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Do Certification Schemes Enhance Coffee Yields and Household Income? Lessons Learned Across Continents

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While the market for sustainably certified products grows, the debate on whether smallholder farmers benefit from this certification movement is far from over. We present empirical findings across three continents. Identical household surveys were conducted among 738 smallholder coffee farmers organized in primary cooperatives in Ethiopia, India and Nicaragua. The comparative analysis which is based on the propensity score matching approach shows that the impacts of Fairtrade certification on coffee yields and income vary across countries. In Ethiopia, the coffee farmers from Fairtrade certified cooperatives fare worse than their non-certified counterparts both in coffee yield and income. In the Indian case study, the Fairtrade cooperative members have yield and price advantages over the non-certified farmers. This has in turn led to higher net revenue from coffee for certified farmers. In Nicaragua, coffee farmers from Fairtrade and double (Fairtrade-Organic) certified cooperatives also benefit in terms of net revenue but there is no statistically significant effect on yield and household income. A comparison of the Fairtrade minimum floor price and the weight-equivalent Fairtrade cooperative price in the three countries shows that Nicaraguan Fairtrade certified farmers have obtained a higher average price than the Fairtrade mandated minimum price, whereas in Ethiopia the certified farmers received a much lower price. In India, the certified average price was closer to the minimum floor price. We conclude that coffee cooperatives and the motivation and capability of their staff play a central role in training their member farmers about each aspect of coffee growing and certification.

Keywords: Fairtrade certification, organic, cooperatives, Ethiopia, India, Nicaragua

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INTRODUCTION

In the last three decades, certification of tropical commodities (coffee, bananas, cacao, etc.) has become a "flagship program" that aims at promoting several Sustainable Development Goals (SDGs) such as decreasing poverty (SDG 1) or sustainable production and consumption (SDG 12) (UN., 2020). Certification is based on the idea that consumers are willing to pay higher prices for the products that meet certain required attributes, which have to be met by smallholder producers in exchange for higher producer prices and a social price premium which is provided to the cooperatives (Grote et al., 2007).

Voluntary certification schemes for coffee such as Fairtrade or Organic aim at creating new opportunities for smallholder coffee producers in the international coffee value chain. Fairtrade promoted by the Fairtrade Labeling Organizations International (FLO) and Organic promoted by the International Federation of Organic Agriculture Movements (IFOAM) are among the most widely used certification standards. The Fairtrade system focuses on poverty reduction and works with minimum prices as a safety net for farmers at times of low world market prices. Furthermore, it aims at ensuring fair labor standards and claims being gender-inclusive (Fairtrade Foundation, n.d.). Organic certification is a process-based certification scheme where strict standards are set for input use due to environmental and health concerns (Parvathi et al., 2018). Prices of Organic products are normally higher than for non-certified ones and thus compensate for often lower yields and more labor input. Prices for Organic-certified products are a result of negotiations between seller and buyer and are not regulated as, e.g., for Fairtrade-certified products (IFOAM., 2015).

The scale and scope of studies on certification in the coffee sector are expanding. They often focus on its socio-economic outcomes to document in how far smallholder producers in developing countries benefit. However, papers have been criticized based on their quantitative rigor and qualitative soundness in providing evidence in this field. There are seven major meta-analyses of socio-economic impacts of agricultural certification with selected studies that demonstrate robust results (Blackman and Rivera, 2011; Beghin et al., 2015; Bray and Neilson, 2017; DeFries et al., 2017; Oya et al., 2018; Meemken, 2020; Schleifer and Sun, 2020). They commonly conclude that certification has rather mixed results when it comes to improving welfare of smallholder producers in the coffee sector. While some do show positive impacts on income and poverty reduction (Maertens and Swinnen, 2009; Karki et al., 2016; Schuster and Maertens, 2016; Jena and Grote, 2017; Mitiku et al., 2017), most studies find no difference between certified and non-certified producers (Valkila, 2009; Beuchelt and Zeller, 2011; Jena et al., 2017). This is mainly explained by increasing production costs and a lower productivity which may neutralize much of the benefits accrued from the higher price premium (DeFries et al., 2017; Meemken et al., 2018).

Furthermore, Fairtrade certification does not necessarily always lead to higher farm-gate prices owing to the excess supply of Fairtrade products. That is the reason why Fairtrade certified cooperative farmers sell their products to conventional traders and not to certified ones (Bacon, 2005; Valkila, 2009; Beuchelt and Zeller, 2011; Jena et al., 2017; Lernoud et al., 2018). Some studies show that certification has only a marginal effect on income and may favor disproportionately richer farmers (Ruben and Fort, 2012; Nelson and Martin, 2013; Hansen and Trifković, 2014). Ruben and Zuniga-Arias (2011) show that Fairtrade in Nicaragua provides higher prices compared with independent producers, but private labels out-compete Fairtrade in terms of yield and quality performance. While Fairtrade can support initial market incorporation, private labels offer more suitable incentives for quality upgrading.

Several supply-side constraints may seriously undermine the seamless transaction of the certified product from cooperatives to the exporters. Jena and Grote (2017) observe that income effects of certification schemes depend on the certified cooperatives' ability to make regular supplies in the certified value chain. Some of the Fairtrade certified cooperatives find it hard to meet the supply quantity threshold fixed by the Fairtrade traders and thus lose out on regular contracts. In rare cases, DeFries et al. (2017) even find negative results indicating that farm households are not able to compensate for the additional costs of compliance and/or higher production costs.

A recent systematic review by Schleifer and Sun (2020) broadens the scope of potential impacts of certification by adding issues such as land use, land rights and gender equality to the socio-economic impacts. Their review shows that evidence on socio-economic impacts of certification is weakly positive and highly context-specific, and the relationships that link certification to food security via its influence on land use, land rights, and gender equality are only indicative. Another recent paper explores the health impacts of Fairtrade certification which indirectly affect the welfare of the farmers (Sellare et al., 2020). They find that the cases of pesticide-related acute health issues are significantly reduced among Fairtrade certified farmers compared to non-certified ones. Chiputwa et al. (2015) analyze the poverty reduction effects of three certification standards such as Fairtrade, Organic and UTZ standards in Uganda. They find that while Fairtrade improves the household living standards by 30% and reduces the prevalence of depth of poverty, Organic and UTZ standards have no such effects. Parvathi et al. (2018) also add a new aspect to the literature by focusing on the effects of double certification, namely Fairtrade and Organic with inconclusive welfare impacts.

