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The economic impact of sustainability standards on smallholder coffee producers: Evidence from Sidama Region, Ethiopia

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The Economic Impact of Sustainability Standards on Smallholder Coffee Producers: Evidence from Sidama Region, Ethiopia

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Abstract

Voluntary Sustainability Standards (VSS) has grown in global agricultural trade, emerging as the de facto supply chain management practice. Certification and traceability measures are now essential to enhance prices and marketability. In Ethiopia, a significant number of smallholder coffee farmers possess both Fairtrade and Organic certifications. In light of this, we conducted an assessment to determine the economic impact of double Fairtrade-Organic certification on smallholder coffee producers in the Sidama region of Ethiopia. Our evaluation relied on survey data and employed various estimation methods, including Ordinary Least Squares, Propensity Score Matching, and Nearest Neighbor Matching, to ensure the robustness of our findings. The results indicated a positive and significant impact of certification on coffee yield (red cherry), price, and dividends from coffee. These outcomes were consistent across different estimation methods, which further validated our findings. Additionally, our Nearest Neighbor Matching estimation unveiled a significant increase in coffee income, household income, and consumption expenditure among certified coffee producers, indicating an improvement in their living standards. To comprehensively assess the impact of VSS, we controlled for cooperative performance as a proxy for cooperative characteristics, which are likely to be correlated with VSS and outcome indicators. Despite a slight change in the magnitude of the estimate, our findings suggest that VSS still has a significant positive effect. The estimated changes in the coefficients imply that cooperative performance plays a role in the success of VSS, underscoring the significance of understanding local contexts and other institutional heterogeneities in fully comprehending the impact of VSS on smallholder farmers. Tailored support programs that address the specific needs of smallholder farmers and primary cooperatives could increase VSS adoption and perceived benefits.

Key words: voluntary sustainability standards, Fairtrade, Organic, coffee, smallholder farmers, Ethiopia

1. Introduction

As the world grapples with a wide array of challenges, ranging from poverty to climate change, it has become increasingly evident that addressing these issues requires a more coordinated and collaborative effort among international leaders, donor organizations, the public and private sectors, and non-governmental organizations. The 2030 Agenda for Sustainable Development underscores the importance of concerted actions to promote innovative and responsible business practices, including reducing production's environmental and social impacts and fostering a sense of shared responsibility. One of the initiatives aimed at achieving sustainable development is the Voluntary Sustainability Standard (VSS), which establishes criteria for various sustainability measures that market participants in the value chain can adhere to. The VSS system offers incentives expected to enhance market functionality, productivity, and diversification opportunities, encouraging policymakers and business leaders to adopt sustainable practices.

At its core, the VSS system is founded on a firm commitment to sustainability, which involves establishing mutually agreed-upon terms for consumers to purchase goods with sustainability attributes and for producers to manufacture and sell products that meet the required sustainability standards. VSS has gained increased attention in global sustainability and development programs, particularly following the introduction of the 2030 Agenda and the Sustainable Development Goals (SDGs). Its principles align with several SDGs, such as poverty eradication (SDG1), gender equality (SDG5), decent work and economic growth (SDG8), protection and sustainable use of terrestrial ecosystems (SDG15), and, notably, sustainable production and consumption patterns (SDG12) (Negi et al., 2020; Blankenbach, J., 2020; Bissinger et al., 2020; UNFSS, 2018; WWF and ISEAL Alliance, 2017).

However, as the challenges and costs associated with VSS become more apparent, disagreements and disputes over sustainability standard systems are rising. On one hand, proponents argue that VSS serves as a mechanism to address market failures and deliver economic, social, and environmental benefits to millions of producers worldwide (Nugnes & Larrea, 2020; Smith et al., 2019; Correa, 2019; Partiti, 2019; Bennett, 2018; Thorlakson et al., 2018; UNFSS, 2018; Bray & Neilson, 2017; Marx, 2017; Castka & Corbett, 2016). On the other hand, critics characterize VSS as a trade barrier, arguing that compliance with these standards imposes additional economic and social costs, hampers the participation of developing countries in the global market, and undermines their comparative advantages (Dietz et al., 2019; UNCTAD, 2020; Thorstensen et al., 2018; van der Ven et al., 2018; ITC, 2016; UNFSS, 2018; ODI, 2013; DeFries et al., 2017).

Thus far, the available evidence does not conclusively support either of these arguments regarding the impact of VSS (Oya et al., 2017; DeFries et al., 2017; Elliott, 2018; Traldi, 2021; Minten et al., 2015; Reardon et al., 2009). The results vary depending on the specific VSS, the local context in which they are implemented, the indicators measured, and the evaluation methodologies employed (UNCTAD, 2023). Many reviews of VSS research acknowledge that studies with a high risk of bias were prevalent in the selection process. For instance, the Campbell systematic review (Oya et al., 2017), one of the earliest and most rigorous reviews of VSS, found no studies featuring randomized controlled trials (RCTs), and the majority of studies deemed rigorous, which employed various quasi-experimental designs, were considered to have a medium or high risk of bias. Another influential review by DeFries et al. (2017) examined only a few papers with a low risk of bias. Nevertheless, subsequent reviews, such as Traldi (2021) and Evidensia (2019), reported improvements in research design since 2016.

These reviews encompassed various certifications across multiple crops and regions, yielding mixed results. In most studies, there were relatively positive outcomes and no significant differences compared to their noncertified counterparts, although there was an imbalance in the studies examining specific crops, regions, and types of VSS. Elliot (2018) and Bray and Nielson (2017) specifically reviewed the impact of coffee sustainability schemes on smallholder livelihoods and found that while the effects on different livelihood outcomes varied, VSS generally had mixed results with no consistent positive or negative impacts. In addition to the methodological limitation, it is widely acknowledged in the reviews that contextual factors play a significant role in shaping the outcomes of VSS implementation, resulting in mixed and inconclusive assessments. Therefore, it is crucial to interpret the results within the specific context where VSS is applied and consider a range of interventions in a complex environment with various facilitators and obstacles. Contextual factors encompass a wide range of elements, including existing institutions such as producer cooperatives and facilitating organizations, the socioeconomic conditions and prevalence of poverty in the producer community, the support system for certification compliance, the structure of the value chain, established relationships with buyers, as well as development policies and regulatory frameworks (Oya et al., 2017; Elliot, 2018; Qiao et al., 2018; van Rijsbergen et al., 2016; Evidensia, 2019).

Numerous impact studies on VSS have focused either on the economic, social, or environmental dimensions of sustainability separately. Only a limited number of studies examined all three dimensions together (Vanderhaegen et al., 2018; Ingram et al., 2018; Minten et al., 2018; Morgans et al., 2018). When comparing the results across the three sustainability dimensions, the economic and environmental aspects show a relatively higher proportion of positive outcomes than the social indicators (DeFaries, 2017). Economic aspects have been more frequently studied and generally exhibit moderately positive or neutral differences in most cases (Oya et al., 2017; DeFaries et al., 2017; Traldi, 2021). However, there is considerable variation across different outcome indicators within the economic dimension, such as price, yield, and income, which are commonly used measures

(Traldi, 2021), as well as poverty and changes in livelihoods (Mitiku et al., 2017; Jena & Grote, 2016; Akoyi & Maertens, 2018).

Let us examine the impacts of Voluntary Sustainability Standards (VSS) on the commonly studied economic indicators in the existing literature. The indicator of "yield" pertains to the amount of targeted crop harvested per unit of land by individual producers. While VSS is expected to contribute to the sustainability of agricultural production processes (Osterveer et al., 2014), research findings have shown mixed results regarding yield outcomes. Some studies have reported higher yields associated with VSS implementation (Cepeda et al., 2013; García et al., 2014), while others have found no significant effects on yields (Kuit et al., 2016) or even decreased yields (Jena et al., 2012; Ruben & Fort, 2012). It is important to note that contextual factors play a crucial role in yield outcomes. For instance, improved training and facilities tend to enhance yields. In contrast, practices like organic farming (involving reduced chemical usage) or pruning trees (in the case of coffee farming) may lead to temporary yield reductions (Oya et al., 2017). The age of productive trees also influences yield levels.

Another significant economic outcome is "price," which refers to the monetary compensation producers receive for their crops. The primary aim of VSS for producers is to gain exclusive access to niche markets and secure premium prices for their certified products, thereby making standard certification an effective tool (Marx, 2018; Dietz et al., 2019). Numerous studies have examined the effects of VSS on prices, with the majority indicating that VSS-certified crops command significantly higher prices compared to noncertified crops (Meemken, 2020; Minten et al., 2015; Weber, 2011; Ruben & Zuniga, 2011). However, there have been instances where certified farmers were unable to sell their entire harvest within certified value chains due to an oversupply of certified products (Méndez et al., 2010; Ruben & Fort, 2012), and some studies have reported no significant effects on prices (García et al., 2014; Ruben & Zúñiga-Arias, 2011). Among the various VSS, Fairtrade certification stands out as it consistently provides higher prices by guaranteeing minimum prices for certified producers. Nevertheless, it is crucial to consider the associated costs of certification. Most studies faced challenges in comprehensively measuring the input costs of production. For instance, while organic production practices, such as reduced use of synthetic fertilizers, may lower input costs, increased labor requirements and adherence to associated standards may elevate labor costs.

Income is another crucial outcome influenced by Voluntary Sustainability Standards (VSS), although its impact is more complex to describe due to variations in outcome levels reported in studies. These levels include gross crop income (revenue from a specific crop), net income (profit from the crop), total household income (income from all crops and other sources, including off-farm income), and net household income (total household income minus all production costs and household expenses). Gross crop income is affected by changes in yield and price, making it challenging to assess the financial position accurately. Net crop income provides insight into the profitability of certified crops but may involve trade-offs with total household income. Farmers might allocate more labor and time to cultivating and managing certified crops, shifting their focus from other productive activities and off-farm employment, which can reduce total household income, depending on the magnitude of changes from certified crops. Measuring household income and net household income with accuracy poses significant challenges, as Oya et al. (2017) highlighted in their review, where previous research needed to provide more information on their measurement methods.

Despite potential measurement errors and differences in significance levels, in most cases, farmers with VSS certifications have higher gross crop income than noncertified farmers. This is supported by studies such as Meemken (2020), Cepeda et al. (2013), García et al. (2014), Waarts et al. (2016), Bennett et al. (2012), Mueller and Theuvsen (2015), Ruben and Fort (2012), van Rijsbergen et al.

(2016), and Bekere and Megersa (2021). However, a considerable number of cases also reported no significant differences (Evidensia, 2019; Jena et al., 2017; Kuit et al., 2016; Ruben & Zúñiga-Arias, 2011). Most results concerning household income indicated no significant difference between certified and noncertified farmers (Oya et al., 2017; Ruben & Fort, 2012). Net household income is rarely addressed as an outcome indicator. Some studies, like Chiputwa and Qaim (2015), attempted to proxy household income using indicators such as household expenditure and reported a significantly positive impact. Overall, according to DeFaries et al. (2017), a higher rate of positive income effect on gross crop income is reported compared to producers' household income, suggesting that VSS primarily improves premiums rather than the overall economic situation of producers. However, despite the mixed and context-dependent income effects, it is likely that farmers who manage to reduce costs, either through improved farm management or reduced input costs, experience positive income gains from VSS certification (De Janvry et al., 2014).

Even though the number of VSS impact studies in Africa is increasing, research conducted in Ethiopia still needs to improve. Four studies have focused on environmental impacts (Takahashi and Todo, 2013, 2014, 2017 and Mitiku et al., 2018), while three others (Jena et al., 2012; Mitiku et al., 2017, and Bekere and Megersa, 2021) have assessed the effects on income and producer livelihood, explicitly focusing on the Jima Zone. Even though certified coffee production is spread across the country, only Minten et al. (2018) looked into the impact of VSS on the coffee sector, taking into account multiple outcomes and covering major coffee-producing regions such as Sidama, Jimma, Nekempte, Harar, and Yirgacheffe. Anteneh & Grote (2014) attempted to assess the effects of multiple certifications on smallholder coffee livelihoods in southern Ethiopia. However, their findings may be subject to a high risk of bias due to the lack of control for potential selection biases. Other studies conducted in Ethiopia and Uganda have examined Fairtrade and labor issues (Cramer et al., 2016) and children's welfare in coffee-producing households concerning private sustainability standards (Akoya et al., 2020). Additionally, in Ethiopia and Brazil, sustainability performance has been evaluated based on expert judgment (Winter et al., 2020).

We conducted this study for three primary reasons. Firstly, our research uniquely represents an understudied but significant coffee-producing region in Ethiopia that plays a substantial role in the national economy as the largest supplier of washed coffee. Secondly, considering the evolving circumstances, challenges, and opportunities in Ethiopia's coffee industry, including new policies and strategies, it is crucial to reevaluate the impact of VSS within this context. Lastly, to the best of our knowledge, no study has empirically accounted for the institutional heterogeneity of cooperatives when examining the impact of VSS on smallholder coffee producers in Ethiopia, despite the consensus among most studies that the performance of cooperative organizations is strongly linked to the implementation of VSS certification.

Most Voluntary Sustainability Standards (VSS) certifications are granted to farmers through cooperative organizations. In the study area, all certified cooperative members are considered VSS-certified farmers, and the intervention of VSS is closely intertwined with the inherent functions of these cooperatives. To the best of our knowledge so far it was Sellare et al. (2020) conducted a comprehensive analysis of cooperative effects in their examination of how fair trade certification influences cocoa farmers in Cote d'Ivoire, whereas many other studies controlled just for cooperative membership (Akoyi & Maertens, 2018; Minten et al., 2018; Mitiku et al., 2017; Ibanez & Blackman, 2016; Jena et al., 2012).

Both cooperatives (Meemken et al., 2017; Mitiku et al., 2017) and VSS (Tran & Goto, 2019; Chiputwa & Qaim, 2016) have a well-documented track record of assisting farmers in improving their economic conditions by providing access to inputs, facilitating better market opportunities, and delivering

training on enhanced agricultural practices. Therefore, the impacts that we thought were attributable to the certification intervention might be influenced by the performance and quality of cooperative services. In other words, cooperative characteristics may impact both certification and outcomes, making it crucial to control for these characteristics to avoid any potential biases resulting from omitted variables (Sellare et al., 2019). To address this concern, we randomly selected several cooperative organizations and used a questionnaire tailored to capture cooperative performance indicators as a proxy measure for assessing their characteristics. By doing so, we can disentangle the cooperative effect and provide a causal explanation for the potential relationship between the effects of VSS treatments and cooperative institutional effects.

Despite conflicting evidence in the literature, the adoption of Voluntary Sustainability Standards (VSS) in agricultural trade has expanded significantly. Certification and traceability have become essential for enhancing prices and marketability, which has motivated governments and non-governmental organizations to participate in the development, implementation, and facilitation of these standards (Meemken et al., 2020; Oya et al., 2017; Henson & Humphrey, 2010).

Ethiopia, as Africa's leading producer of Arabica coffee and the fifth-largest exporter globally, relies heavily on coffee for its economy, socio-cultural fabric, and spiritual significance. The coffee sector contributes approximately 30 to 35 percent of the country's total export earnings, and around 25 percent of the Ethiopian population directly or indirectly depends on the coffee value chain. Smallholder farmers are Ethiopia's primary coffee producers, accounting for 95% of the country's coffee production. These farmers predominantly operate small family-owned farms with an average size of less than 2 hectares (Francom & Tefera, 2016). In 2021/22 alone, Ethiopia produced 289,873 metric tons of coffee, valued at 1,516,877,102 USD, representing 4.88% of the global market (USAD, 2023). The coffee industry in Ethiopia has undergone various policy reforms. Before 1991, coffee production and marketing were heavily regulated by the state. However, subsequent reforms opened up new opportunities for private exporters and cooperatives, aiming to ensure market stability and better prices for smallholder farmers. In 2001, the Ethiopian government modified its coffee marketing regulations, allowing coffee grower cooperatives to sell to export markets directly. Despite these reforms, Ethiopian producers faced challenges in accessing markets. The Ethiopian Commodity Exchange (ECX) establishment in 2008 aimed to raise producer prices and improve agricultural marketing. All coffee market participants were required to trade exclusively through the ECX, except for cooperatives and large plantations. While this was seen as a significant policy development, there was insufficient evidence to support the notion that the ECX improved the livelihoods of smallholder farmers. In response to pressure from various stakeholders in the value chain, the government further revised its policy in 2017, liberalizing the coffee industry and allowing coffee trading outside of the ECX (Aparisi, 2021).

The comprehensive coffee strategy for 2019-2023 has been introduced to increase value chain incomes, especially for smallholder farmers, while also maximizing Ethiopia's coffee exports. Under this new policy, farmers have the option to sell their coffee where they believe they can obtain better prices, including direct exporting if feasible. This shift is expected to benefit Ethiopian coffee farmers who have historically been at the bottom of a lengthy value chain, earning an estimated 60% of the export price, significantly less than Brazil (90%) (Aparisi, 2021).

The global trade of VSS-certified coffees has experienced substantial growth, particularly in response to the significant decline in coffee prices in the early 2000s, which posed challenges for impoverished smallholder coffee-producing households (Giovannucci et al., 2014). During that time, Ethiopia had recently introduced VSS certification for its coffee, with only one qualified certifier available. However, since 2006, the country has attracted several foreign certifiers, such as Fairtrade, Organic,

UTZ, and Rainforest Alliance (Jena et al., 2012). The number of Fairtrade-certified cooperatives in Ethiopia increased from 18 in 2003 to 111 by 2013, although the rate of VSS adoption growth was slower compared to the global average (Minten et al., 2015). Nevertheless, adopting certification and traceability has become crucial for enhancing coffee prices and marketability, leading to increasing cooperatives obtaining various certifications. According to Minten et al. (2015), the share of VSS-certified coffee exports from Ethiopia grew from 2 percent in 2005 to 5 percent in 2015.

Given the dynamic changes and policy developments in recent years, we assert that the rationales above warrant an assessment of the economic impact of Voluntary Sustainability Standards (VSS) on smallholder coffee farmers. Specifically, our objective is to ascertain whether farmers who possess VSS certification (specifically the Fairtrade-Organic dual certification) experience superior quality yields, improved pricing, and enhanced income compared to their noncertified counterparts. Moreover, we aim to explore the institutional impact of cooperatives on the outcomes mentioned above. However, it is imperative to utilize longitudinal data to gain a comprehensive understanding of changes over time.

2. Methodology

2.1. Study area and sample selection

The study examines the emerging effects of Voluntary Sustainability Standards (VSS) on smallholder coffee producers in the Sidama region of Ethiopia. The Sidama region, selected for its prominence as the leading coffee-producing area and largest supplier of washed coffee in the country, is home to cooperatives registered with standard certifications for a considerable duration, enabling a deeper understanding of their impacts. The region spans an area of 10,000 km2, with approximately 48.70% of the land dedicated to farming, 2.29% forested, 5.04% comprising shrub and bushland, 17.47% serving as grazing land, 18.02% remaining uncultivated, 6.38% considered unproductive, and 2.10% utilized for other purposes. The Sidama region experiences three major climates: the warm weather region, Gamoojje or Woinadega, covers 54% of the area and lies between 1500 and 2500 meters above sea level. The Kolla region, characterized by a hot climate, constitutes 30% of the total area and ranges from 500 to 1500 meters above sea level. The highlands of the mountains exhibit a cool climate known as Aliicho or Dega, accounting for 16% of the land and situated between 2500 and 3500 meters above sea level. The annual rainfall in the region ranges from 1600 mm to 1999 mm (SDCPS, 2000). The Sidama economy primarily relies on subsistence agriculture, employing traditional production practices. However, in a significant portion of Sidama, coffee is the main income source for rural households.

In order to gather preliminary information for data collection, we visited various relevant offices, including federal and regional Agriculture and Rural Development Offices, the Coffee and Tea Authority, the Cooperatives Agency, and the Sidama coffee farmers' cooperative unions. Through these visits, we identified the Sidama region's main coffee-producing areas (known as woredas). We compiled a comprehensive list of coffee cooperatives, their participation in VSS certifications, and household information. This process involved consulting official registries and zonal and woreda offices.

In the Sidama region, there are about 57 primary coffee cooperatives, which collectively involve around 85,000 smallholder farmers cultivating 8,000 hectares of Arabica coffee. According to Minten et al. (2015), among the 47 cooperatives represented by the Sidama Cooperatives Union at the time, the distribution of VSS certifications was as follows: Fairtrade (87.2%), Organic (83%), Rainforest (6.4%), and Utz (10.6%). However, we observed during the survey that Rainforest Alliance and UTZ certifications were no longer in operation. Currently, there are 41 Fairtrade-certified cooperatives, 32 of which are Organic certified, implying that all Organic certified cooperatives are Fairtrade-certified, and the region has 32 Fairtrade-organic double-certified cooperatives in total. These two VSS certifications, Fairtrade and Organic, are well-recognized and require full compliance as a prerequisite for certification. Ethiopia is also the largest exporter of organic and Fairtrade coffee in Africa, and double certification of these VSS is widely practiced (Winter et al., 2020; Minten et al., 2015). Consequently, this study specifically evaluated the economic impact of the Fairtrade-Organic double certification, and the term "VSS certification" was used to refer to the Organic-Fairtrade double certification.

A multi-stage sampling technique was used to obtain a representative sample based on the sustainability standard registration map and cooperative and household information. We initially selected six coffee-producing woredas: Dale, Wonsho, Aleta Wondo, Titicha, Shebedino, and Lokabaya. These woredas were chosen based on their coffee production potential. From these six woredas, 12 certified and eight noncertified coffee cooperatives were randomly selected from respective lists of certified and noncertified cooperatives to form the treatment and control groups, respectively. Finally, 370 certified households and 160 noncertified households were chosen randomly from the list of cooperative members in proportion to the size of each cooperative. This process resulted in 530 sample households. In Dale woreda, where there is no noncertified cooperative, a control group was established in an adjacent woreda with the same agroecological zone and comparable observable characteristics to the treatment group with the assistance of secondary sources, experts and key informant advice. In fact, coffee growers in the region are often referred to as having comparable agro-climatic conditions and farming systems. Data from secondary sources, such as the Rural Household Survey (RHS), and findings from other studies are gathered to inform the research.

2.2. Survey instrument design and data collection

We have developed a comprehensive and systematic survey design to capture household income and net household income effectively. This includes detailed information on household expenditure and other sources of income, as well as specific data related to coffee income, price, yield, and household characteristics. Additionally, we have created a questionnaire specifically focused on cooperative performance and characteristics at the cooperative level, ensuring that this information is linked with the members' household data. We attempted to improve the data structure and address measurement error and coverage issues to improve our empirical analysis's internal and external validity. Drawing from best practices in questionnaire design, we took measures to minimize measurement errors stemming from unclear wording, poor formatting, priming effects, excessively long questions, improper sequencing and skipping of questions, and differences in reference periods or response coding.

Special attention was given to reducing potential errors associated with interviewers. We carefully recruited data enumerators based on their education, ability, motivation, and language skills. These enumerators underwent training to enhance their skills and ensure a thorough understanding of the questionnaire content. Before the entire survey, the instrument was pre-tested on a sample of households to ensure accurate interpretation of indicators within the specific context. The survey

was then conducted under close supervision. To minimize errors associated with respondents, a brief explanation was provided to encourage accurate responses. Finally, each questionnaire was checked for completeness, and any gaps or inaccuracies in the data were communicated for additional verification and proper editing.

2.3. Analytical method

We employed a quasi-experimental study design to evaluate the economic impact of voluntary sustainability standards (VSS) on smallholder coffee producers. Our approach involved disentangling the effects of VSS certification from the cooperative effects. In addressing the first objective, we formulated a hypothesis that posits a positive impact of certification on farmers who have obtained certification, resulting in higher coffee yields, better quality coffee, improved prices, and increased income compared to noncertified growers with similar observable characteristics. Coffee yield is measured as the quantity of coffee harvested per hectare, expressed in kilograms, and coffee that possesses specific attributes and is sold at a premium under any of the VSS certifications is considered to be of higher quality. The coffee price is measured as the amount paid to the producer per kilogram during the study period, measured in Ethiopian Birr (ETB). We measured a wide range of farmers' incomes in ETB, including coffee revenue, net coffee income (less coffee production costs and plus cooperative dividends), household income (coffee income plus non-coffee income, including off-farm income), and net household income (all income minus consumption expenditure).

Our objective is to determine the impact of standard certification by computing the typical effect of certification on various outcomes within the target group. This allows us to attribute changes in these outcomes to the implementation of voluntary sustainability standards (VSS). In order to address attribution adequately, we would ideally compare changes in outcomes between both certified and uncertified scenarios within the target group. However, selection bias in observational research can undermine the exchangeability assumption, resulting in biased association measures. To reduce the risk of selection bias, we carefully selected treatment and control groups with comparable observable characteristics. We have also conducted robustness tests to address any lingering selection bias, enabling us to assume conditional exchangeability.

Several methods have been proposed to address selection bias and endogeneity in observational studies. These include propensity score matching (Rosenbaum & Rubin, 1983), the Heckman selection model (Heckman, 1997), endogenous switching regression models (Lee & Trost, 1978), instrumental variable models (Nelson & Startz, 1990), the entropy balancing method (Hainmueller & Xu, 2013), and others. In order to ensure the validity of our empirical findings, we conducted robustness tests using different models. While biases in observable and unobservable covariates can only be eliminated through a randomized experiment, such an experiment was not feasible for our study due to practical, ethical, and self-selection bias concerns. The lack of base-year information also prevented us from using the Difference-in-Differences (DID) method. However, alternative methods have been employed to approximate the impacts reliably.

