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Exploring variability across cooperatives: economic performance of agricultural cooperatives in northern Ethiopia

RESEARCH ARTICLE

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Abstract

The number of agricultural cooperatives increased quickly in Ethiopia since the 1990s. While many papers studied the impact of membership of Ethiopian cooperatives, not much is known on their performance. This study takes a cooperative-level perspective which is unique in an African context. It compares the economic performance proxied by sales revenue and profit of a wide range of agricultural cooperatives in northern Ethiopia. Data were collected from 511 agricultural cooperatives in 12 districts of Tigray. The contributing factors of the performance are analyzed with Ordinary Least Squares regression (OLS) and Heckman selection models. Our results underscore the importance of membership size, total assets, presence of conflict among members, and union membership. Chairperson characteristics and the internal organization of a cooperative seem to be less correlated to performance.

Keywords: agricultural cooperatives, performance variability, profit, audit, Ethiopia
JEL code: Q12, Q13

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1. Introduction

As a result of cooperative development policies since the market liberalization campaigns in the 1990s, the cooperative movement across Africa has been expanding, diversifying and growing at a rapid pace (Wanyama *et al.*, 2009). The government of Ethiopia promotes cooperatives as one of the main pillars of service provision support policies that aim at boosting agricultural transformation, improving food security and reducing rural poverty. As a result of the government's Agricultural Development Led Industrialization strategy launched in 1990, the number of cooperatives has been growing throughout the Ethiopian agricultural sector (Bernard *et al.*, 2010). Cooperatives have also been attributed a major role in the more recent Agricultural Cooperative Sector Development Strategy 2012-2016, and the Growth and Transformation Plans (ATA, 2012; MoFED, 2010).

Many studies on African cooperatives point to the potential positive impact of membership on farm-gate prices (Bernard *et al.*, 2008b; Fischer and Qaim, 2012), increased farm income of members (Ahmed and Mesfin, 2017; Getnet and Anullo, 2012; Mojo *et al.*, 2017; Shumeta and D'Haese, 2016; Verhofstadt and Maertens, 2015), improved farm productivity (Ariyaratne *et al.*, 2006; Chagwiza *et al.*, 2016), increased farm technical efficiency (Abate *et al.*, 2014; Ahn *et al.*, 2012; Huang *et al.*, 2013), increased adoption of modern inputs (Abebaw and Haile, 2013; Verhofstadt and Maertens, 2014; Wossen *et al.*, 2017), and increased product quality (Cai *et al.*, 2016). Some other studies (e.g. Cechin *et al.*, 2013; Chagwiza *et al.*, 2016; Pennerstorfer and Weiss, 2012; Soboh *et al.*, 2009) refute the positive impact of cooperative membership. Grashuis and Su (2019) provide an extensive overview of studies on member benefits. Many studies so far have focused on member-level performance and their results are mixed (Abebaw and Haile, 2013; Bernard *et al.*, 2008b; Chagwiza *et al.*, 2016). Cooperative-level studies are scarcer in the African context compared to that of Western countries. A review by Benos *et al.* (2018) distinguishes performance studies at cooperative level based on the outcome variable that was used, namely business financial, business efficiency, or subjective business indicators. Of interest to this paper, the business financial cooperative literature uses financial ratio analysis (e.g. profitability, liquidity, debt ratios) or sales-based metrics (e.g. sales growth, market share) to compare the performance of cooperatives with that of firms (Grashuis, 2018; Guzmán and Arcas, 2008; Melia-Marti and Martinez-Garcia, 2015). The business efficiency measurement uses production function data for efficiency assessment and comparisons (Franken and Cook, 2015; Soboh *et al.*, 2009). In this overview of cooperative performance studies, only a handful consider African agricultural cooperatives (Benos *et al.*, 2018) despite their widespread occurrence. The discrepancy between the high number of member-level impact studies and fewer cooperative-level studies is remarkable. This can be attributed to, first, the complexity of data collection as exemplified in some recent cooperative-level studies in the African context that use smaller samples (Mathuva, 2016; Mathuva *et al.*, 2016; Sisay *et al.*, 2017; Wouterse and Francesconi, 2016). Secondly, at member-level, it might be easier for researchers to find a proxy for the counterfactual. Finally, measuring performance at the cooperative-level might be difficult given the complex objectives of cooperatives.

Performance, which is defined as the 'progress toward achieving pre-determined objectives' (Bourne *et al.*, 2003: 6), is not an easy concept to grasp, especially in cooperatives as the relationship between the 'firm' and its objectives is not accurately defined (Soboh *et al.*, 2009). Since cooperatives are in essence hybrid institutions characterized by member ownership, member control, and member benefits (Ménard, 2004), the benefits members get arguably depend on the performance at both collective and member level. As such, members will benefit from the way cooperatives function (Nilsson, 2001) and the cooperative itself benefits from the member's patronage to the cooperative (Wollni and Fischer, 2015). These particular cooperative features complicate the definition and measurement of economic performance of cooperatives. Moreover, as cooperatives are complex organizations that may serve a variety of purposes and perform a wide variety of functions, there may be no single objective that is generally accepted by all members (Royer, 2014).

In this paper, we embrace these challenges and take a cooperative-level perspective. We aim to add insights into factors affecting the variability of cooperative performances, using cooperative sales and gross profit as

performance indicators. Earnings (profit) maximization and increasing sales are among the many objectives a cooperative may pursue (Royer, 2014). Although cooperatives, unlike profit-oriented firms, do not move where profit might be the highest, this does not mean that cooperatives can sustain themselves without achieving a certain level of financial success nor does it mean that members do not want economic stability. Thus, for cooperatives to survive, and to address their members' needs, they need stable and sufficiently high capital levels. This requires a sound economic performance.

Field experience shows a wide variability in performance across Ethiopian agricultural cooperatives. Some suffer from a lack of sufficient capital, poor management and/or failure to modernize their operation, lack of adequate supervision by the board, and a general disincentive to behave cooperatively, overdependence on the government, and serious governance or institutional capacity problems (Bernard *et al.*, 2008a; Fulton and Hueth, 2009; Tefera *et al.*, 2017). Some cooperatives are government- or NGO-initiated and may (partly) depend on this external support (Bernard *et al.*, 2008b; Tefera *et al.*, 2017) while others are grassroots initiatives. While they share the key member-owned and member-controlled characteristic, cooperatives widely differ in function, structure and management support. Yet, we lack evidence and insights on how these cooperative characteristics impact on their performance.

In this paper, we aim to fill this gap in research with empirical evidence on economic performance, proxied by sales and profit, across an extensive sample of agricultural cooperatives. We seek to explain the differences in performance we find based on cooperative-level governance and structural characteristics. Understanding performance variability determinants is particularly relevant because the country aims to transform the agricultural sector via increasing smallholder commercialization and ensuring value-added processing. We use a unique data set of cooperative-level information from the Tigray region of Ethiopia.

The paper continues as follows. The next section explains the empirical approach and gives a brief summary of agricultural cooperatives in Ethiopia and Tigray. We then present the study area and sampling technique, and detail the model specification. This is followed by a presentation of the discussion and results. The final section gives some concluding remarks.

2. Empirical approach

2.1 Dependent variable: performance at cooperative level

The boundaries of the cooperative as a 'firm' are not well-defined. Also the organizational forms are highly diverse, which makes a comparative analysis of the performance of cooperatives particularly challenging (Soboh *et al.*, 2009). Moreover, cooperatives have a dual purpose of maximizing profit at both member and cooperative levels (Feng and Hendrikse, 2012; Soboh *et al.*, 2009). As such, multiple objectives arise that may be different for the cooperative compared to its members (Soboh *et al.*, 2009). Yet, it is reasonable to assume that most cooperatives need to operate in such a way that their economic performance is at least sufficiently high enough for it to keep afloat from one year to another.

