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Welfare Effect and Elite Capture in Agricultural Cooperatives Intervention: Evidence from Ethiopian Villages

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ABSTRACT

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This paper evaluates the impact of the Purchase 4 Progress (P4P) intervention implemented by World Food Program in Ethiopia on per capita income as well as across sub-social groups. The intervention is intended to improve the market power of smallholder farmers through cooperatives that has the potential to increase the relative farm gate price of agricultural produce, particularly staple crops. Using a semi-parametric difference-in-difference (DID) model, which relaxes the parallel trend assumption, we show that the P4P intervention has raised per capita consumption of smallholders. Estimates of the treatment effect from alternative specifications of our preferred models ranged between Ethiopian Birr (ETB) 188.3 and ETB 248.6 (15.10% and 19.93%). Moreover, our analysis suggests heterogeneous treatment effects related to elite capture within Farmer Organizations. Policy implications are discussed.

JEL Classification:	D23, Q02, D02
Keywords:	P4P, welfare effect, distributional bias, semi-parametric DID

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1. Introduction

More often than not, agricultural commodity markets in the developing world operate in a constrained environment of prohibitive transaction costs arising from inadequate provision of such public goods as physical infrastructure (road, electricity, telecommunication, etc.) and institutional infrastructure (effective legal mechanisms to enforce contracts, standardization and certification services, market information services) (Gabre-Madhin, 2001; Barret, 2008; Francesconi and Heerink, 2010).

Transaction costs related to searching, screening and enforcement have considerably limited smallholder participation in agricultural commodity markets (Tadesse and Shively, 2013). Transaction costs are also to blame for poor integration of geographic markets and imperfect competition within each of them (Gabre-Madhin, 2001; Barret, 2008), which in turn, appear to constrain smallholder market participation respectively via price volatility and higher mark-up by merchants with monopsonic market power (de Janvry et al., 1991). Consequently large shares of smallholders are bound to engage in subsistence or semi-subsistence agriculture and are thus, unable to benefit from market liberalization reforms (Jayne et al., 2002). Barret (2008) observes that subsistence production, often characterized by low specialization, rudimentary technology (low productivity) and thus lower income, has caught smallholders in a lower-level equilibrium (poverty trap) across eastern and southern Africa. Public investment in physical and institutional infrastructures is expected to remedy the situation via reducing transaction costs and stimulating smallholder market participation thereby raising net returns to agricultural production (Renkow et al., 2004; Barret, 2008).

One such institutional alternative is organizing agricultural marketing cooperatives, commonly dubbed Farmer Organizations (FOs).[1] FOs economize on transaction costs and develop countervailing power by integrating vertically their members into marketing chains, either upstream (purchasing cooperatives) or downstream (marketing cooperatives).[2] In fact, FOs provide a special form of vertical integration in that they involve not only vertical coordination, but also horizontal coordination i.e. agents horizontally coordinate (form a club) to accomplish vertical integration (Sexton, 1986). This suggests that cooperatives face different governance cost and incentive structures compared to vertically integrated investor owned firms.

For most part though, FOs have failed to fully deliver on their promises in spite of common expectation that they would revitalize agricultural production and commercialization (Bernard et al., 2012).[3] Although they are faced with growing competition, and hence substantial investment and commitment required to survive the competition, many FOs appear to be severely resource-constrained and have seen a declining membership commitment. Both theoretical and empirical evidence from organization economics literature confirm that FOs often suffer from various incentive problems; lack of clearly-defined property rights assignments and management

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[1] In fact, recent years have seen a proliferating optimism within policy and donor circles that farmer organizations (FOs) could overcome smallholders' marketing constraints (World Bank, 2003).

[2] In the context of Ethiopian smallholders, a large part of transaction cost relates to information asymmetry of price and product quality. Compared to traders, smallholders have little or no information about prevailing central market prices for the quality and quantity of products they are supplying to the market in which case they either face considerable cost in searching for better price or receive below market price for their produce (Tadesse and Shively, 2013). Apart from generating scale economy, FOs reduce or eliminate this cost (raise selling prices as a consequence of superior bargaining strength) and thereby stimulate gainful market participation of smallholders.

[3] Particularly, the recent decade has witnessed revived interest and optimism within policy and donor circles to promote farmer organization as a natural avenue for stimulation of agricultural commercialization owing to reduction in the transaction costs of accessing input and output markets, bargaining power of smaller farmers vis- à-vis large buyers or seller (Kherallah and Kristen, 2001).

inefficiencies; eroding members' incentive to invest in FO resources (Cook, 1995; Cook and Iliopoulos, 2000).[4]

Normally, one would expect that cooperative members invest in their organization to earn residual income in the form of dividend and higher prices for their produce. However, if an open membership policy is adopted and FO services are freely accessible to non-members too, free-riding on investing in FO resources is the optimal strategy of each member, a realization that traps the organization in the equilibrium of underinvestment. This problem is real among Ethiopian FOs as they follow an open membership policy and provide services for non-members in their respective villages (Bernard et al., 2012).[5]

As a solution, donors (NGOs) or government often finances the needed investments to leverage FOs capacities.[6] Recent interventions by the World Food Program (WFP) through the Purchase for Progress (P4P) initiative is partly a case in point. WFP has since 2009 implemented five-year Purchase for Progress (P4P) pilot initiatives in 20 countries in an effort to bolster FOs capacity to connect smallholders to formal agricultural commodity markets.

The P4P intervention was two-pronged. First, it was aimed at addressing resource constraints of FOs via investing in their physical and human capitals. In effect, it provided FOs with such support

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[4] Some of major incentive problems in traditional cooperatives are the free riding problem (gains from cooperative action can be accessed by individuals that did not fully invest in developing the gains), the horizon problem (residual claims that do not extend as far as the economic life of the underlying asset), the portfolio problem (the organization's investment portfolio may not reflect the interests of any given member), the control problem (control of the manager by the members) and influence costs (decisions affect the wealth distribution among members (Cook and Iliopoulos, 2000).

[5] Ethiopian FOs are engaged in a broader portfolio of service provision including improved seed and fertilizer and credit, agricultural services, price information, consumption services, literacy trainings, HIV prevention and provision of public infrastructures both for members and non-members (Bernard et al., 2012).While some of these activities complement core commercialization activities of the FOs, others such as consumption services and public goods provisions are unrelated to their primary purpose.

[6] As external (donor's) commitment is often unlikely to remain a sustainable source. However, combining it with establishment of well-defined may sustainably avoid FOs' serious resource constraints.

as skills training including organization management, farming techniques, quality control, post-harvest handling and equipped them with storage infrastructure.[7] These interventions were expected to reduce FOs resource constraint and help aggregate commodities, add value (e.g., achieve WFP and its partner's quality standards to fetch better price), and identify and sustainably access markets (Krieger, 2014b; Erin and Upton, 2015). Second, at the upstream level (demand side), P4P provided an additional source of demand, possibly a larger one, via purchasing food for aid locally from FOs.[8]

In the Ethiopian context, there are two-tier FOs: the first tier being the Cooperative Union (CU), which comprises of its members, Primary Cooperatives (PCs), as the second tier. In providing smallholders with better markets, WFP used the CU as the entry point in the sense that it targeted the CU both for procurement and capacity building support. The CU has a greater capacity for aggregating the commodity and both the market and capacity stimulus provided at the CU level was expected to transmit all the way down to the PCs and their smallholder members (Krieger, 2014).

The present research set out to evaluate the welfare and distributional impacts of this multi-faceted P4P intervention. Drawing on panel data analysis, we provided cogent causal evidence of whether smallholder participation in P4P programs raises households' per capita consumption.[9] We also provided comprehensive empirical evidence of heterogeneity of these effects across gender and income group to test for the distributional bias of the program. We used the Ethiopian P4P dataset

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[7] This is referred to as supply-side (downstream level) intervention and is expected to further reduce the transaction cost for smallholders who sell their produce through the FOs.

[8] WFP purchase of local food for aid has taken the form of direct contracts, forward delivery contracts, and "soft" competitive tenders although this appears to vary across intervention countries (Erin and Upton, 2015).

[9] These items include all food consumption; non-food consumption items were restricted to direct consumables (matches, soap, linen, and clothes), school and health expenditure, as well as taxes and extraordinary contributions.

for the analysis. Our analysis confirmed that P4P raised per capita consumption by 15.10% to 19.93% supporting the hypothesis that the return to the P4P intervention is positive. We also uncovered that the distribution of this effect is heterogeneous and appears to be biased toward FOs management and non-poor smallholders.

These findings do not lend support to evidence from previous studies, which generally showed inconclusive evidence of the impact of P4P on household welfare in three program countries; Ethiopia, El-Salvador and Tanzania. Specifically, the previous Ethiopian study found that program households had seen income fall compared to non-participants (Krieger, 2014b). However, the analysis uncovered an insignificant welfare effect of the P4P on program households in El-Salvador and Tanzania (Krieger, 2014a,b,c).

Our study was motivated by the following major empirical gaps in this literature. First, although previous analyses by Krieger (2014a,b,c), provided initial indications of the program impacts, there appeared to remain some key methodological questions. These studies employed a standard difference-in-differences (DID) estimator, which is based on a strong identification assumption of parallel trend. This assumption requires that, in the absence of the treatment, the outcome variable would have followed the same trend in both the treated and untreated groups. Unfortunately, this assumption may not hold if pre-treatment characteristics that are correlated with the dynamics of the outcome variable are unbalanced between the treated and the control. This may happen, for example, if selection for treatment is influenced by individual-transitory shocks on past outcomes (Abadie, 2005).

In our data, the P4P program roll-out did not follow a random assignment mechanism both at FOs and smallholder levels (Krieger, 2014b; Lentz and Upton, 2015). This means that exposure to the

program among FOs and their respective members was rather driven by observed and unobserved heterogeneities. As some of these heterogeneities are time varying and drive the dynamics of outcome variables, hence implausibility of the parallel trend assumption, the evidence which emerged from preliminary P4P impact evaluation is likely to be biased.

Second, beside the restrictions imposed by methodology arising from the program design and sampling issues, the preliminary analysis did not control for key FOs attributes that are likely to shape P4P effects. Particularly, in mapping out the causal mechanism of P4P impacts, there is a clear need to account for the institutional context of FO governance. Marketing cooperative organizations are often prone to incentive and governance problems.[10] First, cooperative governance structures are such that members, as formal owners of a cooperative, delegate control to management teams and exercise ownership rights through voting and influencing activities (Cook, 1995; Iliopoulos & Hendriksen, 2009). Divergence of interests between members (principals) and management teams (agents) in a cooperative organization is what constitutes the agency problem in the governance of these organizations.

Agency problems exist, to a certain degree, within any organization in which there is separation of ownership and control rights. However, the absence of a market for exchanging equity shares, and the lack of equity-based management incentive mechanisms and formal Boards of Directors exacerbate this problem in cooperatives (Cook, 1995). Particularly, the control rights of cooperative management teams provide scope for patronage and rent seeking (elite capture) (Banerjee et al., 2001). In the developing country context, several mechanisms give rise to elite

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[10] Additional incentive problems in traditional cooperatives are: The horizon problem (residual claims that do not extend as far as the economic life of the underlying asset), the portfolio problem (the organization's investment portfolio may not reflect the interests of any given member), and influence costs (decisions affect the wealth distribution among members) (Cook and Iliopoulos, 2000).

capture within cooperative organizations. Usually using retained earnings and funds made available by donors, cooperative organizations engage in a broad range of investments, including capacity expansion of the organization, training, and provision of public goods. Using their information power on the quality and cost of these services, the elite can capture rents via over-invoicing of goods and services purchased for the projects or by outright theft or fraud.[11].

It follows that elite capture undermines the success of cooperative organizations in the commercialization of products as it erodes members' incentives and trust in investing in the organization's resources. However, the empirical literature on marketing cooperatives has rarely confirmed the existence and extent of these incentive problems.

2. Methodology

2.1 Data and descriptive statistics

Our analysis was based on the Ethiopian P4P panel data that spanned three waves collected from P4P PCs by member households and non-P4P PCs households. The Ethiopian WFP country office commissioned data collection from samples of P4P FOs/CUs and PCs in every year of the five-year pilot and samples of non-P4P FOs/CUs and PCs in year 1, the baseline, year 4, and year 5.[12] These surveys also generated a panel data set from members of the PCs. Moreover, it generated information on initial and current capacities (managerial and marketing) of FOs/CUs and PCs, their respective size marketing experience, location, services provided to members, storage

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[11] They may be guarded against such malpractices through political connections, which serve as a source of favoritism. Cayers and Dercon (2012) found that Ethiopian rural households, which are vertically connected to those in power within the "Kebele" have 12 percentage points higher probability of obtaining food aid. Moreover, Bernard and Spielman, (2009) found a lower tendency of participating in marketing FOs among poorer Ethiopian smallholders. The authors also uncovered that when they do participate, they are often excluded from decision-making processes supporting our priori that control right and the attendant management decisions rests with the elite group.
[12] Note that we are using CUs and FOs interchangeably.

capacity, marketing activity, and credit utilization, among others. At the household level, it generated data on household characteristics including gender of household's head, age of the household's head, education, membership in FO management, production practices, marketing activity, credit utilization, and income from crops, livestock, and off-farm sources, and consumption among others.

Our treatment variable is defined as a smallholder participation in an FO subjected to the P4P intervention.[13] We used per capita household consumption expenditure as the outcome variable. In studies like ours, consumption rather than income is widely used for several reasons (Skoufias and Katatyama, 2010). First, consumption is commonly believed to provide better evidence of the standard of living than income. Second, an income survey may not capture informal, in-kind or seasonal income, and, thus, may be more susceptible to under-reporting. Third, due to consumption smoothing, consumption expenditure exhibits lesser fluctuation than income in the short run. Fourth, consumption expenditure provides information about the consumption bundle that fits within the household's budget, although credit market access and household savings affect that.

We also used the transaction cost of selling maize and maize yield as intermediate outcomes. Evaluation of P4P effects on these variables help us ascertain the mechanisms through which the program effects are realized. The transaction cost is measured as the total cost a smallholder incurred to sell maize in different markets.

Our descriptive statistics analysis (seeTabel1 in appendix) suggests that many of the household level baseline covariates, with the exception of household size, including gender, landholding, land allocation to maize production and transaction cost of maize marketing, per capita consumption

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[13] The major intervention in the Ethiopian P4P took the form of WFP's direct investment in increasing CU's storage capacity suggesting that increased access to storage can be interpreted as major part of the P4P treatment.

were balanced. The same evidence emerged at the FO level for many of capacity measures (access to long-term store, access to tent store). But there is evidence of the unbalanced distribution of FO size; access to basic storage (granary), storage capacity of long-term store across the treatment groups raising concern about selection bias alluded to in the preceding section.

2.2 Econometrics

Our data set presents two major econometric challenges. First, assignment to the P4P program, both at FOs and smallholder levels: Non-random assignment meant that there are differences in the distribution of pre-intervention observable and unobservable characteristics across treatment and control groups. The presence of such differences leads to biased estimates of the program causal effects. More worryingly, if FOs and smallholders characteristics are unbalanced across the treatment and control groups and differences are associated with the dynamics of the outcome variable, then they affect the difference in the outcome's time trends between the two groups. In that case, the parallel trend assumption does not hold, which leads to biased impact evaluation estimates of the conventional DID analysis.

Second, the program effect can be heterogeneous across individual characteristics or group characteristics, for instance gender group, in which case pre-treatment differences in observed characteristics can lead to non-parallel outcome dynamics (Abadie, 2005).

In responding to these econometric challenges, we drew on a broader set of identification strategies within the difference-in-differences (DID) method to evaluate the welfare effect of the P4P intervention. As a baseline, we started with the standard two period simple DID specification in (1);

$$Y_{ipt} = \alpha + \gamma d_t + \lambda t + \tau(d_t * t) + \mu_p + \varepsilon_{ipt} \tag{1}$$

where Y_{ipt} is per capita household consumption of smallholder i in FO p at time t, and d_t is the dummy for P4P program participation by smallholder i in FO p and t is the time dummy for the post-intervention period, λt is the time-series difference across periods, μ_{ip} is a cross-sectional difference across treated and control groups, and ε_{ipt} is an individual-transitory shock that has mean zero at each period, with the possibility of correlation in time. Our parameter of interest in (1) is τ, which represents a difference-in-difference treatment effect estimate of the P4P program. Identification of τ relies on the untestable assumption of parallel trend, which implies that $E(\varepsilon_{ipt}|d_t * t) = 0$. The lack of an explicit test for this assumption, however, raises the concern about the acceptability of τ as an exact program effect.

To overcome these challenges and thereby provide cogent causal evidence of the program, we employed alternative identification strategies of DID that relax the parallel trend assumption. In effect, we followed a class of DID models that matches treatment and control groups by adjusting for pre-program covariates (Abadie, 2005; Blundell et al., 2001; Heckman et al., 1997). Particularly, we applied a semi-parametric estimator due to Abadie (2005). This estimator relaxes the parallel trend assumption of the conventional DID model by allowing for the distribution of both observed and unobserved factors to differ between the treated and untreated. Identification of τ thus, obtains provided that the unobserved factors experience the same variation, on average, for treated and untreated groups (Abadie, 2005).[14]

It also allows for treatment effects to vary among individuals, a feature that helps us unpack the effect of the treatment for different groups of our sample households (gender groups and FO management team). We matched treatment and control smallholders on selected baseline

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[14] In the interest of brevity, we refer the interested reader to Abadie (2005) for an excellent treatment of the identification strategy of this estimator.

covariates including, but not limited to, the size of landholding, education, gender, access to alternative market, FO's initial capacity, and FO distance to the WFP warehouse.

Moreover, we extended (1) to a quantile DID method to estimate the distribution of treatment effects, and provide a wider indication of the welfare effects of P4P interventions. The variation of the treatment effect across the welfare distribution allowed us to describe the pro-poor or anti-poor bias of P4P. The models thus, afforded us unique advantages to ascertain whether the variation in treatment effect arises from the presence of elite capture within the program.

3. Result and discussion

In this section, we present results of P4P's welfare and distributional impacts from different empirical strategies. We will do so considering the following set of hypotheses. Theoretically, each or a combination of P4P components appears to have a significant implication for smallholders' welfare outcomes. Supply-side interventions obviously lift FOs capacity to aggregate products via improved management efficiency. Moreover, establishing the storage infrastructure not only increases product aggregation, but also adds value both through quality management and speculative storage. On the demand side, P4P's procurement bolsters market demand and raises commodity prices. Higher prices thus, not only earn greater income directly, but also provide an incentive to invest in productivity-enhancing technologies and practices, the latter of which, in turn, yields additional income (the quantity effect). Overall, production of larger quantities and selling at higher prices will eventually increase household welfare.

In what follows, we start with the presentation of the treatment effect estimates of the P4P intervention on the total transaction cost of selling maize produce and the area allocation for maize production i.e. an intermediary outcome and a production decision, respectively.

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Table2 reports statistically significant estimates of P4P's treatment effects on the transaction cost of selling maize and areas allocated to maize production, the latter being across two production seasons. In particular, the estimate of the DID estimator suggests that the P4P program has cut the total transaction cost of selling maize by ETB 4.25 among participating smallholders.[15] Moreover, we find that the program has increased area allocated to maize production by 1.8% and 6% in the first and second production seasons, respectively. Combined, these results support the hypothesis that P4P intervention has spurred an incentive to increase maize production among smallholders (a crop for which they receive a better price due to reduced transaction costs or due to WFP's local purchase).

Table2 about here

In the ensuing analyses, we present the welfare and distributional effects of P4P. Table3 reports estimates of the average treatment effect on the treated (ATT) of P4P from alternative DID identification strategies. We first analysed the treatment effect using traditional DID models. Within this context, we implemented a simple DID model and one that controls for pre-intervention observable characteristics of FOs and smallholders; respectively these are denoted as model_I and model_II. The covariates included various FO's capacity measures (access to long-term store, access to tent store and storage capacity), size of working capital, FO's size, FO's distance from WFP warehouses and size of a smallholder landholding. As many of these covariates have missing values, we imputed them using the multiple imputation methods of Rubin (1987). The imputed value is not the true value, even though the estimation techniques will treat it as such; it is rather the true value plus some measurement error, but the error has been rendered invisible (Wittenberg, 2017). Multiple imputation yields appropriate point estimates and standard errors, as

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[15] ETB stands for Ethiopian Birr (1USD≅ETB22 in May 2016).

it takes into account the differences in estimates between analyses run on different versions of the data and make use of the variance of the estimators within any of the complete versions of the data (ibid).

The estimate of the P4P impact from model_I is negative and statistically significant suggesting that the program has caused a reduction in per capita consumption by ETB214. The result lends support to the finding by Krieger (2014b), who used the same data set and identification strategy. However, we expect that this estimate is downward biased than the true causal effect as no observable and unobservable covariates are controlled for. A positive and statistically significant estimate of ETB32.76 emerges once we account for pre-program covariates in the extended model_II, suggesting a positive P4P impact on smallholder welfare. We still suspect that the downward bias is not fully eliminated as we have not yet accounted for the effects of unobservable covariates in driving the dynamics, possibly non-parallel, of the outcome variable.

We thus, extended the analysis to semi-parametric DID models due to Abadie (2005) to control for bias arising from the effects of unobservable. This model also helped us account for heterogeneity in treatment effect across various groups within our sample i.e. gender, membership in FO management as well as the gender of the household members who participate in the FO - whether one or both gender participate in FO.

According to the z-statistics, treatment effects are estimated to be positive and significant in all of the reported analyses (see estimates of Model_III, Model_IV, Model_V and Model_VI in Table4). The estimated treatment effects from these models ranged between ETB188.3 and ETB248.6, depending on the group for which we used to account for treatment effect heterogeneity.

We also find evidence of treatment effect heterogeneity across the groups alluded to above. Particularly, we observe that the program earns average household of mixed participation compositions additional per capita consumption of ETB171.9 compared to the average P4P household. Moreover, the program appears to earn the average P4P household with membership in FO management ETB271.3 higher per capita consumption compared to the average P4P household. Acknowledging that FO management constitutes part of the organization's elite, we argue that this result points to the existence of elite capture. However, the result shows that the average household with only female representation in the FO does not enjoy more benefits than the average P4P household suggesting that the program is gender-neutral.

Table3 about here

4. **Conclusion**

Improving market access for smallholder farmers by reducing transaction costs and information asymmetries have been long recognized to be priority policy. One of key mechanisms through which these could be achieved is by organizing smallholders in the form of FOs or by building the marketing capacity of existing FOs to increase farmers' bargaining power, reduce transaction costs and render economies of scale. Such an intervention is expected to integrate smallholder farmers in local and international markets and eventually open up opportunities to increase their incomes. A recent intervention of the World Food Program's (WFP) Purchase for Progress (P4P) pilot initiative to link smallholders to commodity markets is a case in point. Against this backdrop, we evaluated the impact of WFP's P4P interventions, which involved investment in FOs capacity to aggregate the staple commodity and add value as well as purchasing produce from FOs using guaranteed forward contracts. The P4P procurement and capacity support intervention at the FO

level afforded smallholder famers a value-added and forward market opportunity for their staple produce, the latter of which appears to bolster their income. Using the Ethiopian survey data, we estimated a causal welfare and distributional effect of the P4P intervention among smallholders. Our analysis shows that P4P interventions have raised per capita consumption of the participating smallholders suggesting that the program is achieving the intended outcome of raising smallholders' income. Estimates of this impact from our preferred models ranged between ETB188.3 and ETB248.6. Moreover, we ascertained that there is distributional bias of the welfare benefit of the P4P intervention. First, the analysis showed that smallholders who are members of FOs management capture a greater welfare benefit compared to the average participant. Second, the program's welfare effect has been concentrated at the top part of welfare distribution while those in the lower part of the distribution suffered welfare losses. In other words, the results show that the P4P intervention is not pro-poor but operated in favor of the non-poor. Acknowledging that FO management constitutes part of local elite, the combination of these findings suggest the existence of elite capture which drives the distributional bias of the P4P welfare effect. On other hand, we find that the program's welfare impact is gender-neutral in the sense that its effect is not gender-differentiated.

Overall, our results confirm that return to the WFP's investment in FOs capacities (human and physical capitals) to afford smallholder access to value added and forward market opportunities is positive although such benefit is not defended on equity grounds. The P4P welfare benefit would even be greater if P4P were complemented by additional interventions aimed at designing alternative incentive mechanisms to spur members' sustainable investments in their organization. One option would be to assist FOs to adopt a well-defined property right bundle, which includes a closed membership policy (restricted access right to non-members), establishment of a secondary

market for cooperative's shares (transferable and appreciable ownership right) and enforceable member pre-commitment mechanisms to spur greater incentive to invest in the FOs. There is also a clear need for transparent and broad-based participation in FO management decisions by smallholders to assure a more equal distribution of benefits.

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Appendix

Table 1: Baseline comparison of P4P participants and non-participants (2009)

Variable	P4P		Non-P4P		Difference	p-value
	Mean	SE	Mean	SE		
Size of FOs						
Membership size of FO	877.88	86.94	1173	855.45	295.14	0.030
Capital size of FO	2059955	80617	798198	256089	1261755	0.15
Capacity of FOs						
Access to storage facilities	0.97590	0.01693	98648	0.01351	-0.0106	0.63
Access to basic storage-granny	0.1234	0.0367	0.375	0.057	-0.2515	0.002
Access to long-terms storage	0.888	0.0351	0.698	0.054	0.1902	0.94
Access to tent storage	0.0246	0.017	0	0	0.0246	0.178
Storage capacity (size)	9933.9	1988.91	6294.61	983.66	3639.28	0.07
Household characteristics						
Gender	0.0320	0.0099	0.0326	0.0107	-0.0005	0.969
Education of household head						
Household size	6.214	0.1394	6.643	-0.139	0.031	
Production and marketing of maize						
Land size owned (ha)	1.2095	0.03258	1.246	0.0327	-0.03724	0.4212
Land allocated to maize (season 1)	0.1212	0.0137	0.1343	0.01495	-0.0131	0.52
Land allocated to maize (season 2)	0.5747	0.02313	0.59228	0.03579	0.01758	0.674
Transaction cost of maize sale (ETB)	30.61	13.06	17.5	5.603	13.11	0.319
Consumption						
Total expenditure (ETB)	16095.47	8674.582	6756.116	754.130	9339.355	0.313
Per capita expenditure (ETB)	2025.456	591.0264	1246.917	75.3073	778.5391	0.2245

SE- in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 2. DID estimates of P4P effects on selected intermediary outcomes

VARIABLES	Maize-area Season 1	Maize-area Season2	Transaction cost
Time	-0.00558	-0.0384***	6.565***
	(-1.352)	(-12.68)	(3.881)
treated	-0.0886**	-0.463***	14.83
	(-2.104)	(-16.02)	(1.169)
DID	0.0180***	0.0666***	-4.253*
	(3.102)	(15.18)	(-1.841)
Constant	0.525***	0.587***	-16.54*
	(17.02)	(28.14)	(-1.801)
Observations			912
R-squared	0.014	0.051	0.021

SE- in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table3. DID Estimates of Average Treatment of P4P on welfare

VARIABLES	Traditional DID Models		Abadie Semi-parametric Models			
DID	-214.0***	32.76***	247.6***	248.6***	227.4*	188.3**
	(-5.357)	(3.179)	(12.11)	(11.83)	(10.58)	(7.680)
Women_only				-42.92		
				(-0.472)		
Mixed membership					171.9*	
					(1.973)	
Member_managment						271.3**
						(4.762)
Constant	899.8***	490.1***				
	(5.751)	(10.22)				
Observations	1,163	1,163	1,163	1,163	1,163	1,163

Z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.