0000)
Percentage of production services provided (cumulative %)	17% (0.1480)	17%* (0.0910)	34%*** (0.0100)
Percentage of marketing services provided (cumulative %)	13% (0.1400)	16% (0.1330)	29%** (0.0440)
Likelihood of facilitating access to inputs (cumulative %)	Data not collected from non-P4P FOs in 2012		54%*** (0.0020)
Likelihood of providing production training (cumulative %)	Data not collected from non-P4P FOs in 2012		40%* (0.0650)
Likelihood of planning for production and marketing (%)	32% (0.1710)	0%	32% (0.1710)

Numbers in parentheses are p-values.
* *significant at p< 0.10*
** *significant at p< 0.05*
*** *significant at p< 0.01*

Impact of P4P on FOs' Marketing Capacity

The results framework of Figure 5 identifies three factors that should facilitate improvement in FOs' marketing capacity. These include consistent and sizeable WFP procurement, trust of members' and organizational transparency, and improved access to credit. Anticipated marketing capacity outcomes include increased quantities aggregated and sold, accessing a larger range of markets (including quality-conscious buyers), the ability to provide financing to members, and obtaining higher prices. This section investigates changes in facilitating factors and then links them to marketing capacity outcomes.

Previous sections have already documented trends in WFP's procurement from P4P FOs and concluded that WFP provided a sizeable but inconsistent procurement stimulus. Figure 10 illustrates trends in three additional facilitators of FO marketing capacity: use of credit, percentage of households choosing to sell through the FO (a proxy for members' trust), and the percentage of FOs with leaders trained in organizational and financial management (a proxy for transparency).

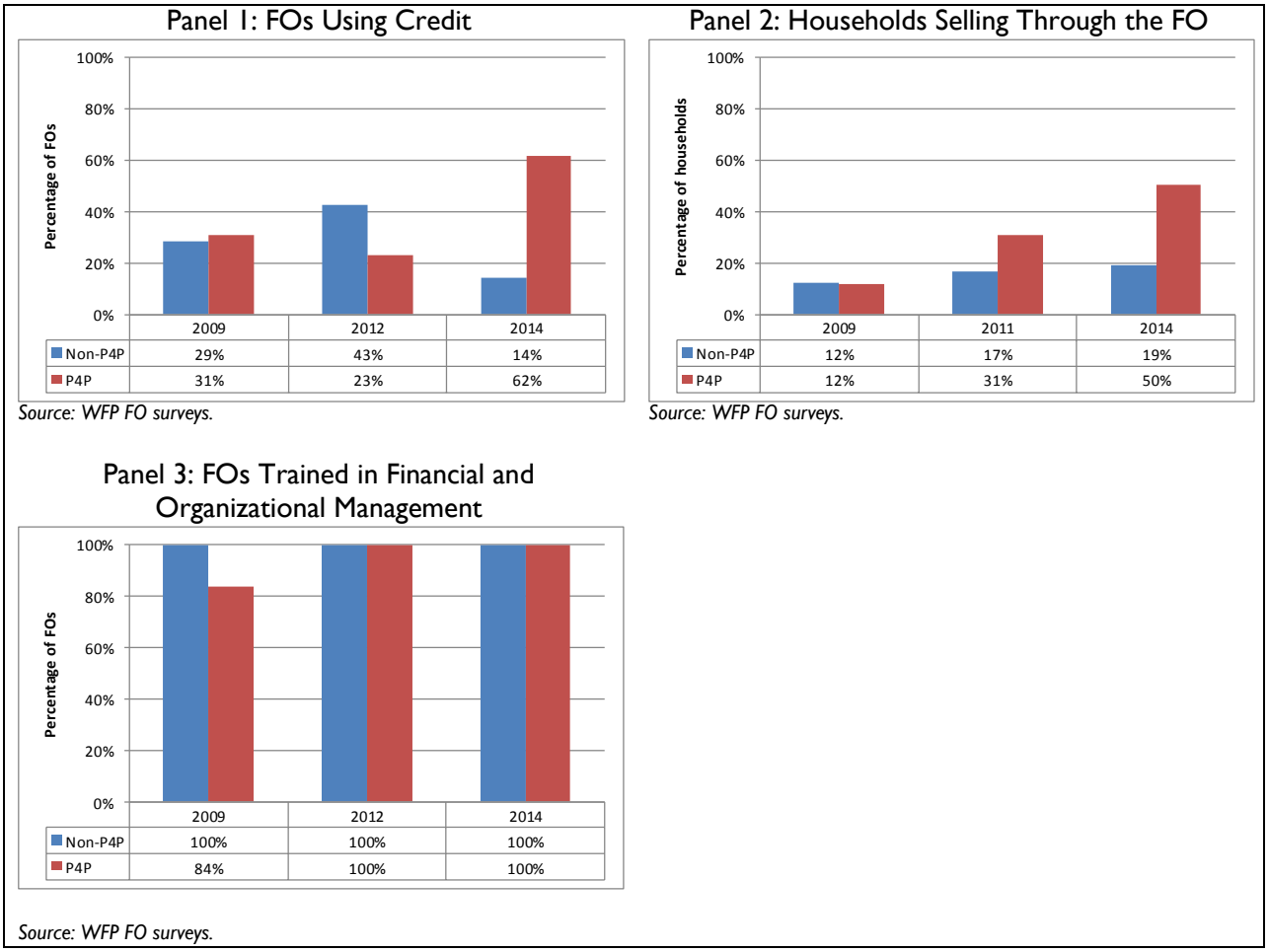
The percentage of FOs using credit (Panel 1 of Figure 10) does not exhibit a consistent trend across the three years for which data exist. However, the percentage of P4P FOs that reported using credit doubled from 31 percent in 2009 to 62 percent by 2014. The DiD analysis attributes the 67 percentage point increase between 2012 and 2014 and the 45 percentage point increase between 2009 and 2014 in the percentage of P4P FOs using credit to participating in P4P (Table 6).

If the percentage of households choosing to sell through the FO reflects, among other things, trust in the FO, then the 38 percentage point increase among members of P4P FOs suggests that members' trust in the FO improved between 2009 and 2014 (Panel 2 of Figure 10). Furthermore, the improvement among P4P FOs relative to non-P4P FOs (i.e., 16 percentage points between 2009 and 2012, 13 percentage points

between 2012 and 2014, and 29 percentage points between 2009 and 2014) were all statistically significant indicating that the changes are attributable to participating in P4P (Table 6).

Almost all P4P and non-P4P FOs reported that their leaders had been trained in financial and organizational management (Panel 3 of Figure 10) although P4P FOs registered a small improvement in this facilitating condition between 2009 and 2012 (Panel 3 of Figure 10). The small change among P4P FOs between 2009 and 2012 is not statistically significant relative to non-P4P FOs (Table 6). The bottom line is that this facilitating condition was in place in most P4P FOs in 2009 and in all of them by 2012.

FIGURE 9: TRENDS IN FO MARKETING FACILITATORS



Source: WFP FO surveys.

Source: WFP FO surveys.

Source: WFP FO surveys.

Improvements in the marketing capacity facilitating conditions among P4P FOs should contribute to positive changes in the indicators of FO marketing capacity: i.e., increased quantities aggregated and sold, increased range of markets (including quality-conscious buyers), ability to provide financing to members, and obtaining higher prices. Figure 10 illustrates trends in quantities of maize sold (to WFP and to other buyers), the percentage of FOs providing financing to members, and average prices received for maize.

Panel 1 of Figure 10 shows substantial increases in the percentage of P4P FOs selling to WFP and to other buyers as well as increases in average quantities sold. Non-P4P FOs reported no corresponding trends. The percentage of FOs with sales is cumulative and thus represents the percentage of FOs with sales during a

particular period or any subsequent period. Data for sales to WFP are from WFP's procurement database while data on sales to other buyers are from the FO surveys. Panels 2 and 3 of Figure 10 present data on sales in a slightly different way. Data are entirely from the FO surveys and thus not necessarily consistent with WFP's procurement data since FOs may record a sale in a different year than the procurement records. Though Panels 2 and 3 show slightly different numbers than Panel 1, the trends are the same, i.e., substantial increases in the percentage of P4P FOs engaged in maize marketing and average quantities sold with no corresponding increase among non-P4P FOs. The DiD estimates in Table 6 attribute many of these changes in sales activity to participating in P4P. In particular, participating in P4P significantly increased the likelihood of P4P FOs selling maize relative to non-P4P FOs as well as the average quantities sold to any buyer and to buyers other than WFP.

Panel 4 of Figure 10 shows no obvious trends in the percentage of FOs providing post-harvest (i.e., financing to bridge the gap between aggregation and sale) financing to their members. The DiD estimates of Table 6, however, show that the 23 percentage point increase between 2009 and 2012 for P4P FOs (coupled with a 14 percentage point decline among non-P4P FOs) resulted in a statistically significant 37 percentage point increase attributable to participating in P4P.

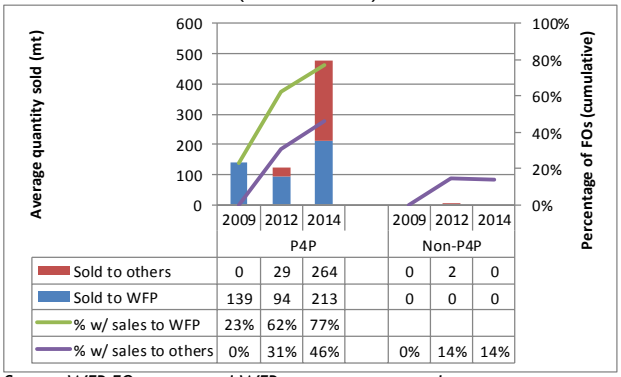
The FO surveys recorded only 11 sales of maize, 10 among P4P FOs and 1 among non-P4P FOs. This number of observations is far too small to identify differences in maize prices between the two groups. The household surveys, on the other hand, contain data on 487 transactions, 185 in 2009, 165 in 2012, and 137 in 2014. Panel 5 of Figure 10 shows trends in reported prices generally following trends in average wholesale prices reported by FAO.[12] It also shows households that are members of P4P FOs reporting higher prices than members of non-P4P FOs. The difference in prices between P4P and non-P4P households is statistically significant only in 2012, a year when WFP purchased from only one FO.

Panel 6 of Figure 10 examines average prices reported by households that sold through the FO and those that did not. As with the previous analysis, trends in prices reported by households generally follow trends in average wholesale prices reported by FAO. However, differences in prices were not statistically significant in any survey period. These results suggest that, with the exception of a 12 percent higher price in 2012, P4P FOs did not obtain higher prices than non-P4P FOs and, more importantly, households that reported selling through the FOs did not obtain significantly higher prices than those that did not.

[12] http://www.fao.org/giews/pricetool/

FIGURE 10: TRENDS IN FO MARKETING CAPACITY

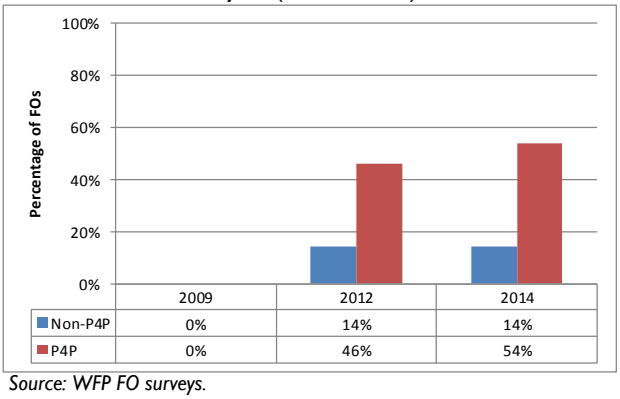
Panel 1: Percentage of FOs Selling Maize (cumulative)



	P4P			Non-P4P		
Sold to others	0	29	264	0	2	0
Sold to WFP	139	94	213	0	0	0
% w/ sales to WFP	23%	62%	77%			
% w/ sales to others	0%	31%	46%	0%	14%	14%

Source: WFP FO surveys and WFP procurement records.