We employed the conventional outcome regression model, incorporating treatment variables and confounders as covariates. This model mitigates some of the limitations associated with the "simple differences technique" and improves estimation accuracy by including covariates. However, it still faces challenges related to unobservable and omitted variables (such as self-selection), which can introduce endogeneity and lead to differing estimates. Various methods have been proposed to address this issue. The instrumental variables (IV) method is considered the most suitable approach for addressing endogeneity concerns in outcome regression. However, identifying a valid

instrumental variable can be challenging since many factors influencing an individual's decision to participate in a program are also directly related to the outcome variable. Therefore, we employed propensity score matching (PSM) as an alternative robustness test to tackle selection bias arising from the self-selection into certified cooperatives. PSM has gained popularity among researchers in various fields and is increasingly used, even with small sample sizes (Howarter, 2015; Pirracchio et al., 2012). However, PSM has limitations, such as the possibility of unmeasured confounding variables and the risk of imbalanced treatment allocation or a large number of covariates. We conducted a model sensitivity analysis and balancing properties to address this issue and used Nearest Neighbor Matching (NNM) as a robustness test.

We use a model representation adapted from Caliendo and Kopeinig (2005) to estimate the average treatment effect. The treatment effect for an individual (i) can be represented as the difference between their outcomes when they are VSS certified and when they are not.

$$\tau_i = Y_i(Di = 1) - Y_i(Di = 0) \quad (1)$$

The treatment indicator (Di) is a dummy variable that equals one for certified individuals and zero for noncertified individuals. Each individual's possible outcomes (yield, price, and income levels) are denoted as Yi (Di), where i ranges from 1 to n, representing the total sample. The average treatment effect on the treated (ATT) is calculated as the difference between the expected outcome for certified individuals and the expected outcome for noncertified individuals, both conditional on being treated.

$$\tau_{ATT} = E(\tau \mid D = 1) = E[Y(1) \mid D = 1] - E[Y(0) \mid D = 1] \quad (2)$$

However, the counterfactual mean for the treated individuals (E[Y(0)|D=1]) cannot be observed since households cannot be observed both with and without certification. Moreover, using the mean outcome of untreated individuals (E[Y(0)|D=0]) in non-experimental studies is generally not recommended due to self-selection bias, where factors influencing the treatment decision may also affect the outcome variable of interest.

$$E[Y(1) \mid D = 1] - E[Y(0) \mid D = 0] = \tau_{ATT} + E[Y(0) \mid D = 1] - E[Y(0) \mid D = 0] \quad (3)$$

$$E[Y(0) \mid D = 1] - E[Y(0) \mid D = 0] \quad (3a)$$

To account for this, we consider the difference between the expected outcome for certified individuals and the expected outcome for noncertified individuals, denoted as treatment effect plus E[Y(0)|D=1] - E[Y(0)|D=0]. This (equation 3a) represents the "self-selection bias," indicating the systematic distinction between participating and non-participating households unrelated to the certification program. The two equations would yield the same results by appropriately selecting a replacement counterfactual that reduces this systematic distinction, with the difference being solely attributed to the certification program.

As previously mentioned, to address the selection bias issue in non-experimental studies, specifically the self-selection into certification in our case, we employ propensity score matching (PSM) as an alternative method. PSM relies on two important assumptions: the Conditional Independence Assumption (CIA) and the Common Support Assumption (CSA). Under the CIA, the potential outcomes are independent of treatment assignment given a set of observable covariates X that are unaffected by treatment. This implies that the treatment assignment does not affect the outcomes for certified individuals and those who are not. In other words, only observed factors are considered during selection, implying that the observed heterogeneity between treated and control groups has been controlled (Caliendo & Kopeinig, 2005). However, it is important to note that the observed

covariates in the probit or logit models used to estimate the propensity score must also satisfy the conditional independence assumption. The propensity score, denoted as P(D=1|X)=P(X), represents the probability of an individual participating in the treatment (certification program) given their observed covariates X. It ranges from 0 to 1, with higher scores indicating a higher likelihood of participating in the certification program.

The Common Support Assumption (CSA), also called the "overlap" condition, states that only the area of common support is used to define the average treatment effect. If this condition is met, the treatment is considered strongly ignorable (Rosenbaum & Rubin, 1983), ensuring sufficient overlap in the characteristics of treated and untreated units to find appropriate matches. In general, given the CIA and CSA, the PSM estimator for the average treatment effect on the treated can be expressed as:

$$\tau_{ATT}^{PSM} = E_{P(X)|D=1}\{E[Y(1) \mid C = 1, P(X)] - E[Y(0) \mid C = 0, P(X)]\} \quad (4)$$

This expression shows that the PSM estimator is simply the weighted mean difference in outcomes over the common support, with the weights determined by the propensity score distribution of the participants.

To assess the impact of cooperatives, we employed an outcome regression model with and without controlling for cooperative characteristics, similar to Sellare et al. (2019). The model without controlling for cooperative characteristics can be represented as:

$$Y_{ij} = \alpha + \beta D_{ij} + \gamma X_i + \varepsilon_{ij} \quad (5)$$

Equation (5) represents the outcome variable (yield, price, and income) for household i in cooperative j is a vector of household-level controls and D_{ij} is a dummy variable indicating whether household i is a member of a certified cooperative (D=1) or a noncertified cooperative (D=0), and ε_{ij} is a random error term. The coefficient β is of particular interest as it indicates the effect of sustainability standard certification on coffee producers' yield, price, and income. A positive and statistically significant β would confirm our hypothesis that certification has a positive impact. However, as mentioned earlier, there may be a correlation between cooperative characteristics and both the outcome and certification, leading to omitted variable bias in the estimation of β. To address this, we incorporated cooperative performance indicators as proxies for cooperative characteristics in a regression model, as shown in the following equation:

$$Y_{ij} = \alpha + \beta C_{ij} + \gamma X_i + \delta Z_j + \varepsilon_{ij} \quad (6)$$

In equation (6), Z is a vector of metrics representing cooperative performance, such as liquidity, leverage, efficiency, and profitability ratios. In this case, our main interest lies in the coefficient β rather than δ. We aim to determine if there is still a positive and significant impact of sustainability standard certification even after controlling for cooperative characteristics. If the coefficient β in equation (6) is smaller than in equation (5), it suggests that members of better-performing cooperatives benefit more from certification compared to those in lower-performing cooperatives. Moreover, it indicates that the impact of certification in equation (5) would have been overestimated if cooperative characteristics had not been taken into account.

3. Results

3.1. Descriptive Summary

This section presents the descriptive summary statistics of the households in the sample, categorized according to their VSS certification status, as illustrated in Table 1. Most of the sampled households are headed by males (0.98) and have an average age of 50. The majority of these households generally have not completed primary school education. Notably, certified farmers have larger family sizes, with an average of 6.6 members, and employ a larger number of family laborers (4.78). Furthermore, certified farmers tend to have more paid seasonal wage workers (5.67) compared to noncertified households. In terms of farming experience, certified coffee farmers demonstrate significantly more years of experience in coffee cultivation and have been members of cooperatives longer than noncertified households. Conversely, noncertified households exhibit greater involvement in nonfarm income-generating activities compared to certified farmers. It is worth mentioning that most sampled households possess a total area of 1.92 hectares. However, certified farmers allocate a significantly larger portion of their land specifically for coffee farming. The average age of productive coffee trees does not differ significantly between the two groups.

In terms of proximity to various facilities, such as the input market, output market, coffee collection center, water source, health facility, and schooling, VSS-certified households are generally situated in closer proximity compared to noncertified households. However, it is important to note that it is difficult to determine the presence of reverse causality at this stage, meaning that certification may facilitate access to these facilities or vice versa.