Commonly used measures of economic performance in empirical studies include profitability or return on assets and growth in sales (Dess and Robinson Jr, 1984; Soboh *et al.*, 2009). Other performance indicators that appear in the literature include financial ratios (Benos *et al.*, 2018), efficiency indicators (Ariyaratne *et al.*, 2000; Guzmán *et al.*, 2009; Hailu *et al.*, 2005; Sexton *et al.*, 1989; Sueyoshi *et al.*, 1998), overall organizational performance (Alho, 2015; Benos *et al.*, 2016; Galdeano-Gómez *et al.*, 2006; Tana *et al.*, 2017), overall satisfaction with cooperative (Arcas-Lario, 2014; Bhuyan, 2007; Figueiredo and Franco, 2018; Liebrand and Ling, 2014), and social capital (Feng *et al.*, 2016; Hansen *et al.*, 2002; Susanty *et al.*, 2017). In this study, we consider two performance indicators: (1) total sales measured by total income generated from core operational activities; and (2) gross profit calculated by subtracting costs from revenue after the cooperative is audited. This is in line with other studies; e.g. Liang *et al.* (2015) studied agricultural

cooperatives in China using sales and sales per member as performance measures. Similarly, Boyd *et al.* (2007) and Grashuis and Cook (2016) used profitability as a cooperatives' performance indicator.

We acknowledge the limitations of these measures of performance as they are mainly operational indicators and may only be partial indicators of the cooperatives' effectiveness in achieving long-term targets or strategies. The measures used may also fail to provide a unified and representative assessment of the overall performance of cooperatives (Salmi and Martikainen, 1994) and may not necessarily be the best indicators (Grashuis and Cook, 2016). Yet, they may allow to show the variability in performance, which was pointed out in earlier studies, but only addressed by few authors so far (Bernard *et al.*, 2008b; Spielman and Bernard, 2008).

2.2 Independent variables

This paper sets out to explain variability of performance across cooperatives by their governance and structural characteristics. The way a cooperative is established, owned, and governed arguably influences its performance.

- *Member control and governance characteristics*

A better educational level of directors and chairs is supposed to improve the cooperative's performance (Burress and Cook, 2010). Carpenter and Westphal (2001) also suggest that managerial experience may lead to better decision-making and enhance performance. As experience increases, chairs become more familiar with cooperative activities, which in turn improves performance (Cook and Burress, 2013).

The number of committees may have both positive and negative impacts on performance. The impact of fewer committees may be positive (Jensen, 1993; Yermack, 1996) as fewer opinions in the boardroom result in faster and less costly decision-making and monitoring on activities (Klimek *et al.*, 2009). Following this thought, a larger number of committees, including a larger number of members participating in these committees, may induce problems of free-riders, control, and influence costs (Cook, 1995) and it is more challenging to monitor managers of a large number of committees. Influence costs can arise between committees with heterogeneous, and sometimes conflicting interests. Conversely, a larger number of committees may point to commitment. The presence of audit committees responsible for overseeing the financial reporting process and ensuring objectivity of financial performance (McMullen and Raghunandan, 1996) may be key to enhance performance as they deter members and directors alike to commit financial fraud. The existence of audit committees within the governance structure may indicate board oversight on financial risks and inspection accounts (Cook and Burress, 2013). Cooperatives are required to prepare accounting entries periodically and maintain financial transactions. This may depend on the knowledge and experience of boards and audit committees in supervising and overseeing financial accounts. Account preparation can play a major role in preventing, detecting and reducing financial fraud by cooperatives, thereby increasing their financial performance. Financial compensation for directors improves the financial performance of the cooperative (Spear, 2004).

Gender diversity among board members has attracted increasing scholarly attention (Adams and Ferreira, 2009). Quotas are enforced not only for the sake of equality but also for governance and performance, where women directors are expected to add a diversity of skills and opinions to the male-dominated boards. Gender diversity adds new perspectives and experiences to the board that leads to flexible thinking and creative problem-solving (Grashuis and Cook, 2016), which, in turn, improves the competence profile of the directors (Carter *et al.*, 2003; Rose, 2007), and is expected to reduce the control problem between managers and members (Yang and Chaddad, 2014).

Indicators used to signal agency problems include conflicts, fraud and membership policy. Cooperatives may face conflicts between stakeholders due to overlaps in responsibilities, individual differences in personality, and resource allocation. Such conflicts may have a negative effect on performance (Cook, 1994). Fraud has

an impact on financing costs, investment decisions and shareholders' wealth (e.g. Lin *et al.*, 2012). Fraud costs tend to influence financial performance (Kellogg and Kellogg, 1991). Closed membership cooperatives can eliminate the problem of free-riders (Karantininis and Zago, 2001). Open membership cooperatives are not expected to produce high-quality products (Hovelaque *et al.*, 2009; Mérel *et al.*, 2009).

■ *Member ownership – structural characteristics*

Older cooperatives may perform better (Bond, 2009), due to having more fixed assets and inventory turnover ratios (Harrington, 1993). Larger membership size may allow for more volume and reduce unit costs of e.g. inputs and transport (Boyd *et al.*, 2007; Huang *et al.*, 2013). However, larger cooperatives are more likely to face free-riding problems as a result of coordination issues (Olson, 1965). Monitoring members' commitments is more difficult and costly, and social sanctions are less effective for large memberships. In smaller cooperatives better information sharing and social sanctions could ensure cooperation (Hardin, 1982; Staatz, 1983). An alternative measure of size of a cooperative is the value of its assets. A cooperative with more assets may be more capable of providing services and having market power. Also both agency and supervisory costs may vary with size (Huang *et al.*, 2013). Moreover, adequate capital is required for initial development and to guarantee long-term sustainability. When capital is limited, the cooperative will not be able to finance investments in assets (Ling, 2005), thereby limiting its performance. Traditional cooperatives, by their very nature, are equity bound due to solely member ownership, and therefore may be expected to rely more on debt financing making them more leveraged than firms. Higher leveraged cooperatives are, therefore, more likely to face financial stress (Gentzoglanis, 1997), leading to poor performance.

As cooperatives expand and diversify their business activities, the need to employ professionals to make strategic, tactical, and operational decisions increases (Cook, 1994; Hueth and Marcoul, 2009). The presence of professional employees makes cooperatives more viable and efficient and enables them to better serve the needs of their members (Adrian Jr and Green, 2001). The availability of infrastructure facilities, such as office and storage areas may contribute to the functioning of the cooperatives (Karami and Rezaei-Moghaddam, 2005).

Unions or secondary cooperatives play an essential role in strengthening the performance of cooperatives (Krahnen and Schmidt, 1995) and are considered to be a source of competitive advantage (Wanyama *et al.*, 2009). External support from the government and donors in the form of a revolving fund, farm machinery, and equipment can have a direct impact on the performance of cooperatives, particularly at the start of the cooperative (Rankin *et al.,* 2007). In contrast, Karami and Rezaei-Moghaddam (2005) argue that too much external support would make them dependent on their financial sustainability endeavors. Business links with other cooperatives operating at the same organization level (e.g. among primary cooperatives) could help cooperatives to increase turnover and boost their competitive market position. Bengtsson and Kock (1999) argues that business relationships with other firms enable a company to gain access to products and other resources of importance for its business.

In this study, we search to understand which and how governance and structural characteristics influence the cooperatives' performance. The empirical evidence is based on data collected in the Tigray region, northern Ethiopia. Before turning to the methodology of data collection and econometric models, we introduce the specificities of agricultural cooperatives in Ethiopia.