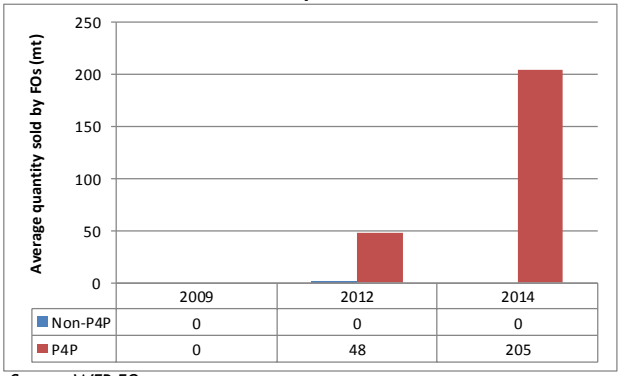
Panel 2: Percentage of FOs with Maize Sales to any Buyer (cumulative)



	2009	2012	2014
Non-P4P	0%	14%	14%
P4P	0%	46%	54%

Source: WFP FO surveys.

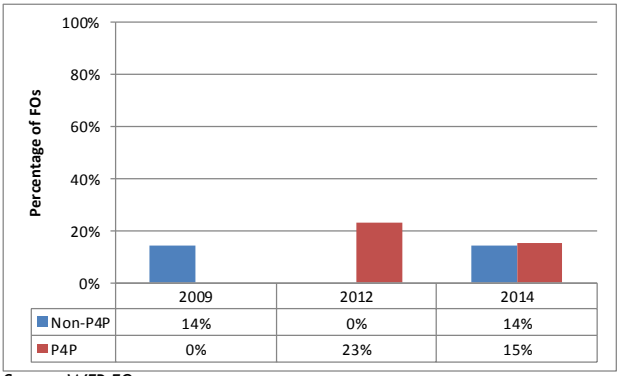
Panel 3: Average Quantity of Maize Sold to any Buyer



	2009	2012	2014
Non-P4P	0	0	0
P4P	0	48	205

Source: WFP FO surveys.

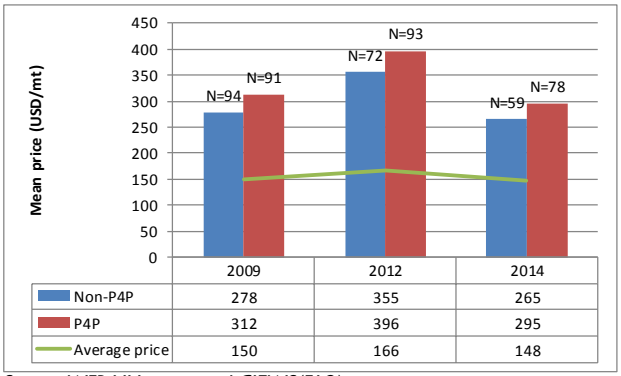
Panel 4: Providing Financing to Members



	2009	2012	2014
Non-P4P	14%	0%	14%
P4P	0%	23%	15%

Source: WFP FO surveys.

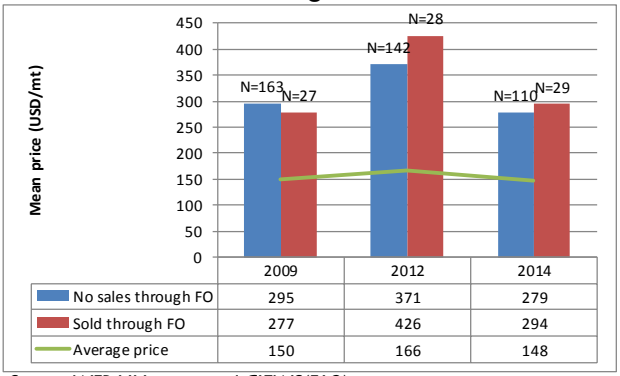
Panel 5: Average Household Maize Prices by P4P Status



	2009	2012	2014
Non-P4P	278	355	265
P4P	312	396	295
Average price	150	166	148

Source: WFP HH survey and GIEWS(FAO).

Panel 6: Average Household Maize Prices by Sales Through FO



	2009	2012	2014
No sales through FO	295	371	279
Sold through FO	277	426	294
Average price	150	166	148

Source: WFP HH survey and GIEWS(FAO).

TABLE 6: DID ESTIMATES OF THE IMPACT OF P4P ON FOS' MARKETING CAPACITY

Model	Impact (coefficient/p-value)		
	2009-2012	2012-2014	2009-2014
Facilitators of Marketing Capacity			
Percentage of FOs using credit (%)	-22% (0.3200)	67%*** (0.0100)	45%* (0.1030)
Percentage of households selling through the FO (cumulative) (%)	15.83%*** (0.0030)	13.22%*** (0.0050)	29.05%*** (0.0000)
Percentage of FOs with financial or organizational management training (%)	15.38% (0.1530)	0.00% (0.2050)	15.38% (0.1620)
Marketing Capacity Indicators			
Total quantity of maize sold to any buyer	22* (0.0770)	15 (0.7040)	36 (0.4250)
Likelihood of selling maize to any buyer (%)	31.87% (0.1250)	7.69% (0.3300)	39.56%* (0.0650)
Average quantity of maize sold to any buyer (mt)	22* (0.0770)	41 (0.1550)	63* (0.1010)
Likelihood of selling maize to buyers other than WFP (%)	16.48% (0.4010)	15.38% (0.1530)	31.89% (0.1310)
Average quantity of maize sold to buyers other than WFP (%)	9* (0.0860)	52 (0.1360)	61 (0.1140)
Likelihood of providing financing to members (%)	37.36%* (0.0520)	-21.98% (0.2710)	15.38% (0.5260)

Numbers in parentheses are p-values.
** significant at p< 0.10*
*** significant at p< 0.05*
**** significant at p< 0.01*

In summary, participating in P4P appears to have contributed to positive change in many of the facilitators of FO organizational capacity which led to significant improvements in indicators of organizational capacity. Statistically significant changes reported by P4P FOs relative to non-P4P FOs (and thus attributable to participating in P4P) include:

- A 49 percentage point increase between 2009 and 2014 in the average percentage of quality services offered;
- A 34 percentage point increase between 2009 and 2014 in the average percentage of production services offered;
- A 29 percentage point increase between 2009 and 2014 in the average percentage of marketing services offered; and
- A 54 percentage point increase between 2009 and 2014 in the percentage of P4P FOs facilitating members' access to inputs.

The period between 2009 and 2014 also saw significant advancement in the conditions facilitating improvement of FO marketing capacities that contributed to:

- A 40 percentage point increase between 2009 and 2014 in the percentage of P4P FOs using credit relative to non-P4P FOs;
- A 29 percentage point increase between 2009 and 2014 in the percentage of members choosing to sell maize through P4P FO relative to non-P4P FOs;

- A 63 mt increase between 2009 and 2014 in the average quantity of maize sold by P4P FOs relative to non-P4P FOs;
- A 9 mt increase between 2009 and 2012 in the average quantity of maize sold to buyers other than WFP; and
- A 37 percentage point increase in the percentage of P4P FOs providing post-harvest financing to members relative to non-P4P FOs.

IMPACT OF P4P ON HOUSEHOLD MARKETING, PRODUCTION, AND WELFARE

At the household level, the P4P development hypothesis posits that increasing the capacity of FOs will improve access to markets for the farmer members of the FOs. Furthermore, to the extent that higher capacity FOs are able to obtain higher prices, perhaps because they can identify and access markets that demand quality, farmers may earn higher returns from producing staple crops and invest more in productivity. Training in agricultural production practices and quality management coupled with improved access to equipment (e.g., threshers, cleaning and drying equipment), inputs, and services (e.g., credit) facilitated by P4P may also contribute to increased agricultural productivity

WFP purchased maize and beans from P4P FOs in El Salvador. Maize accounted for 95 percent of the total quantity (5,473 mt of a total of 5,758 mt) and more FOs sold maize than beans (10 sold maize to WFP and 3 sold beans).[13] These statistics suggest that impacts from WFP procurement are more likely for maize than for beans. For this reason, the technical review panel that WFP convenes annually to guide P4P also recommended in 2013 that the quantitative analysis of impacts focus on maize. Consequently, the analysis of this section considers only maize.

Following the results framework of Figure 6, the analysis of this section first examines the impacts of P4P on three broad classes of household results; marketing, production, and welfare. The sub-sections on marketing and production set the stage for understanding anticipated outcomes by first exploring the status of the conditions expected to facilitate improvements in marketing and production. The welfare sub-section considers the combined effect of changes in household marketing and production on several measures of household welfare.

Each of the three sub-sections first presents the data in a graphical format that facilitates a visual comparison of trends in key facilitators and outcomes over time for P4P and non-P4P households. The analysis then presents DiD estimates derived from a regression model that incorporates covariates to control for factors other than participation in P4P that may influence the outcome measures differently for P4P and non-P4P households. Relevant covariates include factors on which P4P and non-P4P households differed at the time of the baseline and also factors that might be expected to differentially influence outcomes and which are exogenous to the treatment. Many of the candidate variables are not exogenous. For example, higher maize yields might indicate that a particular farmer is more likely to be using productivity-enhancing technologies or practices which are also anticipated outcomes of the treatment. For this reason, the regressions use baseline values for the selected covariates which are exogenous because they are measured prior to the treatment. Table 11 describes and summarizes baseline values for the covariates included in the analysis.

[13] WFP procurement records through May 2014.

Location-specific characteristics such as weather, agricultural productivity, input availability, population, distance to urban centers, and transportation infrastructure might also influence agricultural production and marketing activity. To control for these factors, the covariate model included dummy variables for each of the three regions in which the households reside.

The P4P development hypothesis suggests that many of the anticipated household-level outcomes of P4P are contingent on selling through the FO. However, few surveyed households reported selling through the FOs. In fact, only 19 percent of non-P4P households and 50 percent of P4P households reported having sold through the FOs at any time between 2009 and 2014. In an attempt to isolate impacts for this group of households, a separate set of analyses estimated impacts for all household indicators using selling through the FOs as the treatment. Those analyses identified no significant impacts, perhaps because the numbers are small, and the results are not reported here.

TABLE 7: COVARIATES IN HOUSEHOLD ANALYSIS

Variable description	Baseline values				
	P4P status	N	Mean	Median	Standard deviation
Household characteristics					
Indicator of household head having completed at least a secondary education	P4P	112	0.06	0.00	0.2431
	Non-P4P	125	0.08	0.00	0.2724
Indicator of female headed household	P4P	112	0.21	0.00	0.4122
	Non-P4P	125	0.26	0.00	0.4382
Age of household head (years)	P4P	112	56.76	57.00	13.1712
	Non-P4P	125	54.78	54.00	13.2450
Indicator of farming as household head's primary occupation	P4P	112	0..87	1.00	0.3411
	Non-P4P	123	0.84	1.00	0.3705
Percentage of household income from off-farm sources	P4P	110	0.19	0.00	0.3701
	Non-P4P	119	0.39	0.00	1.1607
Number of family members involved in farming	P4P	112	2.44	2.00	1.8540
	Non-P4P	125	2.06	2.00	1.6884
Number of household members	P4P	112	5.75	5.00	2.7361
	Non-P4P	125	5.33	5.00	2.4122
Indicator of access to an improved source of water	P4P	112	0.96	1.00	0.2074
	Non-P4P	125	0.79	1.00	0.4075
Indicator of household member in FO leadership	P4P	112	0.42	0.00	0.4957
	Non-P4P	125	0.32	0.00	0.4684
Indicator of dirt floor	P4P	112	0.59	1.00	0.4942
	Non-P4P	125	0.70	1.00	0.4618
Agricultural production					
Area of land owned (ha)	P4P	98	1.79	1.04	2.2558
	Non-P4P	105	0.97	0.70	1.0720
Area allocated to maize production (ha)	P4P	112	1.33	1.04	1.1484
	Non-P4P	125	0.86	0.70	0.6474
Indicator of receiving agricultural inputs on credit from FO	P4P	112	0.73	1.00	0.4448
	Non-P4P	125	0.53	1.00	0.5012
Indicator of receiving loans for agricultural purposes	P4P	112	0.36	0.00	0.4813
	Non-P4P	125	0.32	0.00	0.4684
Indicator of hiring labor for agricultural production	P4P	112	0.89	1.00	0.3107
	Non-P4P	125	0.78	1.00	0.4186
Indicator of using fertilizer	P4P	112	0.42	0.00	0.4957
	Non-P4P	125	0.29	0.00	0.4546
Quantity of maize sold	P4P	112	2.46	1.35	3.5204
	Non-P4P	125	1.21	0.54	2.5235
Location					
Indicator of household located in region 3 (Sonsonate)	P4P	112	0.04	0.00	0.2074
	Non-P4P	125	0.27	0.00	0.4468
Indicator of household located in region 10 (San Vicente)	P4P	112	0.14	0.00	0.3515
	Non-P4P	125	0.08	0.00	0.2724
Indicator of household located in region 11 (Usulután)	P4P	112	0.38	0.00	0.4863
	Non-P4P	125	0.22	0.00	0.4132

The results reflect the panel of households described in Table 2.

