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IFPRI Discussion Paper 00722

October 2007

Smallholders' Commercialization through Cooperatives

A Diagnostic for Ethiopia

Tanguy Bernard, International Food Policy Research Institute
Eleni Gabre-Madhin, International Food Policy Research Institute
and
Alemayehu Seyoum Taffesse, African Centre for Economic and Historical Studies

Markets, Trade, and Institutions Division
and
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ABSTRACT

This paper examines the impact of cooperatives on smallholder commercialization of cereals, using detailed household data from rural Ethiopia. We review the involvement of cooperatives, in terms of who participates and where they are located. We then use the strong government role in promoting the establishment of cooperatives to assume that the decision of where to establish a cooperative is largely driven by external considerations, and is thus exogenous to the members themselves justifying the use of propensity-score matching in order to compare households that are cooperative members to similar households in comparable areas without cooperatives. Four conclusions are derived from the analysis. First, despite the spread of cooperatives – they existed in less than 15 percent of districts in 1994 and nearly 35 percent in 2005 – there are important disparities across regions. Within regions, cooperatives tend to be located in areas that already have better access to markets and lower exposure to price and environmental risks. Second, at the household level participation is only 9 percent, with poorer households less likely to participate. Third, while cooperatives obtain higher prices for their members, they are not associated with a significant increase in the overall share of cereal production sold by their members. Fourth, these average results hide considerable heterogeneity in the impact across households. In particular, we find smaller farmers tend to reduce their marketable surplus as a result of higher prices, while the opposite is true for larger farmers.

Keywords: Smallholders' marketing, cooperatives, Ethiopia

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 households' production decisions from their 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 unable to exploit the potential gains from commercialization (de Janvry, Fafchamps, and Sadoulet 1991; Key, Sadoulet, and de Janvry 2000). In the absence of mechanisms to overcome 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 suggests that the proportion of farmers engaged in subsistence agriculture remains very high. At the same time, those who participate in markets often do so only at the margins because of the high risks and associated costs (Jayne, Zulu, and Nijhoff 2006).

During the past decade, donors and governments have regained interest 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 (for example Uphoff 1993; Tendler 1983; Sharma and Gulati 2003; Neven, Reardon, and Hopkins 2005; Damiani 2000; Chirwa et al. 2005; Attwood and Baviskar 1987; Bernard et al. 2006).[1] This growing literature documents the external and internal conditions under which these cooperatives may be more or less effective at serving their members. Less studied, however, is the effective impact of collective action on members' level of commercialization compared to their likely situation had they not been members. One reason is the inherent challenge of addressing selection biases in both the location and the membership of these organizations. This is where we hope to contribute to the literature, by providing a diagnosis of the effective impact of cooperatives on smallholders' marketing behavior, in the context of Ethiopia.

Cooperatives have a long and tumultuous history in Ethiopia, starting from the Imperial era and continuing through the military regime (the Derg, 1974–1991). The largely negative experiences of cooperatives led to their dissolution following the fall of the Derg. In 1994 the Government of Ethiopia expressed renewed interest in collective action to promote greater market participation by smallholders (

[1] See also the several case studies presented at a recent workshop on "Collective Action and Market Access for Smallholders" organized by the CGIAR Systemwide Program on Collective Action and Property Rights (CAPRi) at www.capri.cgiar.org/wks_marketrel.asp.

FDRE 1994 and FDRE 1998).[2,3] 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" (FDRE 1998). This was later re-affirmed in the Sustainable Development and Poverty Reduction Program (SDPRP) (FDRE 2002) and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (FDRE 2005), in which cooperatives are given a central role in the country's rural development strategy.

In 2002, the Federal Cooperative Agency of Ethiopia was created to organize and promote cooperatives at the national level. Its ambitious five-year development plan (2006–2010) aims to provide cooperative services to 70 percent of the population through the presence of at least one such organization in each *kebele*[4] by 2010. (In 2005 when our data was collected the figure was 35 percent.) We use this strong government effort to promote cooperatives to assume that the decision of where to establish a cooperative is largely driven by external considerations, and is thus exogenous to the members themselves. This is further supported by cooperative-level data indicating that only 26 percent of these organizations were initiated by members themselves. Controlling for a set of observable variables, such as market access, population density, and agricultural potential, one can therefore compare households living in *kebeles* with access to a cooperative to similar households living in comparable *kebeles* but without access to such an organization.

Our analysis reveals four major findings. First, cooperatives have developed strongly in the country since the mid-1990s, with the percentage of districts with at least one such organization having reached nearly 35 percent in 2005, from less than 15 percent ten years before. However, this national average hides important disparities across and within regions, in particular that these organizations are more likely to be found in districts that already have better than average access to markets and lower exposure to price and environmental risks.

Second, at the household-level we find that membership in cooperatives remains low (less than 10 percent) and that poorer households in a given community appear to be less likely to participate, although the cooperatives themselves are meant to be non-discriminatory.

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

[3] In Ethiopia, empirical estimates show that 28 percent of the total agricultural output is commercialized (Dessalegn et al., 1998). More recent estimates suggest that among all teff producers, only 38 percent sell part or all of their production, and the figure is even lower for the other cereals (Alemu, Pender, Dejene, and Gabre-Madhin 2006).

[4] 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.

Third, the analysis of the impact of cooperatives on their members' cereals commercialization shows nuanced results. On average, cooperatives do not have a significant effect on the share of members' production effectively sold despite a significant price effect: the output price paid to members is on average 7 percent higher than the price paid to comparable non-members.

Fourth, this can be explained by an important degree of heterogeneity among members. In particular, we find that smaller farmers tend to sell less as a result of their membership of cooperatives, while larger farmers sell more. This cannot be explained by differences in the price received by small and large farmers, as we do not find such differences within the cooperative.

We begin this paper by briefly describing the data used (Section 2), before detailing the incidence of cooperatives, and investigating the determinants of their presence as well as of households' membership levels (Section 3). The methodological considerations of measuring the impact of cooperatives are discussed in Section 4, and the corresponding matching is described in Section 5. Section 6 presents the impact of cooperatives on members' commercialization behavior. In Section 7 we investigate further by looking at the heterogeneity of cooperatives' impact across members. Section 8 concludes.

2. DATA

This diagnostic is based on a new dataset specifically collected to investigate the commercialization behavior of Ethiopian smallholders. The Ethiopian Smallholders Commercialization Survey (ESCS) was jointly designed by the International Food Policy Research Institute (IFPRI), the Ethiopian Development Research Institute, and the Central Statistical Agency of Ethiopia to support an in-depth analysis of smallholders' commercialization behavior. Data were collected during June and July 2005 from 7,186 households randomly drawn from 293 *kebeles.* The sample is considered statistically representative at the national level and regional level for four regions: Amhara, Oromia, Tigray, and the Southern Nations, Nationalities, and Peoples regional state (SNNP).

