Food Standards, Certification, and Poverty among Coffee Farmers in Uganda

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Abstract.— Voluntary standards are gaining in importance in global markets for high-value foods. We analyze and compare impacts of three sustainability oriented standards – Fairtrade, Organic, and UTZ – on the livelihoods of smallholder coffee farmers in Uganda. Using survey data and propensity score matching with multiple treatments, we find that Fairtrade certification increases household living standards by 30% and reduces the prevalence and depth of poverty. For the other two certification schemes, no significant impacts are found. Several factors that can explain differential impacts are discussed. Overly general statements about the effects of sustainability standards on smallholder livelihoods may be misleading.

Key words— coffee; smallholder farmers; Organic; Fairtrade; Uganda

1. Introduction

Food systems around the world are undergoing a rapid transformation, with modern retailers, private standards, and vertically integrated supply chains gaining in importance (Reardon, Barrett, Berdegué, & Swinnen, 2009). This transformation is partly driven by changing consumer preferences, induced by rising living standards and growing concerns about food safety and the environmental and social consequences of agricultural production (Mergenthaler, Weinberger, & Qaim, 2009). To satisfy consumer demands, retailers and manufacturers – in cooperation with certification bodies and NGOs – increasingly use sustainability oriented standards and labels (Liu, Byers, & Giovannucci, 2008). This trend is especially pronounced for luxury foods, such as coffee, tea, or cocoa. For coffee, the global market share of products with sustainability certification – such as Organic, Fairtrade, UTZ, or Rainforest Alliance – has doubled from 4% in 2006 to 8% in 2009; this share is expected to grow to over 20% in the next couple of years (ITC, 2011). In rich and emerging countries in particular, many consumers are willing to pay more for foods that are labeled to be sustainably produced. For coffee and other tropical products, this also involves consumer perceptions to contribute to improved livelihoods of smallholder farmers (Basu & Hicks, 2008; Elfenbein & McManus, 2010). However, actual evidence about producer benefits is mixed (ITC, 2011). Here, we analyze the impacts of sustainability standards on smallholder coffee producers in Uganda. Uganda is one of Africa's major coffee exporters. Around 500,000 small-scale farmers produce coffee in Uganda; around 10% of them are already certified under different sustainability standards (UCDA, 2012).

There is a growing body of literature about the impacts of standards on coffee farmers, yet with shortcomings in terms of regional coverage, methods used, and outcome variables considered. Most existing studies concentrate on Latin America (e.g., Raynolds, Murray, & Leigh Taylor, 2004; Bacon, 2005; Utting-Chamorro, 2005; Bacon, Mendez, Gomez, Stuart, & Flores, 2008; Jaffee, 2008; Valkila, 2009; Valkila & Nygren, 2010; Beuchelt & Zeller, 2011; Barham, Callenes, Gitter, Lewis, & Weber, 2011; Barham & Weber, 2012), while there are only a few papers focusing on Africa (e.g., Bolwig, Gibbon, & Jones, 2009; Jena, Chichaibelu, Stellmacher, & Grote, 2012). Concerning the methods used, many impact studies do not control for possible selection bias (Utting-Chamorro, 2005; Bacon et al., 2008; Valkila, 2009; Valkila & Nygren, 2010; Beuchelt & Zeller, 2011), so it is unclear whether observed differences between certified and non-certified farmers are really attributable to certification. In terms of outcome variables considered, there is a heavy focus on coffee prices. In many cases, certified farmers

receive higher prices, but sales prices alone are not a comprehensive indicator of livelihood impacts.

A few impact studies controlled for selection bias and also considered broader indicators of household welfare. Jena et al. (2012) used propensity score matching (PSM) to evaluate impacts in Ethiopia. They showed that certification contributes to higher incomes among coffee farmers, but the impact on poverty was insignificant. Ruben & Fort (2012) also used PSM in their study of Fairtrade impacts in Peru. They did not find significant income gains, although certified households were able to accumulate more wealth, possibly due to lower price risk. Arnould, Plastina, & Ball (2009) looked at Fairtrade impacts in Peru, Guatemala, and Nicaragua. While they revealed positive price effects, impacts on household welfare were small and uneven across the three countries. Bolwig et al. (2009) used Heckman selection models to analyze impacts of Organic certification in Uganda, showing that certified production contributes to higher farm revenues.