Impact of P4P on Household Maize Marketing

Following the outline of the results framework illustrated in Figure 6, this section first examines changes in the factors facilitating changes in household marketing behavior and then links them to observed changes in marketing behavior, i.e., decisions about the location and timing of sales. It then presents evidence of changes in facilitating factors for intermediate marketing outcomes and links them to observed changes in prices received for maize, the primary intermediate household marketing outcome.

Figure 11 illustrates trends in four maize marketing facilitators, use of post-harvest services, use of marketing services, use of loans for agriculture, and use of loans for other purposes. The percentage of P4P households that reported ever using post-harvest and marketing services increased substantially between 2009 and 2014, by 28 percentage points for post-harvest services and 34 percentage points for marketing services. By the end of the P4P pilot, 54 percent of P4P households reported having used post-harvest services and 40 percent reported having used marketing services. Comparable percentages among non-P4P households were 21 percent and 20 percent, respectively.

These findings are consistent with the services FOs would be required to provide in order to satisfy WFP's quality standards and to manage sales. The DiD regression results reported in Table 8 suggest that participating in P4P contributed to establishing these facilitating factors. The opportunity to sell to WFP through P4P contributed to a 23 percentage point increase between 2009 and 2012 in the percentage of households using post-harvest services relative to non-P4P households and a 16 percentage point increase between 2009 and 2014. These results suggest that not only did conditions for facilitating positive marketing outcomes improve for P4P households but P4P contributed to the improvement.

Trends in households' use of credit for agriculture or for other purposes are not as clear. DiD analysis found no statistically significant impact of P4P on households' use of credit (Table 8) but this is not particularly important. What is relevant is that a relatively large percentage of P4P households reported using credit for agriculture and for other purposes at some point during the P4P pilot and thus may not be constrained by one of the barriers to positive marketing outcomes, access to credit.

FIGURE 11: HOUSEHOLD MAIZE MARKETING FACILITATORS

Favorable facilitating conditions should give households greater flexibility in their choices about where and when to sell commodities. If selling through the FO is more profitable, then access to relevant services and credit can address some of the barriers households face selling through the FO. Similarly, services (especially post-harvest services) and credit may make it possible for households to hold commodities for later sale when prices may be higher.

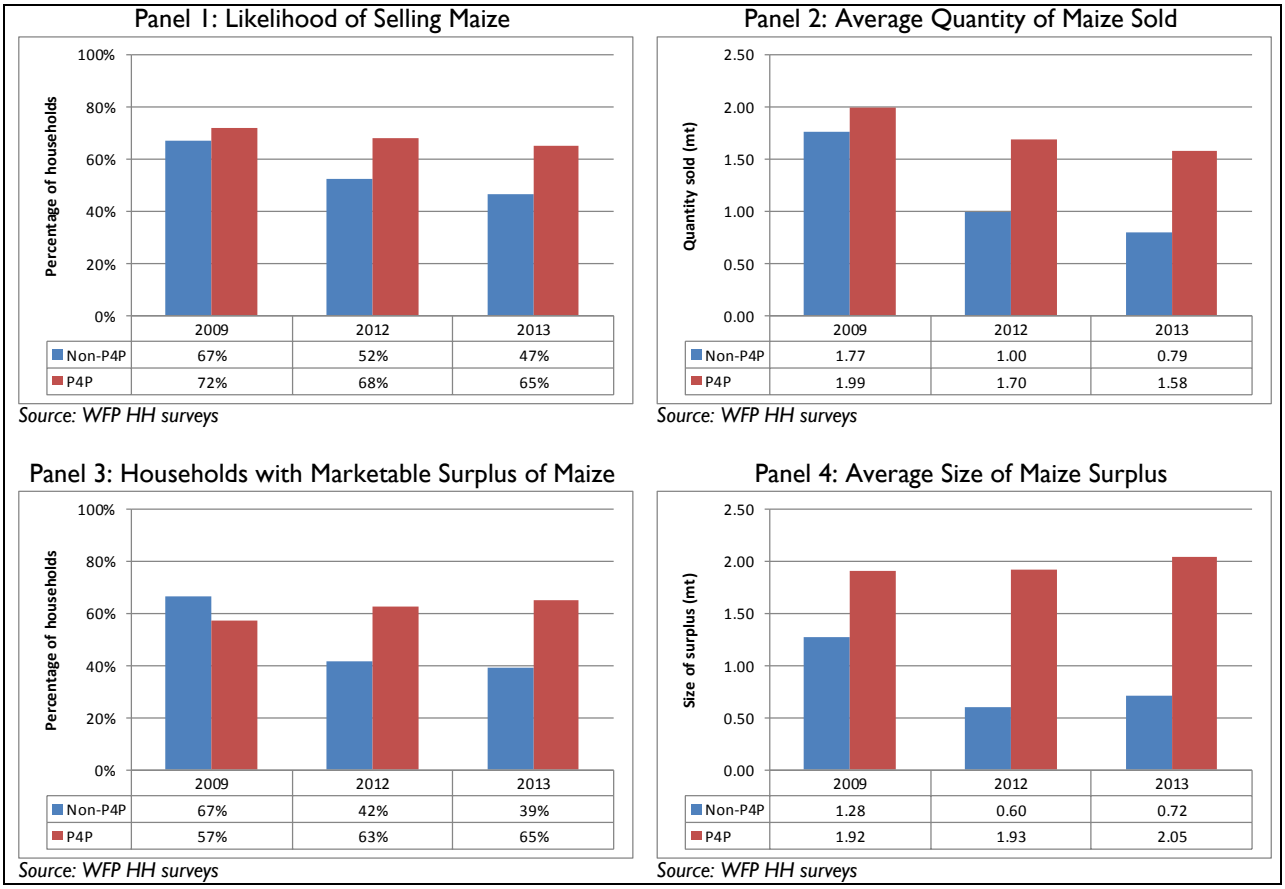
Figure 12 illustrates trends in households' marketing choices. Panels 1 and 2 of Figure 12 show a steady increase in the percentage of P4P households choosing to sell through the FO and corresponding increases in the average percentage of their surpluses they channel through the FO. Non-P4P households reported slower growth in both outcomes. The DiD analysis reported in Table 8 conclude that the changes in marketing behavior are attributable to participating in P4P.

Panels 3 and 4 of Figure 12 show a decreasing percentage of P4P and non-P4P households selling maize four weeks or more after harvest and a corresponding decline in the average percentage of maize sold at that time. This is a more difficult indicator to interpret without knowing the full range of markets available to a household and the terms of sale in each. The DiD analysis results in Table 8 found no statistically significant differences between P4P and non-P4P households in terms of changes in this marketing behavior which suggests that participating in P4P has not affected households' decisions about when to sell maize.

FIGURE 12: LOCATION AND TIMING OF SALES

As a greater percentage of P4P households begin selling larger quantities through FOs that are able to access a wider range of remunerative markets, they should begin to obtain higher prices. Higher prices should induce a greater percentage of households to begin selling maize and increase the quantity of maize they sell. The section on FO capacity concluded that participating in P4P has contributed to an increased volume of sales for P4P FOs. Figure 13 illustrates trends in some of the household level marketing outcomes the P4P development hypothesis suggests will flow from increased engagement with markets at the FO level, i.e., the likelihood of selling maize, average quantities sold, the percentage of households with a marketable surplus of maize, and the average size of the surplus.

FIGURE 13: MAIZE MARKETING PARAMETERS



The charts of Figure 13 tell an interesting story. The percentage of P4P households producing a surplus and the average size of surplus increased slightly between 2009 and 2014 (Panels 3 and 4 of Figure 13). At the same time, however, the percentage of P4P households that reported selling maize and the average quantity sold declined (Panels 1 and 2 of Figure 13).

Taken together, the results reported in Figure 13 suggest that a few households (15 percent in 2009 and 5 percent in 2012) were selling maize even though they did not produce a surplus. These households presumably buy back maize later in the season to meet household needs. The rationality of this strategy depends on anticipated differences in prices between the time of sale and time of purchase as well as the household's need for cash at the time of sale. It is interesting that the gap between those producing a surplus and those selling declines over time and disappears in 2014. Non-P4P households reported a reverse of this trend with no gap in 2009, a 10 percent gap in 2012, and an 8 percent gap in 2014. These results suggest that the percentage of P4P households that find it necessary to sell maize when they have no surplus has declined over time while it has increased among non-P4P households.

A comparison of the size of surplus (Panel 4 of Figure 13) and quantity sold (Panel 2 of Figure 13) suggests that in 2012 and 2014, some surplus-producing P4P households chose not to sell their entire surplus. Non-P4P households, on the other hand, consistently reported selling more than they claimed they had as surplus. The overall story seems to be one of increasing resilience among P4P households while non-P4P households are becoming more vulnerable.

These trends are not impact. Many external factors may affect maize production and households' maize marketing behavior. The impact of P4P is the change among P4P households relative to change among non-P4P households. The DiD estimates of Table 8 conclude that the (statistically significant) impacts of P4P on maize marketing outcomes include:

- The likelihood that P4P households produced a surplus of maize increased by 48 percentage points between 2009 and 2014 relative to non-P4P households.
- The average size of P4P households' maize surplus increased by 1.05 mt relative to non-P4P households between 2009 and 2014.
- The likelihood of selling maize increased by 26 percentage points among P4P households relative to non-P4P households between 2009 and 2014.
- The average quantity of maize sold by P4P households increased by 1.21 mt between 2009 and 2014 relative to non-P4P households.

TABLE 8: DID ESTIMATES OF THE IMPACT OF P4P ON HOUSEHOLD MAIZE MARKETING

Model	Impact (coefficient/p-value)			N	R^2
	2009-2012	2012-2014	2009-2014		
Household marketing facilitators					
Likelihood of using post-harvest services (%)	23.30%*** (0.0000)	-6.89% (0.2050)	16.32%** (0.0160)	390	0.1647
Likelihood of using marketing services (%)	20.92%*** (0.0000)	1.04% (0.8350)	21.96%*** (0.0010)	390	0.1362
Likelihood of using agricultural credit (%)	10.31% (0.2890)	-3.78% (0.6300)	6.54% (0.4290)	390	0.1957
Likelihood of using credit for any purpose (%)	12.04% (0.1070)	-10.95% (0.1890)	1.09% (0.8520)	390	0.3792
Behavioral change					
Likelihood of selling maize through the FO (cumulative % of households)	15.83%*** (0.0030)	13.22%*** (0.0050)	29.05%*** (0.0000)	338	0.1936
Average percentage of marketed maize sold through the FO (%)	12.57%** (0.0440)	1.32* (0.8280)	13.89%** (0.0220)	338	0.1879
Likelihood of selling maize four weeks or more after harvest (%of households)	-11.07% (0.3540)	13.89% (0.1790)	2.82% (0.7550)	338	0.1392
Average percentage of marketed maize sold four weeks or more after harvest (%)	-15.55% (0.1660)	14.80% (0.1140)	-0.0075% (0.9250)	338	0.1271
Household marketing outcomes					
Likelihood of producing a surplus (% of producing households)	0.33*** (0.0030)	0.04 (0.6560)	0.48*** (0.0000)	363	0.1980
Average size of maize surplus (mt) (producing households)	1.04*** (0.0020)	-0.04 (0.9070)	1.05*** (0.0050)	313	0.2575
Likelihood of selling maize (% of producing households)	10.86% (0.2270)	15.21%* (0.0630)	26.06%*** (0.0040)	390	0.1496
Average quantity sold (mt): (selling households)	0.93*** (0.0130)	0.29 (0.4810)	1.21** (0.0300)	338	0.1569

Values in parentheses are p-values
* significant at p< 0.10
** significant at p< 0.05
*** significant at p< 0.01

