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Private Sustainability Standards in the Ugandan Coffee Sector: Empty Promises or Catalysts for Development?

Kevin Teopista AKOYI [1] and Miet MAERTENS [2]

Abstract

In this paper we investigate whether private sustainability standards in the coffee sector in Uganda live up to the promises they make to consumers to improve the welfare and productivity of smallholder farmers. We use cross-sectional household survey data from Eastern Uganda and instrumental variable methods to reveal how participation in two different coffee certification schemes affects smallholders. We find that smallholder participation in a double Fairtrade - Organic certification scheme neither increases producer income, nor reduces poverty. While certified producers do receive higher coffee prices, the certificate results in lower land and labour productivity and the price premium does not compensate for that. For participation in a triple Utz - Rainforest Alliance - 4C certification scheme, we find increases in coffee income, in land and labour productivity but no significant impact on poverty reduction. The results imply that almost a decade after their introduction, the certification schemes have failed to contribute to poverty reduction in a region that is faced with a high incidence of poverty. The results indicate that a price premium to producers is neither necessary, nor sufficient, for private sustainability standards to contribute to rural incomes, and that yields are more important than prices in increasing net returns to coffee farmers. In areas with degraded soils and low average yields, FT certification focusing on fair producer prices, might be better for smallholder coffee farmers when combined with standards that focus on good agricultural practices and productivity growth, such as Utz, than when combined with Organic standards. The results put doubt on the sincerity of private sustainability standards and the justification of the price premium consumers pay for certified products, as standards may not always live up to the expectations they create.

Key Words: Coffee certification, Private sustainability standards, Global value chains, Poverty reduction, Smallholder farmers, Uganda

JEL classification: F14, I32, L15, O12, O13, O17, O18, Q12, Q13, Q17, Q18

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1. Introduction

Over the past two decades, Private Sustainability Standards (PSS) in global food value chains have spread rapidly (Beghin et al., 2015). PSS guarantee specific quality and/or safety attributes of food, and specific ethical and/or environmental aspects of food production and trade (Henson and Humphrey, 2010). They are especially important in international trade relations with developing countries because of information asymmetries between producers in those countries and overseas buyers and consumers (Schuster and Maertens, 2015). Understanding the impact of PSS is particularly important for developing countries because agricultural and food exports are a fundamental component of developing countries' growth and entail the potential to reduce rural poverty (Jaud and Kukenova, 2011). It is far from a proven fact that PSS improve companies export performance, improve farmers' wellbeing and contribute to poverty reduction. There is a growing body of literature investigating this issue but the evidence is quite mixed (see Beghin et al., 2015 for a review). Some studies find that PSS improve companies' export performance (e.g. Henson et al., 2011) while others find no effect (e.g. Schuster and Maertens, 2015); some studies indicate that PSS enhance farmers' welfare (e.g. Asfaw et al., 2010; Handschuch et al., 2013) while others find no or even adverse effects (e.g. Holzapfel and Wollni, 2014; Hansen and Trifkovic, 2014). Understanding the welfare and poverty effects of PSS is important because they raise expectations among consumers about the impact they create in developing countries. For example, Fairtrade claims to *provide farmers with a better deal that allows them to improve their lives* and to *offer consumers a powerful way to reduce poverty through their everyday shopping* (Fairtrade International, 2015). Likewise, Rainforest Alliance claims to *ensure the long-term economic health of forest communities through protecting ecosystems, safeguarding the well-being of local communities and improving productivity* (Rainforest Alliance, 2015).

In this paper, we assess the economic implications of coffee certification for smallholder coffee farmers in the Mount Elgon region in Eastern Uganda. We use cross-sectional household survey data and instrumental variable methods to reveal how participation in two different coffee certification schemes affects poverty, coffee income, coffee production, coffee yields and labour productivity. While several studies have analysed the impact of coffee certification, our study on coffee certification in Uganda makes a relevant contribution. Most evidence on the economic impact of coffee certification for smallholder producers is from Latin-America

(e.g. Bacon, 2005; Bacon et al., 2008; Barham and Weber, 2012; Beuchelt and Zeller, 2011; Mendez et al., 2010; Ruben and Fort, 2012; Ruben and Zuniga, 2011; Valkila and Nygren, 2010; Wollni and Zeller, 2007). Evidence from Africa is limited to a handful of recent papers (Bolwig and Gibbon, 2009; Chiputwa et al., 2015; Jena et al., 2012; Van Rijsbergen et al., 2016). The focus on Uganda is particularly relevant because coffee is a main export crop, considered important in export earnings and rural poverty reduction. Increased adoption of PSS and increased production of 'sustainable coffees' is mentioned in the National Export Strategy as a means to reposition the country in the international coffee market (MAAIF, 2010; ITC, 2012).

There is no consensus on whether PSS are good or not for smallholder coffee farmers. Studies have analysed the impact of different certification schemes in different institutional and agro-ecological settings and have come to diverse conclusions about their impact. Most studies have analysed the impact of one single certification scheme (e.g. Bacon et al., 2008; Bolwig and Gibbon, 2009; Jena et al., 2012; Jena and Grote, 2016; Ruben and Fort, 2012; Valkila and Nygren, 2010); mostly Fairtrade certification as one of the oldest PSS in the coffee sector. There are less studies investigating the impact of more recent PSS in the coffee sector (such as Utz and Rainforest Alliance) or the impact of multiple PSS in the same area – examples are Beuchelt and Zeller (2011), Ruben and Zuniga (2011), Mendez et al. (2010), Barham and Weber (2012), Chiputwa et al. (2014); and Van Rijsbergen et al. (2016). As PSS differ widely in focus and requirements, their effectiveness in improving farmers' welfare and reducing poverty in specific settings may vary as well. Comparative studies contribute to understanding these differences in the effectiveness of PSS, and with our study on two different certification schemes, a double Fairtrade-Organic certification scheme and a triple Utz - Rainforest Alliance - 4C certification scheme, we contribute to this. In addition, we focus on multiple outcome indicators in order to better understand the channels through which certification contributes to farmer welfare and poverty reduction.

The remainder of the paper is structured as follows: In the next section we describe the coffee sector in Uganda, our study area and the data used in the paper. In section three we describe the econometric methods. In section four, the results of a descriptive analysis and the econometric analysis are described. In section five, the results are discussed and interpreted in relation to the literature on coffee standards. Section six concludes.

2. Background and Data

2.1 The coffee sector in Uganda

Uganda currently ranks eighth in world coffee exports and second in Africa, after Ethiopia (ICO, 2015). Coffee constitutes about 20% of Ugandan foreign exchange earnings (UCDA, 2013). During the past two decades, coffee production increased slightly, from about 3.2 million 60 Kg bags of green coffee in 1995 to about 4.8 million in 2015 (figure 1). Coffee production decreased in the early 2000s, mainly as a result of the spread of the Coffee Wilt Disease (*Tracheomycosis*) in Robusta trees but then recovered since 2005. Domestic consumption is very small (4.9%) and the major share of coffee is exported (FAO, 2015). About 20% of the coffee produced is the Arabica variety (*Coffea arabica*), introduced from Central America, and 80% is the Robusta variety (*Coffee canephora / robusta*), indigenous to Uganda. The main coffee producing regions are Central Uganda for Robusta, Western, North-Western and Eastern Uganda for Arabica (and some Robusta).