3. Agricultural cooperatives in Ethiopia

Successive Ethiopian governments (from the Imperial period to the present government) gave recognition to the importance of cooperatives and made deliberate efforts to improve the organizations. During the Imperial era (1932-1974), cooperatives were primarily established to support the production of high-value agricultural products for export (Bernard *et al.*, 2010). Success was however limited due to the presence of feudalistic land tenure systems. The subsequent military rule (1974-1991), which viewed agricultural cooperatives as key

instruments to build a socialistic economy, pursued the cooperative agenda more aggressively. Membership was not voluntary and the organization was undemocratic by nature (Bernard *et al.*, 2010).

Following the collapse of the socialist regime in 1991, cooperatives had become so unpopular and many disappeared quickly. They dissolved in such a disorderly manner that it created a lasting suspicion and distrust of cooperatives, which still haunts the cooperatives' reputation until today (Emana, 2009). In an attempt for a fresh start, successive governments over the last two decades have tried to rectify the flaws and practices made possible by earlier laws (FCA, 2015). The Ethiopian Cooperative Proclamation provides for cooperatives to be established in different sectors/subsectors. The Proclamation also stresses the formation of cooperatives along the principle of one-cooperative-type-per-village. Each type of cooperative must operate based on its registered activity and it cannot compete with other cooperative types. Hence, the cooperative types considered in this paper are exclusive. Over time, the number and diversity of cooperatives increased rapidly. According to the survey conducted by the Agricultural Transformation Agency, the cooperative sector in Ethiopia grew by about 87% over the last five years. The number of cooperatives grew notably in Tigray, Oromia, and Somalia regional states (Bernard *et al.,* 2013). Recent data from the Federal Cooperative Agency estimated the number of cooperatives at 74,000 with 14 million members and a capital of 5.4 billion ETB (FCA, 2015).

According to the Tigray Cooperative Promotion Agency, the number of registered cooperatives in the region is estimated at 4,265, which include livestock, natural resource, multipurpose, and service cooperatives. Livestock cooperatives (about 30% of the total), include: (a) beekeeping cooperatives engaged in production of honey from traditional and modern beehives and sell their produce either to a union or retailers; (b) beef-cattle, sheep and goat fattening cooperatives, which collectively purchase young and less conditioned livestock, feed them for three months and collectively sell them at spot markets; and (c) dairy cooperatives, which collect milk from members who own improved hybrid cows and directly sell it to urban consumers. Many livestock cooperatives are emerging in the rural areas as a government solution to contribute to the livelihoods of landless and unemployed rural youth who have completed vocational school. The second type are the natural resource cooperatives (24%), which include irrigation and forestry cooperatives. Irrigation cooperatives collectively engage in construction and maintenance of river diversion canals and motor pumps for common use of water to members. They are also involved in the production and marketing of fruits and vegetables using irrigation water. Forestry cooperatives are organized by farmers for joint nature conservation and sustainable use of forest resources for example by seedling multiplication and the harvesting of frankincense and other natural gums and resins. A third type are the multipurpose cooperatives (16%) that offer a range of services to members who own land for cultivation. The services include, for example: (a) providing farm inputs such as fertilizers, seeds, and farm implements; (b) facilitating the aggregation of products such as sesame, sorghum, and maize; and (c) providing services such as farm machinery, a grinding mill, and storage. The remaining 30% are service cooperatives that offer savings and credit services. Their aggregate membership reached over 1.5 million people and the value of their pooled capital is estimated at more than one billion ETB (36.8 million USD) (TCPA, 2017). The agricultural cooperatives considered in this study include three of the four types mentioned above, namely livestock cooperatives, natural resource cooperatives, and multipurpose cooperatives.

4. Methods

4.1 Study area and sampling technique

Agriculture is the most important economic activity in the Tigray region and the sector contributes about 40% of the regional GDP. The cooperative sector is strong in the region (Bernard *et al.*, 2013) and it attracts a large membership (estimated at 35% of the population) (TCPA, 2017). We conducted a cooperative level survey in all four zones of the region except the urbanizing Mekelle special zone from April to August 2017. A three-stage random sampling was used to select 511 agricultural cooperatives. In the first stage, we randomly selected three weredas (districts) from four zones (Figure 1). In the second stage, a total of 249 tabias

(villages) were randomly selected from each wereda, proportionately considering the number and type of cooperatives operating (Table 1). In the third stage, using the probability proportion to size technique, we selected 511 agricultural cooperatives from those 249 tabias. The sample includes cooperatives involved in agricultural production and marketing which accounts for 65% of the entire target agricultural cooperatives. Service cooperatives that provide savings and credit services were excluded.

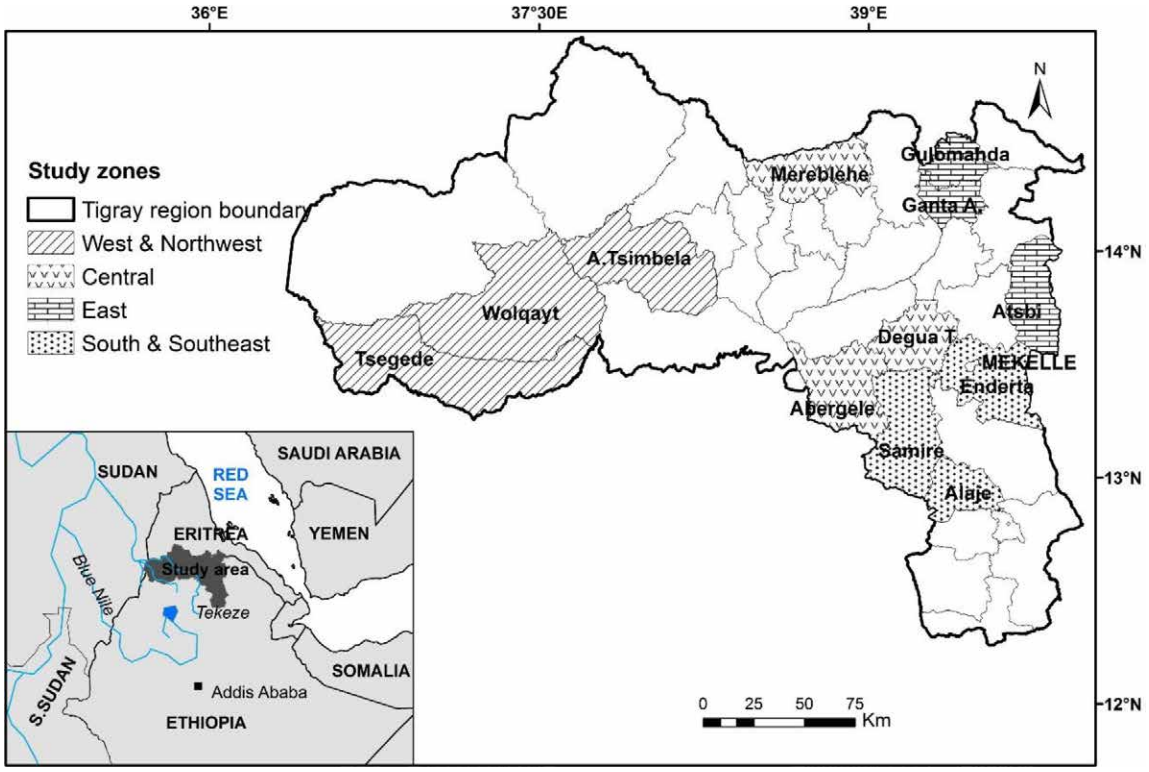

Figure 1. Study area in the Tigray Region, Ethiopia.

Table 1. Distribution of sampled agricultural cooperatives across zones and weredas.

Zone	Wereda selected	Number of selected tabias	Number of selected cooperatives
Eastern	Atsbi Wenberta	33	43
	Ganta Afeshum	16	40
	Gulomekeda	25	51
Central	Abergele	22	32
	Degua Tembien	17	64
	MerebLeke	14	22
South and southeastern	Alaje	16	41
	Enderta	24	53
	Samre	20	41
West and northwestern	AsgedeTsimbla	12	25
	Tsegede	25	57
	Wolqayt	25	42
Total		249	511

A structured questionnaire was used to collect data on the chairperson characteristics, service provision, production and marketing, governance and performance, dividend, and tabia-level variables. In addition to the structured questionnaire, an extensive review of readily available cooperative bylaws, past audit reports, cooperative periodic activity reports including financial statements and strategic plan documents was made. The questionnaire was pre-tested in September 2016 on 65 randomly selected cooperatives (data are not included in the analysis). A group of trained enumerators and supervisors, fluent in Tigrigna, interviewed the chairpersons of the cooperatives. In the case of absence of the chairperson, we interviewed the vice-chairpersons (which was done in 18% of the sample). All interviews were held at the offices of the respective cooperatives.

4.2 Calculation of the outcome variables

To calculate the total sales, six different cooperative income sources are considered, namely: (1) sales of farm inputs to members and non-members (fertilizers, pesticides, herbicides, and seeds); (2) sales of farm implements (sickle, motor pump, treadle pump); (3) sales of members' farm produce (mainly cereals, sesame, fruits and vegetables); (4) sales of livestock and livestock products (like honey, milk, cattle, sheep, goat); (5) NRCs sales include sales of fruits and vegetables, nursery seedling, frankincense, and other gums and resins, fuelwood, grass forage for livestock, and grass; and (6) sales of consumer goods (sugar, cooking oil, coffee). The latter may not be common in other regions, but is a key activity of multipurpose cooperatives in Ethiopia, next to providing agricultural services.

Gross profit is calculated as the total operating revenue for each of the cooperatives minus the total cost of goods sold, which includes the cost of the input or material used in producing or supplying the goods along with the direct labor cost used to produce or supply the goods, and transport costs. The regulator requires cooperatives to set aside 30% of the net profits (after deducting the overhead costs and interest payment from gross profit) into statutory reserves and the cooperative pays out the remaining 70% to members as dividend in proportion to their investment in shares and transaction volume. The dividend policy varies from cooperative to cooperative.

4.3 Econometric model specification

- *An exploratory ordinary least squares regression model on cooperatives performance*

The outcome variables are measured in total value in ETB (Ethiopian currency) and are considered for the year 2015/2016. Except for the gross profit, cooperative sales and sales per member are specified in logarithmic terms. An exploratory Ordinary Least Squares regression model (OLS) was used to identify the drivers of performance in sales and sales per member. The OLS model is specified as follows:

$$Y_j = \alpha_0 + C_j'\alpha_1 + I_j'\alpha_2 + G_j'\alpha_3 + E_j'\alpha_4 + L_j'\alpha_5 + T_j'\alpha_6 + \varepsilon_j \quad (1)$$

where Y_j is an outcome variable, including sales and sales per member of the j-th cooperative; C_j is a vector of characteristics of the chairperson of the j-th cooperative; I_j is a vector of cooperative-specific institutional characteristics of the j-th cooperative; G_j is a vector of governance characteristics in the j-th cooperative; E_j a vector of external linkages and support of the j-th cooperative; L_j is a vector of dummies representing four cooperative locations related to the j-th cooperative; and T_j is a vector of dummies representing three cooperative types (multipurpose, livestock, natural resource); ε_j denotes error terms, and α's are vectors of parameters to be estimated. See Supplementary Table S1 for an overview of the descriptions of variables.

■ *A Heckman selection model for analyzing determinants of profit performance*

The outcome variable profit was taken from the financial statements of the audited cooperatives. In the Ethiopian context, for a cooperative to be declared as profitable or otherwise, it should be audited (Benson, 2014). For a non-audited cooperative, profit is not registered. Financial auditing is carried out primarily to monitor whether the agents of the member-owners (the management staff) and board of directors have utilized the financial resources to serve the interests of the members (Pozzabon *et al.,* 2012). Regular financial audits help to ensure that directors and managers are made accountable for the use of the financial resources based on the interests of the member-owners. Audits contribute to predictability, which helps to respond to changing circumstances that challenge the cooperatives' transparency. It also serves as a means of controlling corrupt practices and to build trust among members and participation to maximize the benefits of cooperative membership (Benson, 2014).

In the study area, cooperatives get auditing services by the government-run cooperative promotion agency. However, because of a shortage of government auditors, due mainly to poor incentive packages and high staff turnover (Benson, 2014), not all cooperatives get this service. Cooperatives are selected for audit in a non-random way, either systematically based on some criteria, or the cooperatives themselves ask for the service. The agency uses informal ways to prioritize which cooperatives should be audited based on the following criteria: (a) the presence of conflict and fraud; (b) the presence of multiple products with large sales turnover; (c) a number of loan defaulters; or (d) a plan to pay dividends to members. As a result, about 44% of the surveyed cooperatives were not audited since their inception. In this case, the audited cooperatives may not constitute a random sample of the population of all cooperatives when analyzing profit. To control for the potential bias due to the selectivity problem that arises because of the non-random auditing, we use a Heckman selection model (Heckman, 1979) with a first step selection (audit) equation, and a second step outcome (profit) equation specified as follows:

$$P_j^* = \beta_0 + C_j'\beta_1 + I_j'\beta_2 + G_j'\beta_3 + E_j'\beta_4 + L_j'\beta_5 + T_j'\beta_6 + v_j \quad (2)$$

Where P_j^* denotes a latent variable for the profit of the j-th cooperative; v_j is a random error term associated with the outcome variable; others are as defined above. The profit P_j^* is not observed for a cooperative that has not been audited. Following Verbeek (2008), we model the likelihood of an audit of the j-th cooperative (selection equation) as:

$$H_j^* = \gamma_0 + C_j'\gamma_1 + I_j'\gamma_2 + G_j'\gamma_3 + E_j'\gamma_4 + L_j'\gamma_5 + T_j'\gamma_6 + S_j'\gamma_7 + u_j \quad (3)$$

Besides including the same variables as in Equation 2, Equation 3 has a vector of identification variables S_j. The relationship between the outcome variable Y_j and the selection variable H_j is given as follows:

$$H_{\mathrm{j}} = \begin{Bmatrix} 1 \; if \; H_j^* > 0 \\ 0 \; if \; H_j^* \leq 0 \end{Bmatrix} \quad (4)$$

and

$$P_{\mathrm{j}} = \begin{Bmatrix} P_j^* & if \; H_{\mathrm{j}} = 1 \\ unobserved & if \; H_{\mathrm{j}} = 0 \end{Bmatrix} \quad (5)$$

Where P_j denotes cooperative j's actual profit. The binary variable H_j indicates whether the j-th cooperative is audited (H_j=1) or not (H_j=0). The error terms v_j and u_j are assumed to be bivariate normally distributed with a zero expected value, variances of σ^2_v and σ^2_u, respectively, and a covariance of σ_{vu}. The conditional expected profit, given that a cooperative is audited, is given by:

$$
\begin{aligned}
E[P_j/H_j = 1] &= C_j'\beta_1 + I_j'\beta_2 + G_j'\beta_3 + E_j'\beta_4 + L_j'\beta_5 + T_j'\beta_6 + E[v_j/H_j = 1] \\
&= C_j'\beta_1 + I_j'\beta_2 + G_j'\beta_3 + E_j'\beta_4 + L_j'\beta_5 + T_j'\beta_6 + E(v_j/u_j > -[C_j'\gamma_1 + I_j'\gamma_2 \\
&\quad + G_j'\gamma_3 + E_j'\gamma_4 + L_j'\gamma_5 + T_j'\gamma_6 + S_j'\gamma_7]) \\
&= C_j'\beta_1 + I_j'\beta_2 + G_j'\beta_3 + E_j'\beta_4 + L_j'\beta_5 + T_j'\beta_6 \\
&\quad + \left(\frac{\sigma_{vu}}{\sigma_u^2}\right) E(v_j/u_j > -[C_j'\gamma_1 + I_j'\gamma_2 + G_j'\gamma_3 + E_j'\gamma_4 + L_j'\gamma_5 + T_j'\gamma_6 + S_j'\gamma_7]) \\
&= C_j'\beta_1 + I_j'\beta_2 + G_j'\beta_3 + E_j'\beta_4 + L_j'\beta_5 + T_j'\beta_6 \\
&\quad + \sigma_{vu} \frac{\phi\left(C_j'\gamma_1 + I_j'\gamma_2 + G_j'\gamma_3 + E_j'\gamma_4 + L_j'\gamma_5 + T_j'\gamma_6 + S_j'\gamma_7\right)}{\Phi\left(C_j'\gamma_1 + I_j'\gamma_2 + G_j'\gamma_3 + E_j'\gamma_4 + L_j'\gamma_5 + T_j'\gamma_6 + S_j'\gamma_7\right)}
\end{aligned} \tag{6}
$$

where the last equality assumes σ_u^2=1 (a normalization restriction) and the expression for the expectation of a truncated standard normal distribution.

The identification variables S_j in the audit Equation 3 were selected based on previous related literature and on our field knowledge on the factors that determine the probability of whether a cooperative is audited or not. The following variables are considered important: (a) total capital; cooperatives with an adequate capital base are more likely to receive audit services; (b) leverage is included to capture the impact of financial debt. It is measured by the ratio of total liabilities to total assets. Regulations set a limit on cooperative borrowing, which will depend on the level of capital reserve. Hence, we expect cooperatives with more debts to be more likely to be selected for audit; (c) audit committee is a dummy that takes value 1 if the cooperative has such committee installed. These committees are expected to conduct internal audits and inspect the documents of the cooperative at least once a month; hence, cooperatives are more likely to receive an audit if they are known to have an audit committee; (d) financial statement is a dummy specifying whether or not the cooperative had prepared financial statements. We assume that cooperatives are more likely to be audited if they can provide financial statements such as income statements, balance sheets, cash and non-grants statement; (e) financial fraud is a dummy that indicates whether financial fraud has occurred in the cooperative since its inception. Regulations stipulate that when a majority of the board members or more than one-third of the total members requests to detect fraud, the government will assign auditors to inspect the financial records. Hence, cooperatives that faced financial fraud are more likely to be selected for audit; (f) access to credit is a dummy indicating whether a cooperative has access to credit. We expect that credit access eases cooperative liquidity constraints which, in turn, may increase the propensity to provide more services to their members. Hence, cooperatives are more likely to receive audits if they are known to have access to external funds; and (g) distance to the cooperative office measured as the distance from the village where the cooperative is located to the wereda cooperative office in minutes is included because we expect that cooperatives close to the government audit office are more likely to be audited.

4.4 Descriptive statistics

Table 2 gives a descriptive summary of the variables of interest in this research. The data confirm that cooperatives in the sample were highly heterogeneous. The annual sales value of the cooperatives ranges from 560 to a maximum of 12.1 million ETB (444,843 USD). The standard deviations of the gross profits were equally large. Interesting to note is that 44% of the cooperatives were not audited since their inception, which is partly attributed to a shortage of government auditors due to the poor incentive packages and high staff turnover (Benson, 2014). As a consequence, these cooperatives were not in a position to pay dividends to their members. Secondly, because of the delay in the audits, cooperatives fail to get services (e.g. credit, fertilizer) from their respective unions, who demand for audit reports in order to reduce the risks of default.

The cooperatives also differ much in their characteristics. Chairpersons have served on average of 3.5 years. Some had been serving for quite a long time which is actually not allowed by the Cooperative Proclamation that limits the terms of office to three years with a maximum of two consecutive terms. During the survey, some chairpersons were found to have served more than one term without consent of the general assembly. Others were not replaced since the start of the cooperative. Most of the cooperatives visited were established

between 2009 and 2016. A number of cooperatives were started as part of the Rural Financial Intermediation program or by initiative of NGOs. The former program provided credit to poor households to support self-employment and small enterprise development and was financed by IFAD, the African Development Bank and the Ethiopia government; it has sparked the formation of a large number of primary cooperatives in rural areas. Also, membership varies. Noteworthy is that the Cooperative Proclamation requires a primary cooperative to be dissolved if its membership falls below ten. However, we still find cooperatives with fewer members. About 52% of the cooperatives have an office, of which about 40% owned it and the other cooperatives either shared it with the village agricultural and rural development offices or rented it.

According to the Cooperative Proclamation, each cooperative should have a board of directors, and five other sub-committees, such as those responsible for control, credit, savings, training and education, and auditing. Not all cooperatives visited had these committees installed. Results also indicate that women remain under-represented in the governance structures of their cooperatives. Few women serve on a board, and only a few cooperatives had a woman director, while women make up on average 45% of the membership. Few cooperatives were found to compensate their board members. A significant number of cooperatives experienced conflicts in the past years among members, and a fifth of the respondents mentioned that financial fraud was committed in their cooperatives.

Although the Cooperative Proclamation promotes that cooperatives are open to all persons who could use the cooperative services and assume membership responsibilities, we find 'closed' cooperatives in beekeeping, irrigation, and livestock. Several of these cooperatives were established by programs of the regional government of Tigray to organize landless and unemployed rural households in these cooperatives in order to support their livelihoods. Depending on the type of cooperative, membership was limited to 15 to 25 persons. Most of the closed cooperatives were given access to area enclosures, forestlands and mountains for joint honey production, livestock fattening and seed multiplication. The membership limit was set by the local government. When a member would withdraw or terminate membership, closed cooperatives create a barrier to entry for prospective members by asking to pay a lump sum to buy themselves into the cooperative. This money is meant to compensate for the labor, time, and resources the current members invested so far in the cooperative.

As mentioned above, some cooperatives received support when they were initiated. About half of the cooperatives had a business link with other cooperatives and/or are member of a union. Such membership to a union is not voluntary although there is no uniformity in the eligibility criteria. Unions are second-tier organizations established by two or more primary cooperatives having similar objectives and perform similar functions. In some cases, cooperatives are forced to join unions through a government-led cooperative agency in order for them to be financially viable and more efficient in their operations through accessing services, such as the supply of farm inputs, consumer goods, output aggregation, value addition through processing, and linking cooperatives to domestic and international buyers. Unions also provide credit, and specialized training (such as bookkeeping and auditing) to member cooperatives and assist them to develop annual strategic plans. Finally, most cooperatives were located in remote rural areas and most households lived in scattered rural communities with a lack of access to transport services.

Table 3 compares the performance of three groups of cooperatives, namely: (1) multipurpose cooperatives (MPCs); (2) livestock cooperatives (LVCs), and (3) natural resource cooperatives (NRCs), which were sampled in almost equal numbers. Noteworthy is again the wide variability across the cooperatives. The highest sales value and gross profit realized were measured among multipurpose cooperatives. This does not come as a surprise given their larger operational area and extensive service portfolio which gives them an opportunity to enlarge membership.

Table 2. Descriptive statistics of the variables included in the models.[1]

Variables (unit)	n	Mean	Std. dev.	Minimum	Maximum
Dependent variables					
Total sales (1000 ETB)	511	657.39	1,545.13	0.56	12,068.12
Sales per member (1000 ETB)	504	3.22	9.08	0.01	94.08
Gross profit (1000 ETB)	284	310.71	2,453.54	-2,682.49	44,206.10
Audited (yes=1)	511	0.556	0.498	0.00	1.00
Independent variables					
Chairperson characteristics					
Chairperson education (years)	511	5.857	2.797	0.00	13.00
Chairperson working experience (years)	511	3.543	2.961	0.00	20.00
Institutional characteristics					
Age of cooperative (years)	504	8.685	7.423	0.500	38.00
Membership size (number)	504	380.62	551.16	4.00	2,550.00
Cooperative size in assets (1000 ETB)	511	692.25	4,720.99	1.50	1,011.00
Total capital (1000 ETB)	511	124.93	2,014.55	1,343.57	44,206.30
Leverage (number)	454	0.148	0.629	0.00	7.510
Presence of employees (yes=1)	510	0.686	0.464	0.00	1.00
Cooperative office (yes=1)	511	0.517	0.500	0.00	1.00
Governance characteristics					
Number of cooperative committees	511	4.523	1.246	1.00	8.00
Women directors (number)	511	1.141	1.106	0.00	5.00
Board education (years)	511	5.787	2.087	0.00	11.00
Board cash compensation (yes=1)	511	0.076	0.266	0.00	1.00
Presence of audit committee (yes=1)	505	0.752	0.432	0.00	1.00
Prepared financial statement (yes=1)	511	0.701	0.458	0.00	1.00
Experiences of conflicts (yes=1)	510	0.429	0.495	0.00	1.00
Presences of financial fraud (yes=1)	510	0.216	0.412	0.00	1.00
Membership policy (closed=1)	510	0.300	0.459	0.00	1.00
External linkages and support					
Received help during set up (yes=1)	506	0.751	0.433	0.00	1.00
Business links with other coops (yes=1)	511	0.524	0.500	0.00	1.00
Access to credit (yes=1)	511	0.652	0.447	0.00	1.00
Union membership (yes=1)	510	0.475	0.500	0.00	1.00
Village level characteristics					
Distance to cooperative office (minutes)	499	27.99	29.101	1.00	360.00

[1] ETB (Ethiopian currency) exchange rate reported by commercial bank of Ethiopia on June 2018, 1 USD = 27.20 ETB.

Table 3. Cooperatives performance measured by sales value and profit.[1]

Type of cooperatives	Total cooperatives	Total members	Mean value (1000 ETB)	
			Sales value	Gross profit
MPCs[2]	180	180,726	1,383.23 (2,042.21)	625.99 (3,735.69)
LVCs[2]	201	5,379	149.19 (766.06)	64.59 (305.28)
NRCs[2]	130	8,023	235.85 (904.85)	122.03 (736.92)
Total	511		605.92 (1,493.79)	303.549 (2,413.12)
F-stat			44.14***	2.38*
Pairwise contrast[a]			MPC > LVC, NRC	–

[1] Significant ***P<1%; ** P<5%; * P<10% with ANOVA. Superscript letters [a] refers mean difference is significant using Tukey's post hoc test. Values in parenthesis are standard deviation.

[2] LVCs = livestock cooperatives; MPCs = multipurpose cooperatives; NRCs = natural resource cooperatives.

5. Results and discussion

5.1 Drivers of sales

Table 4 gives the estimation results of the OLS models on cooperative sales (total and per member) using the explanatory variables introduced above including cooperative and zonal fixed effect dummies. The estimators in the models with cooperative and/or zone dummies are within-group estimators, that control for unobservable cooperative type and/or zonal fixed effects. Estimation results in all models are moderately robust despite a considerable difference in the value of the R-squared (between 0.12 and 0.42). The correlation statistics and variance inflation factor (Pindyck and Rubinfeld, 1998) tests fail to indicate potential multicollinearity problems (tables available upon request by the author). To test the potential endogeneity of union membership and cooperative size to sales as the dependent variable, we estimated alternative two-stage least square (2SLS) instrumental variable (IV) models. The Durbin-Wu-Hausman test statistics of these model indicate

Table 4. Determinants of log transformed sales (Ordinary Least Squares regression model).[1,2]

Independent variables	Ln (total sales)		Ln (sales per member)	
Chairperson characteristics				
Chairperson education	-0.182	(0.142)	-0.085	(0.088)
Chairperson education squared	0.007	(0.011)	0.006	(0.007)
Chairperson working experience	0.045	(0.047)	0.004	(0.027)
Institutional characteristics				
Age of cooperative	-0.029	(0.028)	-0.007	(0.016)
Ln (membership size)	0.575	(0.171)***	–	
Ln (cooperative size in assets)	0.183	(0.036)***	-0.027	(0.023)
Employees	0.417	(0.328)	0.016	(0.195)
Office	0.684	(0.357)*	0.705	(0.207)***
Governance characteristics				
Number of committees	0.026	(0.106)	-0.028	(0.062)
Women directors	-0.132	(0.121)	-0.200	(0.072)***
Board education	0.105	(0.076)	0.006	(0.045)
Board compensation	-0.292	(0.509)	0.235	(0.298)
Conflicts experience	-0.854	(0.288)***	-0.316	(0.168)*
Membership policy	0.045	(0.345)	-0.042	(0.203)
External linkages and support				
Received help during setup	0.146	(0.319)	0.281	(0.187)
Business links with others coop	0.277	(0.290)	-0.308	(0.171)*
Union membership	-0.944	(0.382)**	-0.700	(0.222)***
Location-zone dummies[a]				
Central	0.275	(0.381)	0.246	(0.222)
South and southeastern	0.020	(0.386)	-0.326	(0.224)
West and northwestern	0.316	(0.386)	0.131	(0.224)
Cooperative type dummies[b]				
LVCs	-0.716	(0.755)	1.158	(0.319)***
NRCs	-1.272	(0.702)*	1.144	(0.338)***
Constant	6.148	(1.430)***	6.379	(0.649)***
Number of cooperatives	495		495	
R-squared	42.06		11.93	

[1] ***P<1%; ** P<5%; * P<10% are levels of significance. Figures in brackets are standard errors. [a] denotes Eastern zone is the base category; [b] denotes that membership of MPCs is the base category.

[2] Ln = natural logarithm; LVCs = livestock cooperatives; MPCs = multipurpose cooperatives; NRCs = natural resource cooperatives.

no evidence for the endogeneity of union membership (F_1, 475 = 2.609, P=0.107) and cooperative size (F_1, 54 = 0.122, P=0.882)[1]. The Sargan statistics for over-identification restriction are insignificant for the IVs bank account and distance to the union office (Chi^2=0.010; P=0.920), and lagged assets (Chi^2=0.053; P=0.818), confirming that these IVs used in the model are valid and are not correlated with the error term of the structural Equation 1. While we cannot fully exclude a potential effect of endogeneity on our results, we prefer to present the results of the OLS model. However, the estimation results must be interpreted cautiously.

5.2 Determinants of audits and profits

We estimate the OLS and Heckman models presented in Table 5 using the same vectors of explanatory variables specified in Equation 1. The OLS model and Heckman outcome equation estimate the determinants of profit while the selection equation measures the factors affecting the likelihood of being audited. The model statistics indicate that the association between the error terms of the outcome and selection equations (rho) is statistically different from zero. The likelihood ratio (LR) test of correlation between the error terms of the two equations is significant. The confidence interval of the Lambda values does not include the number zero. This confirms the presence of selectivity problems in the OLS model, which justifies the use of the Heckman selection model.

