

Heterogeneous impacts of cooperatives on smallholders' commercialization behavior: Evidence from Ethiopia

(DRAFT)

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Abstract

This paper examines the impact of marketing cooperatives on smallholder commercialization of cereals using detailed household data in rural Ethiopia. We use the strong government role in promoting the establishment of cooperatives to justify the use of propensity score matching in order to compare households that are cooperative members to similar households in comparable areas without cooperatives. The analysis reveals that while cooperatives obtain higher prices for their members, they are not associated with a significant increase in the overall share of surplus cereal production sold commercially by their members. However, these average results hide considerable heterogeneity in the impact across households. In particular, we find smaller farmers tend reduce their marketable surplus as a result of higher prices, while the opposite is true for larger farmers.

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1. Introduction

It is increasingly recognized that the commercialization of surplus output from small-scale farming is closely linked to higher productivity greater specialization, and higher income (see Timmer (1997)). Furthermore, in a world of efficient markets, commercialization leads to the separation of household production decisions from consumption decisions, supporting food diversity and overall stability. At the macro level, commercialization has also been shown to increase food security and, more generally, to improve allocative efficiency (Timmer (1997), Fafchamps (2005)).

However, in the face of imperfect markets and high transaction costs, many smallholders are rarely able to exploit the potential gains from the commercialization (de Janvry et al. (1991), Key et al. (2000)). In the absence of mechanisms to cope with these constraints, smallholders are unlikely to participate in markets, or when they do, to realize the full benefits of participation. These challenges are particularly important in sub-Saharan Africa, where empirical evidence suggest that the proportion of farmers engaged in subsistence agriculture remains very high. Those that participate in markets often do so only at the margins because of high risks and costs associated (Jayne et al. (2006)).

Over the past decade, donors and governments have regained interests in collective action mechanisms to overcome smallholders' marketing constraints (Collion and Rondot (1998), World Bank (2003)), although the empirical record suggests varying levels of success (e.g. Uphoff (1993), Tendler (1983), Sharma and Gulati (2003), Neven et al. (2005), Damiani (2000), Chirwa et al. (2005), Attwood and Baviskar (1987), Bernard et al. (2006)).¹ This growing experience documents external and internal conditions under which these organizations may be more or less effective at serving their members. Less studied however, is the effective impact of collective action on the level of members' commercialization, as compared to their likely situation had they not been members. One reason is the inherent challenge of

¹ See also the several case-studies presented at a recent workshop on "collective Action and Market Access for Smallholders" organized by the CGIAR system-wide program on collective action and property rights (CAPRi) at: http://www.capri.cgiar.org/wks_marketrel.asp.

addressing selection biases in both the location and the membership of these organizations. This paper attempts to address this challenge by presenting evidence on the relationship between smallholder commercialization and collective action mechanisms in Ethiopia.

Since 1994, a pillar of Ethiopia's rural development strategy has been the active promotion of marketing cooperatives as a means of commercializing smallholder agriculture.² Accordingly, each *kebele*³ is expected to have a cooperative by 2010, through which 90% of the agricultural inputs and 60% of the agricultural outputs will be marketed. As of 2005, only 10% of inputs and surplus production are marketed through cooperatives, suggesting the need for further analysis to meet strategic expectations. It is in this context that this paper assesses the effective impact of cooperatives on smallholders' commercialization behavior.

Our analysis relies on propensity score matching techniques to properly identify the effect of cooperatives on their members, using a new dataset specifically designed to investigate commercialization behavior of Ethiopian smallholders. In particular, we use the strong government support for cooperatives and their target of one cooperative per *kebele* by 2010 to assume that the decision of where to establish a cooperative is exogenous to members themselves. If this is true, we can thus compare households living in *kebeles* with access to a cooperative to *similar* households living in comparable *kebeles* without access to a cooperative. At the time of survey, the extent of coverage was less than 35%, and can thus be viewed as an interim stage in the long-term target.

Our analysis shows that while cooperatives obtain higher price per unit of output for their members, cooperative members do not tend to sell more of their surplus output to the market. We further refine the analysis by investigating the heterogeneity of cooperatives' impact across households, and find that poorer

² In Ethiopia, empirical estimates are that 28% of the total agricultural output is commercialized (Dessalegn et al., 1998). More recent estimates suggest that among all Teff producers, only 38% sell part or all of their production. Similar estimates for the other cereals indicate even lower market participation rates (Alemu, Dejene, Gabre-Madhin (2006)).

³ In Ethiopia, *kebeles* or peasant associations (PAs) are the smallest administrative unit below the *woreda* (district) level. For purposes of comparison, *kebeles* correspond to villages in other countries.

households tend to sell *less* of their product when facing a *higher price* obtained as a result of their membership, while larger farmers tend to behave oppositely.

The remainder of this paper is organized as follows. Section 2 presents the institutional background linked to the recent development of smallholders' marketing cooperatives in Ethiopia. Section 3 presents the propensity score matching strategy adopted in the paper, followed by a brief description of the data use, in Section 4. The effective *kebele*-level and household-level matching procedures are detailed in Section 5 and results given in Section 6. In Section 7, we further refine the analysis by investigating cooperative's heterogeneous impact on smallholders' behavior. Section 8 concludes with a set of policy recommendations.

2. Recent cooperative development in Ethiopia

Cooperatives have a long and tumultuous history in Ethiopia starting from the Imperial era (19xx to 1973) and continuing through the military regime (the Derg, 1974-1991). The largely negative experiences with cooperatives led to their dissolution following the fall of the Derg, until 1994 when the Government of Ethiopia expressed renewed interest in collective action to promote greater market participation by smallholders (cf. Proclamations 85/1994 and 147/1998).⁴ Accordingly, "it has become necessary to establish cooperative societies which are formed of individuals on voluntary basis and who have similar needs for creating savings and mutual assistance among themselves by pooling their resources, knowledge and property; (...) it has become necessary to enable cooperative societies to actively participate in the free market system" (Proclamation 147/1998). This was later re-affirmed in the Sustainable Development and Poverty Reduction Program (SDPRP, 2002) and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP, 2005), in which cooperatives are given a central role in the country's rural development strategy.

⁴ Smallholders represent the vast majority of Ethiopian farmers: about 37% of the farming households in the country cultivate less than 0.5 hectares and about 87% cultivate less than 2 hectares. Only 12.8% of the farmers own more than 2 hectares of land and 0.9% own more than 5 hectares (CSA (2003))

In 2002, the Federal Cooperative Agency of Ethiopia was created to organize and promote cooperatives at the national level. As of today, its ambitious five year development plan (2006-2010) aims at providing cooperative services to 70% of the population by 2010, increasing the share of the cooperative input marketing up to 90%, and increasing the share in cooperative output marketing to 60% (from 10% in 2005). This is expected to be achieved through the establishment of primary cooperatives in each *kebele*, and bolstered by the establishment of 500 new cooperative unions (from 100 at present), six cooperative federations, and a cooperative league (Federal Cooperative Agency of Ethiopia (2006)).

