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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 of such participation, with mixed results. Yet, there are important knowledge gaps. First, most existing studies look at the effects of one standard in one country. When comparing between studies it is not clear whether dissimilar outcomes are driven by differences in standards or local conditions. Second, most studies use cross-section, observational data, so that selectivity issues remain a challenge. Third, the existing work has primarily analyzed effects in terms of purely economic indicators, such as 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.

Key words: certification, education, food standards, nutrition, panel data, welfare

JEL codes: Q01, Q12, Q13, Q18

Introduction

Sustainability standards and certification schemes, such as Fairtrade and Organic, are gaining 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 (Hoogland, Boer, and Boersema 2007; Grunert, Hieke, and Wills 2014; 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 counties, voluntary participation in such certification schemes can facilitate access to more lucrative export markets (Jones and Gibbon 2011; Kleemann, Abdulai, and Buss 2014; Chiputwa, Spielman, and Qaim 2015). However, meeting the requirements can be difficult and costly, especially for marginalized farmers (Handschuch, Wollni, and Villalobos 2013). In a smallholder context, group certification approaches are often encouraged, in order to reduce the cost for individuals (Bolwig, Gibbon, and Jones 2009; Becchetti, Castriota, and Michetti 2013; Chiputwa, Spielman, and Qaim 2015) .

There is a growing literature about the impacts of sustainability standards on smallholder farmers in developing counties (e.g., Bolwig, Gibbon, and Jones 2009; Méndez *et al.* 2010; Jena *et al.* 2012; Chiputwa, Spielman, and Qaim 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 (Dragusanu, Giovannucci, and Nunn 2014). A few studies have looked at indicators beyond purely economic ones, including health, gender equality, child education, nutrition, and ecological sustainability (e.g., Arnould, Plastina, and Ball 2009; Gitter *et al.* 2012; Becchetti, Castriota, and Michetti 2013; Ibanez and Blackman 2016; Chiputwa and Qaim 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 standards in the same setting are hardly possible. Very few studies compare two or more standards, but these do not go beyond purely economic indicators (Méndez *et al.* 2010; Ruben and Zuniga 2011; Chiputwa, Spielman, and Qaim 2015; 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.

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. Around 30 percent 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 in subsequent sections.

Fairtrade

About 1.5 million smallholder farmers in developing countries are members of producer organizations that are certified by Fairtrade International. More than 50 percent 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 2011b). 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 percent 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 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 2011a).

Organic

Worldwide, about 2.3 million agricultural producers in 172 countries are certified Organic. The largest share of these producers (86 percent) lives in developing countries (FiBL and IFOