AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Division of Bioeconomics

DEPARTMENT OF EARTH AND ENVIRONMENTAL SCIENCES
KU Leuven - BELGIUM

Do Private Sustainability Standards Contribute to Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia

Fikadu MITIKU, Yann de MEY, Jan NYSSEN and Miet MAERTENS

Bioeconomics Working Paper Series

Working Paper 2015/03

An updated version of this working paper has been published at:
Mitiku, F., de Mey, Y., Nyssen, J. & Maertens, M. (2017). Do Private Sustainability Standards Contribute to Income Growth and Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia. *Sustainability*, 9, 246.

Division of Bioeconomics
Department of Earth and Environmental Sciences
University of Leuven
Geo-Institute
Celestijnenlaan 200 E – box 2411
3001 Leuven (Heverlee)
Belgium
http://ees.kuleuven.be/bioecon/

Do Private Sustainability Standards Contribute to Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia

Fikadu MITIKU [1,2], Yann de MEY[2], Jan NYSSEN[3] and Miet MAERTENS [2]

Abstract

Private sustainability standards are spreading rapidly in the agri-food sector and are especially important in trade with developing countries. In this paper we analyze the impact of sustainability standards in the smallholder coffee sector in Ethiopia. We look at Fairtrade, Organic and Rainforest Alliance certification in a comparative way. We use cross-sectional survey data from a sample of 427 coffee farmers in the Jimma and Kaffa zones of Ethiopia, with all sampled farmers being member of a coffee cooperative. We analyze the impact of certification to different standards on poverty, income, yield and farm-gate prices in order to unravel the channels of possible poverty-reducing effects. We use logit, tobit and OLS regression models and attempt to control for cooperative-level heterogeneity. We find that Rainforest Alliance certification improves rural income by 72% and reduces the incidence and depth of poverty by 25% and 31% respectively while Fairtrade and Organic certification have no effect. We find that the positive effect of Rainforest Alliance mainly comes from a large impact on producer prices that offsets a negative impact on yields. Also, Fairtrade certification is found to lead to higher producer prices, but to a much smaller extent than Rainforest Alliance, and the price effect does not lead to an overall effect on farmers' income and poverty reduction.

Key Words: Private standards, Sustainability standards, Global value chains, Coffee certification, Poverty Impact, Ethiopia

JEL classification: F 14, I32, L15, O13, Q12, Q13, Q17, Q18

Corresponding author: Miet.Maertens@ees.kuleuven.be

Acknowledgements

We acknowledge funding from the NUFFIC Niche program, Strongbow Project. We thank seminar and conference participants in Leuven, Brussels and Rome for critical and useful comments on an earlier versions of the paper. We also thank enumerators for conducting the survey, farmers for their cooperation to respond to the questionnaires, and cooperative committee, district level experts and union heads for their cooperation in responding to key informant interviews. Without their cooperation this study would have been impossible.

[1] **Department of Agricultural Economics and Extension, Jimma University**
[2] Division of Bioeconomics, Department of Earth and Environmental Sciences, KU Leuven
[3]Department of Geography, Ghent University

Do Private Sustainability Standards Contribute to Poverty Alleviation? A Comparison of Different Coffee Certification Schemes in Ethiopia

1. Introduction

The emergence and proliferation of sustainability standards in the agri-food sector since the late 1990s, is profoundly changing the way food is produced and traded (Beghin et al., 2015). Sustainability standards are private food standards related to food quality and safety issues, social and ethical aspects, and environmental concerns of food production and trade (Henson and Humphrey, 2010). Examples include GlobalGAP, Fairtrade, and Rainforest Alliance, to name a few. These standards are usually set by private companies or civil society actors and enforced through third-party certification. Sustainability standards are mainly stipulated in high-income countries, as a response to changing consumer preferences and growing concerns about the quality, safety, ethical and environmental aspects of food production and trade. Yet, they are most important in the trade relations with developing countries because of information asymmetries (Schuster and Maertens, 2015). Some sustainability standards even specifically focus on produce from developing countries and tropical luxury commodities: for example Utz on coffee, cocoa and tea; 4C on coffee; and Fairtrade on produce from developing countries in general.

There is a growing body of literature describing the trade and welfare effects of sustainability standards, part of which specifically focuses on the welfare effects for producers in developing countries (see Beghin et al., 2015 for a recent review of this literature). There are, however, no general conclusions on whether and how private sustainability standards improve farmers' wellbeing and contribute to poverty reduction in developing countries. Some studies find that private food standards are productivity-, income- and welfare-enhancing (e.g. Asfaw et al., 2010; Handschuch et al., 2013) while others conclude they have no substantial impact on the income of smallholder producers and do not contribute to poverty reduction (e.g. Beuchelt and Zeller, 2011; Jena et al., 2012; Hansen and Trifkovic, 2014; Holzapfel and Wollni, 2014).

Understanding how sustainability standards affect smallholder producers in developing countries remains important. First, it is important from the perspective of smallholder producers themselves who face additional costs to fulfill stringent requirements and get certified, that standards contribute to improving their production systems, incomes and livelihoods. Second, it is important from the perspective of consumers in high-income countries who pay premium

prices for specific attributes of the products or production process of the food they consume. Standards are only genuine and premium prices only justified if standards deliver what they promise to the consumers. Third, it is important for standard-setting and certification bodies to know if their practices are effective. The mere existence of standards with a main focus on ethical aspects is only legitimate if they effectively contribute to improving farmers' wellbeing – if not, they only extract rents from global food chains. Fourth, it is important for the ongoing policy debate on the regulation and harmonization of private food standards to understand the impact of private standards on smallholder producers in developing countries (Marx et al., 2012).

There are two specific limitations in existing studies on the welfare effects of sustainability standards. The first limitation relates to the fact that mostly the impact of a single standard is investigated. There are for example a number of studies investigating the income effect of GlobalGAP certification (Handschuch et al., 2013; Hansen and Trifkovic, 2014; Holzapfel and Wollni, 2014) or Fairtrade certification (Jena et al., 2012; Ruben and Fort, 2012) but very few studies comparing the impact of various standards in the same institutional and agro-ecological setting. Sustainability standards focus on socio-economic and environmental aspects of sustainability to a varying extent – e.g. Rainforest Alliance focuses on biodiversity conservation and also somewhat on producers' welfare, while Fairtrade is mainly concerned with poverty reduction and empowerment of farmers, paying also some attention to sound agricultural practices. The requirements that farmers have to comply with, vary largely across different types of sustainability standards. Some standards may be more or less effective in improving farmers' welfare and reducing poverty than others. There a number of recent studies in which the impact of different types of sustainability standards are compared in a quantitative way. Beuchelt and Zeller (2011) and Ruben and Zuniga (2011) compare different coffee certification schemes in Nicaragua and find that Rainforest Alliance has the largest income-enhancing effect while Fairtrade and Organic certification have no, or a very small, impact on income and poverty. Chiputwa and co-authors (2015) analyze the impact of Fairtrade, Organic and Utz certification on poverty among smallholder coffee farmers in Uganda and find that only Fairtrade has a poverty-reducing effect. Such studies bring important insights in the debate on the effectiveness of sustainability standards to improve farmers' welfare.

A second specific limitation in existing studies relates to difficulties in identifying the pure effect of standards. An important issue in this respect is that standards are usually adopted by farmers in an export or supermarket-driven supply chain and either in contract-farming schemes or through cooperatives. This makes it difficult to partial out the impact of standards

from other confounding factors such as export market access, participation in contract-farming or cooperative membership. Many studies on the impact of standards are based on samples including a mixture of farmers in export and domestic supply chains, a mixture of contract and non-contract farmers, or a mixture of cooperative and non-cooperative members (e.g Maertens and Swinnen, 2009; Jena et al., 2012; Rao and Qaim, 2011; and Minten et al., 2009). With such samples it is difficult to single out the effect of standards. Estimated effects are confounded effects assessing the joint impact of inclusion in export chains, contract-farming schemes or cooperatives, and the adoption of standards. Some studies have looked at the impact of standards on the welfare of smallholders in a more direct and unconfounded way. These studies use various econometric methods to compare adopters and non-adopters of standards within a sample of smallholders that are included in export chains, contract-farming schemes or cooperatives (e.g. Asfaw et al., 2009; Chiputwa et al., 2015; Handschuch et al., 2003; Hansen and Trifkovic, 2014; and Holzapfel and Wollni, 2014). These studies mostly focus on one single standard – with the exception of the study by Beuchelt and Zeller (2011) – but are able to better disentangle the effect of standard adoption from other confounding effects.

In this paper, we analyze the impact of smallholder coffee certification in Ethiopia. We specifically look at three different certification schemes, including Fair Trade, Organic and Rainforest Alliance, in a comparative way – thereby addressing the first limitation discussed above. We use a sample of 427 coffee farmers in the Jimma and Kaffa zones of Ethiopia, with all sampled farmers being member of a coffee cooperative – thereby focusing on direct effects and addressing the second limitation. We analyze the impact of certification to different standards on poverty, income, yield and farm-gate prices in order to unravel the channels of possible poverty-reducing effects. We use Logit, Tobit and OLS regression models and attempt to control for cooperative-level heterogeneity.

2. The coffee sector in Ethiopia

2.1. Coffee production and export

Ethiopia is an important coffee producing and exporting country, ranking first in coffee production and export in Africa, and respectively fifth and tenth in production and export in the world (ICO, 2013). The sector accounts for 24% of total foreign exchange earnings (Minten et al., 2014) and provides a livelihood for more than a quarter of the country's population (Tefera and Tefera, 2014). Coffee production and export grew steadily in the past two decades (figure 1). Coffee production increased from 2.9 million bags (with one bag equivalent to 60kg) in 1990 to 8.1 million bags in 2013 and exports increased from 0.85 to 3.2 million bags over the same period.

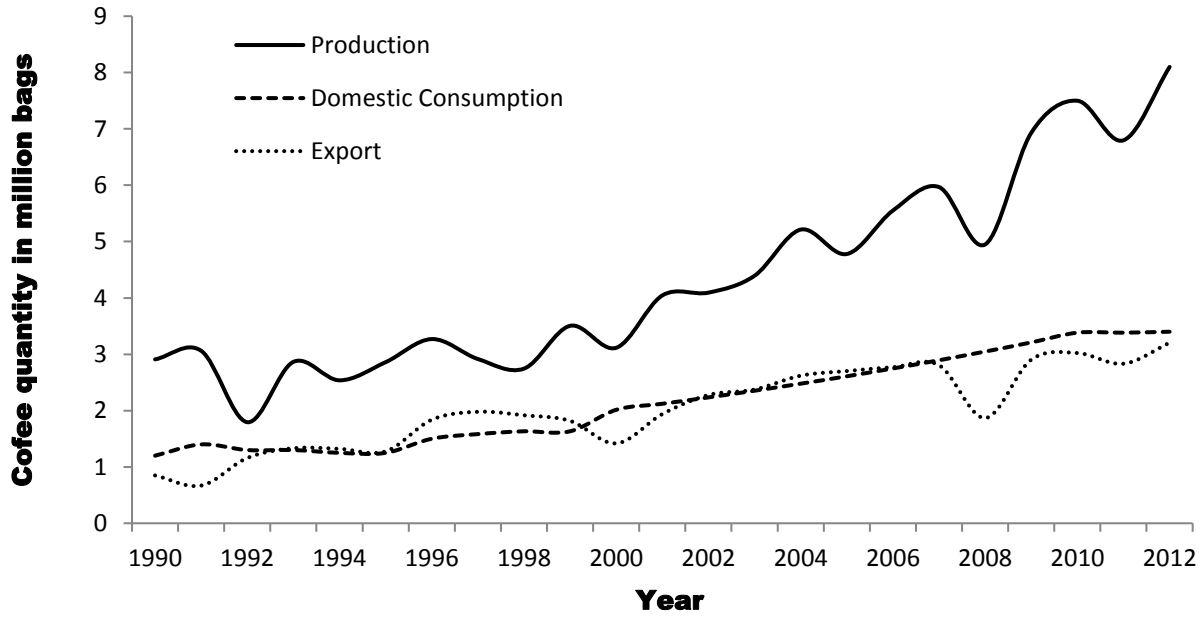

Figure 1: Coffee production, domestic consumption and export million bags (with 1 bag equivalent to 60 kg) in Ethiopia, 1990-2012

Source: Author's calculation based on data from the International Coffee Organization (ICO) (http://www.ico.org/new_historical.asp)

Ethiopia has a specific coffee culture and tradition, and domestic coffee consumption is important. Domestic coffee consumption has increased steadily from 1.2 million bags in 1990 to 3.4 million bags in 2013 (figure 1). About 40% of the coffee produced in Ethiopia is consumed domestically. There is a difference in quality between coffee for the local market and export coffee. In an attempt to increase the country's coffee export performance, the government

prohibits the sale of export quality coffee on the local market. Given volatility in international market prices, the domestic coffee price sometimes the exceed export price (Tefera and Tefera, 2014).

The coffee sector in Ethiopia is largely a smallholder sector with 95% of production realized on small farms (Tefera and Tefera, 2013). There are more than 4 million coffee-producing farm-households in the country and coffee contributes to up to 50% of total income for these households (Wiersum et al., 2008). A substantial share of smallholder coffee farmers is organized in cooperatives – there are 465 primary coffee cooperatives in the country – but independent smallholder coffee production is also common.

2.2. Export channels and certification

Ethiopian coffee is exported through three main channels: a private sector supply chain, a supply chain evolved around parastatal firms; and a supply chain evolved around cooperatives and cooperative unions. During the last decade, the share of coffee exported by cooperative unions and by the private sector increased while that of parastatal firms decreased (Minten et al., 2014). The latter decline is related to the gradual privatization of state farms since 1991 and structural reforms in the coffee sector. The Ethiopian Commodity Exchange (ECX) was established in 2008 as a public institution to facilitate marketing of coffee and control coffee quality. ECX sets requirements for a coffee quality and grading systems, transaction size, payment and delivery modalities. Almost all coffee destined for export is sold on the ECX floor either directly through producer cooperative unions or private exporters (Tefera and Tefera, 2014). Export taxes were removed after the 2002 coffee crisis (Minten et al., 2014), but the Ethiopian government still intervenes in the sector through export bans. The government bans exports by large private traders when they excessively hoard coffee and store more than 500 metric ton without having any shipment contract from importers.

There is low value addition in the coffee sector in Ethiopia and this did not improve substantially over the past decade. Only 30% of coffee exported over the decade was washed and the rest is only sundried and not processed (Minten et al., 2014). Different certification schemes started to emerge in the Ethiopian coffee sector since the early 2000's. Certification is mainly cooperative-based and started in southwestern Ethiopia in 2002 (Stillmacher and Grote, 2011). The main standards are Organic, Fairtrade, Rainforest Alliance and Utz; which all focus to some extent on farmer welfare and poverty. Currently 29% (Organic), 27% (Fairtrade) and 2%

(Rainforest Alliance or Utz) of the primary coffee cooperatives in the country are certified to these standards (Minten et al., 2015). Minten et al. (2014) estimates the average price premium for Fairtrade and Organic certified Ethiopian coffee to be 9% of conventional prices. However, only 5% of the coffee exported in the beginning of 2015 is certified to one of the schemes (Minten et al., 2015).

3. Data and methods

3.1. Data collection

We collected original data from Southwestern Ethiopia through a farm-household survey and through semi-structured interviews with coffee cooperatives and key informants. Data were collected in 2014. A multi-stage stratified random sampling strategy was used to sample smallholder coffee farmers for the survey. In the first stage, we purposively selected the adjacent Kaffa and Jimma zones, where arabica coffee (*Coffea Arabica*) originates from. The two zones are very similar in biophysical and socioeconomic characteristics. In these zones Fairtrade (FT), Organic (Org) and Rainforest Alliance (RA) certification schemes are present for 6 to 8 years. In the second and third stage, three districts (*woredas*) were selected from the Kaffa zone and one district was selected from the Jimma zone and seven cooperatives were selected within these districts (table 1). Districts were purposively selected based on the presence of coffee cooperatives and coffee certification schemes. All coffee certification schemes work with coffee cooperatives and farmers within a certain cooperative are usually either all certified to a specific scheme or all not certified. For each selected district, we aimed at selecting a certified and a non-certified cooperative. This was not possible for one district as no non-certified cooperative could be identified. The sample includes three non-certified cooperatives and four certified cooperatives. In the final stage, we randomly selected farm-households from the cooperative's member lists. The final sample size includes 427 households, including 273 certified coffee farmers and 154 non-certified coffee farmers. Certified farmers are FT, Org, FT+Org or RA certified.

The survey was implemented using a structured questionnaire, consisting of detailed modules on: (i) demographic characteristics of the household; (ii) child labor and child schooling; (iii) land ownership and land use (iv) crop production and marketing; (v) farmers and forest interaction; (vi) off-farm income; (vii) asset ownership and living conditions; (viii) social capital and credit; and (xi) decision making processes in the households. The survey was

implemented by well-trained enumerators. Semi-structured interviews were carried out with cooperative committees, district officials, officials from the coffee unions and some coffee experts.