These findings suggest that the livelihood effects may differ depending on various factors, including regional context and type of standard. Hence, general conclusions about the impacts of sustainability standards on smallholder farmers are not justified. To gain further insights, comparing effects of different types of standards in the same regional context would be useful. Such comparisons are rare in the existing literature. Two exceptions are Bacon (2005) and Ruben & Zuniga (2011). Bacon (2005) compared farmers supplying Fairtrade, Organic, and specialty coffees in Nicaragua, suggesting that higher and more stable prices in Fairtrade and Organic markets may reduce the livelihood vulnerability of smallholders. Ruben & Zuniga (2011) also looked at farmers in Nicaragua, using PSM to compare the impact of Fairtrade, Rainforest Alliance, and Starbucks CAFE. They showed that Fairtrade farmers receive better prices but that Rainforest Alliance and Starbucks CAFE lead to higher yield and quality performance.

We contribute to this literature by comparing the impact of three different standards – Fairtrade, UTZ, and Organic – on smallholder farmers in Uganda. Uganda is an interesting study country for such comparison in Africa, because farmers certified under different schemes and their non-certified counterparts operate in the same locations. Our approach is similar to Ruben & Zuniga (2011). We also use survey data and PSM, but employ a refined approach to estimate propensity scores, which explicitly accounts for the fact that there are multiple treatments (Lechner, 2002). Furthermore, we extend the analysis of welfare effects and also examine impacts of certification on the prevalence and depth of poverty.

2. Fairtrade, UTZ, and Organic standards

Fairtrade, UTZ, and Organic are among the most important sustainability oriented standards in the global coffee market in terms of volumes traded and number of farmers certified (ITC, 2011). All three are relevant for smallholder farmers in developing countries, and all three have social and environmental objectives. Fairtrade certification and labeling systems for coffee were launched in 1988 by the Fairtrade Labeling Organization (FLO) with the aim of improving the livelihoods of smallholder producers and cushioning them from volatile market prices. The Fairtrade label guarantees producers a minimum floor price, whenever the international free market price falls below a certain threshold. In addition, a Fairtrade premium is paid to the producer organization to be used for capacity building, community development, and related projects. The primary focus of UTZ labeling system (formerly known as UTZ Kapeh) is on traceability and sustainable production processes, based on Good Agricultural Practice (GAP) as specified by GlobalGAP. The GlobalGAP standard requires producers to comply with the labor

laws concerning wages and working hours, and to handle agrochemicals responsibly, as stipulated by the International Labor Organization. The UTZ label does not guarantee a minimum price to producers, nor does it provide any premium or protection against price volatility. The Organic standard follows the principles of health, ecology, fairness, and care. Certified farmers have to use production methods based on traditional and scientific knowledge that maximize farm soil fertility and enhance biodiversity. The use of inorganic inputs such as synthetic fertilizers and chemical pesticides is strictly prohibited. Organic certification requires farmers to strictly follow organic production guidelines for a minimum period of three years (referred to as the conversion period) before getting full certification, thus making it one of the most stringent among the voluntary standards (Coulibaly and Liu, 2006). Prices paid for Organic coffee are usually higher than for uncertified coffee.

A fundamental difference between the three standards is that Fairtrade provides a minimum quality-invariant floor price, while UTZ and Organic do not provide such a minimum price. The prices paid for UTZ and Organic coffee may be higher than for non-certified coffee, depending on quality and current demand and supply in the relative market segments, but a price premium is not guaranteed. Furthermore, as for non-certified coffee, prices paid for UTZ and Organic coffee may at times fall below the cost of production, so that farmers face a downside risk. This is different for Fairtrade coffee, where the minimum floor price is calculated such that it stays above the average cost of production. Hence, the Fairtrade minimum price may not only increase the expected average price for farmers participating in this certification scheme, but it also reduces the economic risk.