The results of the selection equation suggest that mainly the older cooperatives and those with more members were audited. Cooperatives with less capital and those located close to the wereda cooperative office were more likely to have been audited. Results also suggest that the cooperatives with relatively more women in their boards, these that had an audit committee, that were able to provide financial statements and had business links with other cooperatives were more likely to have been audited. The results also highlight that access to credit positively influenced the likelihood of audit. In Ethiopia, cooperatives fail to access credit from banks due to collateral shortages. Even in donor financing programs, the credit requests may not be approved unless the agency acts as a security guarantor. Finally, cooperatives located further from the wereda cooperative office were less likely to be audited due to their remoteness and the generally poor state of the infrastructure. LVCs and NRCs were more likely to be audited compared to MPCs.

- *Institutional characteristics*

The age of the cooperative seems not important for sales nor profit, but membership does. Membership size is positively associated with both sales and profit. This finding is consistent with Karami and Rezaei-Moghaddam (2005), Liang *et al.* (2015) and Ragasa and Golan (2014). Also, total assets of a cooperative are positively associated with total sales and profit, but not significant for sales per member. In Ethiopian cooperatives, these assets reflect the value of what the cooperatives received during their initial formation through donation and no substantial change in assets is usually observed (Bernard and Spielman, 2009). Many Ethiopian cooperatives were initiated and formed through top-down interventions by the government or NGOs (Francesconi and Ruben, 2008). This external financial and material assistance attracts members to join cooperatives and is often used to initiate cooperative service operations. While the number of employees seems not to matter for sales, having an office is positively related to sales.

- *Governance characteristics*

We find little evidence that associates the chairperson's characteristics with the cooperative's performance. This is consistent with Bond (2009), who finds an insignificant relationship between the financial performance of US agricultural cooperatives and the directors' characteristics. One result stands out; the coefficient of education of the chairperson was not significant in the sales model, but negative in the profit model. The

[1] To test the endogeneity of the model, a three-step procedure was followed. In step one, we estimated two-stage least square (2SLS) instrumental variable (IV) models for each endogenous variable separately using its respective instrument. In the second step, the 'estat overid' command was applied in STATA to test the over-identification restriction (Sargan-test) as well as the validity of the instrumental variables used. In step three, the 'estat endogenous' command was applied to test if the variables union membership and cooperative size are endogenous (Wu-Hausman F-statistics).

Table 5. Determinants of cooperatives profit and auditing (Ordinary Least Squares regression (OLS) and Heckman model).[1]

Independent variables	OLS profit Equation 1		Heckman model			
			Profit Equation 2		Audit Equation 3	
Chairperson characteristics						
Chairperson education	-131.083	(59.955)**	-123.162	(63.869)*	-0.069	(0.084)
Chairperson education squared	8.704	(4.582)*	7.336	(4.814)	0.005	(0.006)
Chairperson working experience	-10.766	(17.862)	-16.415	(18.885)	0.003	(0.032)
Institutional characteristics						
Age of cooperative	-1.278	(10.349)	-10.809	(11.430)	0.116	(0.023)***
Ln[2] (membership size)	134.393	(69.375)*	147.768	(85.864)*	0.343	(0.113)***
Ln[2] (cooperative size in assets)	13.334	(15.681)	118.602	(50.277)**	–	
Ln[2] (total capital)	–		–		-0.074	(0.023)***
Leverage	–		–		0.052	(0.197)
Employees	-289.495	(177.665)	-367.645	(192.426)*	0.050	(0.190)
Office	236.681	(170.912)	26.911	(196.108)	0.345	(0.202)*
Governance characteristics						
Number of committees	-28.189	(47.596)	-41.169	(50.850)	-0.011	(0.061)
Women directors	-117.497	(51.405)**	-161.817	(58.462)***	0.169	(0.078)**
Board education	40.341	(32.897)	42.879	(35.955)	0.078	(0.046)*
Board compensation	110.957	(177.685)	54.219	(193.305)**	0.344	(0.431)
Audit committee	–		–		0.286	(0.198)*
Financial statement	–		–		0.407	(0.199)**
Conflicts experience	-201.979	(122.994)	252.912	(129.903)*	-0.240	(0.179)
Financial fraud	–		–		0.222	(0.224)
Membership policy	-186.992	(178.767)	-115.609	(192.086)	-0.066	(0.196)
External linkages and support						
Received help during setup	-3.319	(147.609)	-6.346	(160.304)	–	
Business links with others coop	205.784	(129.849)	179.895	(142.856)*	0.470	(0.177)***
Union membership	-222.049	(185.839)	-414.018	(208.278)**	0.134	(0.226)
Access to credit	–		–		0.329	(0.180)*
Village level characteristics						
Distance to coop office	–		–		-0.011	(0.004)***
Location-zone dummies[a]						
Central	-238.015	(171.318)	-155.105	(185.884)	-0.704	(0.238)***
South and southeastern	-210.895	(163.565)	-242.588	(183.629)	-0.620	(0.260)**
West and northwestern	367.849	(160.082)**	386.000	(173.921)**	-0.013	(0.240)
Cooperative type dummies[b]						
LVCs[2]	241.172	(307.961)	237.672	(345.682)	0.809	(0.503)
NRCs[2]	344.344	(292.576)	325.124	(331.079)	0.854	(0.465)*
Constant	325.769	(618.477)	-988.826	(858.134)	-3.545	(0.938)***
Athrho _constant					-0.486	(0.153)***
Lnsigma_constant					6.827	(0.051)***
Mill's lambda					-415.851	(124.108)
Summary statistics						
R-squared	17.60					
Number of observations	276			431		
Censored observations				188		
Uncensored observations				243		
Log likelihood				-2,164.691		
Wald test			chi2(22) =57.29, Prob. > chi2 = 0.000			
LR test for indep. eqns. (rho = 0)			chi2(1) = 4.28, Prob. > chi2 = 0.039			
Mill's lambda			the 95% confidence interval [-659.097, -172.605]			

[1] *** $P<1\%$; ** $P<5\%$; * $P<10\%$. Standard errors in brackets. [a] denotes Eastern zone is the base category; [b] denotes that membership of MPCs is the base category. Ln stands for natural logarithm.

[2] Ln = natural logarithm; LVCs = livestock cooperatives; NRCs = natural resource cooperatives.

latter may be related to the possibility that more educated leaders might have a better understanding of member-relations to the cooperative and, therefore, strive for high member benefits through the provision of good services and low-price inputs instead of maintaining cooperative profits for economic stability. Our models are not conclusive on the importance of the number of committees a cooperative holds nor support a cooperative received during setup and membership policy. Profit seems to be higher for cooperatives of which board members receive a cash compensation. This finding corroborates with Chareonwongsak (2017), who reported a positive relationship between board members compensation and the cooperative performance.

Conflict is negatively correlated with sales and profit. Recent studies have shown that conflict is a result of member heterogeneity. The presence of such heterogeneity may weaken the organizational structure by affecting investment behavior, collective decision-making costs, and members commitment, potentially contributing to a cooperative's demise (Chaddad and Cook, 2007; Fulton and Hueth, 2009; Gripsrud *et al.*, 2001; Hoehler and Kuehl, 2018; Iliopoulos and Valentinov, 2017; Kalogeras *et al.*, 2009).