Krumbiegel et al. (2018) studied the impact of Fairtrade certification standards on the hourly wages of hired labor and their job satisfaction in large pineapple plantations in Ghana and they find that both hourly wages and job satisfaction have increased in certified plantations. The impact of various private certification standards with different levels of focus on labor standards, has been examined on wage, employment conditions, and worker empowerment by Schuster and Maertens (2016, 2017) in the horticultural export chains in Peru. They observe that the laborers under the private certified production, processing, and export chains are more likely to receive a minimum wage, have a written contract, and receive training, however they do not observe any effect on the level of wages and employment period. They also observe that worker empowerment is higher in certified enterprises. Akoyi et al. (2020) while investigating the impacts of adoption of private sustainability standards on school enrolment in Ethiopia and Uganda, find that participation in Fairtrade certification schemes increases the likelihood of children to be enrolled in secondary school and improves their schooling efficiency. They attribute this effect to social capital and awareness-raising campaigns among the Fairtrade certified households. They do not, however, find any evidence of higher incomes or a reduced child labor time in the farm-households due to certification. Vanderhaegen et al. (2018) in a study in Uganda show that the certification standards either improve the socio-economic conditions of the households, or they improve the biodiversity, but they fail to remove the trade-offs between socio-economic gains and environmental benefits. In yet another study from Uganda, Meemken et al. (2018) use panel data from small-scale coffee producers to compare household consumption, child education, and nutrition effects of both Organic and Fairtrade certification standards. Their findings show that both standards improve household consumption, however, while Organic certification ameliorates child education, the Fairtrade standard enhances the nutritional intake of the household members.

In a nutshell, empirical research on the direct and indirect effects of certification on income and poverty is still evolving. The paucity of robust studies has been highlighted in many recent review papers (DeFries et al., 2017; Oya et al., 2018; Schleifer and Sun, 2020). Against this background, the objective of the paper is to investigate and compare the coffee yields and income effects of certification schemes, such as Fairtrade and Organic certification across three country cases. It is designed as a combination of three case study surveys undertaken in the Jimma region of Ethiopia, Araku district of India, and Jinotega region of Nicaragua. The country case studies are not representative of the continents they belong to. In Latin America, there are other countries such as Honduras, Peru, Guatemala, and Mexico which produce a significant volume of Arabica coffee and are as likely a candidate as Nicaragua to be selected as a case study. Similarly, in Africa, Uganda and Kenya also have large number of certified smallholder farmer cooperatives and are known to produce Arabica coffee. Indonesia and Vietnam are significant coffee producers in Asia. The selection of countries for case studies in this study is a random phenomenon. However, the coffee production and marketing in these countries as well as the spread of the certification network make them suitable case studies to examine the yield and income effects of certification.

The current study makes several contributions to the literature on the socio-economic impacts of third-party voluntary certification schemes in Ethiopia, India and Nicaragua. Although there is wide heterogeneity among the three countries and a direct comparison of empirical results across the case studies may not be possible, we have discussed the various aspects of coffee certification cooperatives, value chains and other institutional differences in these countries to create a context for some comparative statements. Most studies examining the socio-economic and ecological impacts have been done within a single country framework. However, Akoyi et al. (2020) examine the effect of private sustainability standards on school enrolment in the framework of an integrative study in two countries such as Ethiopia and Uganda. Arnould et al. (2009) undertake a cross-country analysis of three countries, namely Nicaragua, Peru, and Guatemala, to measure the impact of Fairtrade certification on income, education, and health using logistic regression and path analysis methods. They find convincing positive impacts on income and uneven mixed results for education and health indicators. We also follow a mixed approach in which firstly, we individually examined each case study and explained the results within their respective country backgrounds, and secondly, we undertake an integrative impact evaluation study similar to Akoyi et al. (2020) by combining the empirical data for all three country cases. Several adjustments have been done to bring the data from three country cases to a comparable format. For example, all the monetary variables such as total income, net revenue etc. have been converted to purchasing power parity (PPP) dollar exchange rates of the respective countries prevailed in 2010. The reason for choosing the year 2010 is that the data collection in all three countries were conducted during September 2009 to April 2010. Hence, the data for all three case studies is from the same year and can be compared within the macroeconomic situations of that year. The impact evaluation approach in our study examines the effectiveness of an innovative market-based instrument relying on quantitative measures across a cross-section of communities and countries. It enables us to make insightful statements for the policy intervention.

There are some similarities among these countries. First, they are all important coffee-producing countries. In 2018, Nicaragua accounted for 1.6% of the global coffee production, India for 3.5% and Ethiopia accounted for around 4.3%, making Ethiopia the fifth, India the seventh, and Nicaragua the 12th largest producer worldwide (ICO., 2020). Second, they all produce Arabica coffee, particularly dominated by small-scale production. Third, in all three countries, a large proportion of the total production is produced in extensive highland forest coffee production systems. Fourth, Fairtrade and Organic certification have been increasingly promoted in Ethiopia, India, and Nicaragua as market-based instruments to reduce poverty among small-scale coffee farmers. Fifth, the certified and uncertified rural smallholder coffee cooperatives are structurally similar in all three countries. Subsuming, the product–Arabica highland (semi-) forest coffee–may slightly differ in terms of quality and character, but it is overall the same in all country cases, as the investigated certification standards (Fairtrade and Organic for smallholders) are.

Each of these three countries has different institutional and historical dimensions of coffee production, processing, and marketing. In Ethiopia, the current primary cooperative system has developed in the 1990s from formerly state-run Agricultural Service Cooperatives (Stellmacher, 2007). Organized cooperatives in the coffee sector also have a long presence in Nicaragua. In contrast, organizing coffee farmers under a cooperative is a recent phenomenon in India. Such initiatives are often carried out by Non-Governmental Organizations (NGOs). The three countries also have different macroeconomic backgrounds. The poverty rate is significantly lower in Nicaragua, i.e., 3.2% as per the international poverty threshold of US$1.9 per capita per day, compared to 21.6 and 30.8% for India and Ethiopia, respectively (World Bank., 2020).

We focus on Fairtrade and Organic certification because, (i) they both can generate price premiums and income effects for certified members, (ii) due to direct control on input use in case of Organic and input support provisions in case of Fairtrade, both schemes can generate yield effects, and (iii) both certification schemes are increasingly being administered together in recent years (Parvathi et al., 2018).

The structure of the paper is as follows–Section 2 provides a detailed description of our case study survey areas, sample selection procedures, and methodology. Findings from the quantitative analysis are given in Section 3, while Section 4 supplements the quantitative analysis with the qualitative findings. Section 5 discusses the results from the three case studies. The conclusions and recommendations are furnished in the last section.

DATA AND METHODS

Data Collection and Questionnaire

We conducted household surveys with a total of 738 coffee farmers in Jimma Region in Ethiopia, Araku Valley in India, and Jinotega Region in Nicaragua. The selection of these survey sites was based on the fact that smallholder coffee farmer cooperatives from these regions are subject to Fairtrade and Organic certification schemes. The same survey instrument has been implemented in all the three countries. Only units of measurement have been adapted to local standards.

The Jimma region accounts for a substantial amount of coffee production and for about 20% of the overall export share in Ethiopia. Almost 30 to 45% of the population in Jimma are directly or indirectly involved in coffee production, processing and marketing. Most producers are smallholder coffee producers producing under traditional agroforestry systems. Following the expert interviews conducted with the staff of the Oromia Coffee Cooperative Union in Addis Ababa, three districts namely Limmu Kossa, Gomma, and Manna within Jimma Zone of Oromia Regional State in Southwestern Ethiopia have been chosen for the household surveys. These cooperatives have been on average 20 years old at the time of the survey. From these three districts, six primary coffee cooperatives were selected based on stratified sampling, wherein the certification status of the cooperative is considered as the strata. Among six, four of the primary cooperatives have Fairtrade certification standards and the other two are non-certified conventional cooperatives. The survey instrument has been administered to the cooperative members chosen randomly but drawn on the basis of fixed proportions to the membership population of the selected cooperatives. From the total sample of 249 coffee farming member households, 166 were certified and the remaining 83 were non-certified.

In India, coffee is grown in the southern, eastern and north-eastern regions. However, the three southern states, namely Karnataka, Kerala, and Tamil Nadu, account for 98% of the total production in the country and are known as traditional coffee growing regions. The eastern states of Andhra Pradesh and Orissa and the north-eastern states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Mizoram and Tripura) are known as the non-traditional tribal coffee-growing regions and account for a share of only 2% (CBI., 2010). The Indian Tribal Development Authority (ITDA) had encouraged coffee plantations in this tribal belt of northern Andhra Pradesh in order to protect the forests in this region from "slash and burn" agriculture that the tribal dwellers had practiced and to provide an alternative livelihood to them since the early 1970's. Araku district was selected from this region as a case study site. It is one of the few places in India where smallholder farmers who produce Arabica highland (semi-)forest coffee are organized in a Fairtrade-certified cooperative. This cooperative has been founded in 2007 by an NGO to organize and assists the–mostly Adivasi tribal–smallholder coffee farmers who had been hitherto engaged in forest shifting cultivation. In 2008, the cooperative became certified by Fairtrade standards. A comprehensive survey of 256 farmers was conducted in Araku district. The farmers were purposively sampled from six villages, of which four are under the coffee cooperative coverage and certified by Fairtrade standards while the other two villages are not certified. One hundred and fifty five of the interviewed farmers are members of the certified cooperative.

In Nicaragua, the field study was undertaken in Jinotega municipality which accounts for nearly 65% of the total coffee production in Nicaragua (UCA Soppexcca., 2011). The household survey was carried out in Jinotega Municipality with 233 coffee farmers. Since a very large number of coffee farmers are located in Jinotega Municipality, we followed a disproportionate stratified random sample selection. Four cooperative unions were chosen based on the certification status of the local cooperatives operating under their jurisprudence in the first step of the sample selection. The first two use Fairtrade and Organic certification standards, whereas the latter two are not certified and hence function as a control group. Thereafter, we randomly selected the primary cooperatives under these cooperative unions and finally the individual members of these primary cooperatives. Since the total number of smallholders in each primary cooperative varies, the random selection of these smallholders under each primary cooperative is disproportionate. The cooperatives have been around 20 years old at the time of the survey.

The instrument used for the surveys in the three countries is comprised of mostly closed questions on a wide range of variables such as household and farm characteristics, income and expenditure of the household, certification status, cooperative services, and channels of sales for coffee. The household characteristics include questions on age, education, gender, and both primary and secondary occupation of the household head. The farm characteristics include total farm size, total cultivated land in ha, crops grown, and area under these crops. Identical questionnaires were used for both the certified and uncertified groups, except for the additional questions that only concern certified households (e.g., certification type, certification year, premium, and advantages and disadvantages of certification). The questions regarding the advantages and disadvantages of certification as well as the advantages of the cooperative's community benefit projects were phrased as open-ended questions. Responses to these questions were codified during the data entry process. Additionally, expert interviews took place with cooperative managers and staff from the coffee cooperatives, and some focus group discussions (FGDs) with semi structured guidelines were conducted to add further inputs to the data.

For the data collection, local enumerators were hired and trained in the respective three countries. They also pre-tested the survey instrument with some households. After the interview, which took on average 2 h, each completed questionnaire was cross-checked for plausibility and consistency by another enumerator. In case of incomplete or inconsistent information, the responsible enumerator had to revisit or phone the household to be able to enter the required information into the questionnaire. When the questionnaire was complete, it was passed on to the team leader. The whole data collection lasted 3–4 weeks.

Methodology

To investigate the impacts of certification schemes on crop yield and income, we had to make sure that no selection bias occurs. Selection bias is a common econometric problem when undertaking impact evaluation analyses based on cross-sectional data (Wooldridge, 2002). Selection bias occurs because the adopters of a typical development program which is a certification program in our study, sometimes self-select into the program on virtue of certain factors that are not observed by the researcher. Such omitted variables can create distortion in estimating the impact of the development program in question. If the selection bias is not accounted for in the estimation, it creates endogeneity in the cross-sectional data and thus can lead to inefficient estimations in Ordinary Least Squares (OLS) resulting in misleading interpretations.

A review of methods used across the certification studies show that most studies have used the propensity score matching (PSM) method. Some of the recent studies though have used the instrumental variable (IV) model to correct for endogeneity arising from self-selection bias. These studies are Akoyi and Maertens (2018), Vanderhaegen et al. (2018), and Sellare et al. (2020). Meemken et al. (2017) have used panel data to control for the individual specific unobservable bias. Since our study is based on cross-sectional data collected from three country case studies, finding a valid instrument to use the IV model is not feasible. Thus, we have used the PSM method for correcting sample selection bias in this study.

PSM corrects the self-selection bias caused due to observables, by matching a sub-sample participating in certification to another that does not participate in certification but shares similar observable characteristics. The comparison between the two groups takes place regarding the desired outcomes in the region of common support (Becker and Ichino, 2002). The certification status of each farmer is regressed upon the covariates (which is explained in **Table 2**) that can affect the decision to certify in the first-stage logit model of PSM.

From this first-stage regression, PSM estimates the propensity scores for each observation. The propensity score of each farmer measures his or her tendency to join a certified cooperative. The magnitude of a propensity score is between 0 and 1; the larger the score, the more likely the farmer would join the certification program. The second step is to form two balanced groups based on their estimated propensity scores using a suitable matching method.

The PSM estimations are done in this study following the three essential assumptions for the PSM to estimate the average treatment effect on the treated (ATT), as given in Rosenbaum and Rubin (1983). They are: a) the balancing property of the propensity scores (Equation 1); b) the conditional independence assumption (Equation 2) and c) the common support requirement (Equation 3).

The Balancing Property of the Propensity Score

The assumption requires that the balancing property is always true and says that treated (D = 1) and control (D = 0) groups with the same propensity score e(x) have the same distribution of the observed covariates x:

$$\Pr\{x|D = 1, e(x)\} = \Pr\{x|D = 0, e(x)\} \quad (1)$$

Equivalently,

$$D \prod x \left| e(x) \right.$$

Equation (1) means that the treatment D has to be independent of all observations x conditional on the probabilities e(x) when they would receive the treatment.

Conditional Independence Assumption (CIA)

The CIA assumption states that "given a set of observable covariates x which are not affected by the treatment, potential outcomes are independent of treatment assignment" (Caliendo and Kopeinig, 2008) and can be written as:

$$Y(0),\quad Y(1) \coprod D|P(x) \quad (2)$$

In referential literature CIA is also, the so-called "Unconfoundedness" assumption. Rosenbaum and Rubin (1983) suggest to use the balance score and show that when the potential outcomes (Y1, D=1; Y0, D=0) are independent from the observable covariates x, they are also independent of treatment conditional on balancing scores.

Common Support Requirement (CSR)

Heckman et al. (1999) assume that "there are participants and non-participants for each x which strive to make a comparison" and can be formulated as:

$$0 < \Pr(D = 1|x) < 1 \quad (3)$$

Equation (3) is the so-called "Overlap" assumption, meaning that individuals with the same x values have the probability of being both participants and non-participants (Caliendo and Kopeinig, 2008). For each treated observation there is a matched control observation with similar covariates. Generally bias arises in matching when this assumption is not satisfied or ignored during PSM procedure.

Several matching methods are proposed in the literature such as k nearest neighbor matching, radius matching, kernel matching, and Mahalanobis matching (Rosenbaum and Rubin, 1983; Heckman et al., 1998; Dehejia and Wahba, 2002; Pearl, 2009). The detailed discussion about each matching method is beyond the scope of this study. We have employed the first three matching methods in estimating the ATT.

TABLE 1 | Sensitivity Analysis of PSM Model.

Treatment	Pooled Data (Γ, max P value)	Nicaragua (Γ, max P value)	India (Γ, max P value)	Ethiopia (Γ, max P value)
Coffee yield per ha	2.5, 0.04	2.25, 0.03	3, 0.03	2.5, 0.04
Net revenue from coffee per ha	3.25, 0.05	2.5, 0.05	3, 0.04	2.5, 0.06
Total household income	3, 0.05	2.5, 0.06	2.5, 0.03	2.5, 0.04

The ATT captures the difference in the outcome by households that have participated in a certification program and a counterfactual outcome where the same households had not participated. Since similar groups have been found conditional on the covariates, the only factor that cause the performance difference between them is the treatment variable. The difference in the performance between the matched treated and untreated observations follows a *t*-test for the statistical significance. If the difference is positive and statistically significant then the treatment is yielding its result. By calculating sampling probabilities from a first stage logit and then forming the treatment and control group based upon these probabilities eliminates the selection bias that might have taken place in the observed data.

However, if the omitted variable bias arises due to unobservable variables that are not accounted for in the regression, then the PSM results could be misleading. Such unobservable variables can affect the treatment variable (the decision to join certification) and outcome variables such as income. Such unobservable bias is addressed in a PSM framework by using a sensitivity analysis developed by Rosenbaum (2002, 2005). In a randomized experiment, everyone has an equal chance of receiving the treatment, so $\Gamma = 1$. But, in an observational study, one subject might be more likely to receive the treatment than another one because of unobserved pre-treatment differences, so that $\Gamma \geq 1$.

If $\Gamma = 2$, then the subject is twice as likely as another to receive the treatment. The sensitivity analysis as suggested by Rosenbaum captures this hidden bias—that is, how large Γ can be before the qualitative findings of the study starts changing. The results of the study are highly sensitive to the hidden bias if the conclusions start changing barely above $\Gamma = 1$, and highly insensitive to the bias if they change only at a very high value of Γ. We have estimated the Rosenbaum bound sensitivity scores at different Γ values such as 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, and 5 using the *rbound* command in Stata 14. The results are shown in **Table 1**. The rbound estimates provide the significance values for upper and lower bounds at different Γ values. In **Table 1**, we have reported the maximum Γ value at which the upper bound is statistically significant, after this the results become sensitive to hidden bias.

As robustness check of the PSM estimation in the study, balancing tests have been performed and the results are presented in **Tables S2–S5** in Appendix. Further, common support algorithm is used to enhance the performance of the matching methods. The overlap of propensity scores between the treated and control pairs before and after matching have been plotted. These figures are furnished in the Appendix as **Figures S1–S12**.

FINDINGS FOR ETHIOPIA, INDIA, AND NICARAGUA

The empirical findings have been divided into three sub-sections. The first one describes the key characteristics of the smallholder coffee farmers in the three case study countries. The second sub-section compares the yields, farm gate prices obtained and net incomes generated per ha of coffee land for the three countries. Finally, the third sub-section provides empirical evidence on the impact of certification on income of the smallholders.

Key Characteristics of Coffee Farmers and Their Cooperatives

The covariates used to predict the probability of a household being a member of the certified cooperative are explained in **Table 2**. These covariates are characterized as human resources, physical resources, financial resources, and other control variables. The indicators for human resources are–education of the household head, experience in coffee farming, and training obtained from government agencies and the cooperative. As part of physical resources, size of landholding and livestock are used. The indicator for financial resources is the non-farm income and other control variables used in the prediction model are age and gender of the household head, household size, dependency ratio, and distance to the market.

The dependent variable in the prediction model is the respondents' certification status. This variable is used as the treatment variable in our econometric estimations. Proportionally larger samples were collected from the certified farmers' population compared to the non-certified ones in all three countries. Accordingly, the percentage of certified farmers in the total sample is 70% in the Nicaraguan case, 67% in the Ethiopian and 59% in the Indian case. Most interviewed respondents are smallholders in all three countries: 98% of them depend on coffee production as the main source of income and 69% of them possess not more than 5 ha of total land.

Among the human resource variables, the average number of years of school education of the household heads is similar in all three countries with 4.2 in Ethiopia, 3.3 in India and 3.6 years in Nicaragua. These are remarkably low figures for all coffee farmers across the three countries. Many household heads, especially in Ethiopia and India, are in fact illiterate. The low educational levels of the coffee farmers are likely to pose a constraint to the local implementation and comprehension of certification standards and procedures. The years of experience of the household head in coffee farming vary significantly among the case studies with Ethiopian farmers having most experience (average of 20 years), followed by Nicaraguan farmers (12 years) and Indian farmers (10 years).

TABLE 2 | Comparison of key variables across countries.

Variable name	Variable description	Ethiopia	India	Nicaragua⁺	ANOVA test⁺⁺	Kruskal Wallis test⁺⁺
Sample size		249	256	233		
Human resources						
Education	Education of hh head (in years)	4.23 (3.24)	3.34 (5)	3.6 (3.6)	3.78	
Experience	Experience of hh head in coffee farming (in years)	20 (13)	9.9 (9)	12.5 (9.45)	23.50***	
Training	Yes = 1; No = 0	0.43 (0.49)	0.41 (0.49)	0.92 (0.27)		1.25
Family labor	Members of hh working in coffee	4.2 (2.35)	2.8 (1.17)	3.27 (1.96)	5.32**	
Physical resources						
Size of landholding	in ha	1.67 (1.25)	1.85 (1)	5.07 (7)	20.67***	
Livestock	Yes = 1; No = 0	0.88 (0.33)	0.7 (0.45)	0.85 (0.35)		2.36
Financial resources						
Access to non-farm income	Yes = 1; No = 0	0.12 (0.33)	0.84 (0.37)	0.43 (0.49)		15.87***
Control variables						
Age	Age of hh head (in years)	48 (14)	38.5 (10.3)	47.3 (13)	10.39**	
Gender of hh head	Male =1; female = 0	0.9 (0.25)	0.9 (0.29)	0.74 (0.4)		3.78
HH size	Number of hh members	6.2 (1.9)	4.67 (1.65)	5.84 (2.4)	2.96	
Dependency ratio	Members of hh below 14 and above 65 years relative to total no. of members	0.69 (0.7)	0.4 (0.53)	0.67 (0.7)	5.79	
Distance_market	Distance from homestead to market (in km)	5.2 (5.4)	2.68 (4.47)	21.8 (13.6)	28.35***	

⁺*Nicaraguan sample consists of both Organic and Fairtrade certified farmers while the Ethiopian and Indian sample comprises of only Fairtrade certified farmers.*
⁺⁺*To test the difference in statistical distribution of the variables among three countries, one-way ANOVA for normally distributed variables and Kruskal-Wallis test for categorical variables have been used. F test for ANOVA and Chi-squared test for Kruskal-Wallis test have been reported.*
****Significant at 1% level, **Significant at 5% level, *Significant at 10% level.*
Own calculations.