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

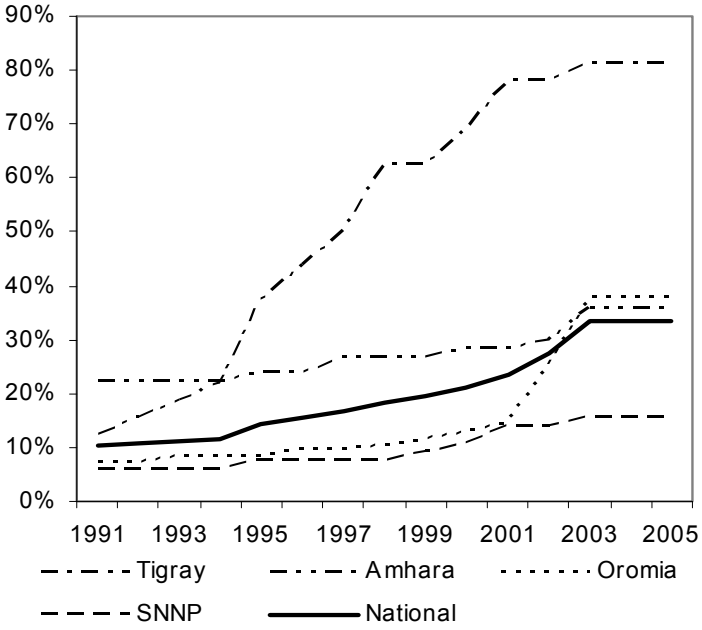
3. *WHERE* AND *WHO*: INCIDENCE OF COOPERATIVES IN ETHIOPIA

In this section, we review the incidence of cooperatives in Ethiopia, and smallholders' membership of cooperatives. The overall effect of these organizations will greatly depend on their actual extent, location, and the characteristics of their members.

Prevalence of Cooperatives in Rural Ethiopia

As a result of the government policies described in Section 1, the number of cooperatives has grown rapidly in Ethiopia during the past decade. Figure 1 show how the number of *kebeles* in the research areas with at least one cooperative went up from only 10 percent in 1991, to nearly 35 percent in 2005. One can also see, however, that much of this trend is explained by the rapid spread of cooperatives in Tigray, from only 12 percent of *kebeles* having a cooperative in 1991 to a staggering 83 percent in 2005

Figure 1. Growth of agriculture cooperatives, 1991–2005 (% kebeles with at least one cooperative)



However, one needs to investigate membership rates to obtain a clearer picture of the effective reach of these organizations. The percentage of households participating in at least one cooperative involved in agriculture is shown in Table 1. As indicated in Column 1, only 9 percent of all farm households report participating in a cooperative, even though 35 percent of all *kebeles* have a cooperative.

Table 1. Incidence of household participation in cooperatives among smallholder farmers in Ethiopia

	1		2		3	
	% Smallholders participating in a cooperative		% Smallholders with a cooperative in their *kebele*		% Smallholders participating when they have a cooperative in their *kebele*	
	% hh	diff/national: Prob >F	% hh	diff/national: Prob >F	% hh	diff/national: Prob >F
Average	9.14		39.59		16.87	
Tigray	20.40	0.0057	87.99	0.0000	20.93	0.3511
Amhara	14.48	0.0630	46.34	0.0000	24.29	0.1362
Oromia	7.35	0.3026	42.54	0.0046	12.18	0.1446
SNNP	3.69	0.0000	18.49	0.0000	8.96	0.0391

We also note significant differences in membership rates across regions, with 20 percent of the smallholders in Tigray participating in cooperatives, while less than 4 percent of people in SNNP participate. Part of this difference is driven by level of saturation of the cooperatives. Thus, as reported in Column 2, 88 percent of smallholders in Tigray have at least one cooperative within their *kebele*, compared to less than 20 percent in SNNP. However, we note from Column 3, that even when there is an organization in their *kebele*, smallholders in SNNP are still less likely to participate in cooperatives, with only 9 percent participation, which is below the study's average membership of 17 percent for smallholders with a cooperative in their *kebele*. We investigate the determinants of this heterogeneity below.

Where are the Cooperatives and *Who* are their Members?

The existence of a cooperative in any given *kebele* is not the result of a random process. And a household's decision to participate in such an organization is likely to be driven by its expected profit from the organization. Here we briefly assess the main correlates of cooperatives' location and household participation.

On the question of location, a set of Logit estimates are used to derive the probability that a cooperative exists in a given *kebele*, using a variety of independent variables. These variables include the total population of the *kebele*, the presence of an all-weather road within the *kebele*, and the distance (in kilometres) from the center of the *kebele* to the first major market for agricultural goods. We also computed a measure of the proportion of local disputes resolved through the Shimagile institution[5] (as

[5] The Shimagile (elders) is the organization that traditionally governs Ethiopian communities.

opposed to either *kebele* or district-level courts), as a proxy for the importance of traditional community institutions in the *kebele*. We measure the community's exposure to income risks through an index of the price variability of the main agricultural product produced in the *kebele* (measured as the standard deviation over the past three years, for the price in January), and the mean level of this price (average price in January over the past three years). We use a proxy measure for environmental risk through a rainfall variability index, computed as the coefficient of variation of yearly rainfalls in the *kebele*, since 1964. Finally, we use regional dummies to control for other unobserved factors that could influence the presence of such organization.[6]

We present three different estimates, increasing each time the number of independent variables, in order to investigate the robustness of our coefficients. The results, shown in Table 2, are relatively clear, indicating that larger *kebeles* are more likely to have a cooperative, whereas more remote ones are less likely to have one. One can interpret these coefficients as proxies for market access, which tend to favor the emergence of cooperatives. In Columns 2 and 3 we test for the significance of our risk exposure measures (in terms of price and weather). Results indicate a negative relationship between the likelihood that a cooperative exists in a given *kebele*, and the *kebele's* exposure to risks.

These findings have relatively strong implications in terms of the cooperatives' benefit to smallholders. They show that cooperatives are more likely to be located in *kebeles* with relatively lower marketing constraints: better market access and lower exposure to environmental and price risks.

Furthermore, as Table 1 showed, only a limited number of households tend to participate in cooperatives, even when there is a cooperative in their *kebele* (17 percent). We now explore further the determinants of household membership in cooperatives, using the subset of *kebeles* with at least one agricultural cooperative. The analysis relies on Logit estimates of the probability of household membership, using a variety of household characteristics as well as regional dummies. As shown in Table 3, the results are robust to the introduction of various control variables as well as regional fixed effects.

[6] As is clear from Figure 1, regional factors play a major role in the development and dynamism of cooperatives.

Table 2. Determinants of the presence of cooperatives

Dep: There is at least one cooperative in the *kebele* in 2005	**Mean (std dev)**	**Marginal effect at mean of independent variable (std error)**		
		1	**2**	**3**
Population (x100)	46.11	0.004	0.003	0.001
	(25.32)	(0.001)***	(0.001)***	(0.002)
All-weather road	0/1	0.168	0.167	0.136
		(0.063)***	(0.067)***	(0.083)*
Distance to main market	13.19	-0.003	-0.004	-0.006
	(16.17)	(0.002)^	(0.002)^	(0.003)*
% conflict resolved in *Shimagile*	56.99	0.030	0.033	0.082
	(49.59)	(0.061)	(0.067)	(0.079)
Average price level	162.50		0.001	0.001
	(77.43)		(0.000)*	(0.000)**
Price variability	21.96		-0.002	-0.003
	(29.82)		(0.001)*	(0.002)*
Rainfall variability	83.72		0.004	-0.006
	(26.17)		(0.001)***	(0.003)**
Regional fixed effects				yes
Prob > Chi2		0.0001	0.0000	0.0000
Pseudo R^2		0.068	0.1214	0.2220
Number of observations		272	247	224

Notes: Robust standard errors in parenthesis. *** = Signif at 1% level. ** = Signif at 5% level., * = Signif at 10% level.

Table 3. Determinants of households' participation in cooperatives

Dep: Household participates in at least one cooperative	Mean (std dev)	Marginal effect at mean of independent variable (std error)		
		1	2	3
Household size	5.13	0.015	0.014	0.019
	(2.25)	(0.003)***	(0.003)***	(0.004)***
Age of the household head	44.4	0.002	0.002	0.001
	(44.36)	(0.000)***	(0.000)***	(0.000)**
Hh head is a woman	0/1	-0.064	-0.063	-0.045
		(0.021)***	(0.021)***	(0.021)**
Hh head is literate	0/1	0.095	0.094	0.101
		(0.021)***	(0.021)***	(0.021)***
Landholding (ha)	1.35	0.043	0.056	0.051
	(1.25)	(0.006)***	(0.010)***	(0.001)***
$(\text{Landholding (ha)})^2$			-0.002	-0.001
			(0.001)*	(0.000)*
Ethnicity dummies				Yes
Regional fixed effects				Yes
Prob > Chi2		0.0000	0.0000	0.0000
Pseudo R^2		0.067	0.081	0.1283
Number of observations		2224	2224	2193

Notes: Robust standard errors in parenthesis. *** = Signif at 1% level. ** = Signif at 5% level. * = Signif at 10% level.

Overall, education and landholding[7] seem to be the dominant variables explaining household participation in cooperatives. Thus, the probability that a household participates in a cooperative is increased by 10 percent if the household head is literate.[8] Participation also increases by 5 percent for each additional hectare of land. We note, however, that the marginal effect of landholding decreases with the amount of land. Eventually, very large farm households (holding more than 14 hectares) are less likely to participate.[9]

[7] Land in Ethiopia is the property of the state and cannot be owned by individual farmers. Nevertheless, land is allocated to households for an undetermined period. Although land cannot be sold, it can be rented out and eventually passed on to heirs. The variable we use here as landholding is the amount of land allocated by the state to the household. It is considered as exogenous and does not capture land rented-in or rented-out by the farmer. For a detailed description of the Ethiopian land tenure system, see Gebreselassie (2006).

[8] Overall, the literacy rate among non-members approaches 27% while it reaches 40% among members. If one considers that literacy is somewhat pre-determined with regard to participation, and that the effect is not driven by other household's unobservable characteristics, then education and literacy programs may constitute a powerful tool to promote participation into cooperatives. Testing these assumptions would however require a more sophisticated estimation of the participation equation, which is outside of the scope of this paper.

[9] Such "middle-class effects" are often observed in the collective action literature. See for example Weinberger and Jutting (2001).

These results raise some concern about the capacity of cooperatives to improve market participation by smallholder producers in Ethiopia. The results rather suggest that, despite their rapid development during the past decade, cooperatives remain marginal in their importance to smallholders (9 percent membership), tend to be located where there are few marketing constraints, and provide services to households that are already better educated and have larger landholdings.[10] From a methodological perspective, these results also show – as expected – that direct intra-*kebele* comparisons of members with non-members will lead to bias estimates;[11] the same is true for a simple comparison of households in *kebeles* with and *kebeles* without cooperatives. Instead, we propose in the following sections 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.

[10] On average, cooperative members control 1.75 hectares, whereas non-members living in *kebeles* with a cooperative control 1.19 hectares. This difference is significant at the 1 percent level.

[11] It is difficult *a priori* to sign the bias of the direct effect of cooperatives on their members' commercialization behavior. While members' self selection may lead to an overstatement of the effect of cooperatives, 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.

4. *WHAT*: COOPERATIVES' IMPACT ON MEMBERS' COMMERCIALIZATION

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 preferences, its entrepreneurial spirit, or its relationship to other cooperative members. Thus, a simple comparison between 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 them, 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 described in Rosenbaum and Rubin (1983), or later in Heckman, Ichimura, and Todd (1998), and now used extensively in the economic evaluation literature (Jalan and Ravallion 2003a). In studies on agriculture and rural development, the application of these techniques includes, 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 2003b) 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 (for example, the household's social capital stock or its entrepreneurship spirit), the distribution of unobservable characteristics may systematically differ between members and non-members, leading to a biased estimate of the impact of cooperatives.[12]

[12] 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 (although it is generally not true). 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 (for example through processing activities). Overall, these spillover effects will tend to exert a downward bias on the measure of the cooperative's impact on their members.

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 at the instigation of an external partner: 63 percent were created by government institutions, 11 percent by a donor agency or NGO, and only 26 percent by members themselves. Dropping from our sample those *kebeles* in which cooperatives were created by their members, we assume that the establishment of cooperatives is exogenous from communities' unobservable characteristics[13] as well as from that of their members. It follows that differences in unobservable characteristics between cooperative members and households with similar propensity scores (but leaving 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 *kebele* where there is a cooperative and 0 otherwise; and the subscripts c and $\not{c}$ denote participation and non-participation, respectively.

$$E\left[y \mid c=1, p(x)\right] - E\left[y \mid c=0, p(x)\right] = E\left[y_c - y_{\not{c}} \mid p(x)\right] \quad (1)$$

It can be argued that even though households are fully comparable, certain environmental conditions may also affect the cooperative's impact on each household's 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.

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, Ichimura, and Todd 1998). Although several studies have found that market integration has significantly increased in Ethiopia since the liberalization of the early 1990s (Dercon 1995 Negassa and Jayne 1997 Negassa 1998), it is likely that geographic location still matters. However, as will be shown later, 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.

[13] This assumption is further supported by the government's objective that there should be one primary cooperative in each *k*ebele 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.

5. MATCHING

In this section we describe in 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 could have participated had they had access (5.2).

Matching *Kebeles*

As mentioned earlier, 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 *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 estimates, 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 there are no cooperatives).

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.[14] 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 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 on local livelihood patterns. 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 estimate where the dependent 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 percent of the existence of cooperatives. Table 4 below presents the distribution of our treatment and control *kebeles* across the 22 different domains.

[14] 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.

Table 4. Treatment and control *kebeles*, by development domains

	Domain	% Control *kebeles*	% Treatment *kebeles*
1	**Highland, moisture reliable, high market access, high population density**	8.97	**13.64**
2	**Highland, moisture reliable, high market access, medium population density**	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 percent of the *kebeles* with at least one externally created cooperative, while the remaining 30 percent 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 5 the distribution of treatment and control *kebeles* across the administrative regions of Ethiopia. There is a Federal Cooperative Agency, but it is the Regional Cooperative Offices who decide where and how cooperatives should be promoted, through directives passed to *woreda* cooperatives offices. As a result, and as was clear from Figure 1, there are important differences in cooperative development across regions which may need to be accounted for in the present analysis.

Table 5. Treatment and control *kebeles*, distribution by region

	Tigray	**Amhara**	**Oromia**	**Beneshangul – Gumuz**	**SNNP**	**Harari**	**Total**
Control *kebeles*	1	25	37	1	22	1	87
Treatment *kebeles*	14	8	19	0	6	0	47

As shown in Table 5, only three regions – Amhara, Oromia and SNNP – display a relatively balanced sample between treatment and control *kebeles*. In Tigray only one *kebele* was missing a cooperative in 2005, 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 the SNNP regions. In Table 6, 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 sufficiently comparable to the control ones.

As shown in Table 6, the sample using all regions performs poorly, evidenced by a significant difference between treatment and control *kebeles* in 50 percent 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*.

Table 6. Balancing tests: Treatment and control *kebeles*

	Sample with all regions			Sample with Amhara, Oromia and SNNP only		
	Control *kebeles*	**Treatment *kebeles***	**Difference: p>t**	**Control *kebeles***	**Treatment *kebeles***	**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-finance institution	25.28	46.80	**0.0111**	23.80	30.30	0.4734
Importance of *Shimagile*	48.81	46.00	0.8629	46.69	50.96	0.4266
Number of	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	

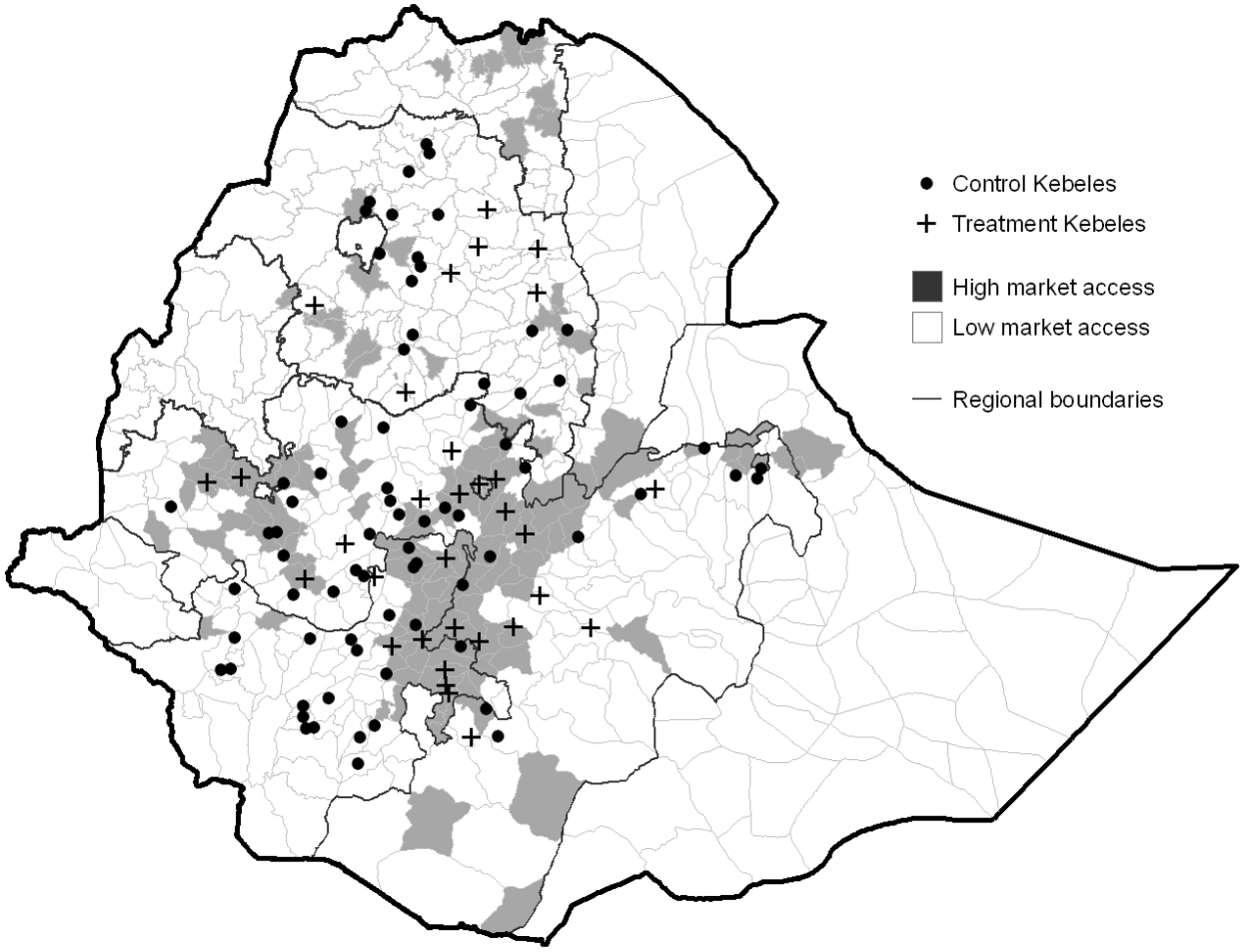
Note: In bold, differences significant at the 10% level.

*kebele is covered by the Productive Safety Net Program.

