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Trading off nutrition and education? A panel data analysis of the dissimilar welfare effects of Organic and Fairtrade standards

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ABSTRACT

Millions of smallholder farmers in developing countries participate in different types of sustainability standards. A growing body of literature has analyzed the welfare effects, with mixed results. Yet, there are important knowledge gaps. First, most existing studies have looked at the effects of one standard in one country. When comparing between studies it is unclear whether dissimilar outcomes are the result of different standards or different local conditions. Second, most studies have used cross-section data, so that selectivity issues remain a challenge. Third, existing work has primarily analyzed effects in terms of purely economic indicators, such as prices and income, ignoring other dimensions of household welfare. We address these shortcomings using panel data from small-scale coffee producers in Uganda and comparing the effects of two of the most popular sustainability standards, namely Organic and Fairtrade. Welfare effects are analyzed in terms of household expenditures, child education, and nutrition. Results show that Organic and Fairtrade both have positive effects on total consumption expenditures. However, notable differences are observed in terms of the other outcomes. Organic contributes to improved nutrition but has no effect on education. For Fairtrade it is exactly the other way around. We explore the mechanisms behind these differences.

1. Introduction

Sustainability standards and certification schemes, such as Fairtrade and Organic, are gaining in importance in international food markets. Often, these standards serve as a link between poor agricultural producers in developing countries and wealthy consumers in industrialized countries (Swinnen and Vandeplas, 2011). Especially for higher-value foods, such as coffee, tea, or cocoa, rich-country consumers are increasingly concerned not only about product quality, but also about the environmental, social, and human rights implications during the process of production. Even though the details of sustainability standards are not always fully transparent, many consumers are willing to pay more for certified products with a sustainability label (Grunert et al., 2014; Hoogland et al., 2007; ITC, 2015).

Depending on the particular standard, certification requirements may involve rules on environmentally friendly farming practices, democratic structures of farmer organizations, non-discrimination, or prohibition of child labor, just to name a few. Compliance is typically audited by an independent certification body. For farmers in developing countries, voluntary participation in such certification schemes can facilitate access to more lucrative export markets (Chiputwa et al., 2015; Jones and Gibbon, 2011; Kleemann et al., 2014). However, meeting the requirements can be difficult and costly, especially for marginalized farmers (Handschuch et al., 2013; Schuster and Maertens, 2013). In a smallholder context, group certification approaches are often encouraged, in order to reduce the cost for individuals (Bolwig et al., 2009; Bravo-Monroy et al., 2016; Chiputwa et al., 2015).

There is a growing literature about the impacts of standards on smallholder farmers in developing counties (Bolwig et al., 2009; Chiputwa et al., 2015; Jena et al., 2012; Maertens and Swinnen, 2009; Parvathi and Waibel, 2016; Vellema et al., 2015). Most existing studies focus on short-term economic indicators, such as prices or income, using cross-section data from a single year, often without properly establishing causality (Beghin et al., 2015; Dragusanu et al., 2014). A few studies have looked at indicators beyond purely economic ones, including health, gender equality, child education, nutrition, and ecological sustainability (Arnould et al., 2009; Becchetti et al., 2013; Chiputwa and Qaim, 2016; Gitter et al., 2012; Ibanez and Blackman, 2016). The results are fairly diverse, without conclusive evidence on whether or not sustainability standards actually promote rural development. Each study typically analyzes the effects of one particular standard in one country. Hence, comparisons between different

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standards in the same setting are hardly possible. In some cases, farmer organizations are double-certified (especially Organic + Fairtrade) to access various certified marketing channels (Mitiku et al., 2017; van Rijsbergen et al., 2016). However, double certification complicates the evaluation of separate impacts. Very few studies compare two or more standards, and those that do only focus on purely economic indicators (Akoyi and Maertens, 2016; Chiputwa et al., 2015; Ruben and Zuniga, 2011; van Rijsbergen et al., 2016).

Our study adds to the existing literature in three ways. First, we analyze and compare the welfare effects of two popular sustainability standards, Fairtrade and Organic, in the same setting. The analysis builds on a survey of small-scale coffee producers in Uganda. Second, we use panel data collected in two survey rounds from the same farmers. Panel data models help to reduce selectivity issues and thus facilitate identification of causal effects. Third, we consider a set of outcome variables that capture several dimensions of household welfare, namely consumption expenditures, child education, and nutrition. A better understanding of the multidimensionality of impacts is important given that in the past the reduction in income poverty was more successful than the achievement of some of the other pressing development goals.

2. Sustainability standards in theory and practice

There are over 200 sustainability-oriented standards in use today (ITC, 2016). In the coffee sector, 4C Association, Fairtrade, Organic, Rainforest Alliance, and UTZ are the most popular ones.[1] Around 30% of the world's coffee production area was certified under one of these five standards in 2013 (ITC, 2015). In this study, we focus on Fairtrade and Organic. The general principles of these two standards are briefly described in the following subsections, before an overview of expected and actual impacts on different dimensions of household welfare is provided. This overview further motivates the empirical analysis below.

2.1. Fairtrade

About 1.5 million smallholder farmers in developing countries are members of producer organizations that are certified by Fairtrade International. More than 50% of these farmers are coffee producers (Fairtrade International, 2015).

Key features of the Fairtrade standard for small producer organizations are the Fairtrade minimum price and the Fairtrade premium. The Fairtrade minimum price is a floor price that becomes relevant whenever the world market price falls below a certain threshold. The Fairtrade premium is an additional amount of money paid to certified farmer organizations as an incentive for continued participation (Fairtrade International, 2011a). In 2014, Fairtrade farmer organizations received an average premium of about 10,000 US dollars, equivalent to about 70 dollars per member. Farmer organizations typically invest the premium in agricultural or marketing facilities, capacity development, and other economic services to their members. About 10% of the Fairtrade premium is used for social community projects, such as investments in health and education (Fairtrade International, 2015).

Fairtrade farmer organizations are required to respect and promote certain social principles such as non-discrimination, health and occupational safety, and the ban of child labor. Children under the age of 18 years must not be involved in exploitative or dangerous work. Further, children under the age of 15 cannot be employed by Fairtrade farmer organizations and cannot work on farms, except for times after school or during holidays. While Fairtrade primarily focuses on social and economic principles, the standard also promotes certain agricultural practices to protect the environment, such as integrated pest management and soil conservation measures (Fairtrade International, 2011b).

2.2. Organic

Worldwide, about 2.3 million agricultural producers in 172 countries are certified Organic. The largest share of these producers (86%) lives in developing countries (FiBL and IFOAM, 2016). There are various Organic standards, most follow the rules of the International Federation of Organic Agriculture Movements (IFOAM).

Organic agriculture is based on the principles of health, ecology, fairness, and care (IFOAM, 2014). While IFOAM also promotes certain social and economic objectives, certification requirements mainly focus on environmental issues. The application of chemical pesticides and synthetic fertilizers is banned. Further, farmers are trained to employ agricultural practices that improve and sustain soil fertility and nutrient cycles, such as intercropping, crop rotation, legume cultivation, and the use of organic fertilizers. Unlike Fairtrade, Organic certification is not associated with a guaranteed price premium. The expectation is that the market will reward farmers for complying with Organic principles.

2.3. Possible economic impacts

Certification is associated with a range of possible costs and benefits (Meemken et al., 2017). Certification can be a tool to link farmers to higher-value export markets, which can be associated with higher and more stable prices (Chiputwa et al., 2015; Kleemann et al., 2014). However, not in all cases are average prices received by certified farmers higher than those received by their non-certified colleagues (Jena et al., 2012; Ruben and Fort, 2012). Moreover, in some cases farmers cannot sell their entire harvest in certified value chains, due to excess supply of certified products (Méndez et al., 2010; Ruben and Fort, 2012).

Beyond output price effects, certification may influence yields, product quality, or production costs in positive or negative ways through banning or encouraging the use of certain inputs, specific training of farmers, or the provision of credit, equipment, and marketing services (Becchetti and Costantino, 2008; Bolwig et al., 2009; Handschuch et al., 2013; Méndez et al., 2010). Required agricultural practices may sometimes also increase labor costs (Ibanez and Blackman, 2016).

Costs and benefits of certification are often highly context-specific. Many studies focusing on Africa conclude that Organic and Fairtrade can have positive economic impacts (Bolwig et al., 2009; Chiputwa et al., 2015; Jones and Gibbon, 2011; Kleemann et al., 2014). In Latin America, in contrast, studies sometimes find less positive effects of certification, especially in the coffee sector (Ruben and Fort, 2012; Valkila, 2009; Vellema et al., 2015). Compared to Africa, the average input intensity in coffee production in Latin America, as well as mean yield and quality levels, are higher even without certification. Under those circumstances, certification may not further increase yield and quality levels.

2.4. Possible impacts on child education

Improvements in child education are an important mechanism to build up human capital, help households escape poverty in the medium and long run, and contribute to development more broadly. Private demand for education tends to increase with income. Hence, if farm households benefit economically from certification under a sustainability standard, they may decide to invest more in child education. Specifically, if Fairtrade or Organic standards increase incomes, households will find it easier to pay for school or tutor fees, learning materials, or school uniforms.

Beyond income gains, sustainability standards can also affect child

[1] In mid-2017, Rainforest Alliance and UTZ announced their intention to merge under the name "Rainforest Alliance".

education through other channels. As mentioned, Fairtrade restricts child labor, thus reducing the opportunity cost of time that children spend in school. Additionally, farmer organizations sometimes use parts of the Fairtrade premium to invest in educational programs. Bacon et al. (2008) describe how educational scholarships provided by a Fairtrade farmer organization in Nicaragua improved school attendance. Such programs can also raise awareness of the importance of child education in the community. Three studies have analyzed the impact of Fairtrade on child education in Latin America. Gitter et al. (2012) showed that Fairtrade certification increased schooling among secondary school children by 0.7 years. Arnould et al. (2009) and Becchetti et al. (2013) found that children of Fairtrade producers are twice as likely to be enrolled in school as children of non-certified producers.

To our knowledge, there is no study that has looked at the effect of Organic certification on child education. Effects may possibly differ from those of Fairtrade. Organic standards do not explicitly address issues of child labor. Organic farming practices are often more labor-intensive. As a result, demand for child labor and thus the opportunity cost of time that children spend in school may possibly increase.

2.5. Possible impacts on nutrition

In smallholder farm households, agricultural products are partly sold and partly kept for home consumption. Certification can potentially affect household diets and nutrition through market and subsistence pathways. The market pathway will primarily be through higher cash revenues from agricultural sales. These additional cash revenues may then be used to purchase more – or more nutritious – foods. However, it is not guaranteed that households will actually use additional income from certified cash crop production to buy food. The literature suggests that income from different types of crops is sometimes earmarked for specific (non-food) purposes (Duflo and Udry, 2004). Hence, the outcome will depend on the types of crops produced and sold, and also on who within the household controls the cash revenues.

The subsistence pathway may play a role because certification could affect the types of crops grown and livestock kept for home consumption. As mentioned, Organic farmers are encouraged to cultivate legumes, have longer crop rotations, and practice intercropping to enhance soil fertility and reduce pest infestation levels. Such measures tend to increase on-farm production diversity. Recent studies suggest a positive association between on-farm production diversity and dietary quality in smallholder farm households, especially in subsistence-oriented environments (Jones et al., 2014; Sibhatu et al., 2015).

We are aware of only two studies that have explicitly analyzed the effects of sustainability certification on household diets and nutrition. Chiputwa and Qaim (2016) found that certification helps to improve dietary quality through positive effects on income and gender equality. Becchetti and Costantino (2008) also showed better-quality diets in certified households, which they attributed primarily to higher farm production diversity. Both studies looked at Organic and Fairtrade certified farms together, without disentangling the effects of each standard, as we do here. Given that Organic and Fairtrade have different principles, effects on diets and nutrition may differ as well.

3. Study context

3.1. Coffee production in Uganda

Coffee plays an important role in Uganda's economy. Coffee is one of the country's main foreign exchange earners and an important source of employment for the rural poor. About 3.5 million households depend on the coffee sector (UCDA, 2016). Arabica and Robusta coffee are both grown in Uganda, but Robusta is more important, accounting for 85% of the country's coffee production. Robusta is grown at somewhat lower altitudes than Arabica, in regions up to 1200 m above sea level (UCDA, 2016). Given its lower quality, Robusta is traded at lower prices than Arabica. In general, world market prices for coffee can be quite volatile, even though prices paid to producers in Uganda were relatively stable in recent years. Specifically, between 2011 and 2015, a time frame that covers both waves of our household survey, prices paid to producers in Uganda ranged between US$ 0.60 and US$ 0.70 per pound of coffee (ICO, 2016).

Robusta coffee is predominantly grown by smallholder farmers with land holdings between 0.5 and 2.5 ha (UCDA, 2016). Farmers typically rely on family labor. Access to agricultural inputs and extension services is limited. As a result, coffee yields are relatively low. In addition, poor-quality infrastructure, inappropriate storage practices, and lack of modern processing facilities limit the opportunities for value addition and the overall returns to coffee cultivation (ITC, 2012).

Recently, the Ugandan government has promoted farmer participation in coffee certification schemes with the intention to increase the value of exports. The National Coffee Export Strategy has set a goal of increasing the amount of certified coffee by 5% each year (ITC, 2012). Perhaps as a result, Uganda has the largest Organic certified area and the largest number of Organic producers among all countries in Africa. Organic coffee is grown on about 6% of Uganda's total area under this crop (FiBL and IFOAM, 2016). The number of Fairtrade certified farmers has also been growing in recent years. Currently, around 55,000 farmers and workers are Fairtrade certified in Uganda, most of them in the coffee sector (Fairtrade International, 2015).

3.2. Panel survey

The empirical analysis builds on two waves of a farm household survey that were conducted in 2012 and 2015. Households to be included were selected using a two-stage sampling strategy. At the first stage, two farmer organizations located in Luwero and Bukomansimbi (previously Masaka) districts, central Uganda, were purposively selected. Both organizations produce Robusta coffee and face similar agro-ecological conditions. One is certified under Fairtrade, the other under Organic. It is important to note, however, that not all members of these farmer organizations actually participate in certification. Whether or not to participate in certification remains a voluntary decision of individual households.

At the second sampling stage, in both farmer organizations certified and non-certified households were randomly selected based on complete member lists. In 2012, a total of 355 households were interviewed. In 2015, we conducted interviews with the same households, to the extent possible. Out of the original sample of 355 households, we were unable to interview 24 in 2015.[2] To mitigate the effect of attrition, we replaced these 24 households with 24 other households that were also randomly selected (Hirano et al., 2001). Additionally, we increased the non-certified subsample by 30 randomly selected households in 2015. For the analysis, we use the unbalanced panel including 409 households.

Table 1 provides an overview of the sample households by year and certification scheme. Certification is time-variant, that is, farmers can enter or exit existing certification schemes. Out of the 331 households that were interviewed in both survey waves, 62 were Organic certified throughout, four newly entered and 28 exited Organic certification between 2012 and 2015. Further, 103 households were Fairtrade certified in both years, 16 newly entered and two exited the Fairtrade scheme between 2012 and 2015.[3]

[2] For most variables, we found no systematic differences in household characteristics collected in 2012 between the 331 households that were included in the second wave and the 24 households that were not (Table A.1 in the online appendix). Hence, we do not expect attrition bias in the analysis.

[3] We do not know why exactly individual farmers exited or entered certification between 2012 and 2015. However, our data show that Organic farmers did not receive higher coffee prices than non-certified farmers on average. In addition, Organic farmers

Table 1
Number of sampled households by year and certification status.

Certification status	2012	2015
Not certified	146	193
Fairtrade certified	108	121
Organic certified	101	71
Subtotal	355	385
Total	409	

Interviews were conducted by local enumerators, who were trained and supervised by the researchers. We used almost the same questionnaires in 2012 and 2015, covering a broad range of farm, household, and contextual characteristics. The interviews were conducted with the household heads. For diet and nutrition related questions (see details below), we also involved the main person in the household responsible for food purchases and cooking.

In addition to the household survey, in 2015 we also carried out focus group discussions with farmers and semi-structured interviews with key informants, such as agricultural extension officers, leaders of farmer organizations, coffee traders, and representatives of local development organizations. The purpose of these focus group discussions and interviews was to gain deeper insights into local conditions, coffee production, and farmers' perceptions of certification.

3.3. Services of farmer organizations

As explained, some of the coffee-producing households in our sample were certified under Fairtrade or Organic schemes, while others were not. Irrespective of their certification status, households do not have binding contracts with the farmer organization or other buyers. That is, even certified farmers are free to sell their coffee in non-certified channels if they wish. This happens especially when price differences between certified and non-certified channels are small and cash is urgently needed. Most farmers sell their coffee as sundried cherries – either to middlemen or to the farmer organizations. The Fairtrade certified organization has an own facility to mill the coffee, thus being able to sell shelled green beans directly to exporters in Kampala.

Both farmer organizations offer additional services to their members, especially services related to agricultural training. The Fairtrade certified organization further operates its own input shop, where trained staff offers advice to farmers on how to apply fertilizers and pesticides. The Fairtrade certified organization also operates a credit scheme, which allows farmers to pre-finance inputs or make other types of farming investments. The input shop, the credit scheme, and also the milling facility were financed through the Fairtrade premium.

4. Empirical strategy

Our objective is to analyze how Fairtrade and Organic certification affect different dimensions of household welfare, including consumption expenditures, child education, and nutrition. In this section, we explain the measurement of the outcome variables and the econometric modelling approaches used.

4.1. Measurement of outcome variables

We use consumption expenditures per adult equivalent (AE) as a general proxy for household living standards (Klasen, 2000). Consumption expenditures include the value of all food and non-food items consumed by household members. Data on non-food purchases were captured on an annual basis, referring to the 12 months prior to each survey wave. Food expenditures were calculated based on a seven-day food consumption recall at the household level. Food expenditures capture the value of all food items consumed, irrespective of whether the food was purchased, home-produced, or acquired from other sources. To aggregate food and non-food expenditures we converted both into daily values per AE expressed in Ugandan shillings (UGX). The official consumer price index was used to adjust for inflation between the two survey waves (World Bank, 2016).

To measure child education, the survey questionnaire included a special section on education-related expenditures (school or tutor fees, uniforms, learning materials, transportation costs to reach the school, etc.). Public schools are free in Uganda, but uniforms and learning materials (pencils, notebooks, etc.) have to be purchased. Otherwise, children are not allowed to attend classes. Further, tutorials (extra classes) are common in Uganda and have to be paid for. Some parents also decide to send their children to private schools, which are generally considered better but charge tuition fees. We therefore expect expenditures to be a good proxy of the quantity and quality of actual education received. To be comparable, we divided household expenditures on education by the number of children in primary and secondary school age.

Education expenditures at the household level were collected in 2012 and 2015. To further increase precision, in 2015 we additionally collected individual-level education expenditures for each child living in the household. These individual-level expenditure data, as well as the number of schooling years completed by each child, are used as additional proxies of child education.

Outcomes in terms of diets and nutrition are measured based on the seven-day consumption recall, covering quantities and values of more than 100 different food items. A first indicator we use is food expenditures, calculated as explained above. In addition, we converted the quantities of food items consumed into energy and nutrient levels, which is a common approach to analyze issues of household food security and dietary quality (de Haen et al., 2011; Chege et al., 2015). We used local food composition tables for Uganda for these calculations (Hotz et al., 2012). In terms of nutrients, we focus on iron, zinc, and vitamin A, because deficiencies in these micronutrients cause large public health problems in many developing countries (Black et al., 2008). To account for the fact that requirements differ by age and gender, quantities consumed at the household level are expressed per AE. We classify households as deficient when the calculated daily consumption level remains below international recommendations (FAO, WHO, UNU, 2001).[4]

4.2. Panel regression models

To analyze the effects of Fairtrade and Organic certification on household welfare, we estimate panel regression models of the following type:

$$Y_{it} = \beta_0 + \beta_1 Certified_{it} + \beta_2 \boldsymbol{X}_{it} + \beta_3 \boldsymbol{Z}_i + \varepsilon_{it} \quad (1)$$

where Y_{it} represents the different welfare measures referring to household i in year t. We estimate different models for each welfare indicator. $Certified_{it}$ is the treatment dummy that takes a value of one when household i was certified under Fairtrade or Organic in year t, and zero otherwise. As mentioned, the certification status can vary over time. $\boldsymbol{X}_{it}$ and $\boldsymbol{Z}_i$ are vectors of time-variant and time-invariant farm, household, and contextual characteristics.

(*footnote continued*)
had lower coffee yields (see below). Low economic benefits for Organic coffee producers are consistent with results by Chiputwa et al. (2015) and may explain why more farmers exited the Organic certification scheme. The opposite holds true for Fairtrade certification. Discussions revealed that Fairtrade certified farmers are quite happy with their scheme, which may have encouraged other farmers in their organization to also enter into Fairtrade certification.

[4] Recommended consumption levels per AE and day are as follows: 2400 kcal for energy; 18 mg for iron; 15 mg for zinc; 625 µg retinol equivalents for vitamin A.

In additional models, we further disaggregate the treatment variable as follows:

$$Y_{it} = \beta_0 + \beta_1 Fairtrade_{it} + \beta_2 Organic_{it} + \beta_3 \boldsymbol{X}_{it} + \beta_4 \boldsymbol{Z}_i + \varepsilon_{it} \quad (2)$$

where $Fairtrade_{it}$ and $Organic_{it}$ are two treatment dummies, which are mutually exclusive in our case because none of the farmers in our sample is double-certified. The models in Eq. (2) allow us to identify possible differences in impacts between Fairtrade and Organic.

The models in Eqs. (1) and (2) are estimated with random effects (RE) and fixed effects (FE) estimators. RE estimators are more efficient, but can lead to biased estimates of the treatment effect when unobserved factors are jointly correlated with certification and the welfare outcomes. This is tested with a Hausman test. FE estimators control for time-invariant unobserved heterogeneity, so that the treatment effect estimates suffer less from possible selection bias.

For the models with continuous dependent variables (consumption expenditures, food expenditures, non-food expenditures, education expenditures), we use log-linear specifications. For the models with dummy dependent variables (energy and micronutrient deficiencies), we use probit specifications. As probit models cannot be estimated with FE estimators, we additionally use linear probability models as robustness checks.