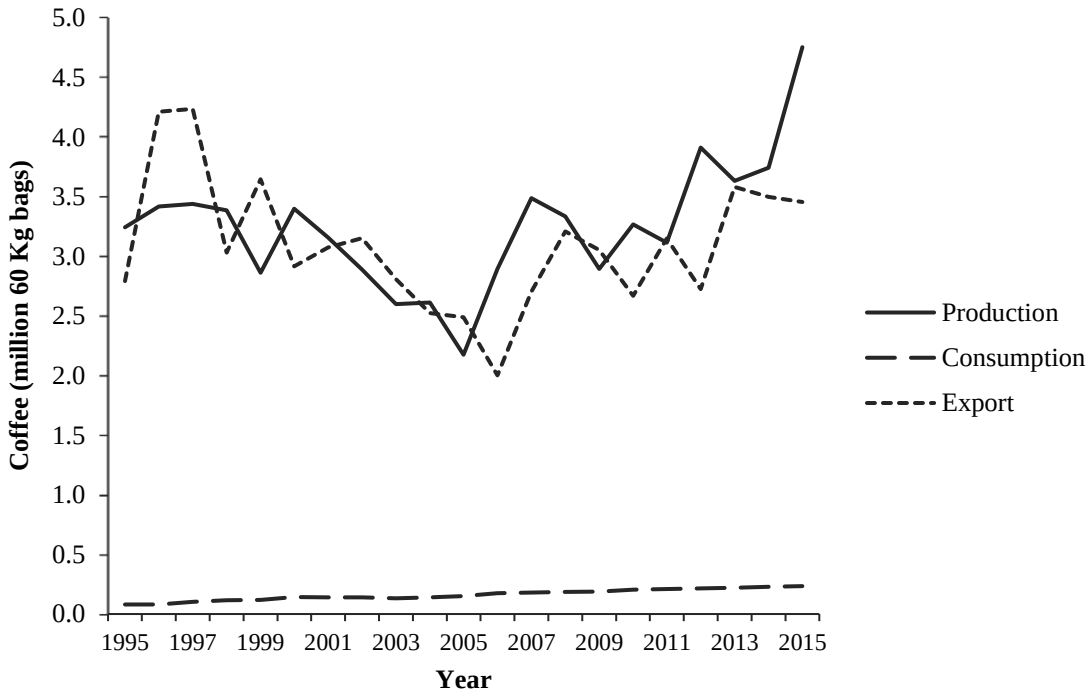

Figure 1: Coffee Production, Consumption and Export Trends in Uganda (1995-2015); *Source:* Derived from FAOstat (www.faostat.org – accessed April 2016)

Until 1991 coffee trade in Uganda was controlled by the Coffee Marketing Board (CMB) and production organized through a centrally-planned cooperative system. Processes of liberalisation and privatisation in the 1990s led to the abolition of CMB, and consequent collapse of many coffee cooperatives. Private companies emerged and currently about 52

private roasting and exporting companies are active in the coffee sector, including four large cooperatives (UCDA, 2013). More than 90% of Ugandan coffee is produced by smallholders. About 1.7 million producers and their families depend on coffee production for their livelihood (UBOS, 2014). Direct employment in various activities in the coffee chain is estimated at about five million people, including farmers, farm-workers, traders, and employees in roasting and exporting companies. Coffee yields in Uganda are low; on average 609 kg of green coffee per hectare or about 2,550 kg/ha of fresh cherries (FAO, 2016). Although higher than the African average of 502 kg of green coffee per hectare, it is only a fifth of the yield of 3,100 kg green coffee (or about 13,000 kg of fresh cherries) per ha obtained in on-station trials in Uganda (FAO, 2016; MAAIF, 2010).

Private sustainability standards started to spread in Uganda in the early 1990s, starting with Fairtrade and consecutively followed by organic certification, Utz, Rainforest Alliance and 4C. Currently about 35,000 Ugandan coffee producers are Fair-trade certified (Fairtrade International, 2015); 30,000 obtained an organic certificate (FiBL and IFOAM, 2014); 65,450 participate in Utz certification; and an estimated 21,200 are certified to the Rainforest Alliance standard (SAN, 2014). 4C certification was introduced in Uganda in the year 2008 but being a sector-wide voluntary standard initiated by the coffee companies themselves, it is difficult to estimate the number of producers currently involved. Certified coffee production is currently estimated to be 3% of total coffee exports and continues to expand. In its National Export Strategy (NES), Uganda states to aim to further increase production of *sustainable coffees* to boost export earnings (ITC, 2012).

2.2 Study area

We study the implications of coffee certification for smallholder producers in the Mount Elgon region in Eastern Uganda, a main coffee producing area in the country (figure 2). The region includes eight districts; ranges in altitude between 1,100 and 1,800 metres above sea level; and has a bi-modal rainfall pattern and reasonably fertile soils. The region faces increasing population pressure and land degradation, including problems of soil erosion and increased occurrence of landslides (Claessens et al., 2007; Knapen et al., 2006; Kitutu et al., 2011). The region is dominated by two ethnic groups, the Bagisu in the western Bugisu sub-region, and the Sabiny in the eastern Sebei sub-region. Coffee is grown in a garden system, usually inter-cropped with bananas and other food crops. There are four main coffee exporting companies operating in the region: Great Lakes, Kawacom, Kyagalanyi Coffee Limited (KCL) and

Gumutindo Coffee Co-operative Enterprises (GCCE). The latter three are involved in the implementation of coffee certification schemes in the region.

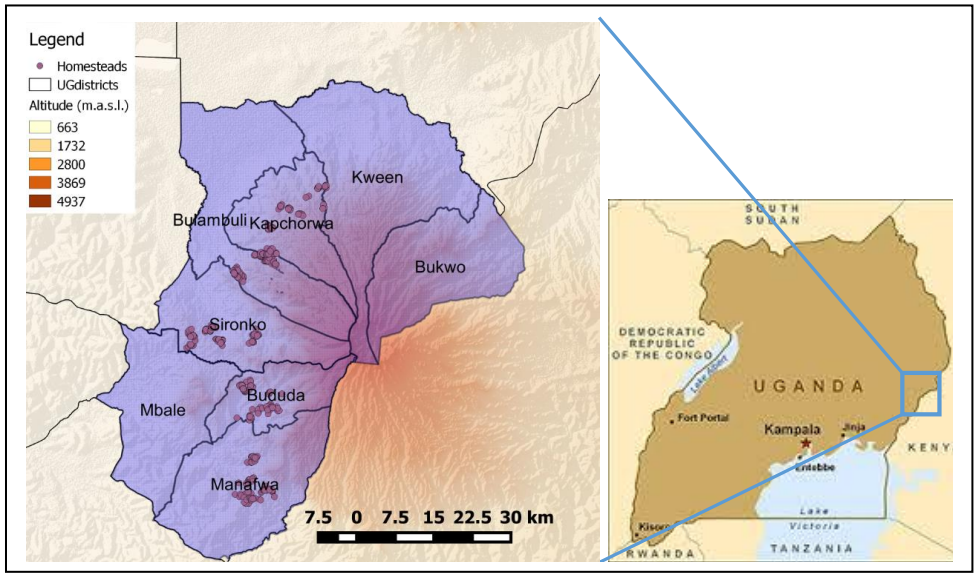

Figure 2: Mount Elgon Region of Eastern Uganda; *Source*: Authors' reconstruction from Uganda GIS database.

Before liberalisation of the coffee sector, production and marketing of coffee in Mount Elgon region was organised by Bugisu Cooperative Union (BCU), a state-controlled cooperative. BCU was one of the largest coffee cooperatives in the country with over 200 Growers' Cooperative Societies (GCSs) and about 467,000 members. It was one of the first cooperatives in Uganda to become Fairtrade certified in 1995. When liberalisation and privatization processes increased competition in the sector, BCU started to face problems. Limited entrepreneurship, failure to fulfil its obligations of delivering high quality Fair-trade coffee to Twin trading UK, and mismanagement of the Fair-trade social premium ultimately resulted in the collapse of BCU in 1997. A new cooperative association was founded on the remains of BCU: the four best performing cooperative societies were grouped into the Gumutindo Coffee Cooperative Enterprise (GCCE). Since its founding in 2000, GCCE is implementing a double Fairtrade and Organic (FT_Org) certification scheme. GCCE runs a cooperative business model, through a network of cooperative societies across the region. GCCE provides coffee specific extension services to its members and does not allow the use of chemical inputs. Registered cooperative societies provide fully washed Arabica coffee to the GCCE unit in Mbale town, with the cooperative societies being responsible for transporting coffee to Mbale. Farmers usually home process their coffee and deliver fully washed Arabica coffee to the cooperative society.

Kyagalanyi Coffee Limited (KCL) is the oldest private coffee export company in Uganda, founded in 1992 when the coffee sector was just liberalised. In Mount Elgon region, KCL implements a triple Utz, Rainforest Alliance (RA) and 4C coffee certification program (Utz_RA_4C) since 2006.

KCL's business model is centred around the company's coffee washing stations and contract-farming with producer organisations. Currently, KCL has six washing stations in the Mount Elgon region; all established close to rivers in order to guarantee access to water for coffee washing. The company selects interested farmers within a 12.5 km radius from the washing stations and organises farmers into Producer Organisations (POs) per village. The company provides coffee specific extension services, agro-chemicals and protective gear, and facilities for cleaning protective gear and disposal of used chemical containers. KCL offers cash advances to farmers for timely purchase of good quality inputs and deducts these from producers' coffee revenue at the time of buying the cherries. Farmers mainly deliver fresh coffee cherries. KCL provides transport for collecting the coffee cherries from the POs, and the coffee cherries are processed at the washing stations.

Also independent coffee farmers and cooperatives operate in the Mount Elgon region. They sell coffee to traders and agents from the four companies through spot market transactions, without any contractual arrangements. They market their coffee individually or through independent coffee cooperatives or producer organisations. Independent farmers sell fresh coffee cherries, dried coffee (*kiboko*) or fully washed coffee. Drying and washing is done through home-processing. Most of these independent farmers do not receive coffee specific extension services, except for ad hoc trainings from Non-Governmental Organisations (NGOs), the National Agricultural Advisory Services (NAADS), or regional UCDA officers.

2.3 Data collection

We use original cross-sectional household survey data from the Mount Elgon region, collected between February and May 2014. A multi-stage stratified random sampling design was used to sample smallholder coffee producers. In the first stage, the five most intensive coffee growing districts were purposively selected out of the seven rural districts in the Mount Elgon region (table 1). In the second stage, four sub-counties were selected in each district. This happened in a stratified random way with the different certification schemes as strata, and resulted in the selection of one sub-county with FT_Org producers, one with Utz_RA_4C producers and two with non-certified producers. In the third and final stage, we randomly selected three villages and 30 coffee farmers in each sub-county – in the case of smaller, four villages were selected or a reduced number of farmers was selected.

The sampling frame was developed using company databases of certified producers and village Local Council (LC) lists of coffee producers. It includes 3,199 FT_Org certified coffee producers organised in 6 cooperative societies and supplying to GCCE; 5,331 Utz_RA_4C certified coffee producers organised in 198 producer organisations and supplying to six KCL washing stations; and approximately 22,097 non-certified producers in the selected sub-counties. The final sample includes 600 households from 63 villages in 20 sub-counties and five districts, of which 170 are FT_Org certified, 130 are Utz_RA_4C certified and 300 are not certified (table 1). We obtained information on whether

or not coffee farms and individual coffee plots are certified from the survey data. We then cross-checked this information against the companies' producer database, as well as the supply contracts signed between producers and the companies. This was needed because in interviews with farmers, many of them were not aware of the exact scheme they are certified to.

Table 1: Sampling Design

District	Sub-county	Certification	Farm households	Sample
Bududa	Bududa	Utz_RA_4C	2,597	30
	Bumayoka	FT_Org	701	30
	Bukigai	none	2,000	30
	Bushiika	none	2,600	30
Bulambuli	Masiira	Utz_RA_4C	1,215	30
	Namisuni	FT_Org	359	30
	Sisiyi	none	2,480	30
	Bukibologoto/Simu	none	1,380	30
Kapchorwa	Gamogo	Utz_RA_4C	985	40
	Sipi	FT_Org	268	20
	Kaptanya	none	2,400	30
	Tegres	none	2,950	30
Manafwa	Bumbo	FT_Org	320	30
	Magale	FT_Org	262	30
	Bupoto	none	2,320	30
	Buwabwala	none	1,440	30
Sironko	Busulani	Utz_RA_4C	1,251	30
	Buwalasi	FT_Org	1,289	30
	Buyobo	none	2,100	30
	Buwasa	none	1,710	30
Total	**20**		**30,627**	**600**

Source: Authors' derivation from administrative data, company databases and village Local Council lists.

A quantitative structured questionnaire was used, comprising modules on: i) household socio-demographic characteristics; ii) land ownership, land use and landslide risk; iii) coffee production and marketing; iv) other crop production and marketing; v) agricultural training, extension and knowledge; vi) livestock and animal production; vii) off-farm activities and other income; viii) forest and farm household interaction; ix) household assets and living conditions; x) social capital; and xi) attitude towards risk. The survey was implemented face-to-face by a team of trained enumerators. The survey data include detailed information on coffee production, marketing and income, and on general household characteristics and overall income. GPS coordinates of the homestead and all coffee plots were recorded during the survey and available GIS data on the Mount Elgon region was used to derive location-specific indicators. Household survey data were complemented with a village survey in all 63 sampled villages, which was implemented using a structured questionnaire in a face-to-face interview with a small group of village leaders. In addition, semi-structured interviews were carried out with 45 stakeholders in the coffee sector, including coffee exporters, processors, traders, co-operative marketing managers and service providers in the coffee sector.

3. Methods

To analyse the impact of the two coffee certification schemes in the Mount Elgon region, we estimate regression models of the following type:

$$Y_i = \alpha_0 + \beta X_i + \gamma C_i + \varepsilon_i \quad (1)$$

The dependent variable Y_i, measures the welfare outcome of household *i*. To create insights on the channels through which certification affects coffee farmers, we estimate multiple models for the following outcome indicators: 1/ *poverty*, measured as having a per capita household income below the international poverty line[3]; 2/ *coffee income*, measured as the natural logarithm of net coffee income in Ush for the last 12 months; 3/ *coffee production*, measured as the quantity of coffee harvested in kg during the last 12 months; 4/ *coffee yield*, measured as quantity of coffee harvested in kg per hectare; and 5/ *labour productivity*, measured as the net coffee income per person-day of family labour in coffee production, processing and marketing in Ush/man-day. The main explanatory variables of interest are included in $C_{i,}$, a vector of dummy variables for participation in the Utz_RA_4C and FT_Org coffee certification schemes, respectively. These binary variables are mutually exclusive as no producer is contracting with GCCE and KCL at the same time and certification schemes are implemented in different sub-counties.

In a first set of regressions we use a probit model estimation for the binary poverty outcome indicator, and OLS estimations for the other continuous outcome indicators. To control for possible selection bias from observed heterogeneity, we include a large set of observable household and location characteristics in the vector X_i. Household characteristics include indicators of human and physical capital: the education level, gender and age of the household head, the number of adults and the number of children in the household, livestock ownership measured in tropical livestock units, and the coffee area and its square – the latter are replaced with the total farm size and its square for the regression on poverty as outcome indicator. Location variables include the distances between the homestead and the forest margin, the nearest river, the nearest road and Mbale town. The first two distance variables capture differences in agro-ecological and land quality conditions while the latter two variables capture differences in transaction costs for accessing input and output markets. Distance variables are derived from GPS data collected during the survey and available GIS data for the Mount Elgon region.