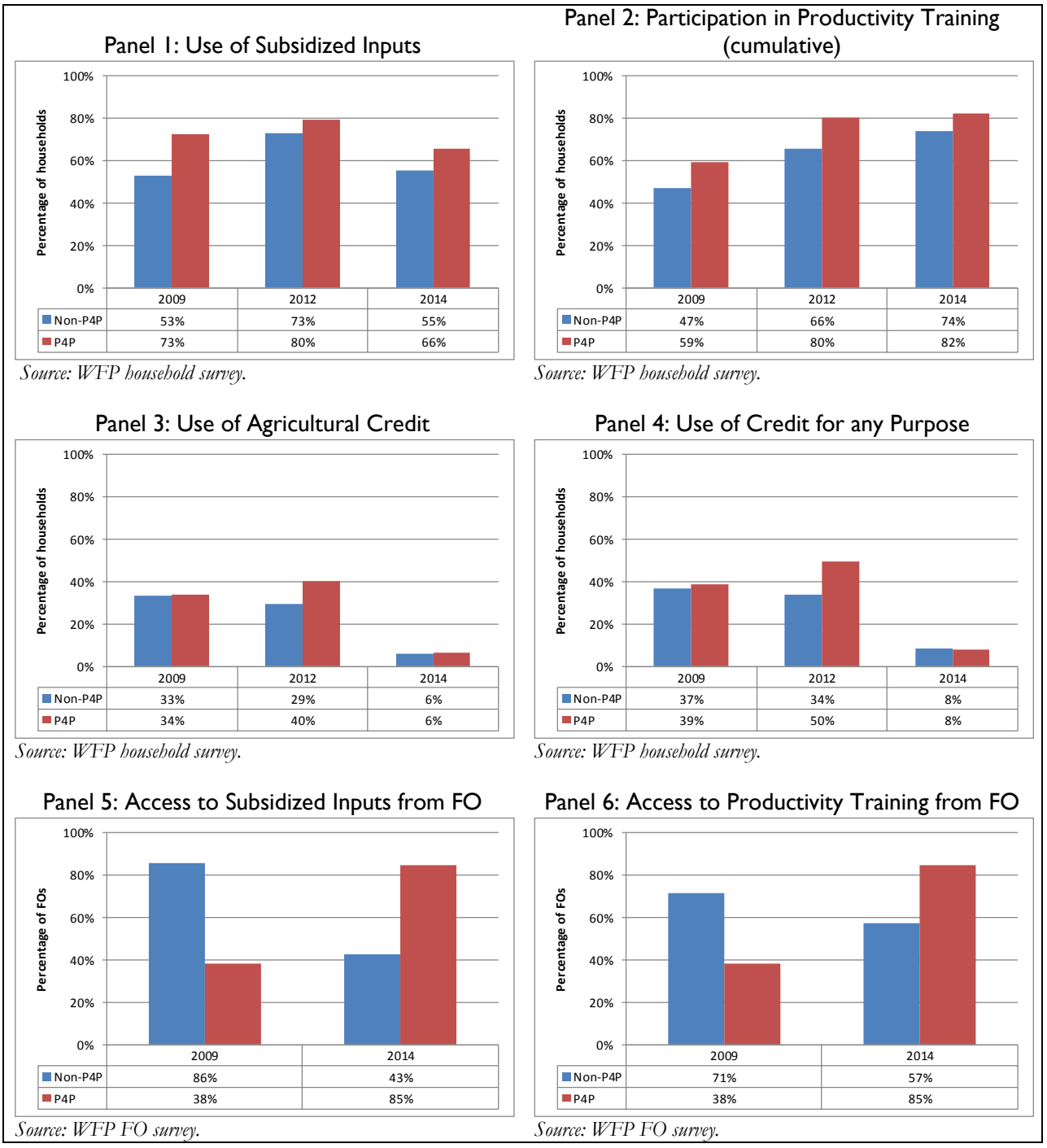
Impact of P4P on Household Maize Production

Maize is a primary staple crop in El Salvador and a large majority surveyed households (between 81 percent and 96 percent depending on the year and strata) reported producing maize. Behaviors that are likely to influence the average quantity of maize households produce include the decision to cultivate maize, the land allocated to maize production, the use of productivity-enhancing inputs such as certified seed and fertilizer, and the knowledge of how to use inputs effectively. Positive changes in these behaviors should increase yields and total quantities produced.

Weather is also likely to strongly influence maize production. In the absence of accessible subnational rainfall data, the regional dummy variables control, to some extent, for weather-related factors that influence production.

The results framework presented in Figure 6 defines a number of "facilitators" that might be expected to influence household production behavior. These include access to productivity-enhancing inputs and training and use of credit. Figure 14 illustrates changes in these facilitators over time for P4P and non-P4P households. Panels 1 through 4 present the household perspective while Panels 5 and 6 reflect results from the surveys of FOs.

FIGURE 14: TRENDS IN FACILITATORS OF BEHAVIORAL CHANGE IN MAIZE PRODUCTION



A fairly large percentage of P4P households reported receiving subsidized inputs from some organization, not necessarily the FO. The percentage fluctuated over time but never dropped below 66 percent (Panel 1 of Figure 14). Non-P4P households reported a similar trend but values lagged somewhat behind P4P households. Similarly, most P4P households reported having received production training with the percentage of households that had received training at some time during the P4P pilot reaching 82 percent by 2014

(Panel 2 of Figure 14). Again, non-P4P households followed a similar trend but with values lagging those of P4P households.

No more than half (depending on the year) of P4P households reported using credit for agricultural or other purposes. The data show no clear trend although the percentage of non-P4P households using credit was never larger than the percentage of P4P households (Panels 3 and 4 of Figure 14).

P4P households' access to subsidized inputs and productivity training through the FO (i.e., the percentage of FOs that reported providing these services) increased substantially between 2009 and 2014 (Panels 5 and 6 of Figure 14). Over the same time period, the percentage of non-P4P FOs providing these services fell precipitously. The relevant point is that by 2014, more than 80 percent of P4P households should have had access to subsidized inputs and productivity training, whether or not they used either service.

In summary, P4P households experienced improvements in three of the six facilitators of production behavior between 2009 and 2014. Even though the percentage of households receiving subsidized inputs declined slightly, the percentage was still relatively high (66 percent) in 2014. Use of credit appears to be the only major unresolved barrier to productivity-enhancing behavioral change among the facilitators considered in this analysis.

The presence of favorable facilitating conditions is more important than whether improvement in the conditions can be attributed to P4P. Of these six facilitating conditions, however, increases in households' use of subsidized inputs and the percentage of FOs providing subsidized inputs and productivity training are attributable to participation in P4P (Table 9).

TABLE 9: DID ESTIMATES OF THE IMPACT OF P4P ON MAIZE PRODUCTION FACILITATORS

Model	Impact (coefficient/p-value)			N	R^2
	2009-2012	2012-2014	2009-2014		
Utilization of subsidized inputs (%) – all households	-19.08** (0.0290)	9.38% (0.2210)	-9.70% (0.2990)	390	0.2072
Utilization of productivity training (%) – all households	7.50% (0.4460)	-8.76% (0.3140)	-1.25% (0.9070)	390	0.1270
Utilization of agricultural credit (%) – all households	10.31% (0.2890)	-3.78% (0.6300)	6.54% (0.4290)	390	0.1957
Utilization of credit for any purpose (%) – all households	12.04% (0.1070)	-10.95% (0.1890)	1.09% (0.8520)	390	0.3792
Likelihood of FOs facilitating access to subsidized inputs (%)	Data for 2012 are missing		89.01%*** (0.0020)	40	0.5419
Likelihood of FO providing productivity training (%)	Data for 2012 are missing		39.56%* (0.0650)	40	0.3953

Note: Estimates based on FO data are based on a non-parametric DiD model with data only for 2009 and 2014. Numbers in parentheses are p-values.
* significant at p< 0.10
** significant at p< 0.05
*** significant at p< 0.01

Generally favorable facilitating conditions should support behavioral change consistent with increasing production. Relevant behaviors include the decision to cultivate maize, area allocated to maize production,

and decisions about using productivity-enhancing inputs such as certified seed and fertilizer. Figure 15 illustrates trends in maize production behaviors reported by P4P and non-P4P households.

The percentage of P4P households that reported cultivating maize remained virtually unchanged between 2009 and 2014 while the percentage of non-P4P households cultivating maize fell by 15 percentage points from 96 percent to 81 percent (Panel 1 of Figure 15). The DiD estimates presented in Table 10 conclude that participating in P4P prevented a 19 percentage point decline in the percentage of P4P households choosing to cultivate maize.

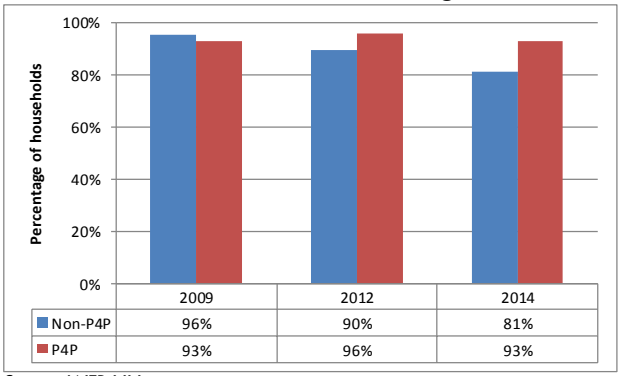
While P4P households allocated less land to maize production in 2014 than in 2009, non-P4P households reported a much steeper decline (Panel 2 of Figure 15). The DiD estimates presented in Table 10 conclude that participating in P4P prevented a reduction of 0.29 ha in average area allocated to maize production.

Non-P4P households were more likely to use certified maize seed in 2009 and used it more intensively, i.e., certified maize seed accounted for a larger proportion of all the maize seed they used (Panels 3 and 4 of Figure 15). Between 2009 and 2014, however, P4P households registered greater growth in these two measures of certified use than non-P4P households. Consequently, even though non-P4P households still had higher values for both indicators in 2014, the improvement among P4P households relative to non-P4P households is an impact of participating in P4P. The DiD analyses reported in Table 10 estimate that participating in P4P was responsible for an 18 percentage point increase in the percentage of P4P households using certified maize seed relative to non-P4P households and a 27 percentage point increase in the average proportion of maize seed that was certified.

The percentage of P4P and non-P4P households that reported using fertilizer increased in tandem between 2009 and 2014 with the percentage of P4P households keeping just ahead of non-P4P households (Panel 5 of Figure 15). By 2014, 94 percent of P4P households reported using fertilizer. Because P4P and non-P4P households reported similar rates of growth in fertilizer use, the increase among P4P households is not attributable to participating in P4P (Table 10).

FIGURE 15: TRENDS IN PRODUCTIVITY-ENHANCING PRODUCTION BEHAVIORS

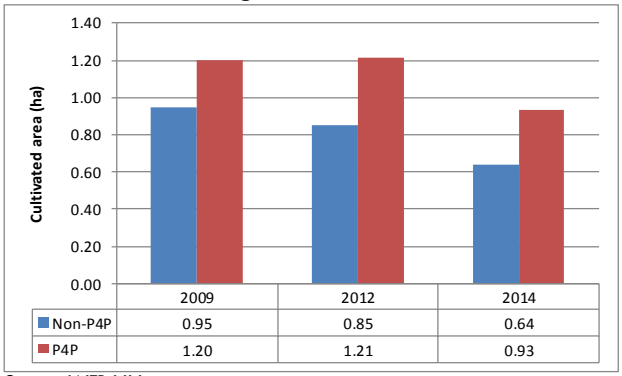
Panel 1: Households Cultivating Maize



	2009	2012	2014
Non-P4P	96%	90%	81%
P4P	93%	96%	93%

Source: WFP HH surveys.
All households

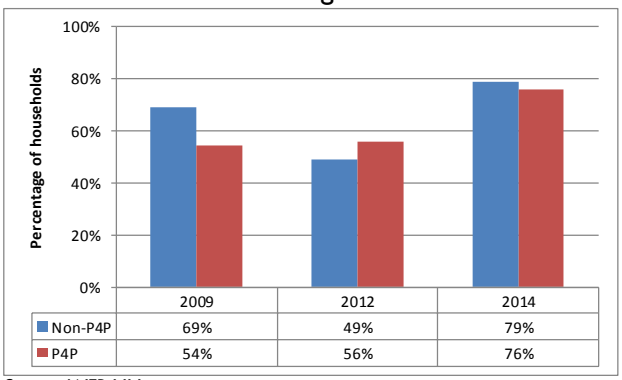
Panel 2: Average Area Planted to Maize



	2009	2012	2014
Non-P4P	0.95	0.85	0.64
P4P	1.20	1.21	0.93

Source: WFP HH surveys.
Households planting maize

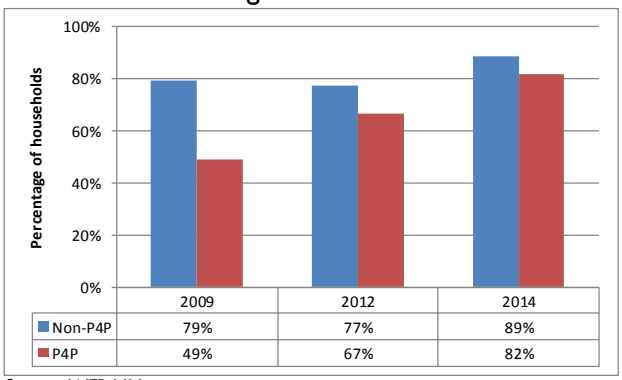
Panel 3: Households Using Certified Maize Seed



	2009	2012	2014
Non-P4P	69%	49%	79%
P4P	54%	56%	76%

Source: WFP HH surveys
Households planting maize

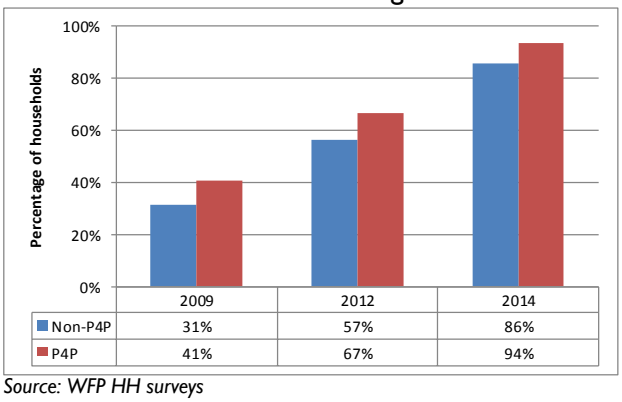
Panel 4: Percentage of Seed that is Certified



	2009	2012	2014
Non-P4P	79%	77%	89%
P4P	49%	67%	82%

Source: WFP HH surveys
Households planting maize

Panel 5: Households Using Fertilizer



	2009	2012	2014
Non-P4P	31%	57%	86%
P4P	41%	67%	94%

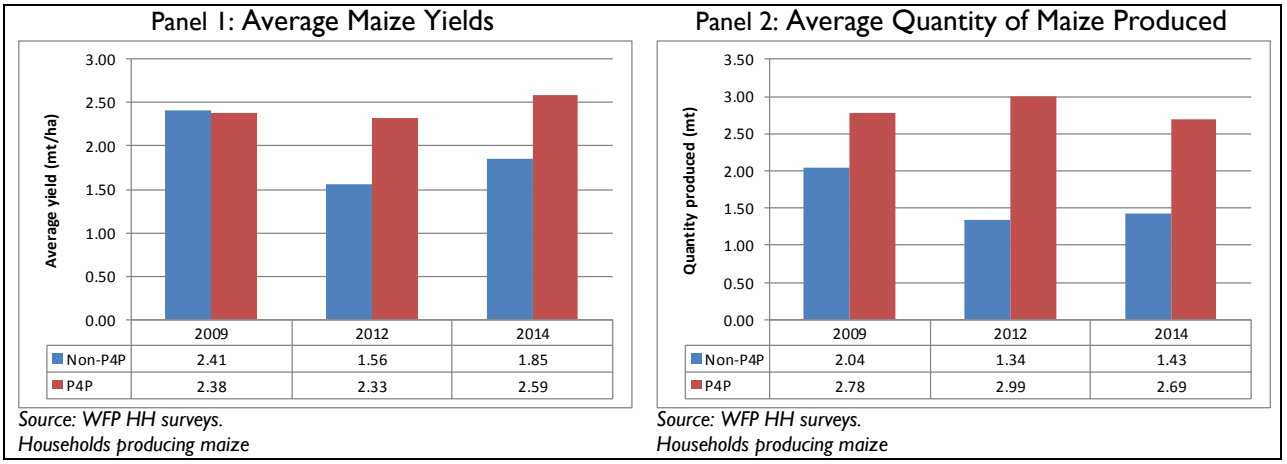
Source: WFP HH surveys
Households planting maize

It is not intuitively clear how the behavioral changes documented in Figure 15 might affect the quantity of maize produced. Increased use of certified seed and fertilizer may, or may not, have offset the decline in the average area allocated to maize. Panel 1 of Figure 16 shows a slight (9 percent) increase in average maize yields among P4P households which is consistent with increased use of certified seed and fertilizer. Non-P4P households, however, also reported increased use of certified seed and fertilizer and yet experienced a 23

percent decline in yields. Anecdotal information from interviews with farmers in El Salvador along with a more formal study of the issue in Mali, however, suggest that training on how to use inputs correctly may be ass, if not more, important than the inputs themselves. It is not clear from Figure 14 whether non-P4P households received appropriate training in inputs use. The percentage of households reporting that they received training increased over time but the percentage of FOs that reported that they provided training fell by 14 percentage points between 2009 and 2014. Regardless of the mechanism through which the effect took place, however, the DiD estimates of Table 10 attribute a 0.87 mt/ha increase in average maize yields to participation in P4P.

A reduction in the area allocated to maize appears to have offset higher yields among P4P households leading to a three percent decline in the total quantity of maize produced (Panel 2 of Figure 16). Even though the quantity of maize produced by P4P households declined, however, non-P4P households experienced a much greater (30 percent) drop in average production. The causal interpretation is that participating in P4P prevented a greater decline in maize production among P4P households. The DiD estimates of Table 10 support this interpretation and attribute a 1.08 mt increase in the quantity of maize produced (relative to the decline among non-P4P households) to participating in P4P.

FIGURE 16: TRENDS IN MAIZE PRODUCTION PARAMETERS



Source: WFP HH surveys.
Households producing maize

Source: WFP HH surveys.
Households producing maize

TABLE 10: DID ESTIMATES OF THE IMPACT OF P4P ON HOUSEHOLD MAIZE PRODUCTION

Model	Impact (coefficient/p-value)			N	R^2
	2009-2012	2012-2014	2009-2014		
Likelihood of cultivating maize (%) – all households	7.57% (0.1200)	11.29%* (0.0690)	18.86%*** (0.0010)	390	0.2343
Average area planted to maize (ha) – cultivating households	0.21 (0.1250)	0.12 (0.1570)	0.29** (0.0280)	378	0.2106
Likelihood of using certified maize seed (%) – cultivating households	9.94% (0.3320)	8.35% (0.3850)	18.29%* (0.0830)	390	0.2531
Average percentage of maize seed that was certified (%) – certified seed using households	11.41% (0.2960)	3.71% (0.6840)	27.17%*** (0.0100)	238	0.2240
Likelihood of using fertilizer (%) – cultivating households	-5.08% (0.6010)	2.22% (0.7890)	-2.87% (0.7240)	390	0.1422
Average maize yield (mt/ha) – producing households	0.76*** (0.0050)	0.12 (0.6750)	0.87*** (0.0060)	378	0.1998
Average quantity of maize produced (mt) – producing households	1.32*** (0.0000)	-0.15 (0.6190)	1.08*** (0.0020)	378	0.1829

Numbers in parentheses are p-values.
* significant at p< 0.10
** significant at p< 0.05
*** significant at p< 0.01

In summary, participating in P4P appears to have:

- Improved P4P households' access to and use of subsidized inputs relative to non-P4P households;
- Improved P4P households' access to, but not use of, productivity training relative to non-P4P households;
- Prevented a 19 percentage point decline in the percentage of households cultivating maize that would have occurred had P4P households not participated in P4P;
- Limited the decline in average area allocated to maize production to 22 percent instead of the 33 percent decline that would have occurred had P4P households not participated in P4P, essentially retaining 0.29 ha per household in maize production that would have been allocated to other uses had P4P households not participated in P4P;
- Increased the percentage of households using certified maize seed by 18 percentage points relative to what would have occurred had P4P households not participated in P4P;
- Increased the quantity of certified seed used (as a percentage of all seed) by 27 percentage points relative to not participating in P4P;
- Prevented a decline of 0.87 mt/ha in average maize yields, and
- Prevented drop of 1.08 mt in the average quantity of maize produced.

Impacts of P4P on Household Welfare Indicators

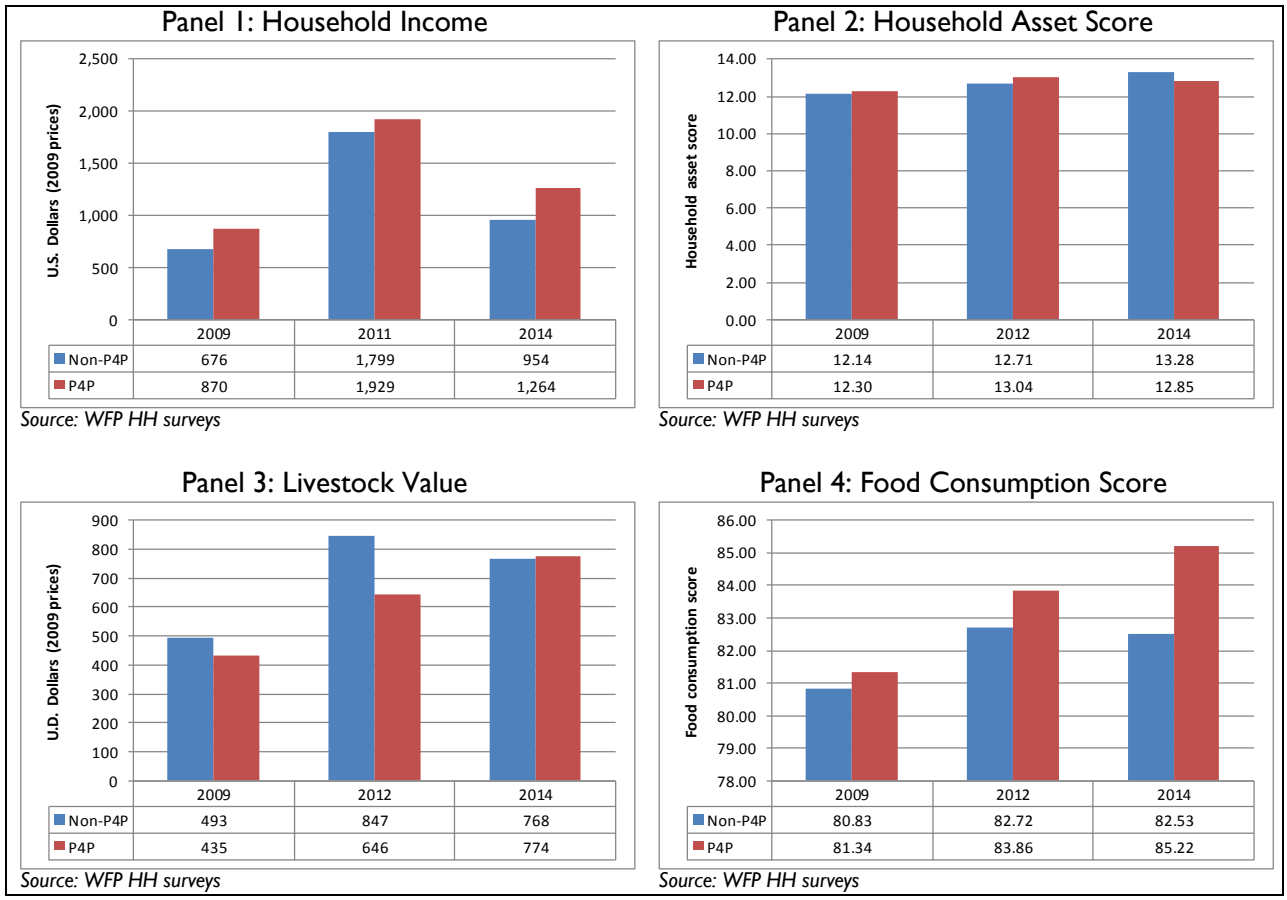
Welfare is a broad concept with dimensions including income, wealth, nutrition, food security, and physical security to name a few. The P4P proposal identified income as the primary household welfare measure. Because of the anticipated difficulty measuring small changes in income, however, the P4P logframe identified several alternate welfare indicators. These include the household asset score (a simple summary of household assets), the value of household livestock (an important store of wealth in many cultures), and the food consumption score (an indicator of food security). The analysis of the impacts of P4P on household welfare examines each of these indicators to provide a well-rounded picture of welfare change.