4.3. Cross-section models

For the individual level child education variables we only have cross-section data, as these were only collected in 2015. For these outcome variables, we estimate regression models of the following type:

$$Y_{ji} = \beta_0 + \beta_1 Fairtrade_i + \beta_2 Organic_i + \beta_3 \boldsymbol{C}_{ji} + \beta_3 \boldsymbol{H}_i + \varepsilon_{ji} \quad (3)$$

where Y_{ji} represents the education indicator referring to child j in household i. $\boldsymbol{C}_{ji}$ and $\boldsymbol{H}_i$ are child-level and household-level control variables. $Fairtrade_i$ and $Organic_i$ are the two treatment dummies, as before. All variables in Eq. (3) refer to 2015.

Education expenditure per child is a continuous dependent variable, for which we use a log-linear specification. Individual years of schooling is a count variable, for which we use a Poisson model.[5] Since many households have more than one child, we estimate standard errors with cluster correction at the household level.

One problem with the cross-section models in Eq. (3) is that the estimated treatment effects for Fairtrade and Organic may suffer from selection bias due to unobserved heterogeneity. To test and control for such bias, we use an instrumental variable (IV) approach. As both treatment variables may potentially be endogenous, we need at least two instruments that are correlated with certification but uncorrelated with child education.

We use distance from the farm household to the main building of the Fairtrade organization as an instrument for Fairtrade certification. As is shown in Table A.2 in the online appendix, households located closer to this building are more likely to be Fairtrade certified. This is plausible because the building is where the staff of the farmer organization (management, extension officers, etc.) and also the coffee milling facility are based. Closeness means that households are more exposed and have better access to Fairtrade activities and services. Distance to the Fairtrade building does not influence child education through pathways other than certification. This was tested by regressing the education variables on the instrument and other controls for the subsample of non-certified households (Table A.3 in the online appendix). One might have expected that the building of the Fairtrade organization is located in a setting with good infrastructure, which could improve households' access to education through various channels. But this is not the case. The building is located in the coffee growing area, away from tarmac roads and not close to schools or other public services.

[5] We tested if the data follow a Poisson distribution and detected no overdispersion.

We use altitude of the farm location as an instrument for Organic certification. Altitude was used previously as an instrument for certification (Chiputwa and Qaim, 2016). While differences in altitude in our sample are relatively small, altitude is negatively correlated with Organic certification (Table A.2 in the online appendix). This is probably related to clustering effects. Altitude does not directly influence education (Table A.3 in the online appendix). Unlike Arabica coffee, the quality of Robusta is less influenced by altitude. Altitude differences in our sample have no direct effect on coffee prices, yields, or other variables that could affect child education.[6]

We also tested instrument exogeneity more formally. With only one instrument available for each endogenous variable, one can add the square terms of the instruments as additional instruments to test the over-identifying restrictions. We did so and calculated Sargan's ($x^2 = 1.22$) and Basmann's ($x^2 = 1.21$) test statistics. Based on these tests, we failed to reject the null hypothesis ($p > 0.1$) that the instruments are uncorrelated with the error term and conclude that the two instruments are valid.

5. Results and discussion

5.1. Descriptive statistics

Table 2 provides descriptive statistics. Fairtrade, Organic, and non-certified households differ significantly in terms of various characteristics. Heads of non-certified households are significantly younger than heads of Fairtrade and Organic certified households. Organic households are more often headed by females than non-certified households. Fairtrade household heads are better educated than their non-certified counterparts.

Table 2 also reveals that the three groups differ significantly in terms of the welfare indicators. While Fairtrade households have higher non-food expenditures, Organic households spend more on food per AE. And higher food expenditures in Organic households are associated with lower levels of energy and micronutrient deficiencies.

Table 3 displays descriptive statistics at the individual level, where all variables refer to the year 2015. The upper part of Table 3 displays child-level characteristics and suggests that children in Fairtrade and Organic certified households spent significantly more years in school than children in non-certified households. Further, Organic and especially Fairtrade certified households have higher education-related expenditures than their non-certified counterparts. The lower part of Table 3 displays household-level characteristics.

5.2. Regression results

We start the regression analysis by providing an overview of the impact of certification in general, before focusing on the differences between Fairtrade and Organic. The first set of regression estimates is shown in Table 4. For each model, results with RE and FE estimators are shown. The test statistics, which are displayed in the lower part of the table, reject the null hypothesis of zero correlation with the error term, so we focus on the FE results for interpretation.[7]

[6] This was tested by regressing coffee prices and yields on the instruments and control variables for the subsample of non-certified households. None of the instruments has a significant effect on prices or yields.

[7] The FE estimates rely on variation of certification status within households over time, that is, they evaluate the effects of entering or exiting a particular certification scheme. As mentioned, a number of households entered Fairtrade between 2012 and 2015, whereas very few exited Fairtrade. For Organic, the situation is reversed, more people exited the scheme. This should be kept in mind when interpreting the estimates. However, for both schemes we also tested how the results change when excluding those who newly entered or exited between 2012 and 2015 (Table A.4 in the online appendix). Due to the smaller sample size and lower data variation, these alternative estimates are less efficient. But the signs of the treatment effects and most of the significance levels remain, so we cautiously conclude that interpretation in both directions is legitimate.

Table 2
Descriptive statistics by certification status (pooled data for 2012 and 2015).

	(1) Full sample	(2) Non-certified[a]	(3) Fairtrade[b]	(4) Organic[c]
Household, farm, and contextual characteristics				
Household size (AE)	4.92	4.64***	4.90	5.50***
	(2.54)	(2.51)	(2.21)	(2.91)
Female-headed household (1/0)	0.22	0.21	0.18	0.31**
	(0.42)	(0.41)	(0.39)	(0.47)
Household head schooling (yrs.)	6.63	6.48	7.92***	5.22***
	(3.64)	(3.46)	(3.47)	(3.65)
Household head age (yrs.)	53.14	49.40***	56.60***	55.89***
	(14.20)	(14.99)	(12.27)	(13.23)
Distance to tarmac road (km)	17.74	18.58**	14.19***	20.82**
	(10.23)	(12.96)	(6.19)	(6.45)
Household consumption expenditures				
Total expenditure (UGX/AE/day)	4938.65	4535.90***	5611.70***	4836.32
	(2679.73)	(2651.40)	(2808.67)	(2383.49)
Non-food expenditure (UGX/AE/day)	1659.65	1420.29***	2368.51***	1187.63*
	(1659.25)	(1554.91)	(1966.63)	(975.51)
Food expenditure (UGX/AE/day)	3279.00	3115.61**	3243.19	3648.70***
	(1794.33)	(1758.57)	(1725.29)	(1907.95)
Expenditure on education (UGX/AE/day)[d]	685.72	489.34***	1098.37***	478.61
	(1027.21)	(999.97)	(1212.82)	(489.16)
Household nutrition				
Energy deficiency (1/0)[e]	0.37	0.38	0.44	0.25***
	(0.48)	(0.49)	(0.50)	(0.43)
Iron deficiency (1/0)[f]	0.48	0.51	0.57	0.29***
	(0.50)	(0.50)	(0.50)	(0.45)
Zinc deficiency (1/0)[g]	0.78	0.79	0.84	0.66***
	(0.42)	(0.41)	(0.37)	(0.47)
Vitamin A deficiency (1/0)[h]	0.39	0.42*	0.49	0.19***
	(0.49)	(0.50)	(0.50)	(0.39)
Observations	740	339	229	172

[a] Significance level in this column refers to the difference between certified (under any standard) and non-certified households.
[b] Significance level in this column refers to the difference between Fairtrade and non-certified households.
[c] Significance level in this column refers to the difference between Organic and non-certified households.
[d] Includes only households with school-aged children.
[e] Energy consumption < 2400 kcal/AE/day.
[f] Iron consumption < 18.27 mg/AE/day.
[g] Zinc consumption < 15 mg/AE/day.
[h] Vitamin A consumption < 625 µg retinol equivalents/AE/day Standard deviations in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 3
Descriptive statistics by certification status (data for individual children in 2015).

	(1) Full sample	(2) Non-certified[a]	(3) Fairtrade[b]	(4) Organic[c]
Child characteristics				
Years spent in school	4.46	3.91***	5.32***	4.47**
	(3.20)	(2.94)	(3.42)	(3.16)
Expenditure on education (UGX/day)	867.98	680.98***	1201.37***	811.51*
	(1189.64)	(916.95)	(1593.34)	(924.92)
Female (1/0)	0.46	0.47	0.46	0.43
	(0.50)	(0.50)	(0.50)	(0.50)
Age (yrs.)	11.64	11.29***	11.91**	12.06***
	(3.66)	(3.58)	(3.76)	(3.65)
Observations	1122	545	345	232
Household characteristics				
No. of children in primary school age	2.23	2.33	1.97**	2.45
	(1.37)	(1.30)	(1.34)	(1.54)
No. of children in secondary school age	1.19	1.06*	1.18	1.55***
	(1.18)	(1.03)	(1.15)	(1.54)
No. of household members[d]	3.60	3.53	3.55	3.84
	(1.73)	(1.63)	(1.66)	(2.12)
Female-headed household (1/0)	0.21	0.20	0.18	0.29
	(0.41)	(0.40)	(0.39)	(0.46)
Household head schooling (yrs.)	6.81	6.58	7.86***	5.47**
	(3.55)	(3.51)	(3.15)	(3.87)
Household head age (yrs.)	54.36	51.20***	57.98***	56.24**
	(13.40)	(14.14)	(12.00)	(11.79)
Distance to primary school (km)	1.34	1.20**	1.50*	1.43
	(1.22)	(0.95)	(1.60)	(0.98)
Distance to secondary school (km)	2.92	2.98	2.73	3.11
	(3.53)	(4.60)	(2.08)	(1.93)
Dist. to Fairtrade cooperative building (km)	79.29	97.04***	5.87***	169.29***
	(77.85)	(72.78)	(3.31)	(21.23)
Altitude (m)	1184.86	1170.24***	1248.75***	1104.31***
	(73.74)	(71.10)	(24.30)	(29.78)
Observations	329	161	110	58

[a] Significance level in this column refers to the difference between certified (under any standard) and non-certified.
[b] Significance level in this column refers to the difference between Fairtrade and non-certified.
[c] Significance level in this column refers to the difference between Organic and non-certified.
[d] Excludes household members of primary or secondary school age. Standard deviations in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

The first two columns of Table 4, which are estimates of the model explained in Eq. (1), suggest that certification increases household welfare in terms of total consumption expenditures per AE. Columns (3) and (4) show estimates of the model in Eq. (2), with disaggregation of the treatment variable by certification scheme. The effects of Fairtrade and Organic are very similar. The coefficient of 0.32 for Fairtrade in column (4) implies that Fairtrade certification increases total consumption expenditure per AE by 37%.[8] Organic certification increases expenditure per AE by about 36%.[9]

Looking at food and non-food expenditures separately (columns 5–12), we find that Fairtrade certification more than doubles non-food expenditures, but has no significant effect on food expenditures. The opposite holds for Organic certification, which increases food expenditures by almost 30%, but has no significant effect on non-food expenditures. Below, we discuss possible reasons for the dissimilar impact of Fairtrade and Organic.

[8] The percentage effect of dummy variables in log-linear models is calculated as $[\exp(\hat{\beta})-1] \times 100$.

[9] We will show below that the increases in consumption expenditures for Organic certified households are not the result of higher cash incomes from coffee production.

Table 4
Effects of certification on household expenditures per adult equivalent (panel data models).

	Total expenditure				Non-food expenditure				Food expenditure			
	(1) RE	(2) FE	(3) RE	(4) FE	(5) RE	(6) FE	(7) RE	(8) FE	(9) RE	(10) FE	(11) RE	(12) FE
Certified (1/0)	0.21***	0.31***			0.36***	0.49***			0.14***	0.22***		
	(0.04)	(0.08)			(0.07)	(0.17)			(0.04)	(0.08)		
Fairtrade (1/0)			0.24***	0.32**			0.62***	0.82**			0.06	0.14
			(0.05)	(0.14)			(0.09)	(0.41)			(0.04)	(0.14)
Organic (1/0)			0.18***	0.31***			0.06	0.29			0.22***	0.26**
			(0.05)	(0.11)			(0.08)	(0.20)			(0.05)	(0.11)
Year = 2015	0.09***	0.10***	0.09***	0.10***	0.39***	0.39***	0.37***	0.36***	−0.05	−0.05	−0.05	−0.04
	(0.03)	(0.04)	(0.03)	(0.04)	(0.05)	(0.06)	(0.05)	(0.06)	(0.03)	(0.04)	(0.03)	(0.04)
Household size (AE)	−0.14***	−0.16***	−0.14***	−0.16***	−0.11***	−0.18**	−0.11***	−0.19***	−0.15***	−0.16***	−0.15***	−0.15***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)	(0.07)	(0.04)	(0.07)	(0.02)	(0.04)	(0.02)	(0.04)
Household size squared	0.01***	4E−03**	0.01***	4E−03**	0.00	0.00	0.00	0.00	0.01***	4E−03*	0.01***	4E−03*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Female headed (1/0)	−0.11**	−0.52***	−0.11**	−0.52***	−0.29***	−0.96**	−0.25***	−0.95**	−0.06	−0.41***	−0.07	−0.41***
	(0.05)	(0.18)	(0.05)	(0.18)	(0.10)	(0.48)	(0.09)	(0.46)	(0.05)	(0.15)	(0.05)	(0.16)
Household head school (yrs.)	0.02***	−0.01	0.02***	−0.01	0.05***	−0.02	0.04***	−0.02	0.01	0.01	0.01**	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
Household head age (yrs.)	3E−03**	−0.01*	3E−03**	−0.01*	−0.00	−0.02	−0.00	−0.02	4E−03***	−0.01*	4E−03***	−0.01*
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to road (km)	0.00	−0.00	0.00	−0.00	0.00	−0.00	0.01**	−0.00	4E−03**	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	8.43***	9.52***	8.44***	9.52***	6.77***	8.56***	6.83***	8.53***	8.18***	8.94***	8.15***	8.95***
	(0.10)	(0.33)	(0.11)	(0.33)	(0.20)	(0.64)	(0.20)	(0.64)	(0.10)	(0.30)	(0.10)	(0.30)
No. of observations	740	740	740	740	740	740	740	740	740	740	740	740
No. of households	409	409	409	409	409	409	409	409	409	409	409	409
F-value		18.72***		16.85***		17.97***		15.48***		8.77***		7.93***
Wald χ^2	231.04***		229.74***		170.77***		197.28***		168.87***		178.69***	
Hausman test χ^2	29.68***		30.46***		30.56***		33.77***		14.84*		13.93	
Sargan-Hansen test χ^2	37.47***		38.15***		40.27***		44.17***		17.85**		16.95**	

Robust standard errors in parentheses. The dependent variable in all models is the logarithm of expenditure per adult equivalent (AE). RE, random effects. FE, fixed effects.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

5.3. Fairtrade certified households

Certification may help to increase coffee yields, quality, and income through improving farmers' access to technology, inputs, knowledge, and higher-value output markets. However, the particular requirements and services offered differ by certification scheme, so that the concrete effects may differ too. As explained, the Fairtrade farmer organization provides a number of services to its members, such as agricultural training, provision of credits, value addition through its own coffee mill, and easier access to inputs through the organizations' farm input shop.

Indeed, Fairtrade certified households in our sample use more productivity-enhancing inputs than Organic certified or non-certified households (Table 5). This possibly explains higher yields among Fairtrade farmers (average 365 kg/acre) than among non-certified (315 kg/acre) and Organic (186 kg/acre) farmers.[10] Better production and marketing conditions for coffee also seem to contribute to a higher degree of specialization. Fig. 1 (panel A) shows that Fairtrade farmers use a larger share of their total land for coffee production than the other two subsamples. These observations are in line with research on Fairtrade effects in other countries and regions (Ruben and Fort, 2012; Ruben and Zuniga, 2011).

Fig. 1 (panel B) shows that Fairtrade farmers also received higher average coffee prices (median 2150 UGX/kg) than their Organic certified and non-certified counterparts (median for both groups: 2000 UGX/kg).[11] To some extent, this may be due to the guaranteed Fairtrade minimum price. However, even when Fairtrade farmers sell in non-certified channels, they often fetch higher prices due to better quality and higher levels of processing. The key informant interviews

Table 5
Farming practices by certification status (pooled data for 2012 and 2015).

	(1) Non-certified[a]	(2) Fairtrade[b]	(3) Organic[c]
	Share of households		
Use of pesticides	0.44**	0.58***	0.08***
	(0.50)	(0.49)	(0.27)
Use of chemical fertilizers	0.17	0.34***	0.01***
	(0.37)	(0.48)	(0.08)
Cultivation of legumes	0.87	0.88	0.93**
	(0.34)	(0.33)	(0.26)
Observations	339	229	172

*$p < 0.1$.
[a] Significance level in this column refers to the difference between non-certified households and all certified households combined.
[b] Significance level in this column refers to the difference between Fairtrade and non-certified households.
[c] Significance level in this column refers to the difference between Organic and non-certified households.
** $p < 0.05$.
*** $p < 0.01$.

[10] When comparing yield levels per acre it has to be kept in mind that intercropping of coffee with food crops on the same field is more often observed among Organic certified households.

[11] Average coffee prices reflect what farmers actually received when they sold their coffee. As certified farmers do not sell all of their coffee in certified markets, the numbers do not necessarily reflect price differences (or lack thereof) between certified and non-certified markets.

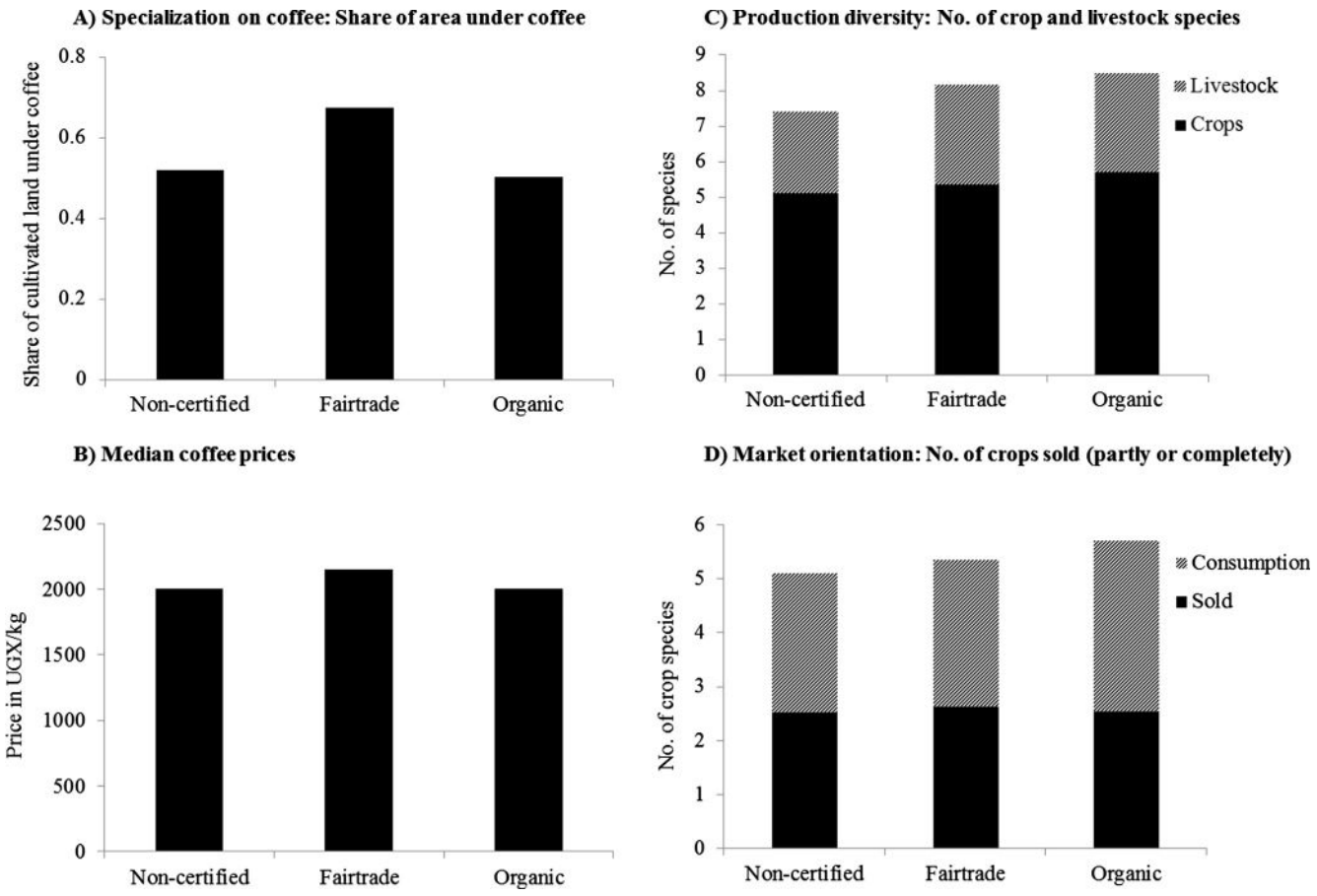

Fig. 1. Differences by certification status.

with traders and other stakeholders of the coffee value chain confirmed that the coffee from Fairtrade farmers is generally considered of high quality in the local context. Similar observations were also made elsewhere (Ruben and Fort, 2012; van Rijsbergen et al., 2016).

The effects discussed so far can explain why Fairtrade farmers have higher incomes from coffee production than the other two groups, but why is this income spent more on non-food goods and services than on food? This question can be answered by analyzing the utilization of different types of income (Duflo and Udry, 2004). Food expenditures occur on a regular basis and are typically made from more regular sources of income. However, coffee income is more seasonal. Larger revenues accrue twice a year during or shortly after the two main coffee harvesting seasons. This money is typically not used for regular food expenditures, but is rather spent on clearing bills or making investments into more durable non-food items, such as school uniforms and learning materials. Indeed, participants in our focus group discussions explained that "coffee pays for children's education." This education effect of higher coffee income is further reinforced by the fact that the Fairtrade standard restricts child labor, thus reducing the opportunity cost of attending school, as explained above.