Table 1. Summery Statistics Sampled Household Characteristics by Certification Status

Variable	**Total Sample (N=530)**	**Non-certified (N=160)**	**Certified (N=370)**
Household size (member)	6.44	6.05	6.60***
	(2.12)	(2.54)	(1.88)
Age of household head (years)	50.02	49.34	50.31
	(12.43)	(12.09)	(12.58)
Male household head (dummy)	0.982	0.96	0.981
	(0.15)	(0.19)	(0.14)
Education of household head (level)	3.63	3.61	3.64
	(2.68)	(2.12)	(2.89)
Number of family labor	4.61	4.22	4.78***
	(1.38)	(1.31)	(1.38)
Number of wage workers	5.10	3.78	5.67***
	(3.14)	(1.66)	(3.45)
Nonfarm participation (dummy)	0.37	0.56	0.29***
	(0.64)	(0.86)	(0.50)
Coffee farming years	28.12	22.88	30.40***
	(10.91)	(11.10)	(10.02)
Years cooperative membership	21.59	10.94	26.23***
	(12.14)	(3.48)	(11.63)
Total land owned (ha)	1.92	1.90	1.93
	(1.01)	(0.80)	(1.09)
Coffee area (ha)	0.62	0.42	0.70***
	(0.39)	(0.33)	(0.39)

Average age of productive coffee tree (years)	12.61	12.02	12.86
	(5.62)	(6.86)	(4.99)
Distance to micro credit and saving facility (km)	9.02	8.83	9.10
	(9.99)	(5.83)	(11.34)
Distance to input market (km)	8.73	14.99	6.03**
	(37.72)	(67.45)	(7.45)
Distance to output market (km)	8.66	14.00	6.35**
	(37.91)	(67.59)	(8.60)
Distance to coffee collection center (km)	5.71	11.59	3.17**
	(37.61)	(67.76)	(5.35)
Distance to coffee seedling source (km)	4.89	4.18	5.20
	(7.83)	(5.37)	(8.68)
Distance to electricity grid (km)	4.71	3.22	5.35*
	(11.76)	(5.29)	(13.59)
Distance to household use water source (km)	1.14	0.47	1.43**
	(2.63)	(0.45)	(3.09)
Distance to health facility or clinic (km)	10.65	8.23	11.70***
	12.92	(8.74)	(14.24)
Distance to primary school (km)	6.29	17.00	1.65***
	59.99	(108.61)	(2.08)

Notes: Mean values are shown with standard deviations in parentheses. Mean values are tested for statistically significant differences; *p < 0.1, **p < 0.05, ***p < 0.01

Coffee Production, Marketing, and Income

Coffee is cultivated in the Sidama region near residential areas at relatively low densities, ranging from 1,000 to 1,800 plants per hectare. The coffee plants are grown under the shade of indigenous trees and alongside staple food crops, primarily "Enset" (false banana). VSS-certified households have an average coffee farm size of 0.7 hectares, significantly larger than noncertified households' average coffee farm size (0.42 hectares). Both of these are larger than the regional average coffee farm size of 0.3 hectares.

Coffee yields are categorized as either dry cherries or red cherries, with growers selecting the type of cherries to harvest based on their intended market during the growing season. Coffee experts in the region have established conversion factors of 0.2 for red cherries and 0.33 for dry cherries to obtain the equivalent weight of clean coffee. Certified farmers recorded significantly higher yields of red cherries (1597.37 kilograms) compared to noncertified farmers (629.57 kilograms), whereas noncertified farmers harvested a significantly higher quantity of dry cherries. Even after converting the cherries into clean coffee using the conversion factors, certified farmers still achieved higher yields (368.75 kilograms) compared to noncertified farmers (225.95 kilograms).

Most coffee production practices among farmers in the study area are similar regardless of their certification status. Most sample households intercrop coffee with other companion crops or leguminous shade trees, engage in coffee tree pruning, apply mulching and composting techniques, and implement soil and water conservation management practices. In line with the government's emphasis on organic agricultural practices in coffee farming, all households reported abstaining from synthetic fertilizers and chemical pesticides. A small number of certified farmers mentioned utilizing organic pesticides.

Table 2. Coffee Farming Practices

Variable (Yes=1)	Total sample (N=530)	Non-certified (N=160)	Certified (N=370)
Intercropping or use of shade trees	0.86 (0.34)	0.83 (0.37)	0.88 (0.33)
Soil and water conservation procedures	0.87 (0.33)	0.84 (0.37)	0.89* (0.31)
Use of mulching/composting	0.83 (0.37)	0.82 (0.38)	0.84 (0.37)
Use of organic pesticides?	0.09 (0.29)	0.04 (0.20)	0.12* (0.32)
Pruning	0.75 (0.43)	0.70 (0.46)	0.77 (0.42)

Notes: Mean values are shown with standard deviations in parentheses. Mean values are tested for statistically significant differences; *p < 0.1, **p < 0.05, ***p < 0.01

Certified farmers face significantly higher costs in coffee production compared to noncertified farmers. Hired labor costs take up a relatively higher share of the total cost of production, and coffee seed, a coffee drying bed or mat, and the relatively small amount of compost preparation costs are just a few of the expenses associated with producing coffee that are markedly higher for certified growers.

The coffee value chain comprises various actors in the study area, including input suppliers, coffee producers, collectors, private processors, cooperatives and their unions, and exporters. Unlike previous trends, the coffee policy reform implemented in 2017 is expected to create opportunities for smallholder producers to sell their coffee directly to a wider range of actors within the value chain. These actors include collectors at primary collection centers, cooperatives, washing and hulling centers owned by exporters or suppliers, as well as regional warehouses operated by the Ethiopian Commodity Exchange (ECX). However, due to limited production capacity and knowledge of international trade, smallholder farmers cannot participate directly in the international marketing segment of the value chain. Instead, they predominantly sell their coffee to lower-level actors, primarily cooperatives and private processors.

Table 3. Descriptive Statistics for Coffee Yield, Price, Cost of Production and Coffee Income

Variable	Total Sample (N=530)	Non-certified (N=160)	Certified (N=370)
Coffee area(km)	0.62	0.42	0.70***
	(0.39)	(0.33)	(0.39)
Coffee yield red cherry coffee (kg)	1305.20	629.57	1597.37***
	(1211.41)	(665.48)	(1276.51)
Coffee yield dry cherry coffee (kg)	195.75	303.13	149.32***
	(642.65)	(1099.01)	(253.92)
Red cherry coffee price (ETB/kg)	50.36	49.36	50.79***
	(2.86)	(4.39)	(1.67)
Coffee income-red cherry (ETB)	65835.08	31579.53	80648.29***
	(60763.72)	(34107.73)	(63742.34)
Dry cherry coffee price (ETB/kg)	83.45	71.00	88.83***
	(57.74)	(63.73)	(54.16)
Coffee income-dry cherry (ETB)	24583.05	39282.88	18226.37***
	(83322.34)	(142994.80)	(31749.40)
Total coffee revenue (ETB)	90418.13	70862.40	98874.65***
	(105134.70)	(147543.20)	(78920.19)
Cost of coffee seed (ETB)	2486.70	1957.19	2715.68***
	(725.56)	(750.05)	(581.51)
Coffee input cost-manure (ETB)	181.35	157.44	191.69**
	(160.47)	(82.14)	(183.44)

Hired labor cost for coffee production (ETB)	3307.76	2223.50	3776.63***
	(2442.62)	(1518.61)	(2613.34)
Other coffee costs-drying process (ETB)	1679.38	1537.50	1740.73***
	(818.38)	(983.00)	(728.88)
Total cost of coffee production	7655.19	5875.63	8424.73***
	(3110.22)	(2612.61)	(2993.29)
Net coffee income (ETB)	82762.94	64986.78	90449.93***
	(104238.40)	(147042.40)	(77872.98)
Dividends	8157.45	2360.68	10664.17***
	(8937.83)	(2789.74)	(9502.57)

Notes: Mean values are shown with standard deviations in parentheses. Mean values are tested for statistically significant differences; *p < 0.1, **p < 0.05, ***p < 0.01

Two coffee processing methods in Ethiopia are commonly employed: sun-dried and wet processing. The majority of coffee produced in the country follows the sun-dried or unwashed method (Tefera, 2021). Certified households predominantly sell approximately 90.4% of their coffee as red cherries, while the remaining 9.6% is sold as dry cherries. These households sell 98% of their red cherries to their respective cooperatives on average. In contrast, noncertified farmers sell 85.6% of their coffee as red cherries and 14.4% as dry cherries, with the latter primarily being sold to private traders. Most certified farmers focus on harvesting and selling red cherries.

Primary cooperatives collect red cherries, process them (washing, pulping, and sorting), and then send the dried parchment to the cooperative union for further processing and value addition, preparing the coffee for export. It is important to note that no specific quality specifications or guarantees are in place to ensure coffee quality. Instead, coffees sold under any of the standard certifications are regarded as high-quality. The overall quality of coffee is largely determined by the processing methods employed, with wet processing considered the best and classified as grade one coffee, and green bean-colored coffee that has had the mucilage removed through fermentation is also considered an indicator of the best quality coffee.

Selling coffee to private processors offers the advantage of immediate payment, while selling to cooperatives may involve delays in receiving payments. However, most farmers prefer to sell to cooperatives because they provide additional benefits. Cooperatives and unions usually pay farmers dividends at the end of the year based on the amount of coffee sold to them. These payments are made in two installments, the first by the cooperatives and the second by the union. The initial farm coffee price offered by cooperatives may be lower than that offered by private processors. However, it gradually increases over time, providing a competitive advantage to cooperative member producers. Specifically, for certified farmers, cooperatives continue to increase the price until they reach certain expected margins, considering the potential dividends to be paid at the end of the year. Based on a survey conducted in 2023, which included prices from late 2022, the average price received by households for red cherries was 50.36 birr/kg. Certified producers received a significantly higher price for red cherries (50.79 birr/kg) than noncertified producers (49.36 birr/kg). A similar trend was observed for dry cherries, with certified farmers receiving better prices than noncertified farmers. Certified producers sold significantly higher quantities of red cherries and lower quantities of dry cherries than their noncertified counterparts.