3. Methods

We use generalized propensity scores to control for pre-treatment differences between certified and uncertified households in estimating the ATT. Propensity score matching (PSM) is often used to evaluate impacts of a binary treatment variable (e.g., Fischer & Qaim, 2012; Ruben & Fort, 2012). However, in our case there are different certification schemes *j* that farmers can participate in, so that the treatment variable can take more than two values. In particular, with three certification schemes and one control group, the treatment variable can have four possible values. We define *j*=0 for farm households that are not certified under any scheme, *j*=1 for households with Fairtrade certification, *j*=2 for households with UTZ certification, and *j*=3 for households with Organic certification. We follow theoretical foundations by Imbens (2000) and Lechner (2001) and empirical applications by Gerfin & Lechner (2002) and Lechner (2002) for estimating propensity scores with multiple treatments. For each marketing channel, we predict the individual probability of participation using an unconditional multinomial probit model. Predicted propensity scores of participation can be written as

$$\hat{P}_j(x),\ j \in J = \{0,1,..3\}. \tag{1}$$

Following Lechner (2002), the resulting pairwise propensity scores are

$$\hat{P}_{j|mj}(x) = \frac{\hat{P}_j(x)}{\hat{P}_j(x)+\hat{P}_m(x)} \qquad \forall m \neq j; \qquad j,m \in J = \{0,1,..3\}, \tag{2}$$

where $\hat{P}_{j|mj}(x)$ is the predicted conditional propensity score of a household participating in channel *j* as opposed to an alternative channel *m*. We want to evaluate the impact of certification

in comparison to no certification. In addition, we are interested in how each certification scheme compares to no certification, and how the different schemes compare against each other. Thus, there are seven pairwise comparisons, namely certified vs. non-certified, Fairtrade, UTZ, and Organic vs. non-certified, as well as Fairtrade vs. UTZ, Fairtrade vs. Organic, and UTZ vs. Organic. Following Lechner (2001, 2002), estimation of ATT with multiple treatments can be extended to

$$\text{ATT}^{j|m} = E\{Y_j - Y_m | J = j\}, \qquad \forall m \neq j, \qquad j \in J = \{0,1,..3\} \tag{3}$$

In our case $\text{ATT}^{j|m}$ estimates the expected average effects of participating in marketing channel *j* compared to the alternative channel *m*. As in any PSM analysis, an algorithm to match treated and control households has to be chosen. We use nearest neighbor matching (NNM) and kernel matching (KM), two commonly used algorithms for empirical analysis (Caliendo and Kopeinig, 2008). NNM involves choosing a partner from the control group for matching with each treated household or individual based on propensity scores. We match each treated household with the three nearest neighbors (with replacement) in terms of propensity score distances. To avoid the possibility of bad matches, we impose a maximum caliper restriction of 0.1. KM uses non-parametric techniques to compare treated and control households based on kernel-weighted averages (Caliendo and Kopeinig, 2008). For the KM, we specified a default bandwidth of 0.06. It should be stressed that PSM builds on the conditional independence assumption (CIA), which is also called selection on observables (Rosenbaum & Rubin, 1983). This means that the method only controls for observed heterogeneity between treated and control households. Estimates of the ATT may still be biased when there is unobserved heterogeneity. We test for the influence of such hidden bias by calculating Rosenbaum bounds (DiPrete & Gangl, 2004; Becker & Caliendo, 2007).

We are interested in analyzing how sustainability certification affects the living standard and poverty of coffee-producing households in Uganda. We use household per capita expenditure on food and non-food consumption items as our measure of living standard. This also includes the market value of home-produced goods. In evaluating poverty outcomes, we make use of the FGT (Foster et al., 1984) class of poverty measures and calculate two measures, (i) the head count index, when $\alpha = 0$, and (ii) the poverty gap index, when $\alpha = 1$. For the calculations, we use the international poverty line of $1.25 a day in terms of purchasing power parity (PPP). Expenditures by households in Ugandan shillings (UGX) are converted to international dollars by using the PPP exchange rate (World Bank, 2013).[1]