The regression results in Table 6 confirm that Fairtrade certification increases expenditures on child education significantly, even after controlling for other relevant factors. In columns (1) and (2), the dependent variable is household education expenditure divided by the number of children in primary school age. In columns (3) and (4), household education expenditure is divided by the number of children in primary and secondary school age. In both versions, the Fairtrade effect is positive and highly significant. The coefficient estimate of 0.90 in column (4) of Table 6 suggests that Fairtrade certified households spend 146% more on child education than non-certified households.

Table 7 shows results from the cross-section models explained in Eq. (3) with OLS and IV estimators. Columns (1) and (2) use individual education expenditure as dependent variable, whereas in columns (3) and (4) the dependent variable is individual years of schooling. The estimates confirm that Fairtrade certification significantly increases investments in child education. Furthermore, controlling for other factors, Fairtrade increases child schooling by 0.66 years. These results are similar to earlier findings for Fairtrade in other countries by Gitter et al. (2012), Arnould et al. (2009), and Becchetti et al. (2013).

Results in Table 7 further suggest that there is no discrimination against girls in child education. On the contrary, households spend about 30% more on girls' than boys' education. And, on average, girls stay 0.57 years longer in school than boys. These effects are independent of certification status[12] and may possibly be explained by higher opportunity costs of attending school for boys and young men (Gitter et al., 2012). In any case, these effects are welcome from a women empowerment perspective.

5.4. Organic certified households

Unlike Fairtrade, for Organic certified households we do not find significant effects on education expenditures or on years of schooling (Tables 6 and 7). This is consistent with results in Table 4 that revealed significant positive effects of Organic certification on food expenditures, but not non-food expenditures. We explain likely

[12] We tested whether Fairtrade and Organic standards affect girls' and boys' educational opportunities differently by interacting the treatment variables with the female child dummy (Table A.5 in the online appendix). The interaction terms were insignificant in the education expenditure and years of schooling models. We conclude that standards do not change the relative cost of sending girls or boys to school, nor do standards seem to change parents' relative preferences to invest in their daughters' or sons' education.

Table 6
Effects of certification on education expenditure (panel data models).

	Expenditure per child of primary school age		Expenditure per child of primary or secondary school age	
	(1) RE	(2) FE	(3) RE	(4) FE
Fairtrade (1/0)	0.85***	1.03***	0.92***	0.90**
	(0.17)	(0.39)	(0.17)	(0.36)
Organic (1/0)	0.26	0.65	0.23	0.63
	(0.17)	(0.56)	(0.18)	(0.53)
Year = 2015	0.65***	0.67***	0.60***	0.67***
	(0.12)	(0.17)	(0.12)	(0.15)
No. of children primary school age	−0.22***	−0.14*	−0.02	−0.01
	(0.05)	(0.09)	(0.05)	(0.08)
No. of household members[a]	0.19***	0.08		
	(0.03)	(0.06)		
No. of children secondary school age			−0.06	−0.25**
			(0.06)	(0.11)
No. of household members[b]			0.18***	0.11**
			(0.04)	(0.05)
Female-headed household (1/0)	0.01	−1.84	−0.04	−1.96*
	(0.18)	(1.14)	(0.20)	(1.03)
Household head schooling (yrs.)	0.07***	−0.03	0.07***	−0.03
	(0.02)	(0.06)	(0.02)	(0.05)
Household head age (yrs.)	−0.00	0.00	−0.01	−0.03
	(0.01)	(0.02)	(0.01)	(0.02)
Distance to primary school (km)	−0.01	−0.10	−0.04	−0.09
	(0.06)	(0.08)	(0.06)	(0.08)
Distance to secondary school (km)	0.00	−0.00	0.00	−0.01
	(0.02)	(0.03)	(0.02)	(0.03)
Constant	5.16***	6.46***	4.87***	7.86***
	(0.35)	(1.57)	(0.40)	(1.42)
No. of observations	596	596	643	643
No. of households	358	358	374	374
F-value		6.73***		3.83***
Wald χ^2	164.59***		132.59***	
Hausman test χ^2	17.43*		18.05*	
Sargan-Hansen test χ^2	16.61*		16.59	

Robust standard errors in parentheses. The dependent variable in all models is the logarithm of expenditure. RE, random effects. FE, fixed effects.
[a] Excludes household members of primary school age.
[b] Excludes household members of primary or secondary school age.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 7
Effects of certification on individual child education (cross-section data models).

	Education expenditure (log)		Years of schooling	
	(1) OLS	(2) IV	(3) Poisson	(4) IV
Fairtrade (1/0)	0.72***	0.64***	0.69***	0.66***
	(0.19)	(0.16)	(0.13)	(0.13)
Organic (1/0)	0.34	0.16	0.10	−0.00
	(0.22)	(0.25)	(0.15)	(0.16)
Children primary school age	0.13**	0.13**	0.11***	0.11***
	(0.06)	(0.06)	(0.03)	(0.03)
Children secondary school age	0.02	0.02	−0.02	−0.01
	(0.06)	(0.06)	(0.03)	(0.04)
Household members not school age	0.06	0.06	−0.05	−0.05
	(0.05)	(0.05)	(0.03)	(0.03)
Female-headed household (1/0)	0.17	0.18	0.25*	0.26*
	(0.23)	(0.21)	(0.13)	(0.13)
Household head schooling (yrs.)	0.07***	0.07***	0.06***	0.05***
	(0.02)	(0.02)	(0.02)	(0.02)
Household head age (yrs.)	−0.01*	−0.01	−0.00	−0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Distance to primary school (km)	−0.03	−0.04	0.03	0.03
	(0.08)	(0.08)	(0.04)	(0.04)
Distance to secondary school (km)	0.01	0.01	0.01	0.01
	(0.02)	(0.02)	(0.01)	(0.02)
Female child (1/0)	0.24*	0.23**	0.59***	0.57***
	(0.13)	(0.11)	(0.09)	(0.09)
Age of child (yrs.)	0.06***	0.06***	0.63***	0.63***
	(0.02)	(0.02)	(0.01)	(0.01)
Constant	10.39***	10.43***		
	(0.42)	(0.54)		
No. of observations	1122	1122	1120	1120
No. of households (clusters)[a]	329	329	329	329
F-value	4.16***			
Wald χ^2		72.91***	1137.09***	2210.51***
Hausman test χ^2	24.46**		4.80	
Wald (χ^2) first stage Fairtrade[b]		64.76***		64.76***
Wald (χ^2) first stage Organic[b]		37.58***		37.58***
Goodness-of-fit χ^2			91.31	

Cluster robust standard errors in parentheses. Years of schooling were modelled with a Poisson, for which marginal effects are shown.
[a] Only includes households with children aged 6–18.
[b] Test for weak instruments (Ho: coefficient of instrument in first stage is equal to zero).
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

mechanisms for these effects below.

As discussed, food expenditures capture the value of all food items consumed by the household, including subsistence production. Home-produced foods are important components of diets in smallholder farm households, and this is especially true for Organic certified households in our sample. Indeed, higher food expenditures among Organic households are attributable to a greater focus on subsistence food production – not to higher cash incomes from coffee sales. As argued above, Organic certified households in our sample have lower yields and do not receive higher prices for their coffee, so Organic certification does not increase coffee income. Fig. 1 shows that Organic certified households are less specialized in coffee production (panel A) and have more diversified farm production systems (panel C) than Fairtrade and non-certified households. This can be explained by the principles of the Organic standard that explicitly promote measures to increase production diversity. For instance, the large majority of Organic certified households grow legumes to improve and maintain soil fertility (Table 5). Higher production diversity and a stronger focus on subsistence consumption tend to be associated with foregone benefits from specialization and lower cash incomes (Sibhatu et al., 2015). This can also explain the lower non-food expenditures observed in Organic certified households.