The result on the presence of women directors is puzzling and may be due to the limited number of women directors. The models suggest a negative correlation with sales per member and profit. The negative correlation with sales per member and profit may be due to the fact that regulations encourage women members to be elected to the board of directors through gender quota rather than merit-based selection. Consequently, women will end up with a passive role with men usually dominating the decision-making. Women may also be time-constrained due to their responsibilities in the households' production and reproduction activities. They may also be more limited in establishing socio-political networks compared to men (Barham and Chitemi, 2009), which hinders their participation in stimulating customer demand, which in turn leads to lower sales and profit. The finding is consistent with Grashuis and Cook (2016), who also report on a negative correlation between women directors and performance. Contrary to our expectations, closed membership policy seemed not to matter for the performance of the cooperative.

■ *External linkages, support, and location*

Having business links with other cooperatives is negatively correlated with sales per member, yet positively correlated with profit. The latter positive effect may relate to the reduction in transaction costs while dealing with other organizations. This result is consistent with the findings of Ragasa and Golan (2014). Yet, transaction costs may be less important for sales values and explain the negative effects on sales per member. Moreover, competition for potential members may have implications for sales volume.

Union membership is negatively correlated with sales and profit. This finding contradicts with those of Ragasa and Golan (2014), who found that being a member of umbrella organizations had a positive correlation with the performance of rural producer organizations. Actually, unions are established to provide services which the cooperatives are normally not able to access. In the study area, most cooperatives did not seem to benefit from a union membership. This could be due to several reasons including impacts on price (union charges higher price than the market), quality (union supplies unsafe or defective products), quantity and timing of product delivery, and transport cost. This result is consistent with the many complaints we heard during respondents' interview regarding union service delivery system.

Some interesting results on the probability to be audited stand out. Older cooperatives and those with more members have a higher probability to be audited (Table 5). The latter may be due to a pressure of more members on the cooperative to conduct audit and affect timely distribution of dividends. On the contrary, we find that cooperatives with less capital have are more likely to be audited. Audit service providers may prefer cooperatives with smaller amount of capital, with low transaction activities. Not surprisingly, having an office is positively correlated to the probability for audit. This is because having an office with key facilities and located at a known area is a basic requirement to receive an audit service. In the case of governance indicators, the level of education of the board is found to be positively correlated with audit. This may generally point to a higher level of education creating a higher sense of awareness about the benefit of audit

and more likely to take part in maintaining records and periodic reports. The presence of an audit committee is positively associated with the likelihood of receiving an audit. Hence, cooperatives whose audit committee invests time in preparing accounting entries, are likely to take part in an audit. Moreover, cooperatives that prepared financial statements have a higher probability for receiving an audit.

In order to check the robustness of our results**,** we run a separate OLS model for each cooperative type (Table 6). The results are in line with those presented above. Additionally, the variable indicating that board members would receive a compensation, was positive in the sales model for MPCs. The variable signaling a presence of conflict in a cooperative has a negative coefficient in the sales model for NRCs which contradicts Tadesse and Kassie (2017). Union membership had a negative coefficient in the sales model for MPCs. Business links with other cooperatives is negatively correlated to sales for LVCs. In addition to the regression models by each type of cooperative, we also present alternative models with selected variables in Supplementary Table S2, which serve as robustness checks. The results are similar to those shown in the full model of Table 4.

Table 6. Effects of log transformed sales by cooperative type.[1]

	Ln[2] (total sales)		
Independent variables	**MPCs[2]**	**LVCs[2]**	**NRCs[2]**
Chairperson characteristics			
Chairperson education	-0.030 (0.152)	-0.114 (0.213)	-0.369 (0.489)
Chairperson education squared	-0.004 (0.013)	0.002 (0.014)	0.015 (0.041)
Chairperson working experience	-0.007 (0.032)	-0.202 (0.132)	0.218 (0.154)
Institutional characteristics			
Age of cooperative	0.002 (0.016)	0.156 (0.105)	-0.192 (0.130)
Ln[2] (membership size)	0.370** (0.182)	1.134*** (0.362)	0.421** (0.377)
Ln[2] (cooperative size in assets)	-0.016 (0.034)	0.178*** (0.065)	0.258*** (0.081)
Employees	-0.050 (0.775)	0.253 (0.465)	-0.001 (0.757)
Office	0.525 (0.548)	0.528 (0.481)	1.077 (0.969)
Governance characteristics			
Number of committees	-0.142 (0.106)	-0.032 (0.158)	0.080 (0.280)
Women directors	-0.112 (0.135)	-0.072 (0.183)	-0.144 (0.357)
Board education	-0.039 (0.063)	0.223* (0.123)	0.086 (0.224)
Board compensation	0.379 (0.302)	6.038*** (1.760)	0.381 (1.928)
Conflict experience	-0.161 (0.249)	-0.173 (0.472)	-2.171*** (0.810)
Membership policy	0.203 (1.076)	0.618 (0.468)	-0.099 (0.834)
External linkages and support			
Received help during setup	0.383 (0.281)	-0.065 (0.558)	0.504 (0.827)
Business links with others coop	0.213 (0.262)	-0.777* (0.471)	0.222 (0.808)
Union membership	-2.037*** (0.517)	0.714 (0.555)	1.166 (0.935)
Location-zone dummies[a]			
Central	-0.175 (0.352)	1.442** (0.599)	-0.391 (1.103)
South and southeastern	-1.081*** (0.337)	1.058 (0.653)	0.279 (1.074)
West and northwestern	0.232 (0.338)	0.053 (0.606)	1.127 (1.235)
Constant	10.110*** (1.448)	2.993* (1.642)	5.794** (2.811)
Number of cooperatives	177.	192	126
R-squared	30.56	31.27	26.17

[1] ***P<1%; ** P<5%; * P<10%. Standard errors in brackets. [a] denotes the Eastern zone is a base category.

[2] Ln = natural logarithm; LVCs = livestock cooperatives; MPCs = multipurpose cooperatives; NRCs = natural resource cooperatives.

6. Conclusions

In Africa, much research was done on the impact of cooperatives at member-level, but much less is known on the drivers of the economic and financial performance at cooperative level. This paper aims to fill this knowledge gap by studying agricultural cooperatives in north Ethiopia. Agricultural cooperatives in the rural areas of Ethiopia have been attributed important roles in poverty reduction, ensuring food security and development by providing agricultural services to their members.

Some results stand out: (1) we find large variability for the sales and profit indicators we have used for performance and for the cooperative institutional and governance characteristics. (2) Many indicators related to the chairperson characteristics seem not to be clearly associated with performance. (3) Membership size has a positive correlation with cooperatives' performance. (4) In terms of organizational structure, we find little evidence on the effect of board members' cash compensation on economic and financial results. We also did not find differences in the performance between closed and open membership cooperatives, most probably because this is linked to the type of cooperative for which we control in the analysis. (5) Cooperatives with low level of conflict seem to perform better in terms of sales. This effect is mainly found for NRCs, where access to resources may lead to disagreements. (6) The horizontal linkage among cooperatives is very weak as perhaps the link is at its infant stage and little recognition is given to the benefits of networking. The vertical integration of cooperatives with unions seems to influence performance negatively. (7) Cooperative performance is also determined by the geographical location. The coefficients for the West and northwestern zone turn out to be positive and significant for-profit, relative to cooperatives in other zones. This analysis of unique cooperative-level data shows the large variability in performance across the studied agricultural cooperatives. This variability is partly explained by the characteristics of the cooperative chairperson, but even more by institutional and governance characteristics including the membership size, total assets, presence of conflict among members and union membership.

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Supplementary material

Supplementary material can be found online at https://doi.org/10.22434/IFAMR2019.0215

Table S1. Variables and descriptions.
Table S2. Determinants of log transformed sales (OLS model).

Declaration of conflicting interests

The author(s) declare no potential conflicts of interest with respect to the research, authorship, and /or publication of this article.

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