One last validity check was undertaken to ensure that treatment and control *kebeles* correspond to sufficiently similar locations, that is that the treatment and control observations have the same markets for their comparisons to be valid. Indeed, in the case where the treatment *kebeles* are clustered in different areas 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 2 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 2. Geographical location of treatment and control *kebeles (PAs)*



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. Among the latter, 142 are cooperative members (see Table 7).[15] Recall that the rationale for propensity-score matching is to compare households that are members of cooperatives with households in *kebeles* without cooperatives who would *probably* have 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 treatment *kebele* household's "propensity score" or likelihood of joining a cooperative using a flexible Probit model where the dependent variable is membership status. Domain fixed effects are used to ensure matching within the

[15] Although the sub-sample still includes a majority of the initial treatment *kebeles*, our efforts to increase robustness may come at the expense of national representativeness of the results.

domains.[16] Household characteristics include measures of the household's assets (education level, radio ownership, non-farm income, landholding, livestock, and so on) 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.[17, 18]

Table 7. Distribution of households across treatment and control *kebeles*

	Control *kebeles*	**Treatment *kebeles***	**Total**
Non-cooperative members	1,798	674	2,472
Cooperative member	0	142	142
Total	1,798	816	2,614

The Probit estimate 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 8. 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 percent of the observed membership in cooperatives. These coefficients are then used to generate propensity scores for the households living in control *kebeles*, determining which would *probably* have participated had they had access to a cooperative. On the basis of these propensity scores, households participating in cooperatives are matched to *similar* ones in *kebeles* without access to such an organization.

[16] Alternatively, one could have performed the matching separately for each domain (and eventually proceed similarly for the estimate 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.

[17] All households in this sample are involved in cereal production.

[18] One may argue that involvement in the production of a particular cereal 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 the marketing behavior of households engaged in similar production, whether or not this was driven by the cooperative. In addition, the present estimates are limited to cereals, the production of which 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, and barley along a north-south meridian in the middle of the country (Atlas of the Ethiopian Rural Economy 2006 p 59). Finally, all the estimates 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.

Table 8. Probit estimate of determinants of cooperative participation

	Coefficient	*p*-value		Coefficient	*p*-value
Age of household head	0.012	0.006	Number of small ruminant owned	0.040	0.180
Gender of household head	-0.606	0.002	(Number of small ruminant owned)^2	-0.000	0.850
Household head is literate	-0.003	0.979	Number of poultry owned	0.013	0.685
Household size	0.063	.0631	(Number of poultry	-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 income	-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 households		Non-	Member	Total
Pseudo-R^2:	Predicted	614	93	707
Correct prediction rate:	Predicted	28	47	75
	Total	642	140	782

Several matching techniques can be used to match treatment and control households. Here we focus on two widely used methods, the non-parametric Kernel-regression matching proposed by Heckman, Ishimura, and Todd (1998), and 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 observation based on the propensity score distribution. For 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 the characteristics of an average household within the treatment sample to the corresponding characteristics of the control group generated. An absence of significant differences between the treatment and control groups will suggest 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 9, 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 matching, only two significant differences are observed, in the gender of the household head and the number of ruminants owned. Overall, these results suggest that matched samples are adequate to perform an impact analysis, whereas the non-matched samples are not.

Table 9. Balancing tests of matched samples

	1. Unmatched samples			2. Kernel-based matching			3. Five-nearest-neighbors matching		
	Treatment *kebeles* households	**Control *kebeles* households**	**Diff: p-value**	**Treatment *kebeles* households**	**Control *kebeles* households**	**Diff p-value**	**Treatment *kebeles* households**	**Control *kebeles* households**	**Diff: p-value**
Age of head of hh	48.529	42.993	**0.000**	48.28	49.52	0.519	48.28	49.29	0.598
Gender of head of hh	1.10	1.18	**0.012**	1.10	1.06	0.220	1.10	1.04	**0.043**
Hh head is literate	0.37	0.31	0.104	0.38	0.34	0.542	0.38	0.36	0.705
Household size	6.05	5.14	**0.000**	5.93	5.82	0.689	5.93	5.81	0.675
Household owns radio	1.41	1.21	**0.000**	1.39	1.34	0.455	1.39	1.34	0.480
Non-farm income	1.50	1.54	0.421	1.50	1.54	0.461	1.50	1.54	0.526
Land-owning hh	2.186	1.35	**0.000**	2.05	2.17	0.465	2.05	2.19	0.386
Hh owns oxen	1.67	0.89	**0.000**	1.54	1.45	0.588	1.54	1.54	0.980
Hh owns cattle	5.30	3.42	**0.000**	4.97	4.63	0.468	4.97	4.87	0.839
Hh owns ruminants	3.32	2.47	**0.012**	2.81	3.70	0.109	2.81	3.89	**0.052**
Hh owns poultry	3.69	2.06	**0.000**	3.69	3.11	0.253	3.69	3.13	0.263
Hh produces cereal	1156.8	682.76	**0.000**	1086.8	1018.6	0.628	1086.8	1042.2	0.765

Note: 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 in 6.1 by defining the dependent variables used in the estimates, before turning to the actual results in 6.2.

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 actual composition of the outputs (Alemu, Gabre-Madhin, and Dejene 2006). Indeed, a farmer's involvement in producing cash crops such as coffee or *khat* rather than staple crops such as cereals may in itself reflect the commercial orientation of the household. In this paper, however, there are very few farmers producing cash crops who are also members of cooperatives. Due to this data limitation, we focus on the cooperatives' capacity to provide market access to smallholders for major cereals crops (teff, sorghum, oats, maize, barley, wheat, and millet).[19] Our sample is therefore slightly reduced by focusing only on cooperatives with a stated involvement in the commercialization of cereals.

We assess the impact of cooperatives on smallholders' commercialization through two types of indicators. We first consider a measure of 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 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 do, in fact, 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 not only access more markets, but also get them a better price. 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_{ij} is the proportion of land that was allocated to cereal j and sold by the household in 2005, p_{ij} is the price

[19] It should be noted that 98 percent of grains produced in Ethiopia are produced by smallholders, of which 80 percent are cereals (Gabre-Madhin 2001). In addition, a recent study shows that 70 percent of all planted areas in Ethiopia are dedicated to cereals production (Alemu, Gabre-Madhin, and Dejene 2007). As such, our estimate is likely to reflect the general situation of non-pastoralist smallholders in the country.

received by this household for product *j*, and $\overline{p}_j$ is the average price received by the households sampled, for one kilogram of product *j*.[20]

$$PD_i = \sum_j l_{ij}.\left(p_{ij} - \overline{p}_j\right)$$

One may argue that the use of the sample average, $\overline{p}_j$, as the reference point is problematic. For instance, if cooperatives are located in areas with higher prices to start with, a higher price for cooperative members may wrongly be attributed to the cooperative's efforts 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.[21] 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.

Average Impact of Cooperatives on their Members

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 with sampling 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 10.

[20] 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 estimates were also performed on non-weighted aggregates without significant effects on the results.