We now analyze whether the higher food expenditures caused by Organic certification are also associated with improved household diets and nutrition. Regression results in Table 8 confirm that Organic certification is associated with lower levels of energy and micronutrient

Table 8
Effects of certification on energy and micronutrient deficiency (probit panel data models).

	(1) Energy deficiency RE	(2) Iron deficiency RE	(3) Zink deficiency RE	(4) Vitamin A deficiency RE
Fairtrade (1/0)	0.05	0.05	0.03	0.06
	(0.04)	(0.04)	(0.04)	(0.05)
Organic (1/0)	−0.19***	−0.22***	−0.12***	−0.24***
	(0.05)	(0.05)	(0.04)	(0.05)
Year = 2015	−0.05	0.08**	0.03	0.12***
	(0.03)	(0.04)	(0.03)	(0.04)
Household size (AE)	0.07***	0.07***	0.06***	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Household size (AE) squared	−0.00	−0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Female headed household (1/0)	−0.03	−0.03	0.02	−0.02
	(0.05)	(0.04)	(0.04)	(0.05)
Household head schooling (yrs.)	0.00	0.01**	0.00	0.00
	(0.01)	(0.01)	(0.00)	(0.01)
Household head age (yrs.)	−0.00	2E−03*	−3E−03***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Distance to all-weather road (km)	−0.00	−0.00	−4E−03**	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)
No. of observations	740	740	740	740
No. of households	409	409	409	409
Wald χ^2	59.97***	62.72***	70.82***	41.05***

Marginal effects are shown with standard errors in parentheses. RE, random effects.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

deficiencies. The marginal effects suggest that Organic certification reduces the likelihood of energy deficiency by 19 percentage points, and the likelihood of iron, zinc, and vitamin A deficiencies by 12–24 percentage points.

However, the probit models in Table 8 cannot be estimated with a FE estimator. In Table A.6 in the online appendix we show alternative results, using a linear probability model and comparing RE and FE estimates. The FE coefficients for Organic certification are insignificant in all models except for iron. Thus, while there is a clear positive association between Organic certification and dietary quality, we only have weak evidence to prove causality. For Fairtrade certification, all diet and nutrition effects in Tables 8 and A.6 are statistically insignificant.

5.5. Further robustness checks

We carry out two additional tests to analyze the robustness of the findings with respect to the choice of the control group. In the estimates so far, the control group included non-certified members of the Fairtrade and Organic farmer organizations. However, as the farmer organizations may differ also in terms of characteristics not directly related to certification, a combined control group may possibly be inappropriate. In the first test, we ran separate panel regressions, comparing certified and non-certified households in each farmer organization (Table A.7 in the online appendix). The results are similar to those in Table 4 with the combined sample. One exception is the effect of Organic on non-food expenditures, which is significant in Table A.7. Nevertheless, as before, these alternative results still suggest that Fairtrade has a larger effect on non-food expenditures than Organic. Hence, the comparison of effects between the two standards remains robust regardless of how exactly the control group is defined.

The second test also relates to the control group and appropriate sample to use for estimating the effects of each standard, but focuses on the cross-section IV regressions. As explained above, in the IV regressions we used two instruments, one for Fairtrade certification (distance to Fairtrade building) and one for Organic certification (altitude). It is possible that both instruments are correlated, which could influence the combined IV estimates. To examine this further, we conducted separate IV regressions for each farmer organization, using only one instrument (distance for the Fairtrade regression and altitude for the Organic regression). The results, which are shown in Table A.8 in the online appendix, support the finding that Fairtrade positively affects education expenditures, while, Organic does not. Yet it should be noted that in the separate IV regression for Organic, altitude does not qualify as a strong instrument anymore. This may possibly be due to the smaller sample size (N = 144). Against this background, some caution is warranted when interpreting the IV regression results regarding the effect of Organic certification on individual-level child education. However, as these IV results are consistent with the household-level RE and FE panel data estimates, we have various pieces of evidence to support the finding that Organic certification has no significant effect on child education.

6. Conclusion

The empirical evidence on impacts of sustainability standards in the small farm sector is growing. We have contributed to this literature by comparing the effects of two popular sustainability standards, Organic and Fairtrade, on household welfare in Uganda. Unlike most previous research that built on cross-section data, we have used panel data that are more suitable to reduce selection bias. Moreover, we have looked at various indicators of household welfare, including consumption expenditures, child education, and nutrition.

In line with previous research, we have shown that Fairtrade and Organic certification have positive welfare effects in terms of total consumption (Chiputwa et al., 2015). However, in terms of the other welfare indicators we found remarkable differences. Fairtrade increases non-food expenditures and child education, whereas Organic increases food expenditures and to some extent nutrition. We found no effects of Fairtrade on food expenditures and nutrition, and no effects of Organic on non-food expenditures and child education. These differences in impacts were explained with differences in the principles of each standard and different types of services offered to certified households. Such insights are not only relevant for producers, but also for consumers and other actors along certified value chains.

Our results suggest that food standards can be a tool to promote sustainability goals in the small farm sector. On the one hand, standards can contribute to higher household incomes. On the other hand – through trainings and recommended practices – standards also have the potential to raise awareness on issues such as education, nutrition, or gender equality. A precondition is that such social issues are specifically addressed in certification schemes. Fairtrade includes specific rules and activities to reduce child labor and increase education, but not to improve nutrition. Given widespread dietary deficiencies among smallholder farm households, the design of sustainability standards should place more emphasis on nutrition. Certification agencies could instigate participating farmer organizations to offer training on nutrition – as is already common practice for other topics such as environmental stewardship.

More generally, our results show that economic gains from agricultural development interventions are not necessarily reflected in terms of other welfare dimensions, such as child education, household diets, and nutrition. Analyzing welfare effects beyond purely economic indicators is of particular importance for achieving the United Nation's Sustainable Development Goals (SDGs). The analytical approaches proposed and used in this study can be further refined and possibly used

also for the evaluation of other types of rural development projects and policies.

A few limitations of our study should be pointed out that could be addressed in follow-up research. First, the impacts of a food standard do not only depend on the principles of the standard itself, but also on the specific local conditions. Hence, the concrete results from our study in Uganda should not be generalized. Second, farmers in our study were sampled from only one Fairtrade and one Organic certified farmer organization. This setup makes it difficult to separate the effect of a standard from possible effects of a farmer organization as such.[13] We tried to control for farmer organization effects by comparing certified and non-certified households from the same organization. However, better understanding the role of organizational characteristics would require sampling a larger number of farmer organizations. To our knowledge, this has not yet been done in the literature. Third, our study builds on a short panel with relatively little variation in the treatment variables. Variation over time is especially relevant for the efficiency of the FE estimates. Many of the estimated treatment effects are statistically significant, but others are not. We cannot rule out the possibility that some effects are insignificant due to the lack of statistical power. Longer panels with more variation would be useful – and would also allow further reducing possible issues of time-variant unobserved heterogeneity, which cannot be controlled with FE estimators alone. Finally, although we looked at different areas of household welfare, not all dimensions of potential interest were actually captured. For instance, gender equality is one dimension that was not included here, but that would be relevant to include in future research.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.foodpol.2017.07.010.

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