As with previous sections, the inquiry begins with illustrations of changes in income and other welfare measures (Figure 17). Income fluctuates as might be expected for households that depend largely on agriculture for their income (Panel 1 of Figure 17). P4P and non-P4P households reported similar trends in income and the difference between the two groups was statistically significant only in 2014. Assets are not likely to respond quickly to a transitory change in income and they do not, falling only slightly for P4P households as income declined between 2012 and 2014 (Panel 2 of Figure 17). Asset scores for P4P and non-P4P households were statistically identical in all survey periods.

Because livestock is more liquid than physical assets, it might respond more quickly to falling incomes. This is the case for non-P4P households between 2012 and 2014 but not for P4P households (Panel 3 of Figure 17). Similarly, the food consumption score should respond very quickly to falling incomes. Again only non-P4P households reported a decline in the food consumption score associated with falling incomes between 2012 and 2014 (Panel 3 of Figure 17). The household surveys were conducted immediately after harvest however when food consumption scores would be expected to be at their annual high point.

Taken together, these results suggest that P4P households are more resilient to shocks than non-P4P households. When income fell in 2014, P4P households weathered the decline without corresponding reductions in livestock assets or food consumption. Non-P4P households, on the other hand, had to deplete their wealth (livestock assets) and reduce their food consumption to cope with falling incomes.

FIGURE 17: HOUSEHOLD WELFARE INDICATORS



In spite of what look like meaningful differences in trends, particularly in the food consumption score, the DiD analysis found only the -0.55 fall between 2012 and 2014 in P4P households' asset score relative to non-P4P to be associated with participating in P4P.

TABLE 11: DID ESTIMATES OF THE IMPACT OF P4P ON HOUSEHOLD WELFARE INDICATORS

Model	Impact (coefficient/p-value)			N	R^2
	2009-2012	2012-2014	2009-2014		
Household income (2009 U.S. Dollars)	124 (0.7040)	-252 (0.4220)	-128 (0.5940)	390	0.3139
Household asset score	0.30 (0.5030)	-0.55** (0.0270)	-0.21 (0.6860)	375	0.1609
Value of livestock (2009 U.S. Dollars)	-8 (0.9610)	201 (0.4150)	193 (0.4480)	364	0.2089
Food consumption score	-2.36 (0.4060)	-0.50 (0.8650)	-4.10 (0.2260)	376	0.1484

Numbers in parentheses are p-values.
* significant at p< 0.10
** significant at p< 0.05
*** significant at p< 0.01

CONCLUSIONS

El Salvador initially purchased from first-level FOs that appeared, in the baseline survey, to be relatively low-capacity organizations. None of the P4P or non-P4P FOs reported selling maize prior to the 2009 baseline survey and only 2 of 13 (15 percent) P4P FOs reported having access to long-term storage facilities.

These basic conditions define the "baseline" for achieving the anticipated results laid out in the results framework of Figure 5 and Figure 6. The remainder of this section frames the conclusions in the context of the results framework. It presents results in the sequence in which they are likely to occur; FO organizational capacity, FO marketing capacity, household marketing, household production, and household welfare.

In the results framework figures in this section, facilitating conditions are not necessarily outcomes of P4P, they merely represent conditions that may facilitate or enhance the potential for positive outcomes. The results framework figures therefore indicate whether the facilitating conditions are positive (+) or negative (-); attribution to P4P is not important. The columns of results attributable to P4P, however, indicate whether the facilitating conditions and participation in P4P caused a statistically significant change in the outcome indicator relative to non-P4P FOs and households.

Impact of P4P on FO Capacity

Figure 18 summarizes changes in facilitating conditions and anticipated results for FO capacity and serves to frame the conclusions presented in this section.

The facilitating conditions supporting increased FO organizational capacity generally improved over the course of the P4P pilot. The percentage of FOs reporting access to long-term storage facilities increased from 15 percent to 75 percent. P4P FOs also reported substantial improvements in access to supply-side support. By the end of the P4P pilot, 100 percent of P4P FOs reported receiving supply-side support for

organizational strengthening, post-harvest handling, production, marketing, and inputs. The greatest changes were a 62 percentage point increase in the percentage of FOs receiving marketing support, a 54 percentage point increase in support for infrastructure, and a 38 percentage point increase in post-harvest handling support. The increases in post-harvest management, inputs, infrastructure, production, and marketing align with the particular areas on which the El Salvador P4P program focused.

WFP's procurement stimulus was relatively sizeable with the minimum quantity purchased from an FO in a given year at 40 mt, a maximum of 1,057 mt, and a mean of 342 mt.[14] However, procurement was inconsistent; WFP purchased in more than one year from only 3 of 10 P4P FOs registered as WFP suppliers.

The improvements in the facilitating environment prompted significant impacts in indicators of FO organizational capacity. In particular:

- Participating in P4P substantially increased P4P FOs' capacities to provide services to members relative to non-P4P FOs. The percentage of quality services offered increased by 49 percentage points, production services by 34 percentage points, and marketing services by 29 percentage points.
- Relative to non-P4P FOs, the percentage of P4P FOs facilitating members' access to inputs increased by 54 percentage points.
- The percentage of P4P FOs providing production training to members increased by 40 percentage points relative to non-P4P FOs.

The facilitating environment for marketing outcomes also generally improved for P4P FOs. The percentage of P4P FOs utilizing credit doubled from 31 percent to 62 percent between 2009 and 2014. WFP's procurement, although very inconsistent, was sizeable. These facilitating factors led to substantial increases in FO marketing capacity indicators. Although the indicator values increased substantially, only one could be attributed to P4P, probably because of the number of observations was too small to identify them as causal effects.

Specific marketing outcomes included:

- The percentage of P4P FOs reporting sales to any buyer increased by 29 percentage points relative to non-P4P FOs and average quantities sold increased by 262 mt.
- The percentage of P4P FOs reporting selling to buyers other than WFP rose from 0 percent to 54 percent – a 54 percentage point increase. However, probably because of the small number of observations, the result was not statistically significant relative to non-P4P FOs.
- Price data at the FO level was too thin for inferences. However, P4P households reported receiving significantly higher prices than non-P4P households in 2012 (12 percent higher), the year when WFP purchased the most and from the largest number of FOs.

[14] WFP procurement records through May 2013.

FIGURE 18: SUMMARY OF IMPACT OF P4P ON FO CAPACITY

Maize Marketing

	Indicators	Results attributable to P4P		Facilitators	Status	
Organizational capacity	Planning	→	Percentage of P4P FOs planning for production and marketing increased by 32% relative to non-P4P but difference not statistically significant.	Infrastructure	+	Revolving loans and direct support from WFP contributed to increasing access to storage. P4P FOs reporting access to storage increased from 15% to 75%.
	Services	↑	Statistically significant increases in percentage of quality services (49%), production services (34%), and marketing services (29%) provided by P4P FOs relative to non-P4P FOs.	Procurement	-	Sizeable but inconsistent procurement stimulus
	Inputs	↑	54% increase in percentage of P4P FOs facilitating members' access to inputs relative to non-P4P FOs.	Supply-side support	+	Substantial increase in supply-side support for marketing (62% increase), infrastructure (54% increase), and post-harvest handling (38% increase)
	Training	↑	40% increase in percentage of P4P FOs providing production training to members relative to non-P4P FOs.			
Marketing capacity outcomes	Sales	↑	The percentage of P4P FOs reporting sales to any buyer increased by 29 percentage points relative to non-P4P FOs and average quantities sold increased by 262 mt.	Procurement	-	Sizeable but inconsistent procurement stimulus
	Market diversity	→	32 percentage point increase in percentage of P4P FOs selling to buyers other than WFP but not statistically different from non-P4P FOs.			
	Financing for members	→	15 percentage point increase in percentage of P4P FOs providing post-harvest financing to members but not statistically different from non-P4P FOs.	Access to credit	+	Percentage of FOs utilizing credit doubled – from 31% to 62%.
	Prices	↑	Price data at the FO level was too thin for inferences. However, P4P households reported receiving significantly higher prices than non-P4P households in 2012 (12% higher), the year when WFP purchased the most and from the greatest number of FOs.			
Impacts	Sustainable access to value-added staples markets (increasing trajectory of quantities sold, especially to formal buyers; declining dependence on WFP market, established relationship with financial institutions, access to permanent storage facilities of at least 500 mt capacity)					

Legend

↑	Statistically significant positive impact attributable to participating in P4P.
↓	Statistically significant negative impact attributable to participating in P4P.
→	No statistically significant impact associated with participating in P4P.
+	Favorable conditions/change.
-	Unfavorable conditions/change.

Impact of P4P on Household Maize Marketing

The conditions facilitating change in household maize marketing behavior improved across the board in El Salvador during the P4P pilot (Figure 19). The percentage of P4P FOs selling maize increased as did the average quantities sold. The percentage of quality and marketing services available from the FO increased: quality services by 49 percentage points and marketing services by 29 percentage points. The percentage of P4P households using credit for agricultural and other purposes increased between 2009 and 2012; by 6 percentage points for agricultural loans and 8 percentage points for non-agricultural loans.

The improved facilitating conditions led to changes in household maize marketing behavior. Specifically:

- The percentage of P4P households that reported selling through the FO at some point during the pilot increased by 21 percentage points relative to non-P4P households and the average percentage of surpluses sold through the FO increased by 19 percentage points relative to non-P4P households.
- A 12 percentage point increase in the percentage of P4P households selling four weeks or more after harvest relative to non-P4P households was not statistically significant. However, the 13 percentage point increase, relative to non-P4P households, in the average percentage of maize surpluses sold was.

These behavioral changes, primarily the choice to sell through the FO in a year when WFP procurement was high, led to P4P households receiving significantly higher prices for maize than non-P4P households. The difference between the USD 396 reported by P4P households and the USD 355 obtained by non-P4P households represents an 11 percent higher price associated with being a member of a P4P FO.