With regard to labor input for coffee farming, smallholders largely make use of their own household labor force. An average of about three household members per farm are involved in coffee farming in Nicaragua and India and four members in Ethiopia. The average size of the farmland is fairly different in each case study. Nicaraguan farmers hold an average farm size of 5 ha, Indian farmers 1.85 ha, and Ethiopian 1.67 ha. Total land area and area under coffee are largest in Nicaragua and smallest in India. While the total land area amounts to between 1.59 ha in Ethiopia and 2.8 ha in Nicaragua for non-certified or single certified farmers (only the total area for double certified farmers amounts to 4.88 ha), the area under coffee varies between 0.8 ha in India and 1.92 ha in Nicaragua. Total land area and area under coffee are generally slightly larger or about the same for Fairtrade certified farmers as compared to the non-certified farmers. Most coffee farmers in the study areas possess livestock: 87% of the Ethiopian farmers, 85% of the Nicaraguan farmers, and 70% of the Indian farmers.

Non-farm income is a crucial indicator for farm income diversification and resilience, and can be a cushion for reducing poverty. Our data shows that the Ethiopian coffee farms have by far the least access to such income. Only 12% have reported to have non-farm income. In the Nicaraguan case, 42% of the coffee farms have non-farm income. The surprise result is from India though, where 84% of the coffee farms reported to have non-farm income. This can be explained by the fact that the Indian case study is undertaken in an area with a large proportion of Adivasi tribal people being subject to special state programs such as road construction. Thus, many farm household members work as day laborers in such programs. The daily wage is, however, relatively low compared to other non-farm activities such as fixed salary jobs and shop-owning. The age composition of the respondents is similar in the three case study areas with average ages between 38 and 48 years. Between 74% and 90% of the interviewees are male. The household size differs among the country cases with 6.2 persons in Ethiopia, 5.8 in Nicaragua, and 4.7 in India. The dependency ratio is higher in Ethiopia and Nicaragua with 69 and 67%, respectively, whereas it is 40% in the Indian case. The average distance of the farm to the coffee selling point is rather large for Nicaraguan farmers with 21 km, whereas it is only 3 km on average for Indian farmers since coffee merchants tend to buy the produce directly at farm gate.

While organizing smallholder coffee farmers under the umbrella of a cooperative system is relatively common, historically rooted and politically supported in Ethiopia and Nicaragua, it is a new development in India. Regarding the provision of extension services, Nicaraguan cooperatives score higher than Ethiopian and Indian cooperatives as 92% of interviewed farmers in Nicaragua ever have obtained extension service compared to 43% and 41% in Ethiopia and India, respectively. This shows the differences in agricultural capacity

TABLE 3 | Comparison of key variables in certified and conventional channels across countries.

Indicators	Ethiopia		India		Nicaragua			
	Fairtrade certified	Non-certified	Fairtrade certified	Non-certified	Fairtrade certified	Organic certified	Fairtrade-Organic certified	Non-certified
No. of households	166	83	155	101	79	38	46	70
Total land (ha)	1.70 (1.20)	1.59 (1.34)	1.96** (1.19)	1.68 (0.82)	2.13 (1.65)	2.84*** (2.73)	4.88*** (5.20)	2.13 (1.73)
Area under coffee (ha)	1.20*** (0.14)	0.84 (0.09)	0.90* (0.56)	0.82 (0.41)	1.60** (1.85)	1.92** (1.60)	1.88** (1.26)	1.65 (1.52)
Coffee yield (kg/ha)	871 (61.5)	1,035* (95.08)	530 (486)	515 (470.6)	1,561*** (1,208)	1,165 (745.7)	1,210 (862)	1,206 (988)
Price from coop (US$ per kg of red cherry)	0.26 (0.01)	0.25 (0.01)	0.4 (0.01)	n.a.	0.82 (0.11)	1.03*** (0.12)	1.1*** (0.1)	0.82 (0.09)
Price from private trader (US$ per kg of red cherry)	0.43 (0.02)	0.5*** (0.02)	0.35** (0.04)	0.33 (0.03)	0.73 (0.1)	0.7 (0.08)	0.7 (0.1)	0.72 (0.13)
Net revenue from coffee per ha (US$)	351.6 (36.4)	428.7 (47.5)	243*** (260.7)	160 (155)	1,290*** (1,170.8)	1,294*** (900.35)	1,522*** (1,978)	849 (883.5)

****Significant at 1% level, **Significant at 5% level, *Significant at 10% level.*
The statistical significance test is a comparison between the certified and non-certified group in each country. The stars show the level of significance at which there is a statistical difference and the stars are placed as a superscript to the value which is higher. Figures in parenthesis are standard deviations; n.a. – not applicable. To test the difference in statistical distribution of the variables among three countries, one-way ANOVA for normally distributed variables and Kruskal-Wallis test for categorical variables have been used. F test for ANOVA and Chi-squared test for Kruskal-Wallis test have been reported.

building efforts between the three case studies which is instrumental in delivering the benefits of certification.

A Comparative Analysis of Yields, Prices, and Net Revenue

The mean values of coffee yields, prices from both cooperatives and private merchants on local markets as well as the gross margins per unit of land of coffee cultivation for the case studies in Ethiopia, India and Nicaragua have been produced in **Table 3**. We compare between certified and non-certified channels of marketing.

The average values and the mean separation test for Ethiopia suggest that Fairtrade certified farmers in our sample have a yield of 871 kg per ha as compared to the yield rate of 1,035 kg per ha of non-certified farmers (see **Table 3**). In the Araku district in India, the average coffee yield for the certified farmers is 530 kg per ha whereas the same for the non-certified farmers is 515 kg per ha, however, the difference is not found to be statistically significant. There is wide heterogeneity in the yield figures as represented by the high standard deviation which is partly due to the difference in individual farmers' engagement in their coffee farms and the lack of access to the necessary inputs. When the respondents were asked to state three major reasons for their low yields in coffee production, they mentioned coffee plant diseases, insufficient rain or no access to irrigation, and high labor costs. In the Jinotega Municipality in Nicaragua, average coffee yields were significantly higher than in Ethiopia and India. Fairtrade certified coffee farmers have higher yields than both the conventional and Organic coffee farmers in Nicaragua. While the mean harvest of Fairtrade farmers is 1,561 kg of coffee per ha, conventional farmers harvest only 1,206 kg. Farmers who are both Organic and Fairtrade certified produce an average harvest of 1,210 kg per ha and the same for only Organic certified farmers is 1,165 kg per ha. The relatively low yield of Organic farmers is not surprising given that Organic farmers during our focus group discussions express difficulty in accessing the adequate amount of organic manure in the absence of chemical fertilizer. This is mainly because organic fertilizers are hardly available in the input market. The relatively higher yields of the Fairtrade certified farmers may be partly attributed to the Fairtrade cooperatives' extension training programs and provision of equipment.