Table 1: Sample design

Zone	District	Cooperative	Certification status	Members	Sample
Jimma	Shebe Sombo	A	Rainforest Alliance (RA)	550	82
	Decha	B	Organic (Org)	508	64
		C	Non-certified	105	49
Kaffa	Gimbo	D	Organic and Fairtrade (FT+Org)	446	65
		E	Non-certified	44	41
	Gowata	F	Fairtrade (FT)	188	63
		G	Non-certified	124	65
Total		7		1,974	427

3.2. Econometric approach

To assess the impact of certification to different standards on the welfare of farm-households, we estimate regression models of the following type:

$$Y_i = \alpha_0 + \beta X_i + \gamma T_i + \delta C_j + \varepsilon_i \quad (1)$$

The dependent variable in the model, $\boldsymbol{Y_i}$, measures the welfare outcome of household *i*. We are primarily interested in poverty, but to understand the channels through which poverty effects possibly occur, we include additional outcome indicators. We use the following outcome indicators and estimate the model separately for each indicator: (1) poverty, measured as having a per capita income that falls below the national poverty line[4]; (2) poverty gap, measured as the relative income distance from the poverty line[5]; (3) income, measured as the log of total household income; (4) coffee income, measured as the log of net income from coffee production; (5) coffee price, measured as the weighted average price in ETB[6] per kg of dry coffee cherry, weighted by the volume of coffee sold; and (6) coffee yield, measured as the dry cherry equivalent in kg per ha. The first variable is a binary variable and we use a logit model for estimation. The second variable is a left-censored variable because the poverty gap is a positive value for poor households and zero for non-poor households; accordingly we use a tobit model.

[4] We use the national poverty line of Ethiopia, equaling 3,781 ETB per adult equivalent per year (MoFED, 2012).
[5] Based on the Foster–Greer–Thorbecke poverty measure (Foster et al., 1984), we calculate the household poverty gap as $\frac{z-yi}{z}$ with *z* being the national poverty line and y_i household income per adult equivalent.
[6] ETB: Ethiopian Birr – 1 USD is equivalent to 20.2 ETB at the end of December 2014.

The four remaining variables are continuous variables, for which linear regression models are used. The income variables are log-specified in order to reduce the impact of potential influential observations and to be able to interpret results directly in percentage terms.

Our main variable of interest is T_i, a vector of binary variables for certification to FT, Org and RA standards. These binary variables are not mutually exclusive as some farmers are double FT and Org certified. We estimate the model using non-certified farmers as control group (model 2 and 3). In addition, we mutually compare the different standards by estimating the model on a sub-sample of certified households, and using Org as control group in comparison with FT and RA (model 4), and using FT as control group in comparison with RA (model 5).

As certification or membership in a certified cooperative is likely not randomly distributed among coffee farmers, we need to be aware of selection bias. To control for selection on observables, we include a large vector of household-level control variables X_i. This vector includes: the gender, age and education of the household head; household size; dependency ratio; area in ha and its square (total land area owned by the household is used in the regressions on poverty, poverty gap and income while coffee area is used in the regressions on coffee income, yield and coffee price); livestock ownership in tropical livestock units; the number of relatives in the region (as a measure of social capital); years since cooperative membership; a dummy for whether parents were coffee farmers (as a proxy for experience in coffee production); and distance to the district town. In addition, we control for cooperative-level heterogeneity by including a vector of cooperative-level control variables C_j. We use two approaches here. First, we include cooperative fixed effects in the model (model 1). Because cooperative dummies are perfectly collinear with the certification variables, we cannot include both. This models serves as a baseline model to test the influence of cooperative heterogeneity on the outcome indicators. Second, we include the following cooperative-level variables (model 3): cooperative entry fee in ETB before certification; cooperative capital in ETB before certification; cooperative size or total number of members before certification; and cooperative age in years. For non-certified cooperatives, before pre-certification refers to the year certification was introduced in the woreda, except the youngest cooperative for which the year of foundation is considered as it was not founded yet when certification was introduced.

In summary, we estimate equation (1) on six different outcome indicators: poverty, poverty gap, income, coffee income, coffee price and coffee yield. We use logit, tobit and OLS estimations. We use five different model specifications: including cooperative fixed effects but excluding certification $\boldsymbol{T_i}$ (model 1); including certification $\boldsymbol{T_i}$ but excluding cooperative variables $\boldsymbol{C_j}$ (model 2); including certification $\boldsymbol{T_i}$ and cooperative variables $\boldsymbol{C_j}$ (model 3); including certification $\boldsymbol{T_i}$ on a subsample of all certified farmers (model 4); and including certification $\boldsymbol{T_i}$ on a subsample of FT and RA certified farmers (model 5). For all models, we use heteroskedasticity-robust standard errors (sandwich variance estimators) and we report marginal effects at the sample means for the logit model on poverty. With our approach, we estimate a more direct effect of certification that is not confounded with an effect of cooperative membership. Our approach also allows us to reduce and understand potential bias from farmers' non-random selection into certified cooperatives and cooperatives' non-random selection into certification, although we cannot completely rule out bias related to unobserved farmer- and cooperative-level heterogeneity. In our research area, the decision to become certified is taken at the cooperative level and not at the individual farm level, and farmers are sometimes not even aware that their coffee is certified. Cooperative-level heterogeneity is therefore specifically important. We are controlling for this to the extent possible by limiting our sample to cooperative farmers only, by comparing the effect of cooperative membership and the effect of certification (model 1 and 2), by controlling for pre-certification observed cooperative heterogeneity (model 3), and by limiting the sample to certified cooperatives only (model 4 and 5). If bias remains in our results, this is likely upward bias as one would expect the best cooperatives to enter certification programs and to have the largest positive impact on their members' welfare.

4. Results

4.1. Cooperative characteristics

Table 2 gives summary statistics on cooperative-level characteristics for the seven sampled cooperatives. For certain variables we have information for the current situation (survey year 2014) as well as the year before certification started. We observed that cooperatives are heterogeneous in observable characteristics. Their size varies from 44 to 550 members, the entry fee from 60 to 600 ETB, their annual supply capacity from 6 to 214 ton, their capital stock from 69,000 to 2,800,000 ETB, and their age from 3 till 15 years (Table 2). All cooperatives have increased in size in terms of members, capital and supply capacity after certification was

introduced, except the youngest cooperative that remained more or less the same. All cooperatives have coffee storage facilities and offer trainings to their members but only three cooperatives have their own washing station. Certified cooperatives are mostly larger in terms of members, capital and supply capacity than non-certified cooperatives, except for the FT cooperative that is relatively small. The latter is the only certified cooperative without an own washing station. Also, the entrance fee of certified cooperatives is larger than for non-certified ones, except for the FT cooperative. These summary statistics show that there is quite some heterogeneity among cooperatives and imply that is important to control for cooperative level heterogeneity when estimating the impact of certification.

Table 2: Cooperative characteristics for individual cooperatives

Variable (units)	Cooperative						
	A	B	C	D	E	F	G
Certification scheme	RA	Org	None	Org + FT	None	FT	None
Year Certification introduced	2007	2005	-	2005	-	2005	-
Cooperative size (# members) before certification							
Total	87	42	12	210	44	44	60
Female members	0	4	0	76	5	1	0
Cooperative size (# members) currently							
Total	550	504	105	446	44	188	124
Female members	96	129	8	76	4	4	2
Entry fee (ETB) before certification	300	42	120	102	300	42	31
Entry fee (ETB) currently	300	250	160	600	360	150	60
Coffee supplied before certification (ton/yr)	26.4	2.64	0.76	21.69	5.28	2.23	4.62
Coffee supplied currently (ton/yr)	214.4	65	6.3	86.87	4.53	9.8	8.65
Capital before certification (10^3 ETB)	27	2.36	25	37.4	11	4	1.86
Capital currently (10^3 ETB)	2,800	1,583	151	1,000	n.a.	69	147
Cooperative age (years)	6	14	11	15	3	13	10
Washing station owned by cooperative	Yes	Yes	No	Yes	No	No	No
Coffee storage owned by cooperative	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provision of training to members	Yes	Yes	Yes	Yes	Yes	Yes	Yes

n.a. = not available; RA = Rainforest Alliance, Org = Organic, FT = Fairtrade

Note: The year of pre-certification for non-certified cooperatives C and G was set at 2004 whereas and 2011 for cooperative E.