Impact of P4P on Household Maize Production

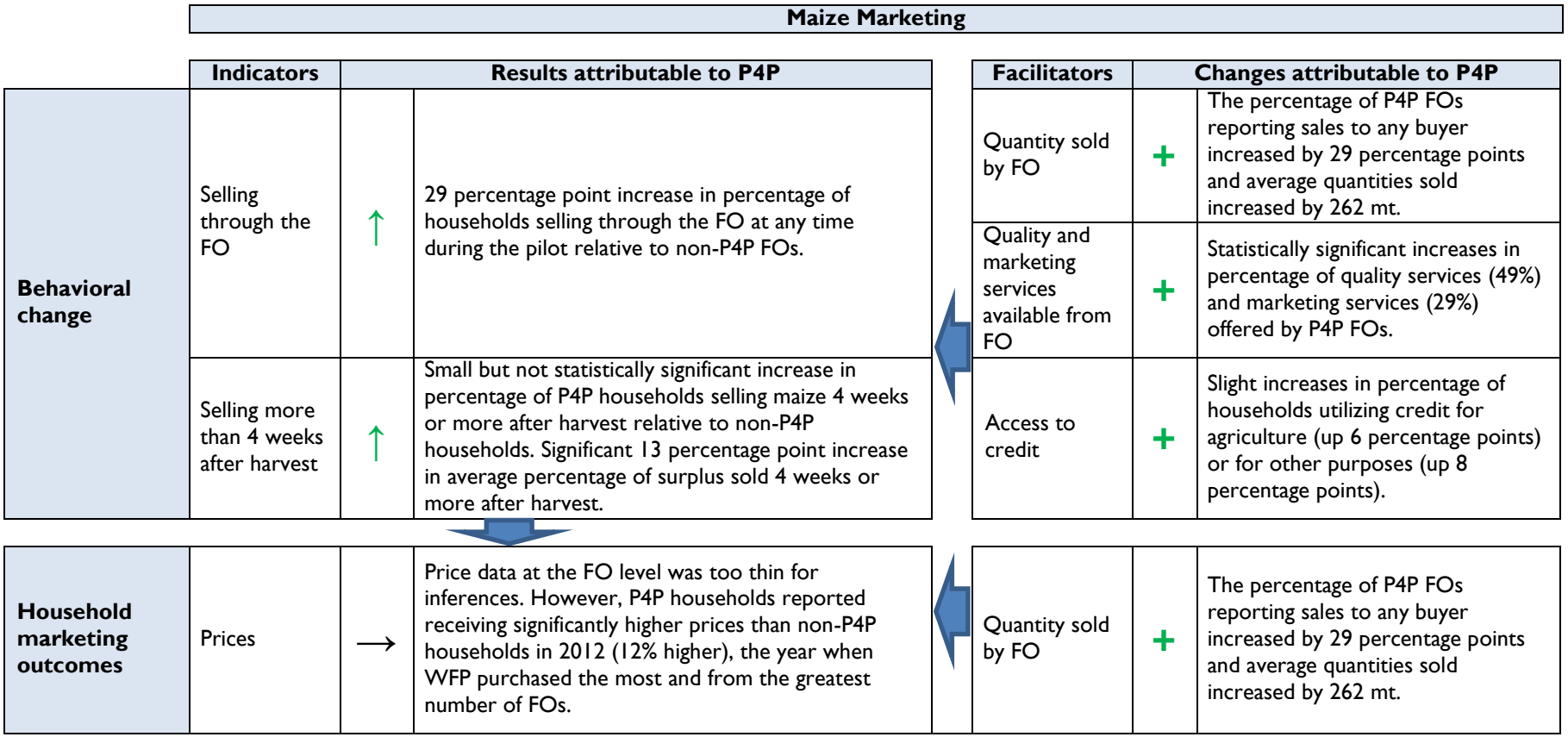
The P4P development hypothesis suggests that positive outcomes in household maize marketing lead to positive production outcomes. For example, higher prices obtained from selling maize through the FOs are expected to provide the incentive to invest in increasing maize production. In addition to the incentive provided by better access to markets, facilitating factors for maize production include access to inputs and credit to resolve financial constraints to investing in agriculture. Specific changes in production facilitating conditions (documented in Figure 20) include:

- The percentage of P4P households reporting receiving subsidized inputs through their FO increased by 7 percentage point.
- The percentage of P4P households using credit for agricultural purposes increased by 6 percentage points between 2009 and 2012.
- The percentage of P4P households receiving production training increased by 23 percentage points.

The positive facilitating environment coupled with a P4P program that provided customized technical packages of inputs and the training to use them correctly prompted P4P households to change their maize production behavior relative to non-P4P households. In particular:

- The percentage of P4P households choosing to cultivate maize increased by 19 percentage points relative to non-P4P households.
- P4P households allocated an average of 0.29 ha more to maize production than non-P4P households.
- The percentage of P4P households using certified maize seed increased by 18 percentage points relative to non-P4P households and the average percentage of maize seed used that was certified increased by 27 percentage points relative to non-P4P households.

FIGURE 19: SUMMARY OF IMPACT OF P4P ON HOUSEHOLD MAIZE MARKETING



Legend

↑	Statistically significant positive impact attributable to participating in P4P.
↓	Statistically significant negative impact attributable to participating in P4P.
→	No statistically significant impact associated with participating in P4P.
+	Favorable conditions/change.
-	Unfavorable conditions/change.

Consistent with the increased focus on maize production and the increased use of certified seed, P4P households reported a significant increase in maize production parameters. Specifically:

- P4P households' maize yields increased by 0.87 mt/ha relative to non-P4P households.
- The average quantity of maize produced by P4P households was 1.08 mt higher than it would have been had the households not participated in P4P.
- P4P households reported selling an average of 2.42 mt more maize than non-P4P households.

Impacts of P4P on Household Welfare

Ultimately, better access to markets and increased production should boost household welfare. However, the well-known difficulties in measuring income and the relatively small change anticipated make it likely that even if P4P "caused" a change in income, it would not be detected through the noise of reporting error (recall) and variability. The analysis therefore also considered alternative measures of changes in welfare where the prospects for detecting change were more promising. These included a summary measure of household assets (the household asset score), an indicator of food security (the food consumption score), the value of household livestock, and characteristics of the households housing (flooring, wall, and roofing materials). Which of these will respond first to changes in income will probably depend to some extent on characteristics of a particular household. For example, a food insecure household may spend additional income on food before investing in housing or livestock.

P4P households were better off in 2014 than in 2009 by almost any measure of welfare.

- Average real incomes increased by 45 percent, from USD 870 in 2009 to USD 1,264 in 2014;
- The average household asset score increased from 12.30 in 2009 to 12.85 in 2014, an increase of 4 percent;
- The average real value of household livestock increased by 78 percent, from USD 435 to USD 774; and
- The average food consumption score increased by 9 percent, from 81.34 in 2009 to 85.22 in 2014.

However, non-P4P households experienced similar improvements and none of the changes observed with P4P households were significantly different from those experienced by non-P4P households.

FIGURE 20: SUMMARY OF IMPACT OF P4P ON HOUSEHOLD MAIZE PRODUCTION

Maize Production						
	Anticipated Results	**Results attributable to P4P**		**Facilitators**	**Changes attributable to P4P**	
Behavioral change	Planting maize	↑	Significant 19 percentage point increase in likelihood that P4P households plant maize relative to non-P4P households.	Access to inputs/credit	+	7 percentage point increase in percentage of P4P households receiving subsidized inputs through the FO. 6 percentage point increase in percentage of households receiving credit for agricultural purposes between 2009 and 2012.
	Area allocated to maize	↑	Significant 0.29 ha increase in average area allocated to maize production by P4P households relative to non-P4P households.			
	Use of inputs	↑	The percentage of P4P households using certified maize seed increased by 18 percentage points relative to non-P4P households and the average percentage of maize seed used that was certified increased by 27 percentage points relative to non-P4P households.	Production training	+	23 percentage point increase in percentage of P4P households receiving production training.
Intermediate outcomes	Yields	↑	Significant 0.87 mt/ha increase in maize yields relative to non-P4P households.	Access to inputs/credit	+	7 percentage point increase in percentage of P4P households receiving subsidized inputs through the FO. 6 percentage point increase in percentage of households receiving credit for agricultural purposes between 2009 and 2012.
	Quantity produced	↑	Significant 1.08 mt increase in quantity of maize produced relative to non-P4P households.			
	Quantity sold	↑	Significant 2.42 mt increase in quantity of maize sold relative to non-P4P households.			

Legend

↑ Statistically significant positive impact attributable to participating in P4P.
↓ Statistically significant negative impact attributable to participating in P4P.
→ No statistically significant impact associated with participating in P4P.
+ Favorable conditions/change.
- Unfavorable conditions/change.

ANNEXES

Annex A: Adjusting for High Attrition Rates

El Salvador experienced substantial attrition in the household panel between the baseline in 2009 and the first follow-up survey in 2012. Of the 349 P4P and 308 non-P4P households interviewed in 2009, 234 (67 percent) of the P4P and 182 (59 percent) of the non-P4P households dropped out in the first follow-up survey in 2012. To address the attrition, the country office selected new households to replace those that dropped out and thus retained cross-sectional samples of 315 P4P and 308 non-P4P households. Attrition rates between 2012 and the final survey in 2014 were negligible; less than 2 percent of P4P households and less than 1 percent of non-P4P households.

High rates of attrition can bias estimated causal effects if 1) households that dropped out of the survey were likely to respond differently to the P4P opportunity than retained households or 2) households selected to replace those that dropped out would respond differently to P4P than those they replaced.

The magnitude and direction of potential bias in either of these situations depends on the reasons for attrition, procedures for selecting replacement households, and assumptions about why some households are more likely to respond to the P4P opportunity than others. For example, households that underperformed in 2009 relative to the entire sample may have experienced poor results because of transient household-specific adverse conditions and may have regressed back toward the mean in the first follow-up survey. If these households dropped out of the P4P sample in disproportionate numbers, ceteris paribus, it would deflate estimates of causal effects. On the other hand, if underperforming households were less progressive farmers, then dropping them from the P4P sample in disproportionate numbers would tend to inflate estimated causal effects.

Short of reconstituting the panel, i.e., locating the households that dropped out and asking them to recall what their answers to the survey questions would have been in 2012 and 2014, there are three options for analyzing the El Salvador household data.

- Treat the data as repeated cross sections. This approach does not eliminate either source of bias.
- Analyze only the data from the small panel. This approach eliminates potential bias caused by differences between replacement households and those that dropped out. However, it does not address potential bias caused by differences between households that dropped out and those retained.
- Stratify households on the basis of likely differences in response to P4P. If it is possible with baseline data to assess households' likely response to P4P, then the analysis could stratify on the response variable and base the causal comparison on differences between P4P and non-P4P households in the same response stratum. The average treatment effect would then be the weighted average of treatment effects across the strata. The difficulty of this approach is finding an appropriate response variable on which to stratify households.

The household analysis followed the third of these options. The rationale for the approach is that the high attrition created a non-representative sample relative to the random baseline. The non-representativeness is a problem only to the extent that different segments of the sample are likely to respond to the P4P opportunity in different ways. Stratifying the remaining households on an measure of their likely response to P4P and then weighting the data in each strata to reflect their proportion in the baseline sample should correct for the disproportional household sample.

The challenge with the stratification approach is identifying an appropriate measure of likely response to P4P. For the analysis of the El Salvador household data the response measure is an index created from a factor analysis of baseline values of 13 anticipated household outcomes including the likelihood of planting maize (pmaize), the area allocated to maize (aream), the likelihood of using certified maize seed (cseedm), the likelihood of using fertilizer (fert), maize yield (yieldm), the quantity of maize harvested (harvestqm), the quantity of maize sold (qsoldm), the likelihood of selling maize through the FO (foi), the likelihood of selling maize four weeks or more after harvest (latersoldi), total households income (totincome), the household asset score (assets), the value of livestock (lasset), and the food consumption score (fcs). Table 12 reports the STATA output for a principle components factor analysis of the variables listed above.

TABLE 12: PRINCIPLE COMPONENTS FACTOR ANALYSIS RESULTS

Factor	Eigenvalue	Difference	Proportion	Cumulative proportion
Factor1	3.1633	2.3080	0.6633	0.6633
Factor2	0.8553	0.2148	0.1794	0.8427
Factor3	0.6405	0.1531	0.1343	0.9770
Factor4	0.4874	0.1319	0.1022	1.0792
Factor5	0.3555	0.2815	0.0745	1.1537
Factor6	0.0740	0.0631	0.0155	1.1692
Factor7	0.0109	0.0658	0.0023	1.1715
Factor8	-0.0549	0.0145	-0.0115	1.1600
Factor9	-0.0694	0.0390	-0.0145	1.1455
Factor10	-0.1084	0.0544	-0.0227	1.1228
Factor11	-0.1628	0.0314	-0.0341	1.0886
Factor12	-0.1942	0.0341	-0.0407	1.0479
Factor13	-0.2283	.	-0.0479	1.0000

Table 13 shows the factor loadings associated with the factor analysis of Table 12.

TABLE 13: FACTOR LOADINGS FOR FACTOR ANALYSIS

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Uniqueness
pmaize	0.2166	0.2544	-0.4955	0.1354	0.2234	-0.0088	-0.0001	0.5745
aream	0.7260	-0.3265	-0.2643	-0.1968	0.2329	-0.0344	-0.0146	0.2021
cseedm	0.1723	0.0249	0.1205	0.0118	0.1638	-0.0667	0.0847	0.9166
fert	0.1843	-0.2435	-0.2546	0.0327	-0.0967	0.0759	0.0296	0.8249
yieldm	0.4995	0.6302	-0.0564	0.2270	-0.0827	-0.0025	0.0036	0.2917
harvestqm	0.9449	0.1168	-0.0203	-0.1654	-0.1024	-0.0467	-0.0159	0.0528
qsoldm	0.8475	-0.0203	0.2020	-0.2196	-0.1642	-0.0298	0.0108	0.1643
foi	0.0019	0.1839	0.2386	-0.1800	0.2568	0.0816	-0.0049	0.8042
latersoldi	0.0853	0.2260	0.2328	-0.1124	0.2606	0.0531	-0.0163	0.8038
totincome	0.5881	-0.0146	0.0732	0.1451	-0.1062	0.1539	0.0042	0.5925
assets	0.3645	-0.2626	0.1326	0.3282	0.0911	-0.0006	-0.0365	0.6632
lasset	0.3827	-0.2349	0.1283	0.2395	0.1191	0.0693	0.0229	0.7051
fcs	0.1802	-0.0607	0.2254	0.2662	0.0567	-0.1466	-0.0102	0.8174

The P4P response index is the predicted value of factor 1 for each household.