[21] As a robustness check, we have also run all the following estimates on the sub-sample of *kebeles* from the Oromia region only. Indeed, Oromia is the only region in our sample that offers a large enough sample size (both in terms of clusters (*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 in Table 10.

We start with the price difference (PD) indicator and find that on average, cooperative members receive 7 percent 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 provide reduced transaction costs to their members, through bargaining power over traders, to benefit from economies of scale in commercialization, or 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 10. Effect of cooperatives on members' cereals commercialization

	Kernel-based matching		**Five-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

Notes: Stratified bootstrap with 100 replications are used to estimate the standard errors. ** Significant at 5%.
* Significant at 10%.

These results may in part 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 suggests 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 in these organizations. Having said this, it can also be argued that the commercialization indicator captures the *total* amount of cereals sold by the farmers, and is *not* restricted to sales through the cooperative. Moreover, since the median age of the cooperatives in this sample is more than seven years old, it is likely 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 because they can earn enough money by selling only some of their crop at the new, higher price. The next section proposes a first investigation towards such mechanism.

7. HETEROGENEOUS IMPACT OF COOPERATIVES

The results presented in Table 10 are averages and as such do not capture the heterogeneity of impact across households. There is, however, no reason to assume without investigation that membership in a cooperative will produce homogenous responses for different categories of farmers. To test this, we plot in Figure 3 the density distributions of cooperatives' impact on members' percentage production sold (upper graph) and on output prices (lower graph).[22,23]

As expected, the figure shows great heterogeneity in members' response. Some cooperative members' share of production sold (PS) is almost double the level of their non-member counterparts. However, for many other members, their share of production sold is significantly lower than their non-member counterparts, presumably because of the higher prices within the cooperative.

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 such low prices for farmers that households are better off being self-sufficient 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 a preference for food self-sufficiency (see de Janvry and Sadoulet (2003) for an in-depth review).[24] As a result, exogenous price increases, unless sufficiently high, may not result in greater market participation among small farmers.

Our results show, however, that some farmers tend to *decrease* their marketed surplus as a result of the price increase secured by the cooperative. Given that we looked only at staple crops, this phenomenon may be explained by comparing the effect of the price increase on the household's production behaviour and its consumption behaviour. While a price increase will probably lead to a positive production response, if anything, its effect on consumption is ambiguous, so the overall impact on market surplus is unclear. This impact may be particularly unpredictable for poorer households who

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

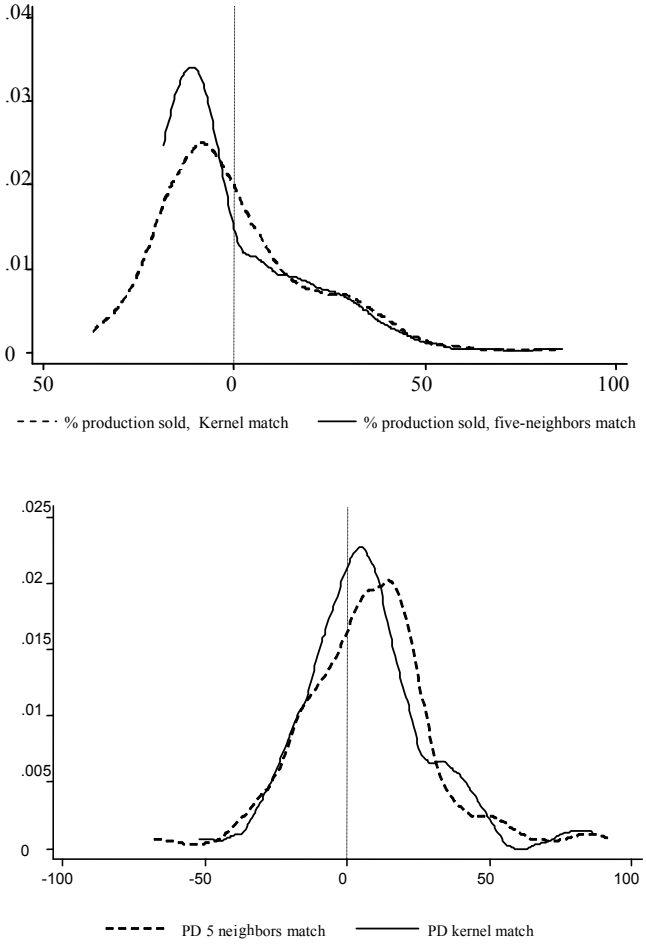
[23] We note that the two matching techniques employed are relatively close to each other in their assessment of the individual impact.

[24] 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 2002; Morduch 1990, 1995; Rosenzweig and Binswanger 1993; Rosenzweig and Wolpin 1993; Saha 1994). Some evidence to that effect has 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 as wealth increases.

cannot necessarily produce more if they want to and whose consumption of cereals is more closely related to their income.[25]

Figure 3. Distribution of cooperative membership impact across households

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



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 self-sufficient and do need cash as they need to fulfil minimum liquidity needs (for consumption, production, or tax purposes), and that ; (ii) poorer farm households typically face food shortage.[26] 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

[25] Evidence suggests that the preference for food self-sufficiency falls as income/wealth rises in Ethiopia (Taffesse Bernard and Yu 2007).

[26] In 2006, the Ethiopian government deemed 8.3 million of its people to be chronically food insecure. Moreover, the 2004 Ethiopian Welfare Monitoring Survey, shows that 47 percent of children under five in Ethiopia have stunted growth.

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 surplus.

Overall, when farmers can sell their staple crops such as cereals at a higher price than before, the smallest farmers may substitute out of the market (sell less and consume more), whereas the larger ones will tend to supply more. We test these predictions in Table 11 below, where we investigate household-level correlates of cooperative impact on both output price and the share of output sold. The first two columns report Ordinary Least Square 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. This means that using actual production levels to differentiate between smaller and larger farmers may be misleading, because production levels may themselves respond to price incentives. Instead we use the number of hectares of land "owned" by the household as a proxy for its actual level of production. Given the land ownership regime in Ethiopia (explained in Section 3), this variable is considered to be exogenous, at least in the short or medium term. Other variables included in the estimate include the household head's level of literacy, 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 more education and who live 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 (meaning surplus-producing areas) tend to have depressing effects on prices and positive effects on households' marketed surplus. Finally, the amount of land owned does not seem to have any effect on the output price received by the household, although each additional hectare owned does lead to a higher sales proportion. In the middle part of Table 11, we show the coefficients on a membership dummy. As expected from the estimates 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.

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 exists between members regarding the output price. In Column 4, however, we find that the effect of membership on the share of production sold increases with the size of the landholding. Furthermore, as indicated by the model's negative constant, the

impact of membership on the proportion of crop sold is negative for the smallest farmers while positive for the larger ones.