S*ource: Authors' calculation from survey and interview data*

4.2. Household characteristics

Table 3 gives summary statistics on farm and household characteristics, according to the different certification schemes. Some general observations from these statistics are that the level of education in the sample is rather low, with on average 3.5 years of schooling of the household head, and that family size is rather high with on average more dependents than workers. Farm size is on average 2.7 ha and on average 1 ha of this is cultivated with coffee. Eighty percent of

the farmers come from families with a tradition in coffee production. Farmers are member of a coffee cooperative on average for 7.3 years.

Table 3: Household and farm characteristics of sampled households, according to certification scheme

Variable (unit)	Total sample	Non-certified	Fairtrade	Organic	Rainforest Alliance
Human capital					
Female hh head (dummy)	0.08	0.06	0.12**	0.12**	0.05
	(0.01)	(0.02)	(0.03)	(0.03)	(0.02)
Age of hh head (years)	45.58	46.68	47.75	46.32	41.08***
	(0.71)	(1.11)	(1.34)	(1.36)	(1.47)
Education of hh head (years)	3.55	3.73	3.64	3.65	3.59
	(0.17)	(0.29)	(0.33)	(0.31)	(0.33)
Family size (#)	6.98	7.68	6.50***	6.26***	6.58***
	(0.14)	(0.24)	(0.25)	(0.22)	(0.34)
Dependency ratio	1.19	1.26	1.09**	1.18	1.20
	(0.04)	(0.07)	(0.06)	(0.08)	(0.09)
Physical Assets					
Total area (ha)	2.75	2.95	2.83	3.04	1.97**
	(0.14)	(0.31)	(0.17)	(0.22)	(0.17)
Coffee area (ha)	1.00	0.65	0.75	1.13***	1.74***
	(0.07)	(0.12)	(0.06)	(0.16)	(0.16)
Livestock (TLU)	4.66	6.30	4.12***	4.12***	2.66***
	(0.17)	(0.34)	(0.22)	(0.23)	(0.33)
Social capital					
Relatives (#)	48.80	30.20	76.32***	87.32***	43.58***
	(4.13)	(2.32)	(2.45)	(2.35)	(5.88)
Years coop member (years)	7.38	8.92	8.33	6.58***	3.99***
	(0.28)	(0.53)	(0.48)	(0.49)	(0.17)
Coffee farm experience					
Parents coffee farmers (dummy)	0.82	0.82	0.84*	0.70	0.94***
	(0.02)	(0.03)	(0.03)	(0.04)	(0.03)
Village infrastructure					
Distance (min)	73.59	106.47	68.93***	47.598***	46.24***
	(3.56)	(8.50)	(3.96)	(1.947)	(2.07)
Sample size	427	154	127	127	81

Notes: Comparisons are made between certified and non-certified households for the three certificates using one-sided t-tests. Significant differences are indicated with * for p<0.1,** for P<0.05, and *** for p<0.01. The figures in parenthesis are standard errors. *Source: Authors' calculation from own survey (2014)*

There are some significant differences in characteristics across households. Certified households are smaller and RA certified households have a slightly younger head. RA farmers have a smaller total farm size (1.96 ha compared to 2.95 for non-certified households) but a large coffee area. On average 88% of their farm land is cultivated with coffee while this is on average 22 to 37% for non-certified, FT and Org farmers. Also, Org certified farmers have a larger coffee area but there is no difference in farm size and coffee area between FT farmers and non-certified farmers. Certified households have less livestock, more relatives in the region and live closer to the district town than non-certified farmers. RA and Org farmers are member of the coffee

cooperative respectively for 4 and 6.6 years on average, which is significantly shorter than FT and non-certified farmers. This implies that a substantial share of farmers joined these cooperatives after they joined certification schemes.

4.3. Household welfare and coffee performance

The outcome variables are compared across certified and non-certified farmers (Figure 2). There is a high incidence of poverty in our study area with 60% of the sampled households falling below the national poverty line. The poverty gap is on average 32%, meaning that on average the poor have an income shortfall of 32% of the poverty line. The incidence of poverty is lower for RA certified households (45%) than for all other households (60%) and the poverty gap is lower (24%) as compared to (30% or more) the other households. Average household income in the sample is 15,545 ETB. Household income is substantially larger for RA household than for all other households; 24,135 ETB compared to 15,000 ETB or less.

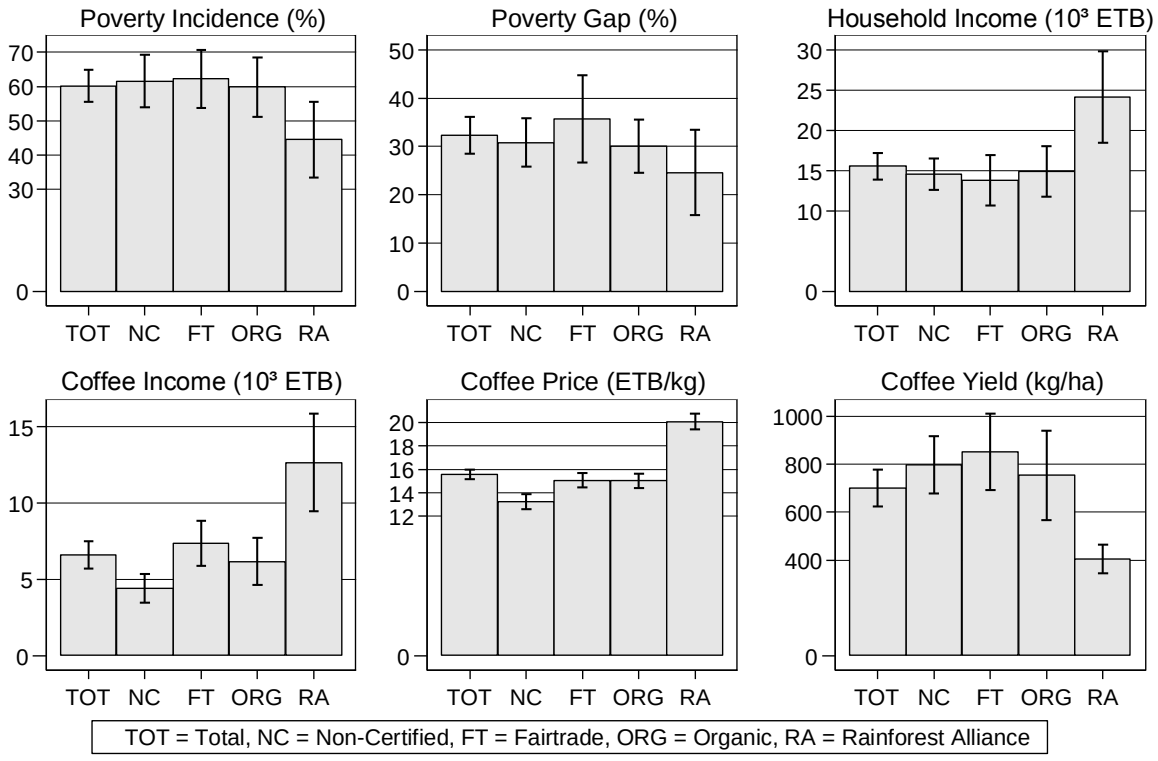

Figure 2: Household welfare and coffee performance according to certification scheme (error bars represent the 95% confidence interval)

The net coffee income in the sample is on average 6,638 ETB per household per year. There is substantial variation in coffee income across farmers, with the largest coffee income among RA farmers (12,673 ETB per household per year) and the lowest for non-certified farmers (4,349 ETB per household per year). The same holds for coffee prices, with an overall average price of 15.6 ETB/kg, the highest price for RA farmers (20 ETB/kg) and the lowest for non-certified farmers (13 ETB/kg). Certified farmers of all schemes have significantly higher coffee incomes and receive significantly higher coffee prices than non-certified farmers. The average coffee yield in the sample is 701 kg dry cherry equivalent per hectare per year. RA farmers have the lowest yields; 404 kg per hectare per year on average, which is significantly lower than all other type of farmers. FT farmers have slightly higher and Org farmers slightly lower yields than non-certified farmers but differences are not significant.

4.4. Econometric results

The estimated effects of certification on the six outcome indicators, are summarized in Table 4. The full regression results are reported in tables A1 to A6 in annex. FT and Org certification have no impact on poverty, neither on the likelihood of being poor nor on the depth of poverty, and household income (Table 4). This result is consistent across models including and excluding cooperative-level variables; apart from the observation that FT has a significant (at the 10% level) negative effect on household income when cooperative-level variables are controlled for. Yet, when comparing the poverty effect of FT and Org, we find that Org performs slightly better than FT in reducing the incidence and depth of poverty.

From the regression model excluding cooperative control variables, we find that RA certification has a significant negative effect on the likelihood to be poor and on the depth of poverty, and a significant positive effect on household income. Effects are quite large, indicating a 25% point reduction in the likelihood to be poor, a 31% point reduction in the poverty gap, and a 70% increase in household income. However, the magnitude of the coefficients reduces, standard errors increase, and the significance disappears when controlling for cooperative-level variables. This could indicate that the poverty and income effects are driven by cooperative effects rather than certification effects, or that these effects cannot be disentangled because of multicollinearity between certification and cooperative characteristics. Yet, the dummy variable on cooperative A (the RA certified cooperative) has no significant effect on poverty in the cooperative fixed effects regression (model 1, Table A1 in annex). Also, the cooperative control variables have no significant effects on poverty (model 3, Table A1 in annex). These

observations support the idea of a poverty-reducing effect of RA certification. When comparing RA respectively with Org and FT, we find that RA outperforms Org and FT in terms of poverty reduction and income enhancement. RA certification reduces the incidence of poverty with 38 respectively 64 percentage points and the depth of poverty with 46 respectively 85 percentage points, and increases household income with 74% respectively 123% in comparison with Org respectively FT certification. These are large effects, pointing again to a poverty-reducing and income-enhancing effect of RA certification.

The impact of RA certification on poverty and household income mainly comes through a price effect. The results show that RA certification has a large positive effect on producer coffee prices and coffee income but a large negative effect on yields (Table 4). The latter is likely related to less intensive cultivation in agro-forestry systems under RA certification. These results mean that the negative effect on yields is more than offset by a positive effect on the price farmers receive, and that this results in larger incomes and reduced poverty. Given that the average coffee price in the study area is 15.6 ETB/kg, the observed price effect of RA certification of 5.78 to 10.44 ETB per kg is a very large effect. It means that RA increases producer coffee prices with 37% to 68%. Also, FT certification has a significant positive impact on producer prices but the magnitude of the effect is much lower. Yet, FT certification does improve net coffee income but the effect is not large enough to translate into an effect on overall household income. This is due to the fact that coffee is less important in the income and activity portfolio of FT farmers. Coffee accounts for 26% of the farm size on average for FT farmers compared to 88% for RA farmers. Org certification has no significant impact on coffee yields, coffee prices and coffee incomes.

Other variables in the models have expected signs. For example, land and livestock ownership and education increase income and reduce poverty while family size increases poverty. Cooperative fixed effects are especially important in explaining coffee prices and coffee income but are less important in explaining coffee yields, household income and poverty. Nevertheless, significant cooperative fixed effects point to the importance of controlling for cooperative-level heterogeneity.

Table 4 Summary of estimated effects of Fairtrade, Organic and Rainforest Alliance certification on household welfare and coffee performance

Variable	Fairtrade vs. non-certified		Organic vs. non-certified		Rainforest alliance vs. non-certified		Fairtrade vs. Organic	Rainforest Alliance vs. Organic	Rainforest Alliance vs. Fairtrade
	model 2	model 3	model 2	model 3	model 2	model 3	model 4	model 4	model 5
Poverty	0.015	0.031	-0.035	-0.098	-0.255***	-0.168	0.234*	-0.387***	-0.642***
	(0.07)	(0.11)	(0.07)	(0.12)	(0.08)	(0.11)	(0.14)	(0.11)	(0.17)
Poverty gap	0.075	0.175	-0.072	-0.072	-0.315***	-0.195	0.329*	-0.461***	-0.851***
	(0.07)	(0.13)	(0.08)	(0.14)	(0.11)	(0.14)	(0.19)	(0.13)	(0.32)
Income	-0.087	-0.469*	0.281	-0.045	0.726***	0.403	-0.457	0.740***	1.232**
	(0.17)	(0.25)	(0.18)	(0.23)	(0.27)	(0.38)	(0.33)	(0.23)	(0.56)
Coffee income	1.086***	0.848***	-0.078	-0.015	1.197***	1.551***	0.934***	1.279***	0.317
	(0.18)	(0.29)	(0.19)	(0.31)	(0.28)	(0.44)	(0.24)	(0.16)	(0.36)
Coffee price	0.78*	1.092**	0.699	0.57	5.777***	10.438***	-0.073	3.432***	3.388***
	(0.43)	(0.51)	(0.49)	(0.45)	(0.62)	(0.76)	(0.79)	(0.62)	(1.05)
Coffee yield	121.50	-18.88	-81.48	-161.04	-239.60**	-367.21**	126.29	-62.31	-221.82
	(103.96)	(158.18)	(123.60)	(235.56)	(94.77)	(172.09)	(186.68)	(159.06)	(149.89)

Notes: *,**, and *** denote significance levels p<0.1, p<0.05 and p<0.01 respectively. Robust standard errors are reported in parenthesis. Model 2 refers to a regression excluding cooperative variables, model 3 to a regression model including cooperative variables; model 4 to a regression on a subsample of all certified farmers; and model 5 to a regression on a subsample of RA and FT certified farmers. The full regression results are reported in annex in Tables A1 to A6

Source: Authors' estimation based on survey and interview data

5. Discussion

The result that RA certification outperforms FT in terms of impact on farmers' welfare is unexpected. One would expect to find a larger effect on farmers' income and a larger poverty-reducing effect from standards that primarily focus on poverty reduction and farmers' welfare and empowerment, such as FT, than from standards primarily focusing on environmental goals, such as biodiversity conservation in the case of RA. Also, the fact that RA outperforms Org is surprising as both standards focus on less intensive farming and reduced agro-chemical input use. The main explanation for these findings lies in the huge differences in the impact of certification on producer prices, with RA certification having a very large positive price effect. We can put forward three possible reasons for this. First, differences in the supply chain might play a role. RA has an exclusive and short supply chain; RA certified coffee is directly supplied to Oromia Forest and Wildlife Enterprise (OFWE) who directly exports the coffee. OFWE only exports RA certified coffee as a specialty coffee. FT, Org and non-certified coffee is supplied by the cooperatives to the zonal coffee union who either exports the coffee as certified produce through direct contacts with buyers or exports non-certified produce via the Ethiopian Commodity Exchange (ECX). In this chain it is more likely that certified and non-certified coffee gets mixed, that the volume of coffee sold on the international market as certified coffee is much lower than the volume supplied with a certificate, and that hence the price premium for certified coffee is spread out over a large number of farmers who supplied certified coffee. The short and exclusive supply chain for RA coffee likely contributes to better producer prices through lower rent extraction throughout the chain.

Second, price differences are likely related to differences in quality. RA farmers and cooperatives receive training from OFWE to establish an internal quality control system, leading not only to better prices on the international market but also to reduce chances of coffee rejections. The ECX grading system, through which other coffee is supplied, results in a lot of coffee rejections due to poor quality (Fikade, 2014). Third, differences in the payment system to farmers might play a role. The RA cooperative is paying a premium directly to farmers after the coffee is sold on the international market. This premium is proportional to the supplied volume, depends on international market prices and adds directly to farmers' income. Also, FT works with a premium but this is not directly paid out to farmers but rather invested in the cooperative or in community development. This benefits farmers only indirectly. In our study area, the FT cooperatives indicated to never have received a premium

from the union because they failed to provide an investment plan, which is a requirement from the union to distribute the FT price premium further upstream the supply chain.

Our results are to some extent in line with previous findings in the literature. We find that FT and Org certification do not have an impact on household total income and on poverty, although FT leads to somewhat higher producer prices. Other studies also find no impact of FT and Org certification on farm profits, farm income and poverty; for example, Beuchelt and Zeller (2011), Valkila (2009) and Valkila and Nygren (2010) for Nicaragua, and Jena et al (2012) for Ethiopia. In addition, we find that RA certification outperforms FT and Org in terms of impact on household income and poverty reduction. Ruben and Zuniga (2011) come to similar conclusions for coffee farmers in Nicaragua. However, in their study the superior impact of RA mainly comes from a large effect on yields; while we find that RA improves farmers' income especially through a large impact on producer prices while yields are lower. Our results differ from the findings of Chiputwa et al. (2015) who show that FT certification reduces poverty among coffee farmers in Uganda while Utz and Org certification have no impact. Differences in how the coffee supply chains are organized might contribute to explaining these different findings. In Uganda, FT certified cooperatives supply milled coffee to private coffee exporters and farmers receive a 30% markup (Chiputwa et al., 2015). In Ethiopia, FT certified cooperatives supply dried coffee cherries to the regional coffee union, where it is milled and processed, and receive a 7% markup. The FT coffee chain is likely more developed in Uganda than in Ethiopia, where a lot of rent extraction takes place.