The certified farmers in the Jimma Zone in Ethiopia receive US$ 0.26 per kg for red coffee cherries from their cooperative whereas the non-certified farmers receive US$ 0.25[1]. The difference between the average farm gate price from cooperatives to the certified and the non-certified farmers is not statistically significant. However, the difference in prices paid by the private merchants to certified and non-certified farmers is significant. A substantial part of their coffee harvest, namely nearly 75% of coffee harvest, is sold by both certified and noncertified farmers to private traders from both certified and non-certified groups. The non-certified farmers achieve a higher net revenue from coffee than their Fairtrade certified counterparts; however, the difference is not statistically significant. While non-certified farmers receive an average of US$ 0.50 per kg of sundried cherries from private traders, the same for certified farmers is US$ 0.43.

The local value chains of certified and non-certified coffee farmers in India vary in their structure and post-harvest management. While the cooperative buys coffee from its members in the form of red cherries, the private traders buy dry parchment coffee from both the certified and non-certified farmers. The cooperative gathers red cherries from its members and wet-process them to coffee beans before selling to the exporters. Although, certified farmers sell about 80% of their red coffee cherries to the cooperative, they still transact with

[1]Using the exchange rate US$ 1 = 12.63 birr from 2010.

private traders for immediate cash as the cooperative pays in installments. The average farm gate price for red cherries is US$ 0.40[2] per kg of red cherries. Considering that 6 kg of red cherries are needed to produce 1 kg of dry parchment coffee, the equivalent price of 1 kg of dry parchment coffee can be calculated as US$ 2.4 using the back of the envelop method. The price of the dry parched coffee that the certified cooperative members obtain by selling to the private traders is US$ 2.1 per kg. So, the certified farmers choose a combined strategy by selling parts of their coffee to private traders for prices lower than those paid by their own cooperative as they are in need of immediate post-harvest cash. This is a common practice observed across all three countries. The cooperatives delay the payments to the member farmers and pay in installments because they wait to receive the returns from the exporters. A comparison of net revenue earned from coffee per ha of land shows that certified farmers earn 66% more than the non-certified farmers. While the revenue per ha for certified farmers is US$ 243, the same for non-certified farmers is US$ 160. This significant revenue difference between the certified and non-certified groups can be attributed to the strong price advantage in the certified value chain.

Selling to both the cooperative and the private merchants on the local markets is prevalent in Nicaragua too. However, Organic and Organic-Fairtrade cooperative members predominantly sell coffee to their cooperatives. The reason for higher reliance on the cooperative channel for the coffee sale is that cooperative prices are significantly higher than the open market prices for Organic coffee (See **Table 3**). Organic certified cooperatives are more specialized in that way. The farmers would rather sell their coffee to the cooperatives and wait for the returns than selling it on open markets at a lower price. It must be noted that the cooperative price varies from year to year depending on supply side constraints. For example, in a bad monsoon year, both the quality and quantity of coffee beans supplied by the cooperative to the exporters may be worse than in the previous year. That may lead to a reduction in prices as the quality of the beans is the key indicator in the international market. However, if the cooperative has a profitable season, it pays a bonus (premia) to its members at the end of the season. Data also shows that Organic and Organic-Fairtrade farmers obtain significantly higher prices than the only Fairtrade and non-certified groups of farmers. All the three certified cooperative farmer groups have earned higher net revenues from coffee per ha relative to the non-certified farmer group. The net revenues for Fairtrade, Organic and Organic-Fairtrade groups are US$ 1,290 [3], US$ 1,294 and US$ 1,522 per year respectively. The conventional farmers earn US$ 849.

THE IMPACT OF CERTIFICATION ON YIELD, NET REVENUE AND INCOME

This section provides the average treatment effect on the treated (ATT) for the case studies in Ethiopia, India and Nicaragua as well as on the three country combined data based on the PSM method. The outcome variables used are net revenue from coffee (2010 PPP$), total household income (2010 PPP$), and yield from coffee (kg per ha). The ATT results are provided in **Tables 4** and **5**. The first stage logit regression results for the pooled data and all three country case studies are presented in the Appendix A1. The first-stage logit regression results are an important intermediary step in PSM, as it creates the basis for matching. However, we have not discussed the findings in detail because the main focus of this study is to show the certification outcome in a comparative framework. The balancing test results are furnished in A2, A3, A4, and A5 in Appendix. These test results show that there is no statistically significant mean difference between certified and non-certified groups across the covariates used in the PSM which is a desired property for a good matching. The overlapping of propensity scores between treated and control observations are plotted both before and after the matching for the pooled data and the three case studies. These plots are shown in Appendix as **Figures S1** through **S12**. The plots show that the overlapping of propensity scores after the matching has improved significantly compared to the plots before the matching for all the outcome indicators in all four cases. This is a desired property of good matching.

TABLE 4 | Average Treatment Effect for yield, net revenue and household income for Pooled data and Nicaragua.

Outcome Variables	Matching Methods	Pooled		Nicaragua	
		ATT	*S. E*	ATT	*S. E*
Coffee yield per ha	Radius	134.09	*72.46*	172.56	*150.08*
	Kernel	99.67	*77.73*	95.03	*160.64*
	5-Nearest neighbor	120.69	*89.83*	208.79	*186.83*
Net revenue from coffee per ha	Radius	593.80***	*190.67*	1,482.92***	*437.51*
	Kernel	445.70**	*202.91*	1,288.01**	*461.35*
	5-Nearest neighbor	482.89	*265.15*	1,334.67**	*495.54*
Total household income	Radius	341.40	*369.69*	−86.96	*1,022.10*
	Kernel	42.75	*399.51*	−207.20	*1,110.96*
	5-Nearest neighbor	409.29	*598.41*	975.73	*1,471.00*

***Significant at 5% level; ***Significant at 1% level.*

Table 4 contains the ATT for the pooled data and Nicaragua and **Table 5** contains the results for India and Ethiopia. The results in these two tables pertain to Fairtrade certification. Since a part of the sample in Nicaraguan case study is either double certified i.e., both Fairtrade and Organic, or only Organic; we have not used that part for the pooled and Nicaragua specifications in **Table 4**. However, a separate estimation for this sample is undertaken and the results are presented in **Table 6**.

The ATTs for the pooled model show that Fairtrade certification has no yield effect as none of the three matching methods have any statistically significant ATT for yield. The

[2] Using the exchange rate US$ 1 = Rs 45 from 2010.
[3] Using the exchange rate $1 = 22.5 C$ from 2010.

TABLE 5 | Average Treatment Effect for yield, net revenue and household income for India and Ethiopia.