Table 11. Heterogeneous effects of membership on commercialization

	Price difference OLS		% Production sold Tobit	
	1	**2**	**3**	**4**
Land owned (ha)	0.134	-0.070	4.147	3.651
	(0.833)	(0.874)	(0.679)***	(0.709)***
Household head literate	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)***
Treatment	12.296	-28.237	0.919	-20.242
	(3.893)***	(27.696)	(3.183)	(20.675)
Treatment x …				
Land owned (ha)		2.383		5.574
		(3.037)		(2.449)***
Household head literate		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)***
# Observations	854	854	1800	1800
			(927 obs censored at %=0)	

Notes: Reported are coefficients for both OLS and Tobit estimations. Robust standard errors in parentheses. * signif. at 10%. ** Signif. at 5%. *** Signif. at 1%.

8. CONCLUSION

During the past decade, Ethiopia's policy has been to promote smallholder farmer marketing cooperatives as a way not only to increase the commercialization of smallholder agriculture, but also to ensure that farmers enhance their livelihoods from market participation. With the benefit of a rich, nationally representative data set collected from a sample of nearly 7,200 rural Ethiopian households, this paper has advanced the understanding of the impact of this policy thrust at a number of levels.

First, we have traced the institutional progression and context as well as the spread of cooperatives across regions and types of households. Our key findings at this level are that, despite the spread of cooperatives from 15 percent to 35 percent of districts in the country, only 9 percent of Ethiopian rural households are members. We find that the cooperatives formed tend to be located in places with better market access and lower exposure to environmental and price risks. We also find that, on average, cooperative members are better educated and farm more land.

Second, at the methodological level, in the effort to analyze the impact of cooperatives in Ethiopia, this study has identified and elaborated the potential self-selection biases that emerge from simple comparisons of members with non-members. These biases have to do with attributes of the areas (*kebeles*) in which cooperatives are located, as well as the attributes of the households themselves. Thus, the paper has shown how one might use the propensity-matching method to evaluate the impact of cooperatives. A key feature of the Ethiopian context that enables such a methodology to be relevant is the fact that cooperative establishment is not endogenous to the members themselves but is largely exogenous, in the sense that it is part of a national, and therefore externally driven, plan to spread cooperatives in rural areas. Thus, using our household survey data to confirm where cooperatives are created at the members' initiative versus where they are established by external actors, we select the sub-sample of the latter type of cooperatives to conduct a rigorous two-step matching. The matching was undertaken between *kebeles* with and without cooperatives, according to specific *kebele* characteristics. It was then undertaken between households that are members of cooperatives and similar households in similar *kebeles* that do not have cooperatives. This careful selection and matching process ensures a relatively unbiased estimate of the true impacts of cooperatives on household commercialization behavior.

At the third level, that of the impact analysis itself, we evaluate impact on two possible outcomes: the extent of market participation (share of production sold on the market), and the prices obtained in the market. The results are somewhat sobering in that, looking at the aggregate of the households in the sample, cooperative membership has no impact on average, on the decision of how much to sell for those

who do participate. The only impact is that cooperative members can sell their produce at higher prices than non-members.

Finally, at a fourth level, we go beyond the aggregate analysis of impact to evaluate the distribution of the impact of membership across households individually. This evaluation suggests that the impact of cooperative membership is heterogeneous, in that different households benefit differently from membership. In particular, we found that smaller farmers tend to sell less of their marketable surplus as a result of higher prices, while larger farmers sell more.

Importantly, because of data constraints, the cooperative's impact was only computed for cereal crops. Although cereals account for most agricultural output, this is nonetheless an important caveat in that the results on cooperatives' impact may not necessarily be a good approximation of the impact of cooperatives involved in the marketing of cash crops or perishable crops such as coffee, dairy products, or *khat*. Moreover, the fact that cooperatives have a limited impact on their members' commercialization does not prevent them from offering other types of benefits. Indeed, cooperatives and farmers' organizations in general are also social organizations, and can therefore affect their members in other ways, not just commercialization.

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.

REFERENCES

Alemu, D., E. Gabre-Madhin, and S. Dejene. 2006. *From farmer to market and market to farmer: Characterizing smallholder commercialization in Ethiopia*. ESSP Working Paper. Washington, D.C.: International Food Policy Research Institute.

Alemu, D., and J. Pender. 2007. Determinants of food crop commercialization in Ethiopia. International Food Policy Research Institute, Washington, D.C. Mimeo.

Antle, John M. 1987. Econometric estimation of producers' risk attitudes. *American Journal of Agricultural Economics* 69(3): 509–522.

Attwood, D., and B. Baviskar. 1987. Why do some co-operatives work but not others? A comparative analysis of sugar co-operatives in India. *Economic and Political Weekly* 22(26): A38–45.

Barrett, Chris. 1993. *On price risk and the inverse farm size-productivity relationship.* Staff Paper Series, No.309, Department of Agricultural Economics. Madison, WI: University of Wisconsin–Madison.

Belete, Abenet, J. D. Dillon, and F. M. Anderson. 1993. Efficiency of small-scale farmers in Ethiopia: A case study in the Baso and Warana Sub-District. *Agricultural Economics* 8: 199–209.

Bernard, T., A. de Janvry, M-H. Collion, P. Rondot, and E. Sadoulet. 2006. Do village organizations make a difference in African rural development? A study for Senegal and Burkina Faso. University of California, Berkeley, Mimeo.

Chamberlain, J., J. Pender, and B. Yu. 2006. *Development domains for Ethiopia: Capturing the geographical context of smallholder development options.* ESSP Working Paper. Washington, D.C.: International Food Policy Research Institute.

Chirwa E., A. Dorward, R. Kachule, I. Kumwenda, J. Kydd, N. Poole, C. Poulton, and M. Stockbridge. 2005. *Walking tightropes: Supporting farmer organizations for market access.* Natural Resource Perspectives 99. London: Overseas Development Institute (ODI).

Collion, M-H., and P. Rondot, eds. 1998. *Background, discussions, and recommendations. Agricultural producer organizations, their contribution to rural capacity building and poverty reduction.* Washington, D.C.: The World Bank.

Cummins, Ewen. 1999. *Hey and Orme go to Gara Godo: Household risk preferences*. CREDIT Research Paper No.99/1. Centre for Research in Economic Development and International Trade (CREDIT). Nottingham, UK: University of Nottingham.

CSA / EDRI / IFPRI, 2006 *Atlas of the Ethiopian Rural Economy*, International Food Policy Research Institute, Washington D.C.

Damiani, O. 2000. The state and nontraditional agricultural exports in Latin America: Results and lessons of three case studies. Report for the Inter-American Development Bank. Washington, D.C.