As a result of this policy thrust, cooperatives have expanded rapidly in Ethiopia. However in 2005, nearly 65% of the *kebeles* still do not have such an organization: on average, these are *kebeles* with lower market access. Moreover, participation into cooperatives remains limited: only 17% of households living in *kebeles* with a cooperative are members. Although cooperatives are not meant to be selective, participants tend to be better-off in terms of physical and human capital (Bernard et al., 2007).

Overall, these results suggest –as expected- that direct intra-*Kebele* comparisons of members with non-members will lead to bias estimates;⁵ the same is true for a simple comparison of households in *Kebeles* with and *Kebeles* without cooperatives. Instead, we propose in the following section a two-step propensity score matching approach to overcome biases due to both the location of the cooperative and the self-selection of members into these organizations.

3. Empirical strategy

We saw in the previous section that relatively better-off households tend to participate more in cooperatives. However, other non-observable aspects may also be at play, such as the household's risk preference, its entrepreneurial spirit, or its relationship to other cooperative members. Thus, a simple comparison between

⁵ Although it is difficult a priori to sign the bias of the direct effect of cooperatives on their members commercialization behavior, it is likely that cooperatives exert spillover effects in their communities (e.g. non-members are sometimes allowed to sell their output through the cooperative), leading to a downward bias on the estimate of their impact on members.

households that are members of a cooperative, with household that are not members, even within the same *kebele* and after controlling for observable characteristics, would lead to biased estimates. This is due to the fact that because people self-select into cooperatives, the observed differences between members and non-members may either totally or partially reflect original differences between members and non-members, instead of the effects of the cooperative as such.

To overcome this selection bias, a proper evaluation would require a comparison at the same point in time between (a) the commercialization behavior of a given household when it is a member of a cooperative and (b) the commercialization behavior of the same household when it is not member of the cooperative. Obviously, such double observation is not feasible. Instead, we propose here to use propensity score matching techniques, as exposed in Rosenbaum and Rubin (1983), or later in Heckman et al. (1997, 1998), and now used extensively in the economic evaluation literature (Jalan and Ravallion (2003)). In studies on agriculture and rural development, applications of these techniques include for example impact assessments of farmers field schools (Gotland et al. (2004)) and community driven development (Rao and Ibanez (2003)), or assessments of infrastructure investments such as pipe water (Jalan and Ravallion (2003)) and road rehabilitation (Van de Walle and Cratty (2002)).

We propose here a two-step propensity score matching approach to overcome biases due to both the location of the cooperative and the self-selection of members into these organizations. In our setting, the propensity score $p(x)$, is defined as the probability that a given household would participate in a cooperative, given a set of observable characteristics, x . The underlying assumption is that, conditional on the propensity score, members and non-members of the cooperatives become comparable. However, since x may only capture a household's observable characteristics despite the fact that less directly observable factors may be influencing the household's decision to join a cooperative (e.g., the household's social capital stock), the distribution of unobservable characteristics may systematically differ

between members and non-members, leading to a biased estimate of the impact of cooperatives.⁶

These potential sources of bias can be overcome by comparing cooperative members to households with similar propensity scores living in comparable *kebeles* without cooperatives. However, non-observable factors may also be at play in the location of cooperatives. In particular, in the case of member-created cooperatives, such organizations are often associated with the presence of effective leadership or other community-specific factors that enable such a group to emerge independently of exogenous policy targets. As such, observed differences in marketing behavior between households that are members of cooperatives and similar households in *kebeles* without cooperatives would lead to biased estimates, even after controlling for the *kebeles'* observable characteristics.

In Ethiopia however, most cooperatives were initiated under the impulse of an external partner: 63% were created by government institutions, 11% by donor agency or NGOs, and only 26% by members themselves. Dropping from our sample those *kebeles* in which cooperatives were member-created, we assume that the establishment of cooperatives is exogenous from communities' unobservable characteristics⁷ as well as from that of their members. It follows that differences in unobservable characteristics between cooperative members and households with similar propensity score (but living in *kebeles* without cooperatives) is considered as random and will not bias the estimator. This is represented in equation (1) below, where y is the measured outcome (for example, the percentage of the household's production that is commercialized); c is equal to 1 for the households living in a

⁶ Other sources of bias when comparing members and non-members within the same *kebele* may come from the likely existence of spillover effects of the cooperative's activity on non-members. For example, we sometimes observe that non-members are allowed to sell their output through the cooperative. In other cases, a successful cooperative may exert market pressures on local traders through increased competition. Finally, non-members may benefit from economic dynamism generated by a cooperative in its community (e.g. through processing activities). Overall, these spillover effects will tend to exert a downward bias on the measure of the cooperatives impact of their members.

⁷ This assumption is further supported by the government's objective that there should be one primary cooperative in each PA of the country, by 2010, such that the present extent of cooperative coverage can be thought of as an intermediate stage in the phasing-in of a nationwide cooperative coverage plan.

kebele where there is a cooperative and 0 otherwise; and the subscripts c and ϕ denote participation and non-participation, respectively.

$$E[y | c = 1, p(x)] - E[y | c = 0, p(x)] = E[y_c - y_\phi | p(x)] \quad (1)$$

It can be argued that even though households are fully comparable, certain environmental conditions may also affect the cooperative's impact on their marketing behavior. We address this issue by matching *kebeles* with and *kebeles* without cooperatives that share similar sets of development constraints and opportunities, using the development domains developed for Ethiopia by Chamberlain, Pender and Yu (2006) and discussed in detail later.⁸

One may also argue that households need to have access to the same markets for the propensity score to provide reliable estimates of the cooperatives' impact (Heckman et al, (1997, 1998)). Although several studies have found that market integration has significantly increased in Ethiopia since the early 1990's liberalization (Dercon (1995), Negassa and Jayne (1997), Negassa (1998)) it is likely that geographic location still matters. However, as will be shown below, in the sample retained for this analysis, *kebeles* with and *kebeles* without cooperatives are quite evenly distributed across the territory, suggesting that such bias—if it exists—is of limited importance.

4. Data

We apply the above-described empirical analysis using a new dataset specifically collected to investigate commercialization behavior of Ethiopian smallholders. The Ethiopian Smallholders Commercialization Survey (ESCS) was jointly designed by the International Food Policy Research Institute, the Ethiopian Development Research Institute, and the Central Statistical Agency of Ethiopia, and aims to provide support to in-depth analysis of smallholders' commercialization behavior. Data were collected over the summer 2005, and include 7,186 households randomly drawn from

⁸ These domains are calculated through threshold in four variables (altitude, population density, distance to the closest market, moisture availability) that best capture the heterogeneity of farmers' livelihoods in Ethiopia.

293 *kebeles*. The sample is considered representative at the national level as well as at the regional level for four regions: Amhara, Oromia, SNNP⁹ and Tigray.