4. Data and descriptive statistics

We carried out a structured survey of coffee-producing households in Uganda between July and September 2012. For the selection of households to be interviewed, we used a multi-stage sampling procedure. At first, we contacted the main coffee associations in Uganda to obtain lists of existing farmer cooperatives, including information on their location, the number of cooperative members, and certification details. Based on these lists and visits to many of the locations, we purposively selected three cooperatives. These three cooperatives had similar agro-ecological and infrastructure conditions. All three are located in the Central Region of Uganda; two of them in Luwero District, and the third in Masaka District. In all three cooperatives,

[1] The PPP exchange rate is 744.62 UGX per dollar. In 2012, the official market exchange rate was around 2600 UGX per dollar.

farmers produce Robusta coffee. Luwero and Masaka are among the top four districts that account for over 50% of Uganda's Robusta coffee production.

All three cooperatives selected had acquired UTZ certification around the year 2007; two of them had added a second certification scheme shortly thereafter. At the time of the survey, one cooperative had only UTZ, the second had UTZ plus Fairtrade, and the third UTZ plus Organic certification. We could not identify farmers that are only certified under Fairtrade or Organic without also having UTZ certification. This may be considered a drawback for the evaluation of individual standards. However, we evaluate the impact of each standard not only in comparison to uncertified farmers but also in comparison to farmers with other standards, so the combination in two of the cooperatives is not a problem. As Fairtrade and Organic standards both have stronger requirements than the UTZ, we refer to the UTZ-Fairtrade combination as "Fairtrade" and to the UTZ-Organic combination as "Organic" below.

Farmers have to be member of a cooperative to participate in the certification schemes, but not all members of the three cooperatives actually participated in certification. Hence, participation is an individual decision. Cooperative management provided us with lists of all members, including details on the location of each farm household and their participation in certification schemes. In each cooperative we randomly selected two parishes, and in each parish we randomly selected three villages. In these villages, we randomly selected households for the interviews. In total, we interviewed 108 Fairtrade farmers, 101 Organic farmers, and 62 UTZ farmers. In addition, 148 control farmers were randomly selected from the lists of non-certified farmers in the same villages. The farmers were interviewed with a structured questionnaire by a small team of local enumerators that were carefully selected, trained, and supervised by the researchers. The questionnaire covered all economic activities of households with a detailed breakdown for coffee production and marketing. We also captured the household demographic composition, food and non-food consumption, and a variety of household contextual characteristics. Food consumption data were collected through a 7-day recall. As the timing of the survey was shortly after the main harvest, consumption levels may be somewhat higher than during other times of the year. Yet, as all farmers were surveyed during a relatively short period, this should not lead to any bias in the impact assessment.

Descriptive statistics (results not shown in this paper) reveal that there are a few significant differences between certified and non-certified farmers. Certified farms have larger households, older household heads, longer experience with coffee cultivation, and better access to credit and agricultural extension. They also have larger farms and shorter distances to all-weather roads and input shops. Furthermore, we observe a few significant differences between farmers in different certification schemes. On average, Fairtrade farmers are better educated, own larger houses, and have better access to credit than UTZ and Organic farmers. They are also more likely to have a leadership position in the cooperative or any other local association, which we use as a proxy for diplomatic skills and social standing. On the other hand, UTZ farmers have better infrastructure conditions, whereas Organic farmers have somewhat larger landholdings. Considering household consumption expenditures and poverty levels, Fairtrade farmers seem to be better off than all other groups. These descriptive statistics suggest that there are systematic differences between participants and non-participants in certified markets and also between participants in different certification schemes. However, without estimating treatment effects we do not know whether the observed differences in household living standards are impacts of certification or the result of other factors. This will be analyzed in the next section.

5. Estimation results and discussion

(a) Factors influencing the certification decision

We start this analysis by analyzing the factors that influence household decisions to participate in a particular certification scheme. We estimate a multinomial probit model for the three certification schemes and take non-certified farmers as the base category and use these results to calculate propensity scores. Hence, we include a broad range of explanatory variables. Estimation results are shown in Table 1. For the calculation of propensity scores it does not matter if the explanatory variables are endogenous. However, to the extent possible we tried to use exogenous variables. For the more durable assets such as size of the house and landholding we preferred values lagged by five years, as this was the time when the certification schemes started in the study region. Thus, we avoid possible reverse causality. Interestingly, lagged size of the landholding does not influence participation in any of the three schemes, suggesting that certification is scale-neutral in this local context. However, the size of the house, which we use as a proxy of wealth, increases the likelihood of Fairtrade and UTZ certification.