6. Conclusion and policy implications

In this paper we analyze the income and poverty effects of Fairtrade (FT), Organic (Org) and Rainforest Alliance (RA) certifications for coffee farmers in southwestern Ethiopia. We find that RA certification improves rural incomes and reduces the incidence and depth of poverty while FT and Org certification have no effect. We find that the positive effect of RA mainly comes from a large impact on producer prices that offsets a negative impact on yields. Also FT certification is found to lead to higher producer prices, but to a much smaller extent than RA, and the price effect does not lead to an overall effect on farmers' income and poverty. Our results entail a few plain implications for policy-makers, donors, food companies and consumers. First, our results imply that private sustainability standards sometimes fail to effectively deliver what they promise to consumers through labels. In our study, this is most

obvious for FT certification that does not create substantial income benefits for farmers and does not contribute to poverty reduction while the standard's main focus is on these issues. While this finding is specific for our study area and likely related to the organization of the coffee export chain in Ethiopia, it does point to weaknesses in the system of private sustainability standards.

In Ethiopia, FT fails to improve farmers' livelihoods through minimum prices and a price premium because rents are captured in the chain and a price premium is not transmitted to farmers. Second, our results show that RA certification improves farmers' livelihood, although the primary focus of RA is on biodiversity conservation. This could be good or bad news from a biodiversity conservation point of view. If RA creates environmental services and higher incomes for farmers (because higher prices offset lower yields), there is a win-win situation in terms of the socio-economic and environmental components of sustainability. Yet, higher prices and incomes may lead to an expansion of the RA certified coffee area. A rational expectation is that there would be a shift from non-certified, FT and Org certified production systems to RA certified systems. Whether this will happen by converting existing coffee systems into RA certified systems or by moving to the forest frontier is crucially important from a conservation perspective.

In our approach we have put a lot of emphasis on cooperative effects. We have only sampled cooperative members to refrain from confounding the effect of certification with the effect of cooperative membership as such. Yet, cooperatives are heterogeneous. While we were not able to rule out bias in our estimates related to this cooperative heterogeneity, our results do show that this heterogeneity is important to take into account when estimating the impact of certification – which was also pointed out by others (Jena et al., 2012). One would need larger samples, including a larger number of cooperatives to better disentangle the certification and cooperative effect.

References

Asfaw, S., Mithöfer, D. & Waibel, H. (2010). What Impact Are EU Supermarket Standards Having on Developing Countries' Export of High-Value Horticultural Products? Evidence from Kenya. *Journal of International Food & Agribusiness Marketing,* 22**,** 252-276.

Asfaw, S., Mithöfer, D. & Waibel, H. (2009). EU Food Safety Standards, Pesticide Use and Farm-level Productivity: The Case of High-value Crops in Kenya. *Journal of Agricultural Economics,* 60**,** 645-667.

Beghin C, J., Maertens, M. & Swinnen, J. (2015). Non-Tariff Measures and Standards in Trade and Global Value Chains. Annual Rev Resour Econ 7.

Beuchelt, T. D. & Zeller, M. (2011). Profits and Poverty: Certification's Troubled Link for Nicaragua's Organic and Fairtrade Coffee Producers. Ecological Economics, 70, 1316-1324.

Beuchelt, T. D. & Zeller, M. (2013). The Role of Cooperative Business Models For the Success of Smallholder Coffee Certification in Nicaragua: A Comparison of Conventional, Organic and Organic-Fairtrade Certified Cooperatives. Renewable Agriculture and Food Systems, 28, 195-211.

Chiputwa, B., Spielman, D. J. & Qaim, M. (2015). Food Standards, Certification, and Poverty among Coffee Farmers in Uganda. World Development, 66, 400-412.

Fikade, B. (2014). Trouble Brewing For Coffee Exports, The Reporter, February 1st, 2014, Accessed On January 19, 2015 At Http://Www.Thereporterethiopia.Com/Index.Php/News-Headlines/Item/1572-Trouble-Brewing-For-Coffee-Exports.

Foster, J., Greer, J. & Thorbecke, E. (1984). A Class of Decomposable Poverty Measures. *Econometrica,* 52**,** 761-766.

Gole, T. W., Borsch, T., Denich, M. & Teketay, D. (2008). Floristic Composition and Environmental Factors Characterizing Coffee Forests in Southwest Ethiopia. Forest Ecology and Management, 255, 2138-2150.

Handschuch, C., Wollni, M. & Villalobos, P. (2013). Adoption Of Food Safety And Quality Standards Among Chilean Raspberry Producers – Do Smallholders Benefit? *Food Policy,* 40**,** 64-73.

Hansen, H. & Trifković, N. (2014). Food Standards Are Good – For Middle-Class Farmers. World Development, 56, 226-242

Henson, S. & Humphrey, J. (2010). Understanding the Complexities of Private Standards in Global Agri-Food Chains as They Impact Developing Countries. The Journal of Development Studies, 46, 1628-1646.

Holzapfel, S. & Wollni, M. (2014). Is Globalgap Certification Of Small-Scale Farmers Sustainable? Evidence from Thailand. The Journal of Development Studies, 50, 731-747.

ICO. (2013). Available: Http://Www.Ico.Org/New_Historical.Asp [Accessed].

Jena, P. R., Chichaibelu, B. B., Stellmacher, T. & Grote, U. (2012). The impact of coffee certification on small-scale producers' livelihoods: a case study from the Jimma Zone, Ethiopia. Agricultural Economics, 43, 429-440.

Maertens, M. & Swinnen, J. F. M. (2009). Trade, Standards, and Poverty: Evidence from Senegal. *World Development,* 37**,** 161-178.

Marx, A., Maertens, M., Swinnen, J. & Wouters,J. (2012). Private standards and Global Governane: Legal and economic perspectives. Edward Elgar Publishing.

Minten, B., Dereje, M., Engida, E. & Tamiru, S. (2015). Who benefits from the rapidly increasing Voluntary Sustainability Standards? Evidence from Fairtrade and Organic certified coffee in Ethiopia. Working Paper 71. Addis Ababa: International Food Policy Research Institute (IFPRI).

Minten, B., Tamiru, S., Kuma, T. & Nyarko, Y. (2014). Structure and Performance of Ethiopia's Coffee Export Sector. Working Paper 66. Addis Ababa: International Food Policy Research Institute (IFPRI).

Minten, B., Randrianarison, L. & Swinnen, J. F. M. (2009). Global Retail Chains and Poor Farmers: Evidence from Madagascar. World Development, 37, 1728-1741

MoFED. (2012). Ethiopia's Progress towards Eradicating Poverty: An Interim Report on Poverty Analysis Study. March 2012, Addis Ababa

Rao, E. J. O. & Qaim, M. (2011). Supermarkets, Farm Household Income, and Poverty: Insights from Kenya. *World Development*, 39**,** 784-796.

Ruben, R. & Fort, R. (2012). The Impact of Fair Trade Certification for Coffee Farmers in Peru. World Development, 40, 570-582.

Ruben, R., Fort, R. & Zúñiga-Arias, G. (2009). Measuring the impact of fair trade on development. Development in Practice, 19, 777-788.

Ruben, R. & Zuniga, G. (2011). How standards compete: comparative impact of coffee certification schemes in Northern Nicaragua. Supply Chain Management: An International Journal, 16, 98-109.

Schuster, M. & Maertens, M. (2013). Do private standards create exclusive supply chains? New evidence from the Peruvian asparagus export sector. Food Policy, 43, 291-305

Stillmacher, T. & Grote, U. (2011). Forest Coffee Certification in Ethiopia: Economic boon or ecological bane? ZEF working paper series 76. Bonn.

Tefera, A. & Tefera, T. (2013). Ethiopia: Coffee Annual Report. Gain report ET-1302. USDA.

Tefera, A. & Tefera, T. (2014). Ethiopia: Coffee Annual Report. Gain Report: ET 1402. USDA.

Valkila, J. (2009). Fair Trade organic coffee production in Nicaragua — Sustainable development or a poverty trap? Ecological Economics, 68, 3018-3025.

Valkila, J. & Nygren, A. (2010). Impacts of Fair Trade certification on coffee farmers, cooperatives, and laborers in Nicaragua. Agriculture and Human Values, 27, 321-333.

Wiersum, K. F., Gole, T. W., Gatzweiler, F., Volkmann, J., Bognetteau, E. & Wirtu, O. (2008). Certification of Wild Coffee in Ethiopia: Experiences and Challenges. Forests, Trees and Livelihoods, 18, 9-21.