In a second set of regressions we use instrumental variable models (IV) - IV probit models for the binary poverty outcome indicator and 2SLS estimation for the other continuous outcome indicators:

$$Y_i = \alpha_0 + \beta X_i + \gamma \hat{C}_i + u_i \quad (2)$$

$$\hat{C}_i = \pi_0 + \pi_1 Z_i + \pi_2 X_i + v_i \quad (3)$$

[3] The World Bank International poverty line of $3.10/day (in 2011 PPP prices) is used; this is equivalent to Ush 3,473.80 /day in 2014 price levels (World Bank, 2015).

With IV models we can reduce bias from unobserved heterogeneity emerging from unobserved factors such as farmer motivation and experience being correlated with the certification variables of interest (C_i). As instruments Z_i in the first stage equation, we use the following variables: 1/ years of experience of the farm-household in BCU; 2/ distance between the homestead and the nearest KCL washing station; and 3/ the square of the distance between the homestead and the nearest KCL washing station. These are relevant instruments. Many farmers had bad experience with BCU before its collapse in 1997 and these farmers are less likely to engage in coffee cooperatives and contracting again. The correlation between the first instrument, years of experience with BCU, is negative and significant at the 1% level for both certification variables, with correlation coefficients of -0.16 for FT_Org and -0.22 for Utz_RA_4C certification. Given the business model of KCL and their practices of sourcing coffee from within a certain radius from their washing stations, farmers located closer to the washing stations are more likely to engage in supplying KCL under the Utz_RA_4C certification scheme while farmers located further from the washing station are more likely to engage in supplying GCCE under the FT_Org certification scheme. Certification to the FT_Org scheme is significantly (at the 1% level) positively correlated with the instruments distance to the washing station and the squared distance – with correlation coefficients of 0.26 and 0.33 – while for Utz_RA_4C certification the correlation is significantly (at the 1% level) negative with correlation coefficients of -0.54 and -0.41. The instruments are plausibly exogenous or only weakly correlated with the error term. The distance to the KCL washing station (and the squared distance) is exogenous to farm-household decision-making. KCL locates its washing stations close to rivers for easy access to water and given that we control for distance to the nearest river in our regression analysis, distance to the washing station can be considered exogenous. The years of experience with BCU before its collapse in 1997, is likely not or only weakly correlated with unobserved factors that determine the outcome indicators because of the time period of more than 15 years. Given the high correlation between the instruments and the instrumented certification variables, potential endogeneity bias is likely reduced in the IV models, even if the instruments are not completely exogenous. We further test the validity of our instrumental variable approach with an F-test for joint significance of the excluded instruments; a Sanderson-Windmeijer Chi2 test and Kleibergen-Paap LM test for under-identification; a Kleibergen-Paap F-test for weak identification; and a Sargan-Hansen test for over-identification restrictions. We also perform an Anderson-Rubin test for endogeneity of the certification variables.

4. Results

4.1 Comparison of certified and non-certified households

In table 2, we present summary statistics for household and location characteristics. We compare respectively Utz_RA_4C and FT_Org certified farm-households with non-certified households. The average age of household heads in the region is 50 years; the average years of education is 8.14; 11% of households are female-headed; and the average household size is 4.3 adults and 4.1 children. The

statistics indicate that FT_Org and Utz_RA_4C certified households have a slightly lower level of education of the household head, and that FT_Org certified households are slightly older with a higher probability to be female-headed.

Despite the slight difference in age, there is no difference in household composition between certified and non-certified households. Farm sizes in the region are small; on average 1.05 ha per household of which 0.6 ha is used for coffee cultivation. While there is no difference in total farm size or livestock ownership between certified and non-certified households, Utz_RA_4C certified households do have a significantly larger coffee area. The distance to Mbale town is on average around 27 km for all types of households but Utz_RA_4C certified households are located closer to the forest margin, closer to rivers, further away from roads, and closer to KCL washing stations. FT_Org certified farmers are located further away from the KCL washing stations. Both Utz_RA_4C and FT_Org certified households have less experience with BCU than non-certified households.

Table 2: Characteristics of certified and non-certified households

	Total sample	**Non-certified households**	**Utz_RA_4C certified households**	**FT_Org certified households**
Sample size	600	300	130	170
Human capital				
Education of head (years)	8.14 *(6.23)*	8.97 *(7.05)*	6.95 *(0.40)* **	7.59 *(0.43)* **
Female head (dummy)	0.11 *(0.01)*	0.06 *(0.01)*	0.08 *(0.02)*	0.22 *(0.03)* ***
Age of head (years)	50.3 *(0.65)*	49.6 *(0.89)*	48.1 *(1.36)*	53.3 *(1.22)* ***
Number of adults	4.32 *(0.10)*	4.33 *(0.14)*	4.12 *(0.23)*	4.46 *(0.18)*
Number of children	4.16 *(0.12)*	4.29 *(0.16)*	4.05 *(0.24)*	4.03 *(0.23)*
Physical assets				
Total area cultivated (ha)	1.05 *(0.05)*	1.00 *(0.07)*	1.18 *(0.10)*	1.06 *(0.08)*
Coffee area (ha)	0.60 *(0.02)*	0.56 *(0.03)*	0.67 *(0.04)* **	0.62 *(0.05)*
Livestock units (TLU)	2.10 *(0.09)*	2.15 *(0.14)*	1.94 *(0.17)*	2.17 *(0.17)*
Location				
Distance to forest (km)	4.27 *(0.10)*	4.81 *(0.13)*	2.56 *(0.15)* ***	4.61 *(0.20)*
Distance to river (km)	1.55 *(0.05)*	1.69 *(0.05)*	0.92 *(0.07)* ***	1.79 *(0.11)*
Distance to road (km)	2.47 *(0.07)*	2.23 *(0.10)*	3.60 *(0.15)* ***	2.03 *(0.10)*
Distance to Mbale (km)	27.0 *(0.38)*	26.6 *(0.63)*	27.8 *(0.57)*	27.0 *(0.63)*
Distance to washing station (km)	7.59 *(0.23)*	8.77 *(0.24)*	1.70 *(0.15)* ***	10.0 *(0.53)* **
Experience				
BCU experience (years)	7.03 *(0.42)*	10.47 *(0.59)*	2.75 *(0.74)* ***	4.30 *(0.73)* ***

Source: Authors' calculation from survey data.

Notes: Standard error in parentheses. Significant differences in means between each certification category and the non-certified control households are indicated with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 3 depicts the incidence of poverty, the average household income and the average coffee income and compares this across certified and non-certified households. In general, we observe a very high incidence of poverty in the research area, with 64% of households under the international poverty line.