At the community level, the ESCS collected information on population, infrastructure, markets prices, institutions and development programs. At the household level, the ESCS covered a large number of issues, including demographics, human capital stock, employment, land production and input use, crop and livestock production and disposition over the previous 24 months, marketing channels and contractual arrangements, physical assets, social capital and participation in cooperatives, as well as primary informations on the cooperative itself. Note, however, that the ESCS did not collect information on household consumption and expenditures.

Among the 293 *kebeles*, 147 had at least one cooperative at the time of the survey. However, only *kebeles* with externally-created cooperatives were considered here in order to satisfy the assumptions set forth in the previous section. Overall, 77 *kebeles* with only externally created cooperatives identified and designated as the “treatment group” for this study. The remaining 146 *kebeles* were thus designated as the “control group”. As will be discussed in the next section, the final sample used in the analysis was further reduced to ensure that estimates properly capture the impact of cooperatives per se.

5. Matching

In this section we detail the matching procedure. We propose a two-step matching procedure where we first match *kebeles* with cooperatives to similar ones without cooperatives (5.1), before matching members of cooperatives to households that would have possibly participated had they had access (5.2).

5.1. Matching *kebeles*

As mentioned above, we consider the present allocation of cooperatives to be exogenous and are thus able to conduct a simple matching of *kebeles* based on selected observable characteristics. However, this assumption can only hold for

⁹ Southern Nations, Nationalities, and Peoples Regional State

kebeles where no cooperatives were created by members themselves, reducing our overall sample from 293 to 223 *kebeles*. To add to the robustness of our estimations, we also remove from the sample the 11 *kebeles* where households are said to have access to cooperatives in nearby *kebeles*. Overall, our sample consist of 66 *treatment kebeles* (where at least one cooperative can be found), and 146 *control kebeles* where no cooperatives exist.

The next step is to ensure that the treatment *kebeles* are sufficiently comparable to the control ones. To do so, we apply the notion of development domains provided by Chamberlain, Pender and Yu (2006) to the *kebele* level.¹⁰ Development domains are defined as geographic locations sharing broadly similar rural development constraints and opportunities. The classification is based on the combination of four characteristics that best capture the heterogeneity of livelihood heterogeneity among smallholders in Ethiopia. These characteristics are altitude, population density, distance to the closest market and moisture reliability. Their aggregation is based on thresholds established to maximize the predictive power of the domains. Although a recent analytical innovation, the development domain framework is increasingly used by various government and donor agencies involved in rural development in Ethiopia.

In our sample, *kebeles* can be classified into 22 different domains. To test the validity of these domains as predictors for the existence of cooperatives (again, only the ones created by the government or by another external partner), we use a Probit estimation where the independent variable is the existence or absence of a cooperative, and the independent variables are dummy variables for each of the domains. Overall, this test performs relatively well in that domains successfully predict 70% of the existence of cooperatives. Table 1 below presents the distribution of our treatment and control *kebeles* across the 22 different domains.

Table1. Treatment and control *kebeles*, by development domains

	Domain	% Control <i>kebeles</i>	% Treatment <i>kebeles</i>
1	Highland, moisture reliable, high market access, high population density	8.97	13.64

¹⁰ Chamberlain, Pender and Yu (2006) calculate domain at the Woreda (district) level. Using their framework, we have re-calculated domains at the Kebele (village) level.

2	Highland, moisture reliable, high market access, medium population	24.83	21.21
3	Highland, moisture reliable, high market access, low population density	2.07	4.55
4	Highland, moisture reliable, low market access, high population density	4.14	0.00
5	Highland, moisture reliable, low market access, medium population density	20.00	10.61
6	Highland, moisture reliable, low market access, low population density	2.76	0.00
7	Lowland, moisture reliable, high market access, medium population density	3.45	1.52
8	Lowland, moisture reliable, high market access, low population density	0.69	0.00
9	Lowland, moisture reliable, low market access, medium population density	1.38	3.03
10	Lowland, moisture reliable, low market access, low population density	4.83	0.00
11	Highland, drought prone, high market access, high population density	1.38	1.52
12	Highland, drought prone, high market access, medium population density	2.76	12.12
13	Highland, drought prone, high market access, low population density	1.38	1.52
14	Highland, drought prone, low market access, high population density	1.38	1.52
15	Highland, drought prone, low market access, medium population density	3.45	13.64
16	Highland, drought prone, low market access, low population density	2.07	3.03
17	Lowland, drought prone, high market access, high population density	1.38	0.00
18	Lowland, drought prone, high market access, medium population density	0.69	3.03
19	Lowland, drought prone, high market access, low population density	2.67	1.52
20	Lowland, drought prone, low market access, medium population density	2.07	3.03
21	Lowland, drought prone, low market access, low population density	4.83	3.03
22	Lowland, pastoralist, high market access, low population density	2.76	1.52
		100 % (146 obs)	100 % (66 obs)

Next, according to our matching procedure, we need to ensure that a sufficient number of treatment and control *kebeles* exist within each domain. It appears from Table 6 that five domains (1, 2, 5, 12 and 15) capture more than 70% of the *kebeles* with at least one externally created cooperative, while the remaining 30% are dispersed among 12 of the remaining 17 domains. It also appears that these five domains include enough control *kebeles* to perform the analysis. Finally, although selective, these five domains are quite heterogeneous, with the only domain attribute not represented being the lowland areas. Some domains are highland moisture-reliable domains (1, 2, 5) while the others are highland, drought-prone domains (12 and 15); some have high market access (1, 2, 13) while the others are more remote (5 and 12); most have medium population density (2, 5, 12, 15), while one is more

densely populated (1). Overall, we further refine our sample by focusing on treatment and control *kebeles* within these five development domains.

To further check the sample’s validity, we present in Table 2 the distribution of treatment and control *kebeles* across the administrative regions of Ethiopia. Indeed, despite the existence of a Federal Cooperative Agency, the Regional Cooperative Offices are the ones deciding where and how cooperatives should be promoted, through directives passed to *woreda* cooperatives offices. As a result, there are important differences in cooperative development across regions (see Bernard et al. (2007) for detailed descriptions) which may need to be accounted for in the present analysis.

Table 2. Treatment and control *kebeles*, distribution by region

	Tigray	Amhara	Oromia	Beneshangul - Gumuz	SNNP	Harari	Total
Control <i>kebeles</i>	1	25	37	1	22	1	87
Treatment <i>kebeles</i>	14	8	19	0	6	0	47

As shown in Table 2, only three regions—Amhara, Oromia and SNNP—display a relatively balanced sample between treatment and control *kebeles*. In Tigray however, only one *kebele* was missing a cooperative in 2005,¹¹ while Beneshangul-Gumuz and Harari only have one *kebele* included in the sample. A further refinement of the sample may thus be limited to Amhara, Oromia and SNNP regions. In Table 3, we test the balancing properties of both samples –including and excluding Tigray, Beneshangul-Gumuz and Harari. Indeed, as was discussed in Section 3, the appropriateness of the sample used is based on whether the treatment *kebeles* are comparable to the control ones.