Given the higher prices and yields for certified producers, it is reasonable to assume that certified farmers generate higher total coffee revenues; however, certified farmers' lower yield of dry cherries lowers the rate of increase in total coffee revenue. Despite the higher costs associated with

certification, certified producers earn a higher average net income from coffee than noncertified farmers. Certified coffee farmers receive significantly higher dividends, increasing coffee income.

Table 4. Household Income and Expenditure

Variable	Total sample (N=530)	Non-certified (N=160)	Certified (N=370)
Net coffee income including dividends	90920.39	67347.46	101114.10***
	(109212.10)	(147871.90)	(85626.50)
Other harvested crops value ETB	61256.83	59998.18	61801.11
	(28465.67)	(23651.02)	(30325.36)
Livestock value ETB	88670.25	89895.00	88140.62
	(57750.17)	(64837.93)	(54486.65)
Other crops sold ETB	21429.91	23824.59	20394.37***
	(9660.84)	(8356.78)	(10007.37)
Livestock product sold ETB	5368.97	8519.94	4006.39***
	(3931.36)	(4782.75)	(2476.67)
Income from other crops and livestock ETB	26798.88	32344.54	24400.76***
	(11129.24)	(11036.00)	(10294.87)
Total cost of other crop and livestock	15564.41	16137.16	15316.73
	(6906.05)	(7666.46)	(6545.55)
Off farm income ETB	3413.59	4727.55	2845.39***
	(6444.45)	(7696.05)	(5739.78)
Total house hold income (Coffee income + other income) ETB	121132.90	104419.50	128360.20**
	(110337.30)	(147291.30)	(89059.08)
Household asset	16686.42	12463.64	18512.49***
	(17954.52)	(10630.68)	(20059.22)
Non-food expenditure	16857.09	13701.80	18221.54***
	(12123.36)	(11891.95)	(11982.71)
Food expenditure	50367.44	46130.21	52199.76***
	(20777.81)	(16822.480	(22041.31)
Total consumption expenditure	67224.53	59832.00	70421.30***
	(28050.41)	(22124.19)	(29717.66)
Net household income	53908.34	44587.54	57938.95
	(93578.33)	(132119.300	(70558.47)

Notes: Mean values are shown with standard deviations in parentheses. Mean values are tested for statistically significant differences; *p < 0.1, **p < 0.05, ***p < 0.01

According to the survey, 75% of the sampled households' income is derived from coffee. Table 4 indicates that certified farmers generally have higher incomes from coffee than noncertified farmers. However, when considering income from sources other than coffee, such as other crops, livestock, and off-farm activities, noncertified farmers tend to have significantly higher income than certified farmers. This suggests a potential shift of resources, including household labor, from coffee to non-coffee income sources for noncertified households. The inverse may be true for certified farmers, where higher coffee yields result from resources being directed toward coffee production instead of non-coffee activities. Nevertheless, the increase in income from coffee has a larger impact on the overall household income, leading certified farmers to receive higher total household income compared to their noncertified counterparts. Certified households also tend to have higher expenditures on food and non-food items than noncertified households.

It is important to note that the differences observed in various outcomes between certified and noncertified farmers may not necessarily be solely attributed to the impact of Voluntary

Sustainability Standards (VSS) certification. To accurately assess the impact, evaluating the average treatment effect is crucial while controlling for any potential selection biases.

3.2. VSS impact

The estimates derived from Propensity Score Matching (PSM) and Nearest Neighbor Matching (NNM) methods exhibit negligible differences, except for the significance level observed in certain outcome variables. Implementing organic practices is anticipated to reduce yields as farmers abandon using inorganic chemicals and transition to organic methods. However, the estimation findings suggest that VSS certification significantly increases red cherry yields for certified farmers while significantly decreasing yields of dry cherries. Moreover, the descriptive statistics indicate that certified farmers, on average, possess more clean coffee than noncertified farmers. It is important to remember that, even if not certified organic, a sizable portion of the region's small-scale coffee growers grow their coffee organically. Therefore, farmers who join certified cooperatives can potentially enjoy advantages such as specialized training, access to credit, facilities, agricultural inputs, and marketing services, all of which contribute to increased yields. Additionally, the trust established within the value chain and the incentives for long-term investment might prompt certified farmers to allocate more resources towards coffee cultivation management.

Table 5. Estimated Effect of VSS Certification for Outcome Variables

Outcomes Measured	**PSM[1]**	**NNM[2]**
Yield Red cherries	888.79**	732.23***
	(162.57)	(70.93)
Yield Dry cherries	-159.39	-150.98***
	(291.59)	(57.36)
Price-Red cherries	0.82**	0.81***
	(0.39)	(0.23)
Price-Dry cherries	3.42	9.97*
	(7.55)	(5.05)
Revenue-Coffee	22071.63	15606.68*
	(36190.36)	(8103.35)
Total Cost-Coffee	2276.92***	1813.87***
	(396.60)	(189.83)
Net income-Coffee	19794.71	13792.81*
	(36161.91)	(8089.42)
Dividends	7731.77***	6916.21***
	(1160.04)	(483.25)
Coffee income including dividends	27526.48	20709.01**
	(36265.83)	(8265.95)
House hold income	26538.09	16877.60**
	(38215.40)	(8161.65)
Consumption expenditure	6681.42*	5501.46***
	(3510.37)	(1789.17)
Net HH income	19856.67	11376.14
	(35899.84)	(7155.27)

Notes: Standard errors are presented in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01
[1]'teffects psmatch' [2]'teffects nnmatch'

Both certified and noncertified farmers reported experiencing better prices during the 2022 harvest season compared to 2033. However, they also highlighted that the substantial increase in inflation and cost of living eroded the price gains.

According to estimates, certified farmers earn about 0.8 more for selling red cherries than noncertified farmers. This represents a price premium of around 1.6% higher compared to the mean price received by noncertified farmers. It is important to note that these findings underestimate the price effect of VSS, as the premium farmers receive is reflected in dividends derived from the sale of certified coffee to cooperatives and the union.

Due to capacity limitations, primary cooperatives can only engage in international trade through their union, SCFU. Consequently, after covering transaction costs, administrative expenses, and VSS certification costs, both cooperatives and the union provide producers with a premium price in the form of dividends. According to the union report in 2023, farmers received first dividends ranging from 5 to 8 ETB/kg from the cooperatives and second dividends ranging from 5 to 6 ETB/kg from the union.

The social premium of $ 0.20/lb is allocated to community projects such as expanding education and health infrastructure. Dividend from coffee is where the quality premium from certification is transmitted to producers, and it is found to be significant across all the estimations. Of course, it increases the estimation of farmers' income from coffee. Survey results indicate that certified farmers, on average, received significantly higher dividends (ranging from 6916.21 to 7,731.77 birr) than noncertified farmers. This implies that certified farmers received an additional 4 birr per kilogram, leading to a substantial increase in the price effect. Coffee prices are highly volatile, and looking at farm prices over time would be advantageous to understand VSS impacts better.

All estimates consistently demonstrate that certification leads to a significant cost increase, ranging from 1813.87 ETB to 2,276.92 ETB on average. The majority of these cost increases can be attributed to higher labor costs (61.84%). It is important to note that the calculation of costs does not include certification registration costs. However, farmers frequently mention additional production costs and certification expenses as primary barriers to participating in Voluntary Sustainability Standards (VSS) programs, and it is expected that these costs will rise, particularly for farmers who hold multiple certifications, such as Fair Ftrade-Organic. These costs have a negative impact on coffee growers' net income in the short term. However, there are cases where short-term cost increases might lead to long-term yield benefits, although it requires a longer time period to capture these effects.

The increase in coffee revenue and net income from coffee is found to be significant only in the nearest neighbor matching (NNM) estimation. These income effects are assumed to arise from the combined impact of yield and price effects. However, despite the positive and significant price and yield effects observed for red cherries, the decrease in dry cherries among certified farmers underestimates the total revenue from coffee. This, combined with the cost effect, ultimately pull down the net income from coffee for certified farmers.

While coffee represents a major portion of household income, noncertified farmers often pursue other income sources that contribute to their overall household earnings. Only the NNM estimation demonstrates a significant increase in household income due to certification, whereas the other estimations do not yield similar results. Certification leads to an increase in consumption expenditure, which suggests improving living standards.

None of the estimations show a significant effect of certification on net household income. However, certified farmers' significantly higher household assets indicate a potential investment using net household income.

3.3. Cooperative effects

The primary objective of cooperatives is to provide products or services to their owner-members and distribute surpluses based on the capital contributions made by members through patronage (Soboh et al., 2011). To attract membership and ensure sustainable dividend payments, cooperatives must demonstrate appealing financial and operating performance (Shamsuddin et al., 2018). This performance is an important indicator of how cooperative benefits are transferred to members in the short term (McKee, 2008). Therefore, to account for institutional heterogeneity, we utilized various cooperative performance indicators such as profitability, leverage, liquidity, and efficiency ratios as proxy measures of cooperative characteristics. The results presented in Table 6 indicate that certified cooperatives exhibit superior performance ratios compared to their noncertified counterparts.

On average, certified cooperatives have a significantly higher number of members, with an average of 3,149 members, whereas noncertified cooperatives have an average of 1,057 members. Additionally, nearly all certified cooperatives in the sample employ managers, whereas none of the noncertified cooperatives have managerial positions.

Table 6. Descriptive Statistics of Cooperatives Performance Indicators

Variables	All Coop	Non-certified Coop	Certified Coop
Coops member	2623.96	1056.68	3149.21***
	(1397.86)	(535.43)	(1188.70)
Coops employed manager	0.67	0.00	0.90***
	(0.47)	(0.00)	(0.30)
Liquidity ratios-current ratio	1.53	1.04	1.74***
	(0.48)	(0.22)	(0.40)
Leverage ratios-Debt to equity	1.20	1.24	1.18***
	(0.18)	(0.19)	(0.17)
Efficiency Ratio-Asset turnover	2.09	1.66	2.27***
	(0.64)	(0.44)	(0.62)
Profitability ratios-Net profit margin (%)	12.47	10.70	13.24***
	(2.17)	(1.27)	(2.02)

Notes: Mean values are shown with standard deviations in parentheses. Mean values are tested for statistically significant differences; *p < 0.1, **p < 0.05, ***p < 0.01

Table 7. VSS Certification Impact on Outcome Variables with and without Cooperatives Effect

Certification effect on	OLS controlled only for HH	OLS controlled for HH and COOP
Coffee yield –Red cherry	712.16***	612.297***
	(112.59)	(162.98)
Price –Red cherry	1.15***	2.152483***
	(0.29)	(0.36)
Total cost	1757.47***	2290.398***

	(280.78)	(386.63)
Dividends	6745.44***	6589.69***
	(801.60)	(1175.41)

Notes: Standard errors are presented in parentheses. *p < 0.1, **p < 0.05, ***p < 0.01

To examine how institutional heterogeneity affects outcomes, we conducted outcome regression analyses while controlling for cooperative performance indicators as proxies for cooperative characteristics. The results in Table 7 demonstrate that even after accounting for cooperative characteristics, VSS certification still has positive and significant effects on coffee yield (red cherry), price, cost, and dividends. This indicates that VSS certification has positive impacts regardless of cooperative characteristics. However, it also suggests that there may be a correlation between cooperative impact and certification impacts, as well as with outcome variables.

As shown in Table 7, the differences in the coefficients of the outcomes indicate that the impact of certification without considering cooperative characteristics may be subject to omitted variable bias. By including cooperative characteristics in the estimation, we better understand how cooperative performance affects the impacts of certification. Upon controlling for cooperative characteristics, it becomes apparent that the influence of certification on coffee yield (red cherry) and dividends diminishes when compared to the findings obtained without accounting for cooperative heterogeneity. This implies that the previous estimation of the certification effect might have been inflated, prior to taking cooperative characteristics into account. These results indicate that farmers belonging to cooperatives that exhibit higher performance levels tend to derive greater benefits from certification in terms of coffee yield and dividends, as compared to farmers affiliated with underperforming cooperatives. Surprisingly, the price effect appears counterintuitive, as certified farmers in cooperatives with lower performance ratios receive a higher price than certified farmers in better-performing cooperatives. However, this can be explained by the fact that many performance indicators are associated with cooperative sales and profits, which may compromise immediate price benefits for producers. However, at the end of the year, better-performing cooperatives tend to pay higher dividends to their members, as indicated by the effects on dividends. It is important to note that we cannot rule out the possibility of reverse causality, wherein certification influences cooperative characteristics. In order to address this, it would be necessary to capture cooperative characteristics prior to certification.

To better understand households' perceptions of VSS certification and validate the above results, we asked them general questions. The findings revealed that 96% of certified farmers believed that certification had benefited them, and 88% believed they had benefited from the premium price associated with certification. Regarding concerns, 41% of respondents stated that certification was expensive, and 42% felt that the requirements were difficult to meet.

We also asked both VSS-certified and noncertified households to rate their observations of changes in relation to their coffee farming over the past five years. The rating scale ranged from 1 (decreased) to 2 (no change) to 3 (increased). The average responses are presented in Table 8.

Table 8. Households Report of Observed Changes on Some Selected Outcomes over the Last 5 years

Certification	Coffee area	Coffee yield	Coffee quality	Coffee price	Area for other crops	Demand for hired labor	Demand for family labor	Household income	Access to coffee markets	Gender equality
Non-certified	2.46	2.45	2.61	2.65	2.55	2.86	2.68	2.46	2.79	2.44

Certified	2.59	2.78	2.88	2.78	1.53	2.95	2.62	2.53	2.87	2.57
Total	2.60	2.68	2.80	2.85	1.84	2.92	2.69	2.56	2.88	2.58

The results in Table 8 indicate that, on average, there have been increases in most of the outcomes listed in the table for both certified and noncertified farms. However, there is a lower rate of area allocated to other crops for certified households, which suggests that certified farmers may be expanding their coffee farms and replacing other types of crops.

4. Discussion

As previous literature has demonstrated, the impacts of voluntary sustainability standards (VSS) in our study area vary depending on contextual factors such as the type of VSS, the local implementation context, the measured indicators, and the methodology used to assess VSS impacts.

Some authors have disaggregated VSS by certification type and examined the impacts on various livelihood indicators (Meemken, 2017; Mitiku et al., 2017; Chiputwa et al., 2015). In contrast, our study aimed to comprehensively evaluate the combined effect of Fairtrade-Organic double certification on specific economic indicators.

Before getting into the details, we asked farmers if they were aware of their Fairtrade-Organic double certification. Surprisingly, 32.7% of households that were members of Fairtrade-Organic-certified cooperatives were unaware that they were also Fairtrade-certified. This lack of awareness compromises the proper and effective implementation of the VSS. It is primarily the responsibility of the cooperatives to ensure that members are well-informed about sustainability standards they are certified with in group, and it seems that cooperatives mainly focus on marketing activities while making limited efforts to raise member awareness of these standards. On the other hand, all sampled coffee producers were aware of the Organic certification and practiced organic farming in their coffee production. Even though environmental impact was not the main focus of our study, we have learned that these farmers avoid using chemicals and have adopted environmentally friendly management practices. Organic agriculture is widespread among coffee farmers in the Sidama region, even without formal certification. This finding aligns with Winter et al.'s (2020) observation that approximately 95% of smallholder coffee farmers in Ethiopia practice organic farming despite only a few being formally certified. Our findings regarding organic coffee farming are also consistent with the studies conducted by Jena et al. (2012) and Minten et al. (2015), which found that the use of synthetic pesticides and fertilizers is almost non-existent among smallholder coffee farmers in Ethiopia, except for some cases where organic pesticides are used.

We recognize that the effects of voluntary sustainability standards (VSS) can vary depending on the specific type of standard, as the certification requirements differ (Ruben & Zuniga, 2011; Chiputwa et al., 2015; van Rijsbergen et al., 2016; Jena et al., 2017). And different results in different locations are expected to be observed due to various contextual factors. However, seeing different outcomes for the same standards in neighboring areas where experiences can be easily shared is a little intriguing. For instance, the Rain Forest Alliance Certification (RA), which is no longer operational in our study area due to a lack of profitability, positively impacted household welfare and income in Ethiopia's Jima Zone; this discrepancy indicates the significance of specific factors in particular locations. The authors of the previous study suggested that the success of RA certification in the Jima

Zone can be attributed to a shorter value chain, where a larger proportion of the price premium is passed on to farmers. On the other hand, producers may abandon certifications if they do not face an issue of over-certification and can sell all their coffee under one or two certifications. This is due to the affordability constraints associated with obtaining and maintaining multiple certifications, leading them to prioritize the certifications they perceive as more profitable.

Our findings are generally consistent with some previous researches, which has shown that VSS certification is associated with higher yields (Cepeda et al., 2013; García et al., 2014), higher prices (Arnould et al., 2009; Meemken, 2020; Minten et al., 2015; Weber, 2011; Ruben & Zuniga, 2011; Bacon, 2005), and higher gross crop income (Meemken, 2020; García et al., 2014; Waarts et al., 2016; van Rijsbergen). However, our findings differ from studies conducted in Ethiopia (Winter, 2021; Jena et al., 2012; Minten et al., 2015; Mitiku et al., 2017), which found no significant positive impact of organic and Fairtrade certifications on coffee farmers' livelihoods due to low price premiums passed down to farmers.

Contrary to arguments (Valkila, 2009; and Jena et al., 2012) suggesting that Fairtrade and Organic certification is associated with lower yields, our study found positive effects on coffee yield, price, and income for Fairtrade-Organic certified farmers. In our case, the combination of Fairtrade and Organic certifications provided a competitive economic advantage for certified farmers, with the Fairtrade premium price and livelihood support contributing to their improved economic outcomes. Additionally, it seems that VSS-certified farmers in our study area are primarily focusing on coffee farming and reallocating more resources, such as labor hours, capital, and previously used farmland for other crops, towards coffee production. This indicates their commitment to coffee farming under VSS certifications. Moreover, coffee marketing heavily relies on cooperative performance and members' commitment. Certified cooperatives play a crucial role in reducing individual risks through collective action. Hence, the membership of certified cooperatives appears to increase farmers' trust in the supply chain and improves their coffee production and marketability.

Although the VSS certification effect on income in our study is less strong than the price and yield effects due to costs and potential trade-offs with non-coffee income activities, we did find that VSS certification increases coffee income, household income, and consumption expenditure. However, it is essential to carefully consider the marginal returns of all resources to determine where to invest resources most effectively. Coffee is the primary source of income for farmers in our study area, and their livelihoods and vulnerability to poverty are heavily dependent on coffee price changes. Therefore, the positive price and yield effects of VSS certification and cost-effective and improved coffee farming systems may contribute to improving farmers' livelihoods. However, it is important to note that VSS certification also increases wage labor demand and labor costs, as certified farmers must adhere to labor standards, which can reduce the income effects of the higher prices and yields. On the other hand, the cost of certification is borne by the union, but it is deducted from the premium price, which is then distributed back to farmers as a dividend.

Unlike studies conducted in Ethiopia's Jima and Keffa zones (Jena et al., 2012; Mitiku et al., 2017), the majority of cooperative members in our study area sell their coffee to their cooperatives at a price set by the union based on market value. Minten et al. (2018) discovered that only about one-third of the premium price is passed on to Ethiopian coffee farmers through dividends; however, farmers still believe that dividends are the primary means by which they benefit from the premium price, and certified farmers receive significantly higher dividends than noncertified farmers.

Generally, the average coffee income of the sampled households in our study area is relatively higher than that of smallholder coffee farmers in Ethiopia. However, we used the nominal income of

households, which refers to the money they received in the current year. In the country experiencing inflation, where prices rise unevenly, certain farmers' purchasing power inevitably declines as their real income, adjusted for inflation, falls. As a result, it is important to recognize the detrimental impact of inflation on farmers' real income, which restricts their ability to make purchases despite the higher nominal income indicated. To determine how much better the farmers' income from coffee is, it needs to be compared to the current-year living income benchmark adjusted for inflation in the study area. According to Gerrie (2020), the living income benchmark in the Sidama region was USD PPP 3.60 per day per adult equivalent in 2017.

Since membership in a cooperative is a requirement for some VSS certifications, the effect of cooperatives is closely linked to the effect of VSS. Several studies have shown that cooperative performance substantially influences member performance and income (Sellare et al., 2019; Minten et al., 2018; Meemken et al., 2017; Mitiku et al., 2017; Jena et al., 2012), highlighting the importance of considering cooperative institutional heterogeneity in VSS impact studies. Our study found that the positive and significant certification effect remains even after controlling for cooperative heterogeneity, indicating that VSS has a positive impact anyway. However, if we had disregarded the institutional heterogeneity of cooperatives, the benefits of both Organic and Fairtrade certification could have been confounded by the impact of cooperatives, leading to overstated results.

Furthermore, we observed heterogeneity among cooperatives, with VSS-certified cooperatives having more members, better management, and improved financial performance. Certified cooperative success is associated with higher yields, higher dividends, and lower prices, despite the fact that VSS certification generally improves all of the aforementioned outcomes when compared to non-certified cooperatives. Yet we are not certain if there is an inverse casualty, but it is expected that certification helps cooperatives enhance their investment and operational capacity. Additionally, governmental and institutional capacities, as well as supply chain management efficiencies, play a role in influencing cooperative operations and VSS certification.

5. Conclusion

The agricultural trading sector has witnessed substantial growth in the Voluntary Sustainability Standards (VSS) system, prompting the implementation of certification and traceability measures to enhance prices and marketability. Although a relatively recent development, most coffee producers in the Sidama region have obtained dual Fairtrade and Organic certifications, which are currently the only certifications in effect in the region. Consequently, our investigation aimed at evaluating the economic impact of dual Fairtrade-Organic certification on smallholder coffee farmers in the region. Understanding the economic incentives is crucial for developing countries like Ethiopia, as they strive to alleviate poverty and promote environmental sustainability through initiatives such as VSS.

To ensure robustness, we employed various estimation metrics and obtained compelling evidence that certified coffee farmers experience significantly higher coffee yields (red cherry), increased coffee prices, and higher dividends. Moreover, our Nearest Neighbor Matching estimation revealed that certification has a positive and significant effect on coffee income, household income, and consumption expenditure, thus indicating an improvement in living standards. It is worth noting that certification also leads to higher coffee production costs, primarily driven by labor expenses.

Coffee is the primary source of income for certified and noncertified farmers in the region. However, noncertified farmers tend to have a higher level of non-coffee income, suggesting a diversion of resources from coffee farming towards alternative activities. Conversely, certified farmers experience higher coffee income, which entails a diversion of resources towards the coffee business. Nonetheless, on average, certified farmers enjoy higher incomes, indicating that the marginal income derived from coffee farming remains significant. Therefore, any decision to shift the business focus away from coffee necessitates a comprehensive assessment of the marginal productivity of all invested resources.

Our result is a little different on the income aspect of smallholder coffee farmers, even from that of studies in the western part of Ethiopia. We observed an overall positive economic impact of Fairtrade and Organic certification in the Sidama region. The fact is that in the southern Ethiopian regions of Sidama and Yirgacheffe, Fairtrade and Organic certification are widespread, and cooperatives in these areas may have well-established facilities and efficient supply chain management. It is evident that the local context and cooperative performance play a role in determining the achievements of cooperative members and the success of Voluntary Sustainability Standards (VSS). The cooperative effect indicates that farmers who are members of better-performing cooperatives benefit more from certification than those in low-performing ones in terms of coffee yield and dividends, whereas the price effect is the inverse. However, the effect of VSS remains positive and significant, even after controlling for cooperative performance indicators used as a proxy for cooperative characteristics, suggesting that certification indeed has a positive and significant effect.

Overall, Fairtrade and Organic certification appear to benefit smallholder farmers in developing countries by offering premium prices, market access, long-term trading relationships, livelihood support, community development, and promoting environmentally responsible production and trading systems. These outcomes align with the aspirations of most developing countries, including Ethiopia, which aims to improve the livelihoods of smallholder coffee farmers while increasing coffee exports, as outlined in its comprehensive coffee strategy. However, the stringent requirements of these certifications may limit smallholders' access to global value chains, potentially marginalizing those who cannot afford the associated costs. As observed in this study, even certified producers, particularly in low-income countries, may be compelled to withdraw their certification if the costs outweigh the perceived benefits. Nevertheless, in certain situations, trade-offs must be made between long-term benefits and short-term cost increases, necessitating coordinated institutional support programs, such as training, technical assistance, and, in some cases, temporary financial aid to cover certification costs.

Overall, despite some technical limitations, such as measurements based on individual recall responses, and group certification, we believe that this study provides policymakers with valuable insights into developing resilient production systems, supply chain management, and sustainable trade policies that align with economic interests and the pursuit of a sustainable future. The lessons learned will help to advance best practices in sustainable production and marketing as scalable and effective solutions that can be adopted and supported by producers, cooperatives, and value chain actors. Furthermore, this research will inform individuals and organizations striving to contribute to the collective effort of promoting sustainable development on a broader scale. Finally, we made a few recommendations to improve the overall situation, addressing various stakeholders in the value chain, including certification bodies. These include fostering collaboration among actors to adapt certification requirements to local contexts, addressing affordability issues, increasing producers' share of premium prices, and improving market access

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