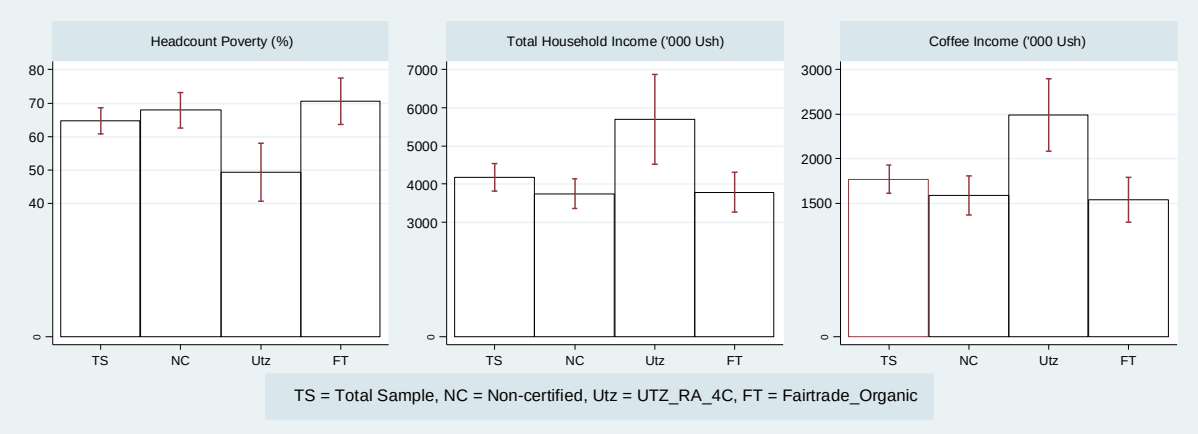

Figure 3 : Household income and poverty mean comparison; Error bars at 95% confidence interval; *Source*: Authors' calculation from survey data.

Average household income is low, at around 4 million Ush, and a main part of the income, around 1.8 million Ush, comes from coffee cultivation. Among the Utz_RA_4C certified households, there is a lower incidence of poverty (around 50%) and total household income, as well as coffee income are substantially higher (around 50% to 60% higher) than for non-certified and FT_Org certified households.

In table 3, we present summary statistics related to coffee production and compare certified with non-certified households. The area planted with coffee is on average 0.6 ha, which comes down to 57% of the average farm size. The coffee area is slightly larger for Utz_RA_4C certified households (0.67 ha) than for non-certified households (0.56 ha) while there is no difference in coffee area between FT_Org certified and non-certified households. FT_Org certified households use on average significantly less inputs (75 thousand Ush/ha) but more labour (360 person-days) in coffee production than non-certified households (315 thousand Ush/ha and 274 person-days). Utz_RA_4C certified household use significantly less labour in coffee production (198 person-days on average). In general, coffee farmers in the research area have an average coffee output of 2,300 kg fresh cherries, an average coffee yield of 4,000 kg fresh coffee cherries per ha (equalling about 960 kg of green coffee per ha) and a labour productivity in coffee production of 8,250 Ush per person-day. There are large differences across farmers. Utz_RA_4C certified farmers have the highest coffee output, yield and labour productivity; coffee output is 57% higher than for non-certified farmers, coffee yield 31% higher and return to labour 120% higher. On the contrary, FT_Org certified farmers have lower yields and labour productivity; coffee yield is 20% lower than for non-certified farmers and return to labour 24% lower. The coffee yield of FT_Org farmers of 3,179 kg/ha is slightly above the national average of about 2,550 kg/ha; the yield of Utz_RA_4C farmers of 5,200 kg/ha is more than the double the national average yield but is still only half the potential coffee yield of 13,000 kg/ha measured in Ugandan on-station trials.

Table 3: Comparison of coffee production and performance indicators across certified and non-certified producers

Variable	Total sample	Non-certified households	Utz_RA_4C certified households		FT_Org certified households	
Sample size	600	300	130		170	
Area with coffee (ha)	0.60	0.56	0.67	**	0.62	
	(0.02)	*(0.03)*	*(0.04)*		*(0.04)*	
Input costs/ha (Ush/ha)	259,892.1	315,541.1	372,038.7		75,227.48	***
	(20193.18)	*(28382.47)*	*(60619.93)*		*(12869.53)*	
Family labour/ha	790.44	882.38	566.49	***	800.64	
	(33.55)	*(50.16)*	*(72.11)*		*(54.11)*	
Coffee production (Kg)	2,336.40	2,146.11	3,366.86	***	1,891.95	
	(87.55)	*(118.57)*	*(227.28)*		*(125.38)*	
Yield (Kg/ha)	4,008.98	3,964.66	5,199.86	***	3,178.60	***
	(43.53)	*(43.16)*	*(78.26)*		*(61.9)*	
Coffee labour productivity (Ush/person-day)	8,249.04	6,887.93	15,317.62	***	5,251.78	*
	(468.07)	*(603.76)*	*(1381.17)*		*(444.88)*	
Price fresh cherries (Ush/Kg)	842.75	857.78	821.05	*	n.a.	
	(10.25)	*(18.31)*	*(9.88)*		*n.a.*	
Price dried cherries (Ush/Kg)	3,105.32	3,092.82	n.a.		n.a.	
	(14.10)	*(14.74)*	*n.a.*		*n.a.*	
Price fully washed (Ush/Kg)	4,244.21	3,947.17	n.a.		4,364.06	***
	(37.57)	*(42.18)*	*n.a.*		*(49.01)*	

Source: Authors' calculation from survey data.

Notes: Standard errors in parentheses. Significant differences in means for each certification category and the control are indicated by; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; n.a. = data for coffee prices is not available because farmers do not or hardly sell coffee in this form.

Coffee prices are difficult to compare as farmers sell coffee as fresh cherries, home-dried cherries or home-processed fully washed coffee. Utz_RA_4C certified farmers mainly sell fresh cherries to the washing stations of KCL; FT_Org certified farmers mainly sell fully washed coffee to the GCCE unit in Mbale; and non-certified farmers sell fresh, dried and/or washed coffee. The price for fresh cherries that Utz_RA_4C certified farmers receive is somewhat (4.2%) lower than the price non-certified farmers receive for fresh cherries; while the price for washed coffee that FT_Org farmers receive is substantially (10 %) higher than the price non-certified farmers receive for washed coffee.

4.2 Econometric results

In table 4, we present a summary of the main estimated effects of Utz_RA_4C and FT_Org certification on the different outcome indicators from probit, OLS and IV estimations. The full regression results are given in tables A1 (first stage results), A2 (probit and OLS results) and A3 (IV results) in annex. Before examining the main results, we first shortly discuss the relevance and validity of the instruments. For both certification variables, the instruments are jointly significant in the first stage regressions and the Sanderson-Windmeijer tests reject the null-hypotheses of under-identification (Table A1). In addition, based on the Kleibergen-Paap LM test we can reject overall under-identification of the model, and the Kleibergen-Paap test for weak identification reveals a Wald F statistic of 37.9, which is above the 10% Stock-Yogo critical value of 13.43 (Table A1). Moreover, all IV regressions except for the IV regression

on coffee yield, pass the Sargan-Hansen test for over-identification restrictions (Table A3). The tests show that the instruments are relevant and plausibly exogenous; only in the case of coffee yield, weak correlation with the error term persists and bias remains in IV results. For most outcome indicators, the Anderson-Rubin test rejects the null hypotheses of certification being exogenous (Table A3), which justifies the use of IV estimations.

Table 4: Summary of estimated effects of certification

	Utz_RA_4C certification		FT_Org certification	
	Probit & OLS	**IV & IVprobit**	**Probit & OLS**	**IV & IVprobit**
Poverty	-0.16 ***	-0.07	0.04	0.21
	(0.06)	*(0.28)*	*(0.05)*	*(0.36)*
Coffee Income (ln)	0.57 **	0.94 *	0.03	-0.42
	(0.25)	*(0.56)*	*(0.24)*	*(0.36)*
Coffee Production (kg)	967 ***	1,038 ***	-410.4 ***	-1,102 ***
	(102.5)	*(124.5)*	*(62.23)*	*(155.5)*
Coffee Yield (kg/ha)	1,427 ***	1,834 ***	-672.8 ***	-1,818 ***
	(85.43)	*(161.3)*	*(65.65)*	*(203.6)*
Coffee labour productivity	8,439 ***	9,698 ***	-2,166 ***	-4,258 **
(Ush/person-day)	*(1,134)*	*(1,379)*	*(596.1)*	*(1,712)*

Source: Authors' estimation from survey data

Notes: Standard errors in parentheses; Headcount poverty based on WB poverty line = $3.10/day (ppp 2011), in 2014 = Ush 3473.80/day; For poverty, marginal effects are reported.

Our results indicate that neither the Utz_RA_4C coffee certification scheme nor the FT_Org scheme is reducing poverty in the research area. While the coefficient for Utz_RA_4C is significantly negative in the probit regression, the coefficient becomes very small and insignificant in the IV probit regression. Given that our instruments are strong and that exogeneity of the certification variables is rejected, the IV probit estimates likely result in the smallest bias and we need to conclude that Utz_RA_4C does not reduce poverty. For FT_Org certification, neither the probit nor the IV probit coefficient estimates are significant. The observed differences in estimated coefficients between the probit and IV probit models can be explained by selection of less poor households in the certification schemes.

We do find effects of the certification schemes on producers' coffee income. For the Utz_RA_4C scheme we find a positive effect on coffee income. The estimated coefficient in the OLS model is 0.57 and significant at the 5% level while the estimated coefficient in the IV model is 0.94 and significant at the 10% level, which is consistent with the IV estimate being less biased but also less efficient. We can conclude that participation in the Utz_RA_4C coffee scheme increases farmers' coffee income between 57 and 94%. For the FT_Org scheme we find no effect on coffee income: the estimated coefficient is positive but small and insignificant in the OLS model, and negative and stronger in magnitude but still insignificant in the IV model.

We can conclude that participation in the FT_Org coffee scheme does not increase farmers' coffee income.

We find positive effects of participation in the Utz_RA_4C scheme on coffee yield, total coffee production and labour productivity but negative effects for the FT_Org scheme. These effects are all significant at the 1% or 5% level and largely consistent across the OLS and IV models, with the magnitude of the estimated coefficients being larger in the IV models. For all three outcome indicators, we need to reject the null hypothesis that the certification variables are exogenous; which leads to favouring the IV estimates over the OLS estimates. We need to note that for the estimates on coffee yield, the instruments pass the weak identification test (at the 10% level) but not the over-identification restrictions, which implies that bias in the IV estimates remains but is likely smaller than in the OLS estimates. For the estimates on total coffee production and labour productivity, we can accept over-identification and validity of the instruments at the 1% level. Relying on the IV estimates, we find that participation in the Utz_RA_4C scheme increases coffee yield with 1.8 ton per ha, total coffee output with 1 ton, and labour productivity in coffee production with 9.7 thousand Ush per man-day. Participation in the FT_Org scheme decreases coffee yield with 1.8 ton per ha, total coffee output with 1.1 ton, and labour productivity with about 4.2 thousand Ush per person-day.

5. Discussion

Our results show that smallholder participation in the Utz_RA_4C coffee certification scheme increases smallholder coffee income. This income effect mainly comes from an increase in land and labour productivity and not from a price effect. Yet, the increase in coffee income is not strong enough to result in significant poverty reduction. In addition, our results show that smallholder participation in the FT_Org coffee certification scheme does not increase producers' income, neither does it reduce poverty. While FT_Org certified producers do receive higher prices for the supplied coffee, the certificate results in lower land and labour productivity and higher prices do not compensate for this. The results imply that 14 and eight years after the introduction of FT_Org and Utz_RA_4C coffee certification schemes, respectively, the schemes fail to reduce poverty in the Mount Elgon region.

The results show that the two certification schemes differ substantially in the impact on smallholder producers. While the Utz_RA_4C scheme contributes to higher yields, labour productivity and coffee incomes, the FT_Org scheme results in lower yields and labour productivity. These differences in findings between the two certification schemes are likely

related to the different coffee production systems the two schemes promote. KCL promotes an intensive coffee production system with a balanced use of organic-inorganic fertilizer combination and different species of shade trees. The company has set up an extension system with company extension agents on motorcycles travelling regularly to all villages in the scheme to give advice over production and management practices to Utz_RA_4C certified farmers. The company provides inputs on credit to farmers and pays farmers cash at time of delivery of the coffee to the washing station and a bonus at the end of the season. For the 2013/2014 season farmers received a bonus of 35 Ush/kg. It is likely the combination of a well-organized contract-farming scheme with extension services, input delivery and timely payments to farmers on the one hand, and the requirements on good agricultural practices and environmental sustainability in the three certificates on the other, that explain the superior impact of the Utz_RA_4C certification scheme on land and labour productivity. GCCE promotes an organic production system that prohibits the use of inorganic fertilizers and pesticides. The scheme includes extension services to members and supports a farmer-to-farmer input sharing system. However, farmers in the GCCE scheme indicate that shortage of organic fertilizer is one of the main constraints for productivity growth; and that access to manure from their own livestock is insufficient while market for manure hardly exists and sharing with other farmers is rarely practiced. Farmers are paid a fixed price which varies according to the quality of their coffee, after the GCS has delivered the coffee to CCCE, and not at time of delivery to the GCS. Farmers receive a bonus per kg of supplied coffee at the end of the season when coffee prices are good, but for the 2013/2014 season FT_Org farmers reported not to have received a bonus. Our results suggest that in the Mount Elgon region, where coffee yields are far below their potential, where soils are increasingly depleted and where access to manure and organic fertilizer is insufficient, an organic production system further reduces yields and results in low labour productivity – and that a price premium of 10% cannot compensate for these productivity losses and improve farmers' income.

Our results are to some extent in line with other studies on the implications of coffee certification for smallholder producers. We find that participation in a double FT_Org certification scheme is associated with higher prices, lower yields and reduced labour productivity, and does not lead to higher incomes or poverty reduction. Other studies have also indicated a lack of impact of FT, Org and double FT_Org certification for smallholder producers. For smallholder coffee producers in Nicaragua, Bacon et al. (2008), Ruben and Zuniga (2011), Valkila and Nygren (2010), and Valkila (2009) conclude that Fairtrade

certification results in higher prices but does not improve yields, poverty and living conditions; and Beuchelt and Zeller (2011) indicate that both Organic and double Fairtrade-organic certification have no impact on farm profits and poverty. For other countries in Latin-America, Ruben and Fort (2012) indicate that Fairtrade certification has no substantial impact on income and productivity for Peruvian coffee farmers; and Mendez et al. (2010) conclude, based on a cross-country analysis, that Fairtrade, Organic and double Fairtrade-Organic certification increase coffee prices but have no effect on poverty and living conditions. For smallholder coffee farmers in Ethiopia, Jena et al. (2012) and Mitiku et al. (2015) find no substantial impact of Fairtrade certification on farm income and poverty, and a negative effect of Organic certification on yields and coffee incomes. For India, Jena and Grote (2016) find that Fairtrade certification increases the income of coffee farmers somewhat but not enough to reduce poverty substantially. Our result are in line with these findings from other countries, and indicate that the price premium in Fairtrade-organic certification is not enough to ensure substantial welfare effects, especially when certification reduces productivity.

We find that participation in the triple Utz_RA_4C certification scheme results in higher yields, higher labour productivity and higher coffee incomes but that these effects are not strong enough to result in substantial poverty reduction. Very few other studies have estimated the economic impact of these type of coffee standards. Ruben and Zuniga (2011) come to very similar findings for Rainforest Alliance (RA) certification among coffee farmers in Nicaragua and conclude that RA outperforms Fairtrade certification because of strong positive yield effects. Mitiku et al. (2015) show that RA certification in Ethiopia increases farm incomes and reduces poverty. However, in their study the superior impact of RA certification mainly comes from a large price effect, while we find that RA improves farmers' coffee income especially through a positive yield effect.

Our results differ substantially from the findings of Chiputwa et al. (2015) who compare similar certification schemes (Utz, double Utz_FT, and double Utz_Org) in Central Uganda, another main coffee producing area in Uganda. They find that Utz_FT certification increases household per capita expenditures and reduces poverty while single Utz and double Utz_Org certification have no impact. This is in contrast with our findings from Eastern Uganda that no certification scheme contributes to poverty reduction, and that Utz_RA_4C certification has a positive impact on yields, labour productivity and coffee income while FT_Org has a negative impact. We put forward possible interpretations of these differences in findings. First, differences in the organisation and structure of the supply chains could contribute to explaining

the observed heterogeneity in effects. Coffee can be sold in different forms at different stages of processing and value-adding. In our sample, FT_Org farmers sell washed green coffee and Utz_RA_4C farmers sell fresh cherries while in the sample of Chiputwa et al (2015) Utz_FT farmers sell milled coffee and Utz and Utz_Org farmers sell fresh cherries. In addition, contract conditions vary. In our sample both certification schemes entail exclusive contracts that do not allow side-selling while Chiputwa et al. (2015) indicate Utz_FT farmers in their sample to have non-exclusive agreements with the coffee company that allow selling to other buyers. In our sample no bonus was paid at the end of the season to FT_Org farmers while Chiputwa et al (2015) indicate Utz_FT farmer to have received a Fairtrade bonus. Adding value through milling, being allowed to look for the highest bidder, and effectively receiving a Fairtrade bonus at the end of the coffee season may increase the return to farmers. Second, the combined results of our study and the study by Chiputwa et al. (2015) may imply that in Uganda, where coffee yields are rather low, FT certification is better for smallholder coffee farmers when combined with Utz certification than when combined with Org certification. Both studies indicate that FT certification results in higher prices, but the combination with Org in our analysis results in lower yields while the combination with Utz in the analysis by Chiputwa et al. (2015) results in better incomes and reduced poverty.

More generally, heterogeneity in the performance of cooperatives and contract-farming schemes importantly drives the results in our analysis – and in other available studies on the impact of coffee certification. In most studies, including our own study, the number of sampled certification schemes is very limited, which makes it impossible to completely disentangle the impact of certification and the impact of membership in a specific cooperative or participation in a specific contract-farming scheme. To better take into account cooperative and contract heterogeneity, and better distinguish the impact of certification, one would need a larger and more varied sample of farmers, including farmers certified to the same standard in different contract and cooperative schemes.

6. Conclusion

In this paper we analyse the implications of two coffee certification schemes, a double Fairtrade -Organic certification scheme and a triple Utz - Rainforest Alliance - 4C certification scheme, for smallholder farmers in Eastern Uganda. Our results show that smallholder participation in the former certification scheme neither increases producer income, nor reduces poverty. While certified producers do receive higher coffee prices, the certificate results in lower land and

labour productivity and the price premium does not compensate for this. For the latter scheme, we find that smallholder participation increases coffee income, as well as land and labour productivity in coffee production. Yet, the increase in coffee income is not strong enough to result in significant poverty reduction. The results imply that 14 and 8 years after the introduction of Fairtrade - Organic and Utz - Rainforest Alliance - 4C coffee certification schemes respectively, the schemes have failed to reduce poverty in the Mount Elgon – a region that is faced with a high incidence and persistence of poverty.

Our results, along with previous findings in the literature, strongly indicate that a price premium to producers is neither necessary, nor sufficient, for private sustainability standards to contribute to increasing rural incomes and reducing poverty. We find that a price premium of 10% in the FT_Org certification scheme cannot offset a detrimental impact on yield while a yield increase of about 45% in the Utz_RA_4C certification scheme results in higher coffee incomes, even without a price premium. Our findings corroborate the conclusions of Barham and Weber (2012), based on evidence from Mexico and Peru, that yields are more important than prices in increasing net returns to coffee farmers; and of Valkila (2009) that low yields and low intensity agriculture, promoted by standards, can trap people in poverty. From the interpretation of our results and the comparison with results from Chiputwa et al. (2015), we put forward that in areas with degraded soils and low average yields, FT certification focusing on fair producer prices, might be better for smallholder coffee farmers when combined with standards that focus on good agricultural practices and productivity growth, such as Utz, than when combined with Organic standards. It is an increasingly popular practice to combine FT and organic certification but this practice is driven by consumer demand and is less evident from a producer perspective because yield effects are more important than price effects in creating gains for smallholder producers (Barham and Weber, 2012; Vlaeminck et al., 2015).

Our results imply that private sustainability standards may not always live up to the expectations they create concerning poverty reduction and improving the welfare of smallholder farmers. In our study, this is most obvious for the double Fairtrade-Organic certification that does not create income benefits for farmers and does not contribute to poverty reduction while the Fairtrade standard claims to *offer consumers a powerful way to reduce poverty through their everyday shopping* (Fairtrade International, 2015). Other studies have come to similar conclusions on the lack of a substantial impact of private sustainability standards in the coffee sector in various countries. This puts doubt on the sincerity of private

sustainability standards and the justification of the price premium consumers pay for certified products.

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Annex

Table A1: First stage regression results on the likelihood of certification

	Utz_RA_4C		FT_Org	
Included variables				
Education of head	-0.0036	**	0.0007	
	(0.0018)		*(0.0030)*	
Female head	-0.0300		0.1560	**
	(0.0364)		*(0.0641)*	
Age of head	-0.0010		0.0037	
	(0.0036)		*(0.0079)*	
Age of head ^{2}	0.0000		-0.0000	
	(0.0000)		*(0.0001)*	
Number of adults	-0.0019		0.0096	
	(0.0078)		*(0.0119)*	
Number of children	-0.0042		-0.0053	
	(0.0063)		*(0.0091)*	
Coffee area	0.0236		0.0797	
	(0.0378)		*(0.0522)*	
Coffee area ^{2}	-0.0106		-0.0147	
	(0.0075)		*(0.0127)*	
Livestock units	0.0071		-0.0036	
	(0.0048)		*(0.0060)*	
Distance to forest	-0.0017		0.0094	
	(0.0064)		*(0.0086)*	
Distance to river	0.0628	***	-0.0263	
	(0.0131)		*(0.0204)*	
Distance to road	0.0262	***	-0.0337***	
	(0.0070)		*(0.0094)*	
Distance to Mbale	0.0014		-0.0037	
	(0.0015)		*(0.0025)*	
Excluded instruments				
Distance to washing station	-0.1704	***	-0.0693	***
	(0.0097)		*(0.0119)*	
Distance to washing station ^{2}	0.0069	***	0.0049	***
	(0.0004)		*(0.0006)*	
BCU experience	-0.0008		-0.0084	***
	(0.0014)		*(0.0020)*	
Constant	0.7589	***	0.3772	*
	(0.1162)		*(0.2135)*	
N-observations	596		596	
F-test for excluded instruments	143.84		63.88	
p-value	0.0000		0.0000	
SW Chi^2 statistic	223.52		133.22	
p-value	0.0000		0.0000	

Notes: Standard errors in parentheses; Significant effects indicated with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; SW Chi^2 statistic = Chi-square statistic for the Sanderson-Windmeijer test for under-identification; The Kleibergen-Paap test for overall under-identification reveals an LM test statistic of 61.03 and a p-value of 0.00; The Kleibergen-Paap test for weak identification reveals a Wald F statistic of 37.9, which is above the 10% Stock-Yogo critical value of 13.43.

Table A2: Results of probit and OLS estimations on different outcome indicators

	Poverty		Coffee Income (ln)		Coffee production		Coffee yield		Labour productivity	
Utz_RA_4C	-0.164	***	0.568	**	967.0	***	1,426.8	***	8,439.3	***
	(0.060)		*(0.250)*		*(102.5)*		*(85.4)*		*(1133)*	
FT_Org	0.036		0.0318		-410.38	***	-672.79	***	-2,170	***
	(0.052)		*(0.24)*		*(62.23)*		*(65.64)*		*(596.1)*	
Education of head	-0.0056		0.0006		2.78		-1.14		16.9	
	(0.0035)		*(0.017)*		*(4.86)*		*(4.76)*		*(52.6)*	
Female head	0.043		-0.149		-195.6		-260.2**	**	958.7	
	(0.071)		*(0.355)*		*(125.4)*		*(106.5)*		*(1,206.5)*	
Age of head	-0.0073		-0.0093		6.99		10.27		-118.25	
	(0.008)		*(0.023)*		*(10.21)*		*(9.92)*		*(104.09)*	
Age of head^2	0.0001		0.0001		-0.0392		-0.115		1.138	
	(0.0001)		*(0.0002)*		*(0.087)*		*(0.086)*		*(0.966)*	
Number of adults	0.0429	***	0.036		-25.92		-2.46		-597.88	***
	(0.014)		*(0.051)*		*(16.45)*		*(16.58)*		*(211.7)*	
Number of children	0.0272	**	0.0043		23.549		6.961		124.50	
	(0.012)		*(0.0555)*		*(15.14)*		*(14.03)*		*(196.0)*	
Total area	-0.2356	***								
	(0.048)									
Total area^2	0.0236	**								
	(0.009)									
Coffee area			2.951	***	4,278.3	***	-377.28	***	16,800	***
			(0.279)		*(163.59)*		*(100.17)*		*(2,025)*	
Coffee area^2			-0.421	***	-264.39	***	56.23	**	-1,310	
			(0.091)		*(47.91)*		*(27.01)*		*(854.99)*	
Livestock units	-0.047	***	-0.012		-5.32		-11.89		-145.2	
	(0.010)		*(0.034)*		*(10.47)*		*(10.87)*		*(146.58)*	
Distance to forest	0.0056		0.093	*	13.67		29.17	**	666.43	***
	(0.011)		*(0.048)*		*(19.31)*		*(14.33)*		*(180.79)*	
Distance to river	0.018		-0.0046		-12.67		-115.04	***	-22.53	
	(0.022)		*(0.075)*		*(32.72)*		*(24.69)*		*(280.96)*	
Distance to road	-0.004		-0.049		-81.42	***	-109.28	***	-157.38	
	(0.013)		*(0.050)*		*(21.28)*		*(17.30)*		*(214.35)*	
Distance to Mbale	0.010	***	0.009		1.39		10.03	***	26.25	
	(0.003)		*(0.011)*		*(3.52)*		*(3.41)*		*(35.13)*	
Constant			11.54	***	-240.64		4,007	***	-343.23	
			(0.749)		*(316.7)*		*(309.1)*		*(2,927)*	
N-observations	596		596		596		596		596	
Chi^2-stat / F-stat	115.56		29.38		93.60		57.26		12.32	
p-value	0.000		0.000		0.000		0.000		0.000	
Pseudo-R^2 / R^2	0.189		0.213		0.886		0.554		0.526	

Notes: Standard errors in parentheses; Significant effects indicated with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; For poverty a probit estimation is used and marginal effects, a Chi^2 test for joint exclusion of variables and the Mc Fadden Pseudo R^2 are reported; For Coffee income, Coffee production, Coffee yield and Labour productivity an OLS estimation is used and coefficient, an F-test for joint exclusion of variables and the R^2 are reported.

Annex 3: IVPROBIT & 2SLS MODELS: Poverty, Coffee Income, Coffee Production, Coffee Yield and Coffee labour productivity vs household, plot and distance characteristics

	Poverty		Coffee income (ln)		Coffee production		Coffee Yield		Labour productivity	
Utz_RA_4C	-0.066		0.935	*	1037.9	***	1834.3	***	9698.3	***
	(0.277)		*(0.561)*		*(124.5)*		*(161.4)*		*(1379)*	
FT_Org	0.212		-0.418		-1100	***	-1820	***	-4260	**
	(0.357)		*(0.364)*		*(155.5)*		*(203.6)*		*(1712.5)*	
Education of head	-0.014		0.0019		1.97		-0.774		20.61	
	(0.010)		*(0.0171)*		*(5.33)*		*(6.18)*		*(52.80)*	
Female head	0.091		-0.025		-0.572		60.30		1539.9	
	(0.226)		*(0.384)*		*(139.6)*		*(157.4)*		*(1261.3)*	
Age of head	-0.022		-0.0085		8.98		13.12		-113.8	
	(0.024)		*(0.024)*		*(12.42)*		*(14.33*		*(108.8)*	
Age of head^2	0.0002		0.0001		-0.045		-0.119		1.143	
	(0.0002)		*(0.0002)*		*(0.109)*		*(0.127)*		*(0.996)*	
Number of adults	0.117	***	0.038		-21.55		3.99		-587.5	***
	(0.043)		*(0.050)*		*(19.93)*		*(24.27)*		*(212.6)*	
Number of children	0.083	**	0.0076		23.83		10.19		135.3	
	(0.035)		*(0.056)*		*(16.73)*		*(19.11)*		*(193.5)*	
Total area	-0.705	***								
	(0.140)									
Total area^2	0.075	***								
	(0.028)									
Coffee area			2.943	***	4322.6	***	-337.8	***	16800	***
			(0.278)		*(155.2)*		*(112.9)*		*(1980)*	
Coffee area^2			-0.418	***	-274.5	***	47.62	**	-1320	
			(0.093)		*(39.04)*		*(22.87)*		*(819.7691)*	
Livestock units	-0.133	***	-0.015		-7.27		-16.32		-155.5	
	(0.028)		*(0.035)*		*(11.95)*		*(13.66)*		*(149.5)*	
Distance to forest	0.042		0.119	*	21.40		60.92	***	758.1	***
	(0.036)		*(0.061)*		*(21.20)*		*(19.33)*		*(202.6)*	
Distance to river	0.077		0.041		21.40		-37.56		156.3	
	(0.068)		*(0.081)*		*(35.3413)*		*(39.09)*		*(303.9)*	
Distance to road	-0.026		-0.082		-108.5	***	-167.6	***	-287.7	
	(0.043)		*(0.060)*		*(21.91)*		*(22.80)*		*(219.8)*	
Distance to Mbale	0.032	***	0.015		5.39		19.52	***	48.6836	
	(0.0093)		*(0.014)*		*(4.098)*		*(4.686)*		*(40.4209)*	
Constant			11.24	***	-322.5		3651.6	***	-1.38e+03	
			(0.881)		*(374.7)*		*(435.7)*		*(3168)*	
N-observations	596		596		596		596		596	
Model Wald Chi^2	109.9305									
Wald P-value	0.000									
Wald Chi^2 exog test	5.318									
Exog Wald P-value	0.070									
F test joint significance			26.19		95.51		19.38		12.92	
P-value			0.000		0.000		0.000		0	
Hansen J Chi^2 statistic			0.050		0.879		8.02		2.375	
Hansen J P-value			0.823		0.349		0.0046		0.123	
Endogeneity Chi^2 statistic			3.39		110.1		202.1		55.61	
Endogeneity test p-value			0.335		0.000		0.000		0.000	

Notes: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; For poverty – marginal effects are reported; World Bank International poverty line = $3.10/day (ppp-2011 = Ush. 2,935.40); In 2014 equivalent to = Ush. 3,473.80 /day & Ush. 1,250,568.00/year; Four observations were dropped due lack of coffee income.