Table 3. Balancing tests: Treatment and control *kebeles*

	Sample with all regions	Sample with Amhara, Oromia and SNNP only

¹¹ As shown in Bernard et al. (2007), 85% of the Kebeles had a cooperative in 2005, while the national average attained 35%.

	Control <i>kebeles</i>	Treatment <i>kebeles</i>	Difference: p>t	Control <i>kebeles</i>	Treatment <i>kebeles</i>	Difference: p>t
Population	4584.66	5454.64	0.0693	4566.45	4713.06	0.7812
% female-headed hh	14.65	21.43	0.0201	14.64	18.27	0.2666
% hh Orthodox	45.41	57.85	0.1500	44.60	42.61	0.8327
% hh Muslim	40.31	25.52	0.1313	39.85	33.14	0.5445
% hh speak Amharic	54.21	46.55	0.2910	56.02	59.85	0.6316
Commercial bank	11.49	12.76	0.8301	11.90	18.18	0.3782
Micro-fī institution	25.28	46.80	0.0111	23.80	30.30	0.4734
Importance Shimagile	48.81	46.00	0.8629	46.69	50.96	0.4266
Number of DAs	1.76	2.54	0.0004	1.77	2.06	0.1958
PSNP	26.43	38.29	0.1574	25.00	27.27	0.8021
Primary school	87.35	91.48	0.4727	86.90	87.87	0.8884
Seasonal/dry road	52.87	68.08	0.0897	53.57	57.57	0.6984
Safe water	44.82	65.95	0.0193	45.23	54.54	0.3688
Number obs	87	47		84	33	

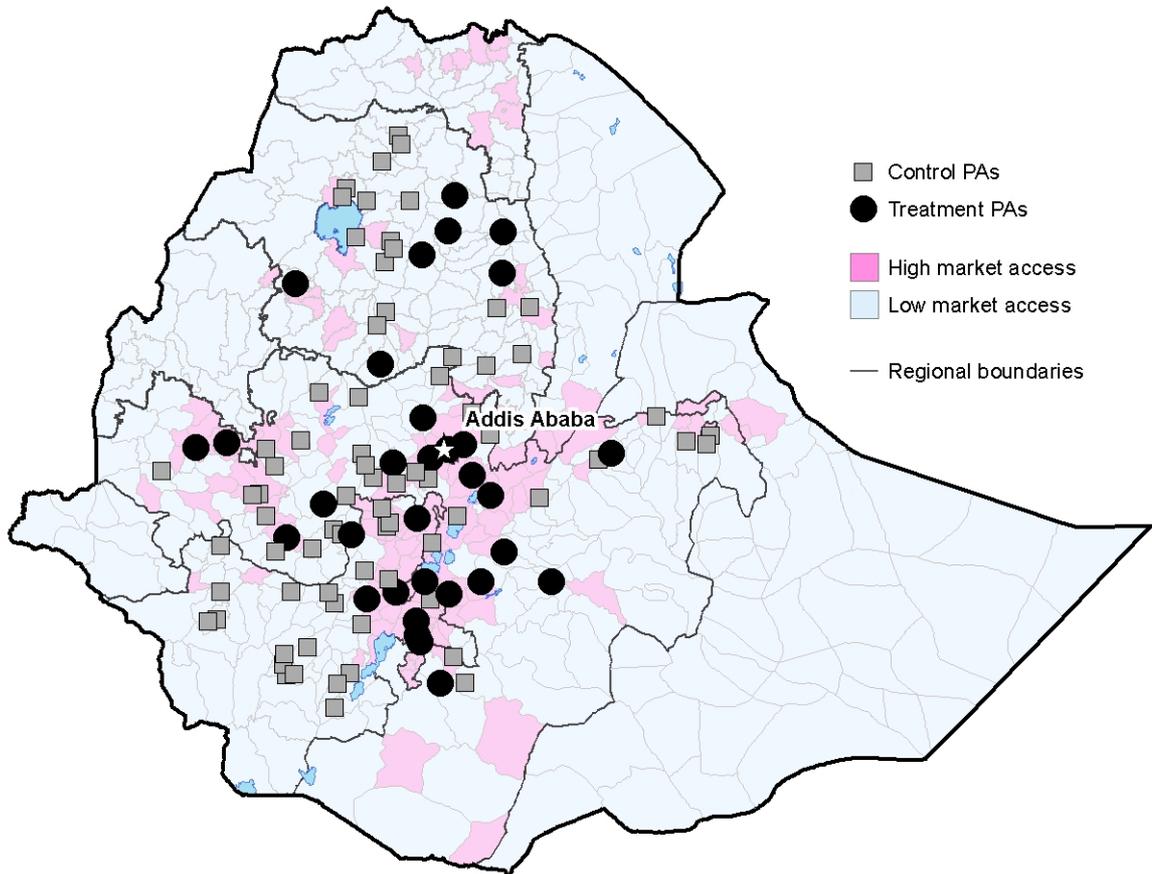
* In bold, differences significant at the 10% level

As shown in Table 3, the sample using all regions performs poorly, evidenced by a significant difference between treatment and control *kebeles* in 50% of the tests performed. By comparison, the sample restricted to Amhara, Oromia and SNNP performs relatively better, as the *kebeles* are on average similar in all dimensions covered by these tests. As such, we reject the suitability of the full sample and restrict ourselves to the sub-sample comprised of three regions which includes 33 treatment and 84 control *kebeles*.

One last validity check is undertaken to ensure that treatment and control *kebeles* correspond to sufficiently similar locations, i.e., that the treatment and control observations are facing the same markets for their comparisons to be valid. Indeed, in the case where the treatment *kebeles* are clustered in areas different from the control *kebeles*, one could argue that the estimated differences between treatment and control reflect more local conditions than impacts of the cooperatives.

Figure 1 shows the geographic location of each *kebele* in our sub-sample against a background shading that indicates the level of market access for each *kebele* based on the development domain calculations. We find that (a) treatment and control groups are geographically mixed, thereby ensuring that the impact of cooperatives will not be driven by area-specific characteristics, and (b) the distribution of treatment and control *kebeles* by level of market access is also fairly balanced.

Figure 1. Geographical location of Treatment and Control *kebeles* (PAs)



5.2. Matching households

As a result of the above exercise, the sub-sample now includes a total of 2,614 households, of which 1,798 are in control *kebeles* and 816 are in treatment *kebeles*, of which 142 are cooperative members (Table 4). Although the sub-sample still includes a majority of the initial treatment *kebeles*, our efforts to increase robustness comes at the expense of national representativeness of the results. The purpose of this paper is

not, however, to draw nationally representative conclusions, but rather to highlights the behavioral responses of households to cooperative membership.¹²

Table 4. Distribution of households across treatment and control *kebeles*

	Control <i>kebeles</i>	Treatment <i>kebeles</i>	Total
Non cooperative members	1798	674	2472
Cooperative member	0	142	142
Total	1798	816	2614

Recall that the rationale for propensity score matching is to compare households that are members of cooperatives with households in *kebeles* without cooperatives that would have *probably* been members, had they had access to such an organization. In other words, we will match the 142 household members in the treatment *kebeles*, or the “treated households,” to households among the 1,798 in the control *kebeles* that most resemble them. For this, we first estimate each household’s “propensity score” or likelihood of joining a cooperative in the treatment *kebeles*, using a flexible Probit model where the dependent variable is membership status. Domain fixed effects are used to ensure matching within the domains.¹³ Household characteristics include measures of the household’s assets (education level, radio ownership, non-farm income, land holding, livestock, etc.) introduced linearly as well as quadratically to augment the model’s predictive power. Finally, a set of dummy variables are included to account for the household’s cultivation of a particular cereal crop.^{14, 15}

¹² The purpose of this paper is not, however, to draw nationally representative conclusions, but rather to highlights household’s behavioral response to their participation into cooperatives.

¹³ Alternatively, one could have performed the matching separately for each domain (and eventually proceed similarly for the estimation of the Average Treatment Effect (ATT) of cooperative membership on household behavior). However, as is clear from this relatively small sample of treated observations, this would have been too constraining on the data.

¹⁴ All households in this sample are involved in cereal production.

¹⁵ One may argue that involvement in a particular cereal’s production may well be a response to participation into the cooperative. As such, the estimated impact may be downward biased as it may not take into account a household’s change in production towards higher profit products. However, the purpose of the present paper is to investigate the cooperatives’ impact on smallholders’ marketing behavior. As such, one wants to compare marketing behavior of households engaged in similar production, whether or not this was driven by the cooperative.

The Probit estimation is better identified when undertaken on treatment *kebeles* only where the choice to join a cooperative does exist. We report estimates of the coefficients in Table 5. We also report the associated p-values although the purpose here is not to identify particular relationships, but rather to maximize the predictive power of the model. We find that the model correctly predicts 85% of the observed membership in cooperatives.

Table 5. Probit estimation of determinants of cooperative participation

	Coefficient	p-value		Coefficient	p-value	
Age of households head	0.012	0.006	Number of small ruminant	0.040	0.180	
Gender of household head	-0.606	0.002	(Number of small ruminant	-0.000	0.850	
Household head reads	-0.003	0.979	Number of poultry owned	0.013	0.685	
Households size	0.063	.0631	(Number of poultry owned) ²	-0.000	0.673	
(Household size) ²	-0.004	0.683	Produces teff	0.297	0.043	
Radio ownership	0.087	0.550	Produces wheat	-0.065	0.693	
Household receives non-farm	-0.103	0.438	Produces maize	-0.270	0.099	
Number of hectares held	0.600	0.000	Produces barley	-0.653	0.000	
(Number of hectares held) ²	-0.058	0.018	Produces Sorghum	-0.176	0.227	
Number of oxen owned	0.049	0.734	Produces oats	-0.798	0.162	
(Number of oxen owned) ²	0.004	0.876	Produces dagussa	-0.556	0.026	
Number of cattle owned	0.019	0.701	Development domain	yes		
(Number of cattle owned) ²	-0.002	0.403	Constant	-1.399	0.023	
Number of observation :	782		Non-member	Member	Total	
Pseudo-R ² :	0.2668		Predicted	614	93	707
Correct prediction rate:	85%		Predicted	28	47	75
			Total	642	140	782

These coefficients are then used to generate propensity scores for the households living in control *kebeles*, determining which would have *probably* participated had they had access to a cooperative. On the basis of these propensity scores, households participating into cooperatives are matched to *similar* ones living in *kebeles* without access to such an organization.

In addition, the present estimations are limited to cereals, which production is largely driven by soil and weather conditions in Ethiopia (Teff is mainly cultivated in highland areas north of Addis Ababa, Maize in the lowlands south of Addis Ababa, Sorghum in the North-West and the East, Barley along a North-South meridian in the middle of the country (Atlas of the Ethiopian Rural Economy (2006) p 59). Finally, all the estimations presented here were also performed without cereal dummies included, as well as with the actual level of each production. In all cases, there was no significant change in the results.

Several matching techniques can be used to match treatment and control households. Here we focus on two broadly-used methods, namely (i) non-parametric Kernel regression matching proposed by Heckman, Ishimura and Todd (1998), and (ii) five nearest neighbors matching. In the first case, each treated household is matched with the entire sample of controls. However, each control observation enters the estimate with a weight inversely proportional to its distance to the treatment one based on the propensity score distribution. In the second method, each treatment observation is matched with an average value of its five nearest control neighbors, again based on the propensity score distribution. To ensure maximum comparability of the treatment and control groups, the sample is restricted to the common support region, defined as the values of propensity scores where both treatment and control observations can be found.

A straightforward way to test the validity of the matching procedure is to compare an average household's characteristics within the treatment sample to the corresponding characteristics of the control group generated. Accordingly, the absence of significant differences between the treatment and control groups suggests a valid matching. We thus undertake a series of statistical tests for differences in household characteristics on three different samples: (a) cooperative members in treatment *kebeles* compared to all households in the control *kebeles* (an unmatched sample); (b) cooperative members in treatment *kebeles* compared to a subset of households in the control *kebeles* with kernel-based matching; and (c) cooperative members in treatment *kebeles* compared to a subset of households in the control *kebeles* selected through the five-nearest neighbors matching method.

As shown in Table 6, the unmatched sample fails to satisfy the balancing properties in that households in treatment *kebeles* are on average significantly different in several aspects from the households in the control *kebeles* (column 1). However, when we use kernel-based matching, no such significant differences appear after kernel-based weights are attributed to control observations (column 2). Finally, in the case of the five-nearest neighbors based matching, only two significant differences are observed, in the gender of the household head and the number of ruminant owned. Overall, these results suggest that matched samples are adequate to perform an impact analysis, whereas the non-matched sample is not.