Dercon, S. 1995. On market integration and liberalization: method and application to Ethiopia. *Journal of Development Studies*, 32(1):112-143

de Janvry, A., M. Fafchamps, and E. Sadoulet. 1991. Peasant behavior with missing markets: Some paradoxes explained. *The Economic Journal* 101: 1400–1417.

de Janvry, A., and E. Sadoulet. 2003. Progress in the modeling of rural households' behavior under market failures. In *Poverty, inequality and development: Essays in honor of Erik Thorbecke*, eds, Alain de Janvry and Ravi Kanbur. Kluwer Publishing.

Dessalegn, G., T. Jayne, and J. Shaffer. 1998. *Market structure, conduct and performance: Constraints on performance of Ethiopian grain markets.* Working Paper 8. Addis Ababa: Michigan State University Grain Market Research Project.

Ellis, F. 1993. *Peasant economics: Farm households and agrarian development*. 2nd ed. Cambridge: Cambridge University Press.

Fafchamps, M. 1999. Rural poverty, risk, and development. Unpublished report submitted to the Food and Agricultural Organisation, Rome.

Fafchamps, M. 2005. *Market institutions in Sub-Saharan Africa*. Cambridge, Mass.: MIT Press.

Federal Cooperative Agency of Ethiopia. 2006. *Five Year Development Plan*. Addis Ababa, Ethiopia.

FDRE (Federal Democratic Republic of Ethiopia). 1994. *Proclamation No 85/1994 Agricultural Cooperative Societies*. Addis Ababa: Federal Negarit Gazeta.

FDRE (Federal Democratic Republic of Ethiopia). 1998. *Proclamation No 147/1998 to Provide for the Establishment of Cooperative Societies.* Addis Ababa: Federal Negarit Gazeta.

FDRE (Federal Democratic Republic of Ethiopia). 2002. Ethiopia: Sustainable Development and Poverty Reduction Program. Addis Ababa.

FDRE (Federal Democratic Republic of Ethiopia). 2005. Plan for Accelerated and Sustained Development to End Poverty. Addis Ababa.

Gebreselassie, S. 2006. *Land, land policy and smallholder agriculture in Ethiopia: Options and scenarios, future agricultures.* Ethiopian economic Association, Addis Ababa.

Gotland, E. M., E. Sadoulet, A. de Janvry, R. Murgai, and O. Ortiz. 2004. The impact of farmer field schools on knowledge and productivity: A study of potato farmers in the Peruvian Andes. *Economic Development and Cultural Change* 53: 63–92.

Heckman, J., H. Ichimura, and P. Todd. 1998. Matching as an econometric evaluation estimator. *Review of Economic Studies* 65:261–294.

Jalan, J., and M. Ravallion. 2003a. Estimating the benefit incidence of an antipoverty program by propensity-score matching. *Journal of Business & Economic Statistics* 21.

Jalan, J., and M. Ravallion. 2003b. Does piped water reduce diarrhea for children in rural India? *Journal of Econometrics* 112(1).

Jayne, T., B. Zulu, and J. Nijhoff. 2006. Stabilizing food markets in Eastern and Southern Africa. *Food Policy* 31(4).

Kebede, Yohannes, K. Gunjal, and G. Coffin. 1990. Adoption of new technologies in Ethiopian agriculture: The case of Tegulet-Bulga District, Shoa Province. *Agricultural Economics* 4: 27–43.

Key, N., E. Sadoulet, A. de Janvry. 2000. Transaction costs and agricultural household supply response. *American Journal of Agricultural Economics* 82: 1273–1279.

Kurosaki, T. and M. Fafchamps. 2002. Insurance market efficiency and crop choices in Pakistan. *Journal of Development Economics* 67: 419–453.

Morduch, J. 1990. Risk, production, and saving: Theory and evidence from Indian households. Harvard University (revised June 1993). Mimeo.

Morduch, J. 1995. Income smoothing and consumption smoothing. *Journal of Economic Perspectives* 9(3): 103–114.

Negassa, A. 1998. Vertical and spatial integration of grain markets in Ethiopia: implications for grain market and food security policies. Working Paper No. 9. Grain Marketing Research Project, Addis Ababa, Ethiopia.

Negassa, A. and T. Jayne. 1997. The response of Ethiopian grain markets to liberalization. Working Paper No. 6. Grain Marketing Research Project, Addis Ababa, Ethiopia.

Neven, D., T. Reardon, and R. Hopkins. 2005. *Case studies of farmer linking to dynamic markets in Southern Africa: The Fort Hare Farmers Group.* East Lansing, MI: Michigan State University.

Rao, V., and A. M. Ibanez. 2003. *The social impact of social funds in Jamaica: A mixed-methods analysis of participation, targeting, and collective action in community-driven development*. World Bank Policy Research Working Paper No.2970. Washington, D.C.: World Bank.

Rosenbaum, P. R., and D. B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70(1).

Rosenzweig, M. R., and H. P. Binswanger. 1993. Wealth, weather risk and the composition and profitability of agricultural investments. *Economic Journal* 103: 56–78.

Rosenzweig, M. R., and K. I. Wolpin. 1993. Credit market constraints, consumption smoothing, and the accumulation of durable production assets in low-income countries: Investments in bullocks in India. *Journal of Political Economy* 101 (2): 223–244.

Saha, A. 1994. A two-season agricultural household model of output and price uncertainty. *Journal of Development Economics* 44: 245–269.

Sharma, V. P. and A. Gulati. 2003. *Trade liberalization, market reforms and competitiveness of India dairy sector.* Markets, Trade and Institutions Division Discussion Paper 61. Washington, D.C.: International Food Policy Research Institute.

Taffesse, A. S., Bernard, T., and Yu, B. 2007. Risk, Consumption Preferences and Production Choices of Ethiopian Farm Households. IFPRI, *mimeo.*

Tendler, J. 1983. *What to think about cooperatives: A guide from Bolivia*. Rosslyn, VA: The Inter-American Foundation.

Thorp, R., F. Stewart, and A. Heyer. 2005. When and how far is group formation a route out of chronic poverty? *World Development* 33(6): 907–920.

Timmer, C. O. 1997. Farmers and markets: The political economy of new paradigms. *American Journal of Agricultural Economics* 79: 621–627.

Uphoff, N. 1993. Grassroots organizations and NGOs in rural development: Opportunities with diminishing states and expanding markets. *World Development* 21(4): 607–622.

Van de Walle, D., and D. Cratty. 2002. Impact evaluation of a rural road rehabilitation project. Washington, D.C.: The World Bank.

Weinberger, K., and J. Jutting. 2001. *Determinants of participation in local development groups: Experiences from group based projects in Kashmir and Chad*. Center for Development Research (ZEF). Bonn: University of Bonn.

World Bank. 2003. *Reaching the rural poor, a renewed strategy for rural development*. Washington, D.C.: The World Bank.

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