Table 1. Multinomial probit estimates for participation in certification schemes

Variables	Fairtrade		UTZ		Organic	
Household characteristics						
Male household head (dummy)	-0.142	(0.384)	0.158	(0.501)	0.893	(0.634)
Age of household head (years)	0.104	(0.077)	0.127	(0.093)	0.270**	(0.115)
Age of household head squared	-0.001	(0.001)	-0.001	(0.001)	-0.002**	(0.001)
Education of household head (years)	0.067	(0.050)	0.073	(0.071)	-0.036	(0.083)
Cellphone ownership (dummy)	0.106	(0.467)	0.334	(0.475)	0.284	(0.586)
Labor capacity (worker equivalents)	0.061	(0.087)	0.172	(0.119)	0.243*	(0.135)
Number of rooms (5 years ago)	0.276***	(0.100)	0.289**	(0.132)	-0.096	(0.211)
Years resident in community	0.006	(0.005)	0.008	(0.011)	0.004	(0.009)
Years growing coffee	0.038***	(0.013)	0.017	(0.020)	0.029	(0.024)
Leadership position (dummy)	0.853***	(0.326)	0.554	(0.466)	-0.695	(0.653)
Access to extension (dummy)	0.389	(0.312)	1.477***	(0.484)	1.357**	(0.584)
Access to savings account (dummy)	0.2	(0.364)	0.312	(0.558)	0.536	(0.666)
Access to credit (dummy)	0.985***	(0.303)	0.631	(0.443)	0.854	(0.523)
Farm characteristics						
Total land owned 5 years ago (acres)	-0.017	(0.042)	-0.089	(0.069)	0.059	(0.071)
Farm altitude (m)	0.018***	(0.004)	-0.044***	(0.009)	-0.076***	(0.010)
Distance to input market (km)	-0.03	(0.027)	0.038	(0.071)	-0.069	(0.071)
Distance to output market (km)	0.039	(0.037)	0.076	(0.088)	0.092*	(0.053)
Distance to all-weather road (km)	-0.058***	(0.015)	-0.161***	(0.037)	0.061**	(0.025)
Constant	-28.25***	(5.239)	42.27***	(9.834)	75.17***	(10.94)
Log likelihood	-178.7					
Chi-square	200.0***					
Observations	419					

Notes: Coefficient estimates are shown with standard errors in parentheses. The base category consists of farmers without any certification. * p<0.1, ** p<0.05, *** p<0.01.

Farmers with local leadership positions are more likely to be Fairtrade certified, while access to extension seems to be more important for UTZ and Organic certification. Organic production involves knowledge-intensive agronomic practices, so farmers with access to

extension may find it easier to participate. Organic practices are often more labor-intensive, too. Hence, households with a larger family labor capacity have an advantage. And, in organic production external inputs such as chemical fertilizers and pesticides are replaced with household resources, which may explain why farms further away from roads and markets are more likely to be certified in the Organic scheme. For them, it is more difficult to access such external inputs anyway. In contrast, better road access increases the likelihood of participation in Fairtrade and UTZ certification. Based on this multinomial probit model, we predict propensity scores for the PSM analysis and eliminated observations in the treatment and control groups that do not find matches due to too low or too high propensity scores.

(b) Impact of certification

Table 2 shows the average treatment effects of certification on household expenditure and poverty levels for the different matching comparisons. On average, the ATTs are somewhat larger with nearest neighbor matching than with kernel matching, although the significance levels are almost identical. Looking at the first comparison between certified and non-certified farmers, we find that certification increases consumption expenditure by UGX 369-479 per capita and day (PPP $ 0.50-0.64). This effect is significant and implies an increase in living standard by 12-15% when compared to mean expenditure levels of non-certified households. However, the effects on household poverty are not statistically significant. These results are similar to the findings of Jena et al. (2012) in Ethiopia; they also concluded that certification somewhat increased household expenditures among smallholder coffee producers, but without a significant effect on poverty.