Table 6. Balancing tests of matched samples

	(1) Unmatched samples			(2) Kernel-based matching			(3) 5 nearest neighbors matching		
	Treatment <i>kebeles</i> households	Control <i>kebeles</i> households	Diff: p- value	Treatment <i>kebeles</i> households	Control <i>kebeles</i> households	Diff p- value	Treatment <i>kebeles</i> households	Control <i>kebeles</i> households	Diff: p- value
Age head	48.529	42.993	0.000	48.28	49.52	0.519	48.28	49.29	0.598
Gender	1.10	1.18	0.012	1.10	1.06	0.220	1.10	1.04	0.043
Head	0.37	0.31	0.104	0.38	0.34	0.542	0.38	0.36	0.705
Household	6.05	5.14	0.000	5.93	5.82	0.689	5.93	5.81	0.675
Radio	1.41	1.21	0.000	1.39	1.34	0.455	1.39	1.34	0.480
Non-farm	1.50	1.54	0.421	1.50	1.54	0.461	1.50	1.54	0.526
Land	2.186	1.35	0.000	2.05	2.17	0.465	2.05	2.19	0.386
Oxen	1.67	0.89	0.000	1.54	1.45	0.588	1.54	1.54	0.980
Cattle	5.30	3.42	0.000	4.97	4.63	0.468	4.97	4.87	0.839
Ruminan	3.32	2.47	0.012	2.81	3.70	0.109	2.81	3.89	0.052
Poultry	3.69	2.06	0.000	3.69	3.11	0.253	3.69	3.13	0.263
Cereal	1156.8	682.76	0.000	1086.8	1018.6	0.628	1086.8	1042.2	0.765

• In bold: difference is statistically significant at a 10% level

6. Average impact of cooperatives

This section presents estimates of the average impact of cooperatives on smallholders' commercialization behavior in Ethiopia. We start by defining the dependent variables used in the estimations (6.1), before turning to the results per se (6.2).

6.1. Measures of smallholders' commercialization behavior.

Several types of indicators can be used to capture commercialization behavior. Commercialization behavior may encompass both the conditions under which a given level of output is sold to market and the composition of output per se (Alemu, Gabre-

Madhin and Dejene (2006)). Indeed, a farmer's involvement in cash crop such as coffee or khat rather than in staple crops such as cereals may by itself reflect the commercial orientation of the household. In this paper however, we focus on the cooperatives' capacity to provide market access to smallholders for output of major cereals (teff, sorghum, oats, maize, barley, wheat and millet).¹⁶ Our sample is therefore slightly reduced by focusing only on cooperatives that have a stated involvement in the commercialization of cereals.¹⁷

Here the impact of cooperatives on smallholders' commercialization is assessed through two types of indicators. We first consider a variable measuring the share of the cereal production that was sold in 2005, denoted *PS*. The expected outcomes are slightly ambiguous. Indeed, if cooperatives provide their members with a better price for their output, it may be the case that members' liquidity constraints are relaxed for a lower level of output sold. In this case, the effect of cooperative membership on the percentage of production sold would be negative for households that are most cash-constrained due to the income effect. We return to these effects in Section 7 below.

We then use a price indicator to capture whether cooperatives enable their members to obtain a higher price for their output. Although it may not fully capture the individual farmers commercialization behavior, it is a fundamental indicator since cooperatives promotion policies often rely on the assumption that collective action can help smallholders increase their bargaining power in the market. The price indicator that we use is a weighted average of the difference between the price received by the household member for each type of cereal sold, and the average price in the sample. This is described in the expression below, where PD_i is the household-level price indicator, L_i is the total quantity of land allocated to marketable surplus in cereals in the 2005 season, l_{ij} is the proportion of this land that is allocated to cereal j and sold by the household, p_{ij} is the price received by this household for product j ,

¹⁶ It should be noted that 98% of grains produced in Ethiopia are produced by smallholders, of which 80% are cereals (Gabre-Madhin (2001)). As such, the present estimations are likely to reflect the general situation of non-pastoralist smallholders in the country.

¹⁷ It should be noted that 25% of the cooperatives officially engaged in the marketing of agricultural output had not sold between 2004 and 2005. However, this is mainly driven by cooperatives in Tigray (55%) and less by the three regions included in the present sub-sample (less than 20%) (see Bernard et al. (2007)).

and \bar{p}_j is the average price received by the households sampled, for one kilogram of product j .¹⁸

$$PD_i = \frac{1}{L_i} \sum_j l_{ij} \cdot (p_{ij} - \bar{p}_j)$$

One can argue that the use of the sample average as the reference point is problematic in that it would lead to an upward bias when measuring the impact of cooperatives. If cooperatives are located in areas with higher prices to start with, a higher price for cooperative members may wrongly be attributed to the cooperatives and instead of local conditions. However, the use of local prices as the reference points may itself lead to downward bias, in that cooperatives are likely to exert spillover effects on local prices—either directly when they provide marketing services to non-members, or indirectly through increased competition for traders. To avoid such biases, zonal or regional-level aggregates as the reference point instead of the entire sample might be recommended. In this case however, the relatively small size of our sample at the zonal level as well as in some regions would provide us with imprecise estimates of the mean price. This in turn may severely affect the precision of our estimates.¹⁹ Overall, the best evidence in support of the use of a sample-wide average is provided by the map in Figure 1, which shows relatively clearly that treatment and control *kebeles* are geographically well-balanced, such that local effects should be observed in similar magnitudes in both treatment and control samples.

6.2. Average impact of cooperatives on their members

¹⁸ In this indicator, the aggregation process across crops is meant to capture the effects of the household's crop production profile. L_i and l_{ij} were proxied using the quantity sold by the household for each crop, and the national average yields for these crops computed by CSA for the years 2003 and 2004. Note however that all price-related estimations were also performed on non-weighted aggregates without significant effects on the results.

¹⁹ As a robustness check, we have also run all the following estimations on the sub-sample of Kebeles from the Oromia region only. Indeed, Oromia is the only region in our sample which offers a large-enough sample size (both in terms of cluster (Kebeles) and in terms of observations (households)) to obtain a relatively precise estimate of the mean price received by farmers. The results, although slightly greater in magnitude, were similar in their sign and statistical significance as the ones below.

Based on the matched sample, we compute measures of cooperatives' impact on their members' commercialization. The "average treatment effect on the treated" (ATT) measures the average difference between members' commercialization indicators and the commercialization behavior of their corresponding match. Because analytical standard errors are not computable for the Kernel density matching methods, we use 100 bootstrap replications stratified at the development domain level to compute robust estimates for them. Note that the bootstrapped standard errors for the five-nearest neighbor estimator are very close to their analytical counterparts. For clarity, we only report the bootstrapped estimates in Table 7.

We start with the price difference (PD) indicator and find that on average, cooperative members receive 7% higher prices for their cereal products than their non-member counterparts. This effect is statistically significant and robust across both matching techniques. Although surprisingly large, this effect is consistent with the idea that cooperatives are able to exert greater bargaining power over traders, or are able to reach more attractive markets. Turning to the share of production sold (PS) however, we find that cooperative membership does not have an impact significantly different from zero.

Table 7. Effect of cooperatives on members' cereals commercialization

	Kernel-based matching		5 nearest neighbors matching	
	ATT	Std. error	ATT	Std. error
% Price Difference (PD)	6.745	2.868**	7.608	4.321*
% Production Sold (PS)	0.601	2.046	0.930	2.531

N.B. Stratified bootstrap with 100 replications are used to estimate the standard errors

** Significant at 5%, * significant at 10%

The overall conclusion from these estimates is somewhat surprising: despite a higher average price received for their outputs, cooperative members tend not to supply more of their production to the market.