Annex

Table A1: Lobit regression results on poverty

Model specifications	1	2	3	4	5
Fairtrade		0.015	0.031	0.234*	
		(0.066)	(0.106)	(0.140)	
Organic		-0.035	-0.098		
		(0.073)	(0.118)		
Rainforest Alliance		-0.255***	-0.168	-0.387***	-0.642***
		(0.082)	(0.112)	(0.106)	(0.168)
Head's sex	-0.095	-0.133	-0.071	-0.258	-0.080
	(0.122)	(0.115)	(0.091)	(0.168)	(0.227)
Head's age	0.001	-0.0004	0.001	0.002	0.003
	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Head's education	-0.007	-0.013	-0.005	0.006	-0.005
	(0.008)	(0.008)	(0.006)	(0.014)	(0.017)
Family size	0.070***	0.065***	0.052***	0.065***	0.078***
	(0.013)	(0.013)	(0.009)	(0.016)	(0.021)
Dependency ratio	-0.048	-0.025	-0.036	0.002	0.060
	(0.037)	(0.036)	(0.028)	(0.047)	(0.068)
Total area	0.009	0.008	0.007	-0.004	-0.021
	(0.017)	(0.017)	(0.012)	(0.041)	(0.093)
Total area²	0.0004	0.0004	0.0003	0.002	-0.0001
	(0.001)	(0.001)	(0.0004)	(0.003)	(0.012)
Livestock (TLU)	-0.050***	-0.048***	-0.038***	-0.062***	-0.064***
	(0.012)	(0.012)	(0.008)	(0.016)	(0.022)
Social capital	0.00004	-0.0003	0.00004	0.0001	-0.001
	(0.001)	(0.001)	(0.0003)	(0.001)	(0.001)
Year since member	-0.009*	-0.008	-0.007*	-0.021*	-0.018
	(0.005)	(0.005)	(0.004)	(0.011)	(0.017)
Parents coffee farmers	-0.243***	-0.216***	-0.183***	-0.324**	-0.255
	(0.077)	(0.078)	(0.056)	(0.149)	(0.241)
Distance	0.001	0.002***	0.001	-0.0003	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Cooperative A	-0.549				
	(0.344)				
Cooperative B	-0.188				
	(0.356)				
Cooperative D	-0.483				
	(0.331)				
Cooperative E	-0.402				
	(0.356)				
Cooperative F	-0.082				
	(0.335)				
Cooperative G	-0.375				
	(0.358)				
Cooperative entry fee			0.001		
			(0.001)		
Cooperative capital			0.002		
			(0.011)		
Cooperative size			-0.003		
			(0.002)		
Cooperative age			0.045		
			(0.031)		
Constant	1.841	0.523	-1.778	1.744	1.934
	(1.82)	(0.70)	(2.613)	(1.07)	(1.785)
Number of observations	418	418	418	201	140
Wald Chi²	77.43	73.34	78.66	50.01	53.94
Prob > Chi²	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.246	0.212	0.246	0.263	0.284
Log Likelihood	-212.14	-221.60	-212.01	-97.84	-68.01

Notes: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Marginal effects at sample means (MEM's) are reported.

Table A2: Tobit Regression results on poverty gap

Model specifications	1	2	3	4	5
Fairtrade		0.075	0.175	0.329*	
		(0.07)	(0.13)	(0.19)	
Organic		-0.072	-0.072		
		(0.08)	(0.14)		
Rainforest Alliance		-0.315***	-0.195	-0.461***	-0.851***
		(0.11)	(0.14)	(0.13)	(0.32)
Head's sex	-0.053	-0.103	-0.052	-0.245	-0.090
	(0.101)	(0.11)	(0.11)	(0.20)	(0.28)
Head's age	-0.001	-0.002	-0.001	-0.0001	0.001
	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Head's education	-0.005	-0.011	-0.005	0.011	0.006
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Family size	0.068***	0.066***	0.068***	0.073***	0.082***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Dependency ratio	-0.033	-0.013	-0.034	0.029	0.052
	(0.03)	(0.03)	(0.03)	(0.05)	(0.09)
Total area	-0.009	-0.007	-0.009	-0.024	-0.030
	(0.01)	(0.02)	(0.01)	(0.04)	(0.09)
Total area^2	0.0004	0.0003	0.0004	0.003	-0.002
	(0.0003)	(0.0003)	(0.0003)	(0.003)	(0.01)
Livestock (TLU)	-0.060***	-0.061***	-0.0597***	-0.080***	-0.083***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)
Social capital	-0.0002	-0.001	-0.0002	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Year since member	-0.012*	-0.012**	-0.013*	-0.031**	-0.032
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Parents coffee farmers	-0.207***	-0.184***	-0.208***	-0.255**	-0.231
	(0.06)	(0.06)	(0.06)	(0.11)	(0.19)
Distance	0.0003	0.001***	0.0003	-0.001	-0.001
	(0.001)	(0.0003)	(0.001)	(0.001)	(0.001)
Cooperative A	-0.546**				
	(0.232)				
Cooperative B	-0.169				
	(0.21)				
Cooperative D	-0.440**				
	(0.21)				
Cooperative E	-0.369				
	(0.23)				
Cooperative F	0.027				
	(0.17)				
Cooperative G	-0.369*				
	(0.21)				
Cooperative entry fee			0.001		
			(0.001)		
Cooperative capital			0.003		
			(0.01)		
Cooperative size			-0.004**		
			(0.002)		
Cooperative age			0.047		
			(0.03)		
Constant	0.601*	0.347*	-0.032	0.519*	0.811
	(0.31)	(0.19)	(0.52)	(0.29)	(0.62)
Standard error σ	0.494***	0.509***	0.494***	0.574***	0.668***
	(0.07)	(0.08)	(0.07)	(0.11)	(0.15)
Number of observations	418	418	418	201	140
F-test	10.70	11.60	10.27	6.33	4.35
Prob > F	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.206	0.174	0.207	0.186	0.176
Log Likelihood	-285.39	-297.03	-285.28	-154.82	-115.50

Notes: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: OLS regression result on log household income

Model specifications	1	2	3	4	5
Fairtrade		-0.087	-0.469*	-0.457	
		(0.17)	(0.25)	(0.33)	
Organic		0.281	-0.045		
		(0.18)	(0.23)		
Rainforest Alliance		0.726***	0.403	0.740***	1.232**
		(0.28)	(0.38)	(0.23)	(0.56)
Sex	-0.159	-0.107	-0.163	0.348	0.054
	(0.37)	(0.37)	(0.37)	(0.29)	(0.39)
Age	0.003	0.004	0.003	-0.003	-0.008
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Head's education	0.028	0.035*	0.028	-0.023	-0.020
	(0.02)	(0.02)	(0.02)	(0.04)	(0.06)
Family size	-0.002	0.002	-0.002	0.001	0.002
	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)
Dependency ratio	-0.097	-0.126**	-0.098	-0.198**	-0.213
	(0.07)	(0.06)	(0.07)	(0.10)	(0.17)
Total area	0.066*	0.064*	0.066*	0.111	0.146
	(0.04)	(0.04)	(0.04)	(0.10)	(0.20)
Total area²	-0.002**	-0.002**	-0.002**	-0.009	-0.002
	(0.001)	(0.001)	(0.001)	(0.01)	(0.02)
Livestock (TLU)	0.120***	0.122***	0.120***	0.142***	0.152***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)
Social capital	0.001	0.001	0.001	0.004**	0.007***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Year since member	0.020**	0.020**	0.020**	0.040*	0.044
	(0.01)	(0.01)	(0.01)	(0.02)	(0.05)
Parents coffee farmers	0.225*	0.194	0.230*	0.273	0.084
	(0.12)	(0.12)	(0.12)	(0.23)	(0.30)
Distance	-0.001	-0.002*	-0.001	-0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)
Cooperative A	0.959*				
	(0.55)				
Cooperative B	0.292				
	(0.49)				
Cooperative D	0.703				
	(0.45)				
Cooperative E	0.371				
	(0.46)				
Cooperative F	-0.13				
	(0.39)				
Cooperative G	0.420				
	(0.46)				
Cooperative entry fee			0.001		
			(0.002)		
Cooperative capital			-0.010		
			(0.02)		
Cooperative size			0.007*		
			(0.003)		
Cooperative age			0.016		
			(0.03)		
Constant	7.60***	7.82***	7.421***	7.95***	7.51***
	(0.71)	(0.45)	(0.71)	(0.58)	(1.20)
Number of observations	418	418	418	201	140
F-test	8.13	8.14	7.76	7.69	6.93
Prob > F	0.000	0.000	0.000	0.000	0.000
R^2	0.162	0.147	0.162	0.174	0.190

Notes: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: OLS regression result on log coffee income