The analysis then stratifies households on the value of the response variable, determines the proportions of the full baseline sample and panel households in the baseline sample, and calculates a weight by dividing the former proportion by the latter proportion. Table 14 shows the distribution of households by strata and illustrates the calculation of weights used to adjust the results to reflect the original baseline sample.

TABLE 14: DISTRIBUTION OF HOUSEHOLDS BY STRATA

		Proportions/(frequency)		
Stratum	Left boundary	Full baseline sample (A)	Panel HH in baseline sample (B)	Weight (A/B)
0	-2.0	0.0096 (4)	0.0127 (3)	0.7559
1	-0.80	0.0554 (23)	0.0380 (9)	1.4579
2	-0.60	0.2530 (105)	0.2152 (51)	1.1757
3	-0.40	0.2916 (121)	0.2911 (69)	1.0017
4	-0.20	0.1181 (49)	0.1435 (34)	0.8230
5	0	0.0843 (35)	0.0717 (17)	1.1757
6	0.20	0.0651 (27)	0.0591 (14)	1.1015
7	0.40	0.0241 (10)	0.0127 (3)	1.8976
8	0.60	0.0241 (10)	0.0295 (7)	0.8169
9	0.80	0.0120 (5)	0.0380 (9)	0.3158
10	1.00	0.0627 (26)	0.0886 (21)	0.7077

The analysis applied these weights using the svy: prefix in all STATA regression commands.

Annex B: Comparison of P4P and Non-P4P FOs and Households

TABLE 15: BASELINE DIFFERENCES BETWEEN P4P AND NON-P4P FOS

Characteristics	P4P FOs	Non-P4P FOs	p-value
FO characteristics			
Number of members	182	103	0.2560
Percentage of female members	0.73	0.64	0.3071
Percentages smallholder farmer members	0.88	0.84	0.8153
Number of full-time employees	14	21	0.1198
Distance from market (km)	105	56	0.2001
Indicator of higher level FO affiliations	0.08	0.29	0.2123
Indicator of higher and lower level FO affiliations	0.08	0.14	0.6392
Indicator of lower level FO affiliations	0.08	0.00	0.4515
Indicator of no FO affiliations	0.77	0.57	0.3572
FO capacity indicators			
Indicator of planning for production and marketing	0.38	0.14	0.2605
Indicator of receiving credit in past two years	0.31	0.43	0.5888
Indicator of providing financing to members	0.00	0.14	0.1621
Indicator of access to storage	0.15	0.00	0.2740
Indicator of receiving credit	0.31	0.29	0.9185
Indicator of using price information	0.00	0.00	
External assistance received			
Indicator of receiving organizational assistance	0.85	1.00	0.2740
Indicator of receiving post harvest assistance	0.62	0.29	0.1596
Indicator of receiving production assistance	0.85	0.86	0.9477
Indicator of receiving marketing assistance	0.38	0.00	0.0518
Indicator of receiving assistance for inputs	0.92	0.71	0.2123
Indicator of receiving assistance for tools	0.38	0.29	0.6583
Indicator of receiving assistance for infrastructure	0.23	0.14	0.6392
Indicator of receiving any assistance	1.00	1.00	
Services provided			
Indicator of providing any services	0.69	1.00	0.1008
Indicator of providing value addition services	0.00	0.00	
Indicator of providing quality services	0.03	0.00	0.3276
Indicator of providing production services	0.26	0.46	0.1997
Indicator of providing marketing services	0.21	0.00	0.0237
Marketing activity			
Indicator of selling during baseline year	0.00	0.00	
Indicator of selling during past two years	0.08	0.14	0.6392

Characteristics	P4P FOs	Non-P4P FOs	p-value
Maximum quantity sold in past two years (mt)	269	50	0.5643

TABLE 16: BASELINE DIFFERENCES BETWEEN P4P AND NON-P4P HOUSEHOLDS

Household characteristic	P4P	Non-P4P	p-value of difference
Number of individuals in household	5.75	5.33	0.2082
Indicator of using certified maize seed	0.59	0.69	0.1146
Indicator of using certified seed on crops other than maize	0.21	0.15	0.2848
Indicator of using certified seed on any crop	0.63	0.75	0.0487
Area of land owned (ha)	1.79	0.97	0.0010
Area allocated to maize (ha)	1.33	0.86	0.0001
Area allocated to crops other than maize (ha)	0.88	0.51	0.0004
Total cultivated area (ha)	2.21	1.37	0.0000
Average maize yield (mt/ha)	2.68	2.47	0.2856
Average quantity of maize harvested (mt)	3.43	1.93	0.0000
Average quantity of crops other than maize harvested (mt)	0.70	0.42	0.0174
Average quantity of all crops harvested (mt)	4.14	2.35	0.0000
Quantity of maize sold (mt)	4.92	2.43	0.0018
Quantity of crops other than maize sold (mt)	0.41	0.23	0.0920
Quantity of all crops sold (mt)	2.87	1.44	0.0013
Size of maize surplus (mt)	2.28	0.99	0.0001
Average percentage of maize sold within 4 weeks of harvest (%)	0.36	0.40	0.5276
Average percentage of maize sold 4 weeks after harvest (%)	0.40	0.26	0.0188
Average quantity of maize sold within 4 weeks of harvest (mt)	1.22	0.76	0.1319
Average quantity of maize sold 4 weeks after harvest (mt)	1.19	0.42	0.0015
Average percentage of maize sold through FO (%)	0.07	0.07	0.8665
Average percentage of maize sold elsewhere (%)	0.29	0.26	0.4865
Average percentage of maize sold at the farm gate (%)	0.39	0.34	0.3672
Average quantity of maize sold through FO (mt)	0.21	0.11	0.3408
Average quantity of maize sold elsewhere (mt)	0.73	0.64	0.7177
Average quantity of maize sold at the farm gate (mt)	1.47	0.44	0.0007
Value of loans received for agricultural purposes (2009 Ethiopian Birr)	392	239	0.2894
Value of loans received for non-agricultural business (2009 Ethiopian Birr)	3	6	0.5662
Value of loans received for any purpose (2009 Ethiopian Birr)	522	345	0.4059
Average food consumption score	81.70	80.00	0.4715
Average food consumption rank	3.00	3.00	
Average household asset score	12.61	12.06	0.2216
Value of livestock assets (2009 Ethiopian Birr)	449	404	0.7475
Average annual household income (2009 Ethiopian Birr)	1,083	653	0.0035
Average annual income from farming (2009 Ethiopian Birr)	826	384	0.0002

Household characteristic	P4P	Non-P4P	p-value of difference
Average annual off-farm income (2009 Ethiopian Birr)	257	269	0.8719
Net value of crops produced (2009 Ethiopian Birr)	798	314	0.0000
Net value of crops consumed (2009 Ethiopian Birr)	270	132	0.0057
Net value of crops sold (2009 Ethiopian Birr)	529	189	0.0008
Net value of staples sold (2009 Ethiopian Birr)	375	127	0.0008
Net income from livestock (2009 Ethiopian Birr)	28	70	0.2037
Income from livestock sales (2009 Ethiopian Birr)	5.71	5.46	0.9654
Value of livestock consumed (2009 Ethiopian Birr)	0.00	-0.11	0.8023
Income from livestock products and services (2009 Ethiopian Birr)	23	65	0.1885
Annual cost of keeping livestock (2009 Ethiopian Birr)	50	96	0.2827
Percentage of household income from off-farm sources	0.19	0.39	0.0780
Annual expenditure (2009 Ethiopian Birr)	4,817	6,366	0.1363
Annual expenditure on household items (2009 Ethiopian Birr)	573	443	0.0786
Annual expenditure on food (2009 Ethiopian Birr)	1,449	1,268	0.2461
Annual expenditure on other items (2009 Ethiopian Birr)	2,768	4,646	0.0656
Annual expenditure on rent (2009 Ethiopian Birr)	26	8	0.1534
Annual crop production expenses (2009 Ethiopian Birr)	529	321	0.0084
Indicator of female household head	0.73	0.54	0.0018
Indicator of metal roof on house	0.06	0.05	0.6245
Indicator of concrete floor in house	0.59	0.70	0.0864
Indicator of concrete or fired brick walls on house	0.44	0.50	0.3386
Indicator of improved toilet facilities in house	0.55	0.46	0.1337
Indicator of household access to improved water source	0.96	0.79	0.0002
Indicator of using fertilizer	0.42	0.29	0.0339
Indicator of access to inputs on credit or subsidized	0.80	0.61	0.0010
Indicator of irrigating maize	0.00	0.00	
Indicator of planting maize	0.94	0.96	0.4303
Indicator of planting crops other than maize	0.85	0.62	0.0001
Indicator of producing a surplus of maize	0.66	0.66	0.9887
Indicator of selling maize within 4 weeks of harvest	0.47	0.46	0.7908
Indicator of selling maize 4 weeks after harvest	0.47	0.34	0.0431
Indicator of selling maize through the FO	0.12	0.11	0.9215
Indicator of selling maize at the farm gate	0.42	0.34	0.1843
Indicator of selling maize elsewhere	0.47	0.43	0.5244
Indicator of receiving loans for agriculture	0.36	0.32	0.5460
Indicator of receiving loans for non-agricultural business	0.02	0.02	0.9118
Indicator of receiving loans for any purpose	0.41	0.36	0.4229

Household characteristic	P4P	Non-P4P	p-value of difference
Indicator of obtaining crop price information through FO	0.32	0.12	0.0002
Indicator of using crop price information	0.96	0.80	0.0003
Indicator of finding price information from FO useful	0.26	0.10	0.0018

Annex C: P4P Treatment Details

TABLE 17: QUANTITIES DELIVERED TO WFP BY FO AND YEAR

Organization type	FO name	Quantity delivered (mt)					Years w/ contracts	Average contract size (mt)[a]
		2009	2010	2011	2012	2013		
FO	ADESCOAGRISAL	280	728	66	868		4	114
FO	ACALESE	178	1,057		200		3	239
FO	ACPA COLIBRI DE R.L.	98					1	98
FO	AGROTROPICAL DE EL SALVADOR, DE RL		472				1	157
FO	ACPASM EL PESOTE DE R.L.		197		40		2	79
FO	ASOCIACION AGROPECUARIA DE TURIN DE RESP			11	86		2	32
FO	ASOCIACION COOPERATIVA DE PRODUCCIO				358		1	45
FO	ASOC COOP DE APRO. AGROPECUARIO,AHORRO,					297	1	0
FO	Asociacion De Productores Agropecuarios				266		1	89
Umbrella FO	UDP PRODUCTORES DE GRANOS BASICOS					557	1	557

Source: WFP procurement records

a. Average contract size may be different than average quantity delivered per year because some FOs had multiple contracts in a given year.

TABLE 18: WFP PROCUREMENT BY MODALITY

Contract year	Procurement modality						Total (all modalities)		
	Competitive tenders			Direct contracts					
	Beans	Maize	Total	Beans	Maize	Total	Beans	Maize	Total
2009					555	555		555	555
2010		660	660	49	1,745	1,794	49	2,405	2,454
2011	25	52	77				25	52	77
2012	211	1,607	1,818				211	1,607	1,818
2013		854	854					854	854
Total	**236**	**3,173**	**3,409**	**49**	**2,300**	**2,349**	**285**	**5,473**	**5,758**

Source: WFP procurement records.

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P4P on Twitter: @WFP_P4P

20 P4P pilot countries
Asia: Afghanistan
Africa: Burkina Faso, Democratic Republic of the Congo, Ethiopia, Ghana, Kenya, Liberia, Malawi, Mali, Mozambique, Rwanda, Sierra Leone, South Sudan, Tanzania, Uganda, Zambia
Latin America: El Salvador, Guatemala, Honduras, Nicaragua