Disaggregating by certification scheme, we find that the positive impact on household expenditure is entirely driven by Fairtrade certification. Participation in Fairtrade increases per capita expenditure by 27-33%, while the effects for UTZ and Organic are both insignificant. Likewise, we find significant poverty-reducing effects for Fairtrade, but not for UTZ and Organic. Participation in Fairtrade reduces the poverty headcount index by 0.13-0.15, implying a 50% reduction of the poverty rates among non-certified households. Fairtrade also reduces the poverty gap by 9-11 percentage points. These results confirm that differentiating impacts by certification scheme is important.

How do the three certification schemes compare with each other in terms of living standard effects? Fairtrade farmers have significantly higher household expenditures than both UTZ and Organic farmers. The differences in the poverty headcount index between certification schemes are not statistically significant. Interestingly, however, Fairtrade farmers below the poverty line have a much lower poverty gap than their colleagues in the UTZ and Organic schemes. Comparing UTZ with Organic, none of the effects is statistically significant. These patterns underline that Fairtrade is more beneficial for smallholder coffee farmers in Uganda than the other two certification schemes. The results also suggest that the combination of treatments in two of the cooperatives is unlikely to confuse the impact assessment. As discussed above, Fairtrade farmers actually have UTZ plus Fairtrade certification, whereas Organic farmers have UTZ plus Organic certification. Our estimates show that participation in UTZ alone has no significant effect on living standard. Hence, it seems justified to attribute the combined UTZ-Fairtrade effects primarily to the Fairtrade standard. This does not rule out that UTZ certification may facilitate participation in more stringent standards, such as Fairtrade or Organic.

Table 2. Average treatment effects on the treated for household expenditure and poverty

	Nearest neighbor matching		Kernel matching		
	ATT	S.E.	ATT	S.E.	**Γ**
Certified vs. non-certified					
Per capita expenditure (UGX)	478.99**	191.88	369.44**	180.24	1.9
Poverty headcount index	-0.08	0.05	-0.05	0.05	1.5
Poverty gap index	0.01	0.04	0.01	0.04	1.3
Fairtrade vs. non-certified					
Per capita expenditure (UGX)	1028.58***	239.84	871.27***	229.69	1.6
Poverty headcount index	-0.15**	0.06	-0.13**	0.05	2.0
Poverty gap index	-0.09*	0.04	-0.11**	0.04	1.5
UTZ vs. non-certified					
Per capita expenditure (UGX)	-51.70	269.70	36.72	254.52	1.2
Poverty headcount index	-0.02	0.08	-0.03	0.07	1.3
Poverty gap index	0.05	0.07	0.05	0.07	1.1
Organic vs. non-certified					
Per capita expenditure (UGX)	242.42	286.99	0.55	252.84	1.3
Poverty headcount index	-0.04	0.08	0.02	0.07	1.4
Poverty gap index	0.06	0.05	0.07	0.06	1.1
Fairtrade vs. UTZ					
Per capita expenditure (UGX)	984.83***	318.74	850.20***	286.93	1.8
Poverty headcount index	-0.07	0.07	-0.07	0.07	1.4
Poverty gap index	-0.21**	0.06	-0.22***	0.06	2.3
Fairtrade vs. Organic					
Per capita expenditure (UGX)	619.75*	334.15	484.8	331.01	1.4
Poverty headcount index	-0.08	0.08	-0.07	0.08	1.1
Poverty gap index	-0.19**	0.08	-0.24**	0.1	2.3
UTZ vs. Organic					
Per capita expenditure (UGX)	97.53	405.28	-106.55	343.34	1.2
Poverty headcount index	0.15	0.11	0.13	0.09	1.1
Poverty gap index	-0.17	0.18	0.03	0.13	1.1

Notes: ATT: average treatment effect on the treated; S.E.: bootstrapped standard errors; **Γ**: Rosenbaum bounds (critical levels of hidden bias). * p<0.1; ** p<0.05; *** p<0.01.