It is possible that these results reflect the troubled history of cooperatives in Ethiopia, and the fact that distrust of cooperatives persists among members and non-members alike. Information obtained through key informant interviews and a

subsequent survey of cooperatives in Ethiopia suggest that suspicion and wariness of cooperatives has continued beyond the era of the Derg regime when cooperatives were used to extend strong government control to the local level and promote socialist ideology through compulsory participation.. The above results could therefore be driven by a slow process of trust recovery into these organizations. Having said this, it can also be argued that commercialization indicator captures the *total* amount of cereals sold by the farmers, and is *not* restricted to sells through the cooperative. Moreover, since the median age of the cooperatives in this sample is over 7 years old, it can be argued that members would have had sufficient time to update their perceptions and expectations of their cooperatives in light of the present Government's strategies.

A more likely explanation may lie in the heterogeneous impact of cooperatives across households, driven by different behavioral responses to these higher prices. Specifically, some households may choose to sell less and retain more for their own consumption since they are compensated by higher revenues from the higher price. The next Section proposes a simple analytical model to illustrate this argument.

7. Heterogeneous impact of cooperatives

The results presented in Table 7 are averages and as such do not capture the heterogeneity of impact across households. There is however no reason to believe a priori that membership in a cooperative will imply homogenous responses for different categories of farmers. To see this, we plot in Figure 2 the density distributions of cooperatives' impact on members' percentage production sold (upper graph) and on output prices (lower graph).^{20,21}

As expected, the figure displays a great amount of heterogeneity in members' response to their participation into cooperatives. We note in particular that some cooperative members' share of production sold (PS) is almost double the level of

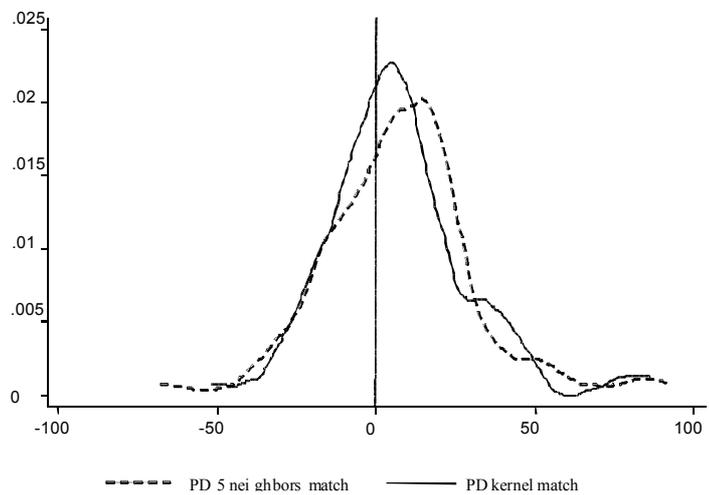
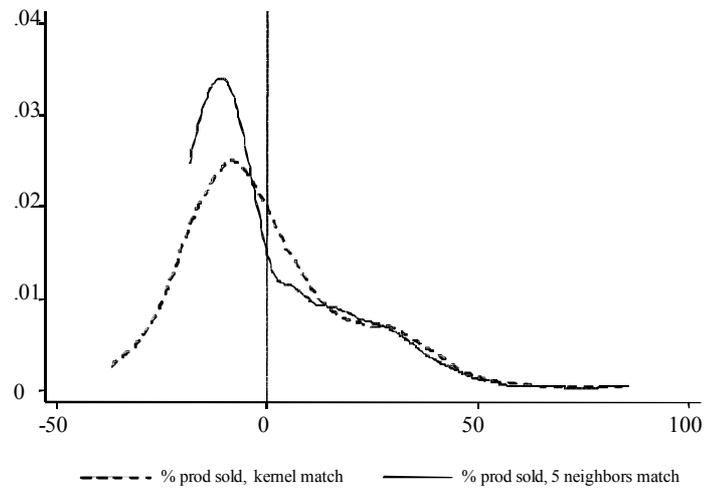
²⁰ Let PS measure the household's share of production sold and \bar{PS} the share of production sold by its generated counterfactual, the curves in the upper graph represent the distribution of $PS - \bar{PS}$. Similarly, the distribution of $PD - \bar{PD}$ is represented in the lower graph.

²¹ We note that the two matching techniques employed are relatively close to each other in their assessment of the individual impact.

their non-member counterparts. However, for a large number of other members, this level is significantly lower than their estimated counterparts, despite higher prices within the cooperative.

Figure 2. Distribution of cooperative membership impact across households

Kernel density estimates: (Y axis measures the density of households, X axis measures the impact of cooperative on the corresponding commercialization indicator)



The low price-elasticity of farmers supply in poor countries has been widely studied over the past two decades. In particular, it has been shown that transaction costs may lead to price bands whereby households are better-off autarkic than participating in markets. In other cases, households may not be able to seize market opportunities due to low asset endowments, credit constraints or price-risk aversion. The latter may be particularly important for very poor households for whom food insecurity and price risk may lead to preference for food self-sufficiency (see De Janvry, Murgai and Sadoulet (1999) and De Janvry and Sadoulet (2003) for in depth

reviews).²² As a result, exogenous price increases, unless sufficiently high, may not result into greater market participation among small farmers.

In the present case however, it appears that some farmers tend to even *decrease* their marketed surplus as a result of the price increase given by the cooperative. Given the staple nature of the crops considered, this phenomenon may be explained by the comparison of the effect of the price increase on both the household's production and consumption behaviour. While a price increase will probably lead to positive (or null) production response, its effect on consumption level is more ambiguous, such that the overall impact on market surplus is unclear. This may be particularly the case for poorer households with lower supply response capabilities and greater (positive) income elasticity of cereals consumption.²³

A simple way to see this is to consider both the facts that: (i) the vast majority of rural households in Ethiopia are not fully autarkic as they need to fulfil minimum liquidity needs (for consumption, production or tax purposes); (ii) poorer farm households typically face food shortage.²⁴ As a result, when facing a price increase allowing them to cover their liquidity needs with a lower quantity of output, poorer farmers will reduce the fraction of output marketed and increase that consumed. In contrast, for larger farmers who already are able to fully cover their consumption needs, an increase in price should lead to an increase marketed.

Overall, facing higher output prices for staple crops such as cereals, the smallest farmers may substitute out of the market, whereas the larger one will tend to supply more. We test these predictions in Table 10 below, where we investigate household-level correlates of cooperative impact on both output price and the share of output

²² Farm households in developing economies tend to be risk-averse, and the poorer ones more so (Antle (1987); Barrett (1993); Ellis (1993); Fafchamps (1999); Kurosaki and Fafchamps (1999); Morduch (1990, 1995); Rosenzweig and Binswanger (1993); Rosenzweig and Wolpin (1993); Saha (1994)). Some evidence to that effect have also been obtained in relation to Ethiopian farm households (Cummins (1999); Kebede, Gunjal and Coffin (1990); Belete, Dillon and Anderson (1993)). In particular, using experimental data collected from a sample of farmers, Cummins (1999) concludes that most farmers are risk averse and that the degree of risk aversion falls with wealth.

²³ Evidence suggesting that preference for food self-sufficiency falls with income/wealth is uncovered in Ethiopia (Taffesse and Yu (2007)).

²⁴ In 2006, the Ethiopian government deemed 8.3 million people as chronically food insecure. Moreover, As per the 2004 Ethiopian Welfare Monitoring Survey, 47% of children under 5 in Ethiopia are stunted.

sold. The first two columns report OLS estimates of the impact of membership on output prices. Columns (3) and (4) report Tobit estimates of the impact of cooperatives on the household's share of cereals production sold – households without any production sold in 2005 are considered censored observations.

Importantly, the above hypothesis predicts that households with a relatively low level of production *before* joining the cooperative will tend to supply less on the market than their non-member counterparts. As such, using the actual production level to differentiate between smaller and larger may be misleading in that, production level may itself respond to price incentives. Instead we use the number of hectares of farm land “owned” by the household as a proxy for its actual level of production. Given the land ownership regime in Ethiopia discussed in Section 3, this variable is considered as exogenous, at least in the short or medium term. Other variables included in the estimation include the household head's reading capacity, household size, and a set of Kebele-level control variables used in the definition of the development domains.

Columns (1) and (3) report simple average estimates of the cooperative's impact. Coefficients in the upper part of the Table indicate as expected that households with higher education and living close to markets sell more of their production and at higher prices. Larger households however tend to sell less of their output. Interestingly, favorable agro-climatic conditions (i.e. surplus-producing areas) tend to have depressing effects on prices, while positive effects on households' marketed surplus. Finally, land owned does not seem to exert any effects on the output price received by the household, although each additional hectare will lead to an increased marketed surplus. In the middle part of the Table, we report the coefficients on a membership dummy. As expected from the estimations in Section 6, cooperative membership does have a significant positive impact on output price, although there is no significant effect on the share of production sold.

Table 8. Heterogeneous effects of membership on commercialization

	Price Difference		% Production Sold	
	OLS		Tobit	
	(1)	(2)	(3)	(4)
Land owned (in ha)	0.134	-0.070	4.147	3.651

	(0.833)	(0.874)	(0.679)***	(0.709)***
Hh head reads	4.322	4.387	3.758	3.929
	(2.172)**	(2.267)*	(1.779)**	(1.851)**
Household Size	0.058	0.201	-0.992	-0.936
	(0.499)	(0.518)	(0.384)***	(0.395)**
Market access	7.223	6.631	4.199	4.245
	(2.293)***	(2.336)***	(1.806)**	(1.830)**
Population density	-5.443	-4.093	-6.555	-6.089
	(3.365)	(3.577)	(2.559)**	(2.724)**
Agricultural potential	-25.164	-26.947	12.030	10.600
	(4.239)***	(4.330)***	(3.098)***	(3.162)***
<hr/>				
Treatment	12.296	-28.237	0.919	-20.242
	(3.893)***	(27.696)	(3.183)	(20.675)
<hr/>				
Treatment x ...				
Land owned (in ha)		2.383		5.574
		(3.037)		(2.449)***
Hh head reads		3.709		0.253
		(8.409)		(6.708)
Household Size		-2.481		-1.173
		(2.031)		(1.578)
Market access		7.591		-8.385
		(14.724)		(11.650)
Population density		-10.738		-0.401
		(10.665)		(7.949)
Agricultural potential		44.080		25.166
		(22.452)**		(15.389)
Constant	12.333	17.527	-16.477	-14.867
	(11.678)	(15.991)	(3.765)***	(3.842)***
<hr/>				
# Observations	854	854	1800	1800
			(927 obs censored at %=0)	

Reported are coefficients for both OLS and Tobit estimations.

Robust standard errors in parentheses. * signif. at 10%; ** signif. at 5%; *** signif. at 1%

In columns (2) and (4), we further refine the analysis by interacting the membership dummy with household and Kebele-level variables. None of the coefficients obtained for the price regression differs significantly from zero, indicating that no obvious discrimination exist between members regarding the output price. In column (4) however, we find that the effect of membership on the percentage production sold increase with the size of the landholding. Furthermore, as

indicated by the model's negative constant, the impact of membership is negative for the smallest farmers while positive for the larger ones.

8. Conclusion

Over the past decade, Ethiopia has embarked on a major policy drive to promote smallholder marketing cooperatives as a way to increase the commercialization of smallholder agriculture and the improvement of smallholder livelihoods. Using data drawn from a survey of nearly 7,200 rural Ethiopian households, this paper attempts to shed light on the policy discourse over the role and impact of cooperatives.

Previous studies have shown that the incidence of cooperatives in Ethiopia remains fairly limited; and that cooperatives tend to be located in places with better market access and lower exposure to environmental and price risks. and are thus less likely to benefit their members relative to more difficult areas. We also found that, on average, cooperative members are better educated and operate more land.

Specifically, this paper has examined the extent to which cooperatives affect their members' commercialization behavior. The analysis is based on propensity score matching, the use of which is justified by the fact that most Ethiopian cooperatives were created under a government policy target of establishing the impulse of an external partner and not by members themselves. This, along with the fact that the government stated policy objective is to provide cooperative access in all *kebeles* of the country allows us to consider the actual cooperative development as an interim phase of a nationwide government-induced program and therefore use standard program evaluation techniques.

In particular, we proceeded to a two-step matching procedure whereby *kebeles* with cooperatives are first matched with *kebeles* without cooperatives using a series of observable characteristics. In a second step, cooperative members were matched with households living in comparable *kebeles* and who would have likely participated to such organizations had they had access to it. This careful selection and matching process ensures a robust and relatively unbiased estimation of the true impacts of cooperatives on household commercialization behavior.

We evaluate impact on three possible outcomes: the decision to sell on the market (marketing position), the extent of market participation (share of output sold on the market), and the prices obtained in the market. The results are somewhat sobering. At the aggregate level, cooperative membership has no impact on the share of members' production that is sold, despite a 7% higher price for the output sold in the organization. When the analysis is further refined, we find that smaller farmers tend to sell less on the market given the higher prices obtained by the cooperative, while it is the opposite for larger farmers. This can be explained by consumption effects that exceed the production effects for smaller farmers.

These findings have significant policy implications. First, they show that cooperatives are effective at providing marketing services to their members: the positive and significant impact of membership on price reveals that cooperatives do serve their expected purpose on commercialization through better market opportunities, higher bargaining power or reduced transaction costs.

Second, these results, when combined with lower cooperative membership rates among smaller farmers, suggest that cooperatives alone may not be sufficient to effectively promote smallholder commercialization. If it is true that commercialization enhances productivity and income in the long run, complementary institutions need to be designed to address the specific needs of the smallest farmers.

Finally, beyond location and household profile, there are particular characteristics of cooperatives themselves that may constrain their capacity to affect their members' commercialization. This latter issue, on the determinants of cooperative performance, is the subject of a forthcoming companion paper.

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