Model specifications	1	2	3	4	5
Fairtrade		1.086***	0.848***	0.934***	
		(0.18)	(0.29)	(0.24)	
Organic		-0.078	-0.015		
		(0.19)	(0.31)		
Rainforest Alliance		1.197***	1.551***	1.279***	0.317
		(0.28)	(0.44)	(0.16)	(0.36)
Head's sex	-0.518	-0.391	-0.523	-0.127	0.101
	(0.40)	(0.42)	(0.41)	(0.30)	(0.33)
Head's age	-0.007	-0.004	-0.007	-0.011	-0.011
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Head's education	0.058***	0.065***	0.058***	0.026	0.043
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Family size	-0.004	-0.003	-0.003	0.022	0.037
	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)
Dependency ratio	0.019	-0.035	0.018	-0.139	-0.236
	(0.11)	(0.11)	(0.11)	(0.12)	(0.20)
Coffee area	0.372***	0.363**	0.367***	0.407**	0.469
	(0.14)	(0.14)	(0.14)	(0.18)	(0.45)
Coffee area²	-0.023***	-0.023***	-0.023***	-0.030**	-0.043
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)
Livestock (TLU)	0.127***	0.119***	0.128***	0.114***	0.140**
	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
Social capital	0.0002	0.0003	0.0002	0.005***	0.005*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Year since member	0.020	0.018	0.021	0.004	-0.004
	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)
Parents coffee farmers	0.043	0.052	0.049	-0.061	-0.208
	(0.22)	(0.22)	(0.22)	(0.17)	(0.26)
Distance	-0.002	-0.011***	-0.002	-0.002	-0.002
	(0.004)	(0.002)	(0.004)	(0.003)	(0.004)
Cooperative A	3.607***				
	(0.97)				
Cooperative B	2.276**				
	(0.93)				
Cooperative D	3.466***				
	(0.88)				
Cooperative E	2.704***				
	(0.88)				
Cooperative F	3.061***				
	(0.80)				
Cooperative G	2.698***				
	(0.93)				
Cooperative entry fee			0.004*		
			(0.003)		
Cooperative capital			-0.093***		
			(0.03)		
Cooperative size			0.020***		
			(0.01)		
Cooperative age			-0.002		
			(0.05)		
Constant	4.36***	7.16***	5.88***	6.94***	7.90***
	(1.11)	(0.46)	(0.98)	(0.55)	(0.90)
Number of observations	418	418	418	201	140
F-test	9.55	9.70	9.27	18.21	6.50
Prob > F	0.000	0.000	0.000	0.000	0.000
R^2	0.350	0.325	0.350	0.313	0.233

Notes: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: OLS regression result on farm-gate coffee price

Model specifications	1	2	3	4	5
Fairtrade		0.780*	1.092**	-0.073	
		(0.43)	(0.52)	(0.79)	
Organic		0.699	0.568		
		(0.49)	(0.45)		
Rainforest Alliance		5.777***	10.438***	3.432***	3.388***
		(0.62)	(0.76)	(0.62)	(1.05)
Head's sex	-0.621	-1.083	-0.628	-1.233	-1.642*
	(0.61)	(0.68)	(0.61)	(0.85)	(0.97)
Head's age	-0.015	-0.023*	-0.015	-0.012	-0.009
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Head's education	0.046	-0.027	0.047	0.030	0.097
	(0.04)	(0.05)	(0.04)	(0.06)	(0.07)
Family size	0.004	0.036	0.005	-0.009	-0.078
	(0.06)	(0.06)	(0.06)	(0.09)	(0.11)
Dependency ratio	0.046	0.081	0.045	0.151	-0.020
	(0.17)	(0.19)	(0.17)	(0.23)	(0.38)
Coffee area	0.242	0.259	0.246	0.746*	1.000
	(0.25)	(0.26)	(0.25)	(0.40)	(0.67)
Coffee area²	-0.021	-0.016	-0.021	-0.137**	-0.100
	(0.02)	(0.02)	(0.02)	(0.06)	(0.09)
Livestock (TLU)	-0.07	-0.093*	-0.068	0.066	0.017
	(0.05)	(0.05)	(0.05)	(0.08)	(0.09)
Social capital	-0.002	-0.006***	-0.002	-0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.01)	(0.01)
Year since member	0.030	0.131***	0.029	-0.022	0.066
	(0.04)	(0.04)	(0.04)	(0.07)	(0.10)
Parents coffee farmers	-0.747*	-0.337	-0.763*	-0.773	-1.733
	(0.42)	(0.46)	(0.42)	(0.63)	(1.29)
Distance	-0.005	-0.014***	-0.006	0.007	0.007
	(0.01)	(0.003)	(0.01)	(0.01)	(0.01)
Cooperative A	7.640***				
	(1.27)				
Cooperative B	4.131***				
	(1.20)				
Cooperative D	1.479				
	(1.15)				
Cooperative E	-1.544				
	(1.28)				
Cooperative F	4.433***				
	(0.93)				
Cooperative G	3.569***				
	(1.27)				
Cooperative entry fee			-0.014***		
			(0.004)		
Cooperative capital			-0.097**		
			(0.04)		
Cooperative size			0.003		
			(0.01)		
Cooperative age			0.058		
			(0.05)		
Constant	13.68***	15.74***	17.17***	16.80***	17.08***
	(1.56)	(1.00)	(1.28)	(1.07)	(1.84)
Number of observations	418	418	418	201	140
F-test	30.21	22.28	31.29	6.16	5.00
Prob > F	0.000	0.000	0.000	0.000	0.000
R^2	0.536	0.399	0.536	0.307	0.338

Notes: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TableA6: The effect of coffee certification on coffee yield

Model specifications	1	2	3	4	5
Fairtrade		121.50	-18.88	126.29	
		(103.96)	(158.18)	(186.68)	
Organic		-81.48	-161.04		
		(123.60)	(235.56)		
Rainforest Alliance		-239.60**	-367.21**	-62.31	-221.82
		(94.77)	(172.09)	(159.06)	(149.89)
Head's sex	-160.62	-127.65	-166.30	-73.48	-86.47
	(141.28)	(142.66)	(142.26)	(202.56)	(153.76)
Head's age	-7.04**	-6.10**	-6.91**	-8.21*	-3.27
	(3.04)	(3.09)	(3.06)	(4.55)	(3.51)
Head's education	6.43	10.93	6.73	-9.17	7.79
	(12.60)	(12.96)	(12.79)	(20.23)	(12.80)
Family size	5.67	6.54	5.90	15.30	-10.39
	(15.96)	(15.95)	(16.14)	(29.32)	(13.85)
Dependency ratio	-93.06**	-109.58***	-94.31**	-54.69	-56.85
	(39.69)	(39.92)	(39.95)	(56.97)	(66.62)
Coffee area	-267.04***	-280.61***	-273.86***	-247.68***	-247.77***
	(51.95)	(51.28)	(52.17)	(58.98)	(84.94)
Coffee area²	14.08***	14.64***	14.43***	16.59***	28.81**
	(3.66)	(3.53)	(3.66)	(4.93)	(12.27)
Livestock (TLU)	9.35	10.54	10.37	27.89	29.77*
	(9.23)	(9.40)	(9.31)	(17.56)	(17.04)
Social capital	0.25	0.47	0.23	1.48	1.48**
	(0.62)	(0.65)	(0.62)	(0.90)	(0.72)
Year since member	-7.78	-8.53	-6.57	-5.96	-9.42
	(7.43)	(6.28)	(7.31)	(13.17)	(21.22)
Parents coffee farmers	-51.22	-58.53	-41.03	117.40	-152.95
	(122.29)	(121.91)	(120.65)	(125.36)	(130.68)
Distance	-0.93	-2.21***	-0.79	0.37	1.05
	(1.04)	(0.51)	(1.04)	(1.22)	(1.21)
Cooperative A	52.99				
	(245.68)				
Cooperative B	104.83				
	(292.18)				
Cooperative D	460.92*				
	(246.48)				
Cooperative E	439.06				
	(277.45)				
Cooperative F	277.24				
	(230.82)				
Cooperative G	397.58				
	(253.16)				
Cooperative entry fee			0.97		
			(1.48)		
Cooperative capital			-12.32		
			(10.10)		
Cooperative size			4.28**		
			(2.01)		
Cooperative age			0.64		
			(41.69)		
Constant	1176.57***	1503.96***	1243.78**	907.71***	1145.62***
	(354.83)	(231.75)	(560.22)	(293.17)	(354.12)
Number of observations	418	418	418	201	140
F-test	5.94	6.02	5.58	3.64	2.92
Prob > F	0.000	0.000	0.000	0.000	0.001
R^2	0.188	0.173	0.186	0.161	0.213

Notes: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$