(c) Robustness tests

As discussed in section 3, PSM controls for selection bias in impact assessment that is caused by observed heterogeneity between treatment and control groups. While we have used a broad set of farm, household, and contextual variables to calculate the propensity scores, it is still possible that there are unobserved factors that could be jointly correlated with the decision to participate in certification and household living standard. Such unobserved heterogeneity could bias the estimated treatment effects. To test the robustness of our results we calculate Rosenbaum bounds for hidden bias (DiPrete & Gangl, 2004; Becker & Caliendo, 2007). Assume two matched individuals with the same observed covariates that differ in their odds of participating in a certification scheme solely by the difference in unobserved factors. The Rosenbaum bound (Γ) measures how big the difference in unobserved factors that drive the participation decision would have to be, in order to render the estimated ATT insignificant.

The Rosenbaum bounds are shown in the last column of Table 2.[2] For the significant ATTs, the values for **Γ** range between 1.5 and 2.3. The lower bound of 1.5 (for the Fairtrade poverty

[2] The Rosenbaum bounds shown in Table 2 refer to the nearest neighbor matching algorithm. We did the same calculations also for the kernel matching algorithm with almost identical results.

gap effect) implies that matched farmers with the same observed covariates would have to differ in terms of unobserved covariates by a factor of 1.5 (50%), in order to invalidate the inference of a significant treatment effect. The upper bound of 2.3 implies that unobserved covariates could even differ by a factor of 2.3 (130%). Based on these results we conclude that the impact estimates are quite robust to possible hidden bias.

(c) Possible impact pathways

We have shown that Fairtrade certification is associated with significant benefits for smallholder coffee producers in Uganda, while UTZ and Organic certification is not. What are the reasons for these differences in impact between certification schemes? Differences in prices that farmers receive for their coffee may play a role. In section 2, we discussed that the three standards involve different pricing schemes. Fairtrade provides minimum support prices to farmers plus a Fairtrade premium to the cooperative, while Organic coffee is supposed to fetch a bonus on top of international market prices. In Table 3, we show average coffee prices received by sample farmers in different marketing channels. As coffee prices can fluctuate considerably, we asked farmers to report prices received over a period of two years. These price data are not normally distributed; we show median prices that better reflect the average than arithmetic means. Prices received by farmers for certified coffee are significantly higher than for non-certified coffee. This is in line with expectations and with studies conducted in other settings (e.g., Bacon, 2005; Wollni & Zeller, 2007). However, further disaggregation by certification scheme reveals that this pattern is primarily driven by the high prices in the Fairtrade scheme. In fact, average prices received for UTZ and Organic coffee are not significantly different from prices received for non-certified coffee. This also confirms farmers' subjective perceptions. Especially Organic farmers in our sample pointed out that there is usually no difference in prices between certified Organic and uncertified channels. An advantage of selling to traders in uncertified channels is that farmers get cash on the spot, while sales in the Organic channels are through the cooperative and associated with payment delays.

Table 3. Median prices received for coffee under different certification schemes

Certification scheme	Median coffee price (UGX/kg)	Interquartile range
All non-certified	1550	1150
All certified	2000[a]	1350
Fairtrade	3233[a,c,d]	1783
UTZ	1750[b]	762
Organic	1500[b]	900

Notes: Median coffee prices received by farmers were calculated over the last two seasons. The interquartile range is analogous to the standard deviation for the median. Median prices between schemes are tested for statistically significant differences using the Kruskal-Wallis test; [a] $p<0.01$ when compared to non-certified; [b] $p<0.01$ when compared to Fairtrade; [c] $p<0.01$ when compared to UTZ; [d] $p<0.01$ when compared to Organic.

6. Conclusion

The role of sustainability standards in global coffee markets is growing. Consumers typically assume that such standards benefit smallholder farmers in developing countries, but robust evidence is relatively thin. We have analyzed and compared the impact of three such standards and certification schemes – Fairtrade, UTZ, and Organic – on the livelihoods of coffee farmers in Uganda. Results show that farm households in all three schemes combined have significantly higher living standards than their matched counterparts in non-certified channels. Poverty effects are not statistically significant for the combined sample of certified households.

These findings are in line with Jena et al. (2012) who analyzed the impact of Fairtrade and Organic certification on coffee farmers in Ethiopia. In Nicaragua, Valkila (2009) and Valkila & Nygren (2010) also looked at Fairtrade and Organic, without finding significant benefits. Valkila (2009) argued that these standards may even contribute to poverty traps through perpetuating low-input production systems. These authors did not disaggregate their analyses by certification scheme.

However, our results suggest that disaggregation is important, because impacts may differ considerably between certification schemes. In Uganda, Fairtrade certification contributes to significant improvements in household living standard, whereas UTZ and Organic certification do not. Fairtrade increases per capita consumption expenditures by 30% and reduces the likelihood of being poor by 50%. Fairtrade also reduces the poverty gap among certified farmers. The observed differences in impact can be explained by various factors. First, Fairtrade guarantees a minimum support price, which increases the average price received by farmers and reduces downside risk. Second, Fairtrade cooperatives receive a premium, which they use for investments in infrastructure and training programs. Such price guarantees and premiums are not provided in UTZ and Organic certification schemes. Third, farmers in the Fairtrade cooperative in Uganda have more freedom in terms of marketing their certified coffee. The cooperative owns the Fairtrade certification documents and can sell to any buyer; thus it is in a better position to negotiate conditions. In contrast, the UTZ and Organic certification documents are owned by specific exporters, to which participating farmers have to sell their coffee. Fourth, and related to the previous point, the Fairtrade cooperative sells most of the certified coffee after milling, which further increases the sales price. UTZ and Organic farmers, on the other hand, sell most of their coffee in unprocessed form, as specified by the exporters that own the certification documents. Some of these factors are specific to the particular cooperatives analyzed here. Therefore, one should not extrapolate these findings to other settings without further analysis. We should also stress that our study is not an attempt to holistically assess all possible impacts of certification. We focused on socioeconomic implications for smallholder producers in terms of living standard and poverty. Especially the Organic standard places higher priority on aspects of environmental sustainability, which we did not analyze.

How do our findings from Uganda compare with case studies on Fairtrade coffee in Latin America? Most of these other studies did not analyze poverty effects, but many compared prices. Generally, mean Fairtrade prices are reported to be higher than free market prices (Raynolds et al., 2004; Bacon, 2005; Arnould et al., 2009; Ruben & Zuniga, 2011), although de Janvry et al. (2010) found that effective price advantages are minimal for some farmers due to over-certification. Over-cerification entails that certified farmers may sell only a small quantity of their coffee through the Fairtrade channel. Such over-certification is not yet an issue in Uganda. Other important points to consider are yield and coffee quality. Based on data from coffee farmers in Mexico and Peru, Barham & Weber (2012) showed that yields may be more important than price premiums for increasing net returns. This is not the case in Uganda, probably because the use of yield-increasing external inputs is not yet very widespread. Concerning quality, de Janvry et al (2010) and Ruben & Zuniga (2011) reported that Fairtrade farmers in Central America do not have sufficient incentives to improve their performance, because the guaranteed minimum price is quality-invariant. As a result, coffee farmers in other certification schemes with different incentive structures outperform Fairtrade farmers in terms of quality performance. This is also not yet observed in Uganda. These regional differences make sense: average yield

and quality levels are still lower in Africa than in Latin America and the markets for certified coffees are not yet as developed.

In conclusion, we highlight two broader lessons to be learned. First, African smallholders are capable of participating in certified markets. The cooperatives investigated in this study, in one of the poorest countries in the world, were certified around the year 2007 and have since managed to fully comply with the different international standards. This is encouraging and disproves pessimistic views that poor smallholders will not be able to participate in high-value markets on a sustained basis. Second, the impact of standards and certification on farmer livelihoods may differ significantly by certification scheme and market conditions. Hence, it is worthwhile to take a closer look. Better understanding impact differences and factors that contribute to these differences may be relevant for all actors along the supply chain, including consumers who wish to make more informed purchase decisions. Better understanding may also help to improve the design of standards and certification systems from a social perspective.

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