Outcome Variables	Matching Methods	India		Ethiopia	
		ATT	S. E	ATT	S. E
Coffee yield per ha	Radius	215.45***	50.79	−164.87	127.37
	Kernel	217.54***	56.00	−127.01	140.47
	5-Nearest neighbor	281.14***	65.37	−21.28	177.89
Net revenue from coffee per ha	Radius	19.66**	6.67	−237.52	194.66
	Kernel	24.30***	7.57	−242.46	212.99
	5-Nearest neighbor	20.12**	9.06	−171.27	281.39
Total household income	Radius	273.72	209.31	1.42	3.49
	Kernel	486.32**	242.87	3.80	3.66
	5-Nearest neighbor	381.51	314.41	5.86	3.56

**Significant at 10% level; **Significant at 5% level; ***Significant at 1% level.*

TABLE 6 | Treatment effects of PSM model for Fairtrade, Organic and Fairtrade-Organic certified farmers in Nicaragua.

Outcome Variables	Matching Methods	Organic		Fairtrade Organic	
		ATT	S. E	ATT	S. E
Coffee yield per ha	Radius	−194.30	231.14	117.78	325.06
	Kernel	−919.63**	340.35	154.22	529.73
	5-Nearest neighbor	−961.88**	474.03	−39.40	522.74
Net revenue from coffee per ha	Radius	6,219.15	5,676.26	27,457.41*	16,461.73
	Kernel	−7,360.03	7,015.52	29,428.46	22,944.45
	5-Nearest neighbor	−7,627.46	10,471.54	31,884.44**	17,933.02
Total household income	Radius	12.09	18.18	−5.37	12.06
	Kernel	8.16	20.66	−15.70	19.38
	5-Nearest neighbor	4.63	23.58	−16.35	34.65

**Significant at10% level; **Significant at 5% level; ***Significant at 1% level.*

same result was observed for the Nicaraguan case where there is no yield difference between Fairtrade certified and non-certified households. On the other hand, there is positive net revenue effect from Fairtrade networks for both pooled and Nicaragua models. The ATT for net revenue per ha of coffee cultivated land in the pooled model is in the range of 445–593 PPP$ and 1,288–1,482 PPP$ in the Nicaraguan model across the three matching methods. For the third outcome variable which is total household income, no statistically significant ATT was observed in pooled and Nicaraguan models. Although, Fairtrade certified farmers earned higher net revenue per ha relative to the non-certified farmers, this difference is not enough for the former to have a distinct advantage in total income. The reasons could be firstly, that the margin of net revenue advantage is narrow and insufficient to make any difference in the total income and secondly, the non-certified farmers may have other sources of income that compensate for their lower coffee income.

For India, the ATT results from **Table 5** show that the Fairtrade certified group has higher yield levels. The ATT is in the range of 215–284 kg of red cherry per ha for the certified group across the three matching methods. There is also statistically significant ATT for net revenues from coffee relative to the non-certified group in Indian case study. The difference in mean net revenues per ha is 19.66 PPP$ from Radius matching, 20 PPP$ from 5-nearest neighbor matching and 24 PPP$ from the Kernel matching methods. The higher net revenues can be attributed to both the higher yield and prices obtained by the certified members of the cooperative. The results for total household income show that only the Kernel matching method finds statistically significant ATT in the Indian case. The other two matching methods fail to produce any statistically significant ATT for household income. So, we cautiously infer that though there is a positive impact of Fairtrade certification on net revenue in the Indian case study, the same is not certain for the total household income for the certified farmers. As household income includes other sources, most notably the non-farm income, the non-certified farmers have been observed to have participated in daily wage non-farm activities. The Ethiopian case study shows that Fairtrade certification has not made any difference in terms of yield, net revenues, and household income in the favor of certified cooperatives on average (**Table 5**). None of the outcome variables show up with statistically significant ATT.

Table 6 presents the ATT for the Organic and Fairtrade-Organic certification standards for Nicaragua. The ATT for yield is negative and statistically significant for Organic certification, which is understandable as organic yield is reported to be lower than non-organic coffee from different studies. However, what is striking is there is no positive net revenue effect from Organic certification. Generally, the Organic price is higher than the conventional market price and Fairtrade price. Despite the yield effect being so strong, the difference in net revenues between the Organic certified price and conventional market price turns out to be negative though not statistically significant. As expected, there is no statistically significant ATT for total household income in the Organic certified network. The double certified farmers may have an edge over the non-certified farmers in terms of the net revenue per ha. Though, there is no positive yield gains in doubled certified cooperatives as it was evident from the nonsignificant ATTs for yield across all three matching methods, the 5-nearest neighbor and Radius matching methods have reported positive net revenues. But again, that was not translated into total household income gains as the ATT for household income is not statistically significant in Fairtrade-Organic certification cooperatives.

The Rosenbaum bound sensitivity analysis in **Table 1** shows that the findings remain insensitive to hidden bias at different levels of Γ for different outcome indicators in pooled and country case studies. In the pooled data, the ATT for yield per ha is sensitive to hidden bias only after $\Gamma = 2.5$ as till this level of Γ, both the upper and lower bounds are statistically significant (lower bound significance values are not shown in **Table 1** because the lower bound is significant even beyond the upper bound starts becoming insignificant, in most cases). Similarly, for net revenue per ha and total household income in pooled data, the findings remain insensitive to hidden bias till Γ is 3.25 and 3 respectively. Similar Γ values were found for the country case studies. The sensitivity analysis therefore, establishes that the PSM findings can be relied upon as the qualitative findings remain unchanged even if the hidden bias is at a level of 2.5–3 times the random assignment.

DISCUSSION

The quantitative analysis shows that overall, there is a positive impact of Fairtrade certification on net revenues from coffee. When we analyze it across the three case studies, it is observed that Fairtrade certification has a positive net revenue impact in Nicaragua and India whereas no such impact was found for Ethiopia. To have a deeper understanding of this issue, we have undertaken a comparison of the FLO mandated price for Fairtrade green beans and the weight-equivalent average price obtained by the Fairtrade certified cooperative members in all three countries. The comparative prices are shown in **Table 7**. It shows that the average price obtained by Fairtrade and Fairtrade-Organic certified cooperative members are much higher than the minimum price set by FLO. The minimum FLO price was 1.4$ per pound of washed Arabica Fairtrade coffee and 1.7$ per pound of washed Arabica Fairtrade-Organic coffee in 2011. Whereas, the weight-equivalent price for Fairtrade coffee in Nicaragua was 2.22$ per pound and for Fairtrade-Organic, it was 3$ per pound of Arabica coffee during the same period. This finding is consistent with our earlier findings that Fairtrade and Fairtrade-Organic certification has a positive net revenue impact in Nicaragua. For the Indian case study, the average Fairtrade cooperative price was 1.27$ per pound of green beans which is lower than the FLO price. However, considering the fact that the cooperative uses a part of the revenue to cover the administrative cost which includes the certification fees, salaries of cooperative staff, and the overhead charges, the difference between FLO minimum price and the cooperative price is not significant. So, it can be inferred that Indian Fairtrade certified coffee farmers obtained at least a price as good as the FLO price.

However, in the Ethiopian case study, the certified average cooperative price was significantly lower than the FLO price. The weight-equivalent cooperative price was 0.83$ per pound of green beans compared to the FLO price of 1.40$ per pound of green beans. This finding is consistent with the PSM results that the net revenue impact is statistically insignificant only in Ethiopia. Further, **Table 3** also shows that the non-certified farmers in Ethiopia have obtained higher prices than the certified members although the difference is not statistically significant. These observations highlight the "cooperative effect" which can undermine the certification effect. The certified cooperatives in Ethiopia suffer from several limitations such as low technical skills of the cooperative staff and trainers, inadequate linkage with the coffee exporters and overseas importing companies, lack of a bottom-up approach and inclusivity, and low level of base finance.

TABLE 7 | Comparison of FLO price and Fairtrade certified cooperative price.

Country	Marketing channel	FLO minimum price per pound of green bean	Cooperative price per pound of green bean equivalent
Ethiopia	Fairtrade certified	1.40$ -Washed Arabica	0.83$
India	Fairtrade certified	1.40$ -Washed Arabica	1.27$
Nicaragua	Fairtrade certified	1.40$ -Washed Arabica	2.22$
	Fairtrade-organic certified	1.70$	3$

Authors' own calculation.

Although, there is a positive net revenue impact from certification schemes in the overall sample and in the Nicaragua and India case studies, no positive impact was observed on household income. This overall finding was also observed by other authors (i.e., Blackman and Rivera, 2011; DeFries et al., 2017; Oya et al., 2018). The impact of certification on net revenue, household income, and coffee yields is thus heterogenous across the three countries. A deeper understanding of the implementation of certification by the farmers' cooperatives sheds more light on the reasons of the differential impacts.

In all three country case studies, the selected primary cooperatives tend to follow a top-down administrative approach. In the absence of strong collective action among the certified members of the farmers' organization, the bargaining power still remains with the traders and exporters of the coffee. Despite this top-down approach in the Fairtrade certified cooperative, member farmers in the Indian case have been able to obtain relatively higher income. This was mainly due to the fact that the case study region was historically an economically backward and tribal region where coffee was introduced as the only source of stable income. Results from the follow-up surveys also support these findings (Karki et al., 2016). Hence, Fairtrade certification does provide a steady source of coffee income which was non-existent earlier. Poor infrastructure and difficult geographical terrains in the Araku valley have made it difficult for the tribal coffee farmers to transport their own produce to distant markets. The Fairtrade certified cooperative has spared its members from carrying their sacks of coffee to the market; instead, the cooperative buys coffee from the village centers. There are also some other benefits provided to the members such as advance credit at the beginning of the planting season and subsidized harvest equipment. Around 30% of the certified respondents report to have obtained credit from their cooperative.

The role of coffee growing is different in Nicaragua and Ethiopia. Coffee is traditionally grown in both countries and it is an integrated part of the culture. Accordingly, farmers allocate a major share of their cultivable land to coffee cultivation (**Table 3**). Cooperatives in the coffee sector exist for the last four decades in both countries. However, the cooperatives differ in terms of capacity building as well as services and training provided to their farmer members. For example, access to credit is an important factor since many coffee smallholders are in need to invest in various forms of upgrading in the production node such as improving product quality, increasing volume, and complying with certification standards (Dunn et al., 2006). Our data shows that only 23% of the respondents in Ethiopia obtain credit from their respective cooperatives. The figures are much higher in certified cooperatives (32%) compared to non-certified cooperatives (5%). In the Nicaraguan case, however, credit provision by the cooperative is far more frequent with 87% of the interviewed respondents stating that they have received credit by their cooperative at least once. That Nicaragua is relatively more successful in terms of capacity building and training can be also derived from the relatively higher coffee yields of Fairtrade coffee producers in Nicaragua compared to Ethiopia.

We conclude that the outcome of certification is very context-specific and depends largely on the organization of supply chains. Similar views are echoed by Oya et al. (2018) in their review paper covering a large number of studies conducted during 1990 and 2016. They observe that context matters substantially in all causal chains and multiple factors shape the effectiveness and causal mechanisms that link interventions associated with certification and the wellbeing of producers, workers and their families.

SUMMARY AND CONCLUSION

The popular notion is that certification of cash crops is a viable strategy as it helps providing access to international markets and also helps in generating sustainable incomes. We ask the question whether coffee certification significantly enhances the yield and household income for smallholder coffee farmers. Based on our empirical case studies in Ethiopia, India and Nicaragua, the quantitative findings of this paper show that certification on average has a differential impact in the three countries and this impact is highly case- and context-specific.

Our findings in Ethiopia show that Fairtrade certified cooperatives have done far less to ameliorate farmers' incomes and livelihoods. The major reasons for this failure to increase incomes by Fairtrade certification is related to the lack of efforts by the cooperatives for capacity building. In the Indian case study, however, Fairtrade certification has positively affected smallholder farmers' income. Farmers who are members of Fairtrade certified cooperatives in India have received community level benefits such as new drinking water installations, school uniforms for girl children and some sports facility. Since the level of the socio-economic parameters (i.e., physical infrastructure, assets of the households and education level) in the case study region had been quite low, the newly established Fairtrade certified cooperative could bring some of the early benefits through its Fairtrade marketing channels. More research needs to be done to understand how some of these new cooperatives have been impacting farmers' livelihoods over the years in India. In Nicaragua, our findings show that farmers in Organic certified cooperatives received comparatively higher farmgate prices but these price advantages are mostly nullified by lower yields resulting in insignificant net revenue gains. Lower yields for Organic farmers are a result of inadequate availability of organic production materials. Fairtrade and double certified farmers earned higher net revenues from coffee relative to their non-certified counterparts. Compared to Ethiopia, a significantly higher proportion of cooperative members in Nicaragua have received credits from their cooperative.

It is worthwhile to note that the "cooperative effect" needs to be considered while evaluating the impact of coffee certification on smallholder's livelihood. Coffee cooperatives in these countries are challenged by a multitude of internal and external obstacles making many of them weak actors (Jena et al., 2012). This finding is supported by Sellare et al. (2020). In their recent work, they have explicitly considered the heterogeneity which exists among the sampled cooperatives in their impact regression. In order to implement certification programs more effectively, cooperatives as key local partners need to be substantially strengthened. The success of certification is hence often interlinked with capacities of the general agricultural sector in the respective country. Second, certification needs proper monitoring. The effective and regular verification of certification requirements by accredited inspectors is still challenging, not only in remote rural areas of developing countries.

Further research is needed in this field. So far, there are only a few studies looking into Fairtrade and gender relations and their results are ambiguous. While Lyon (2008) finds that women in Guatemala do not actively participate in the Fairtrade coffee cooperatives, Chiputwa and Qaim (2016) show that Fairtrade certification in Uganda results in higher gender equity mainly due to increasing income. There is some evidence suggesting that Fairtrade tends to benefit women through the Fairtrade social premium being used for funding projects such as healthcare, childcare, or education and training (McArdle and Thomas, 2012). Low participation of female-headed households in Fairtrade certification raises questions toward Fairtrade's claims of being gender inclusive (Fairtrade Foundation, n.d.). This also calls for the promotion of gender equity via a more participatory certification process in the Fairtrade certified coffee sector.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The current study collects primary data from households involving human participants. The protocols were reviewed and approved by the Scientific Advisory Board of the National Institute of Technology Karnataka, India. The participants provided written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

PJ and UG designed the study, analyzed the data, and wrote the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2021.716904/full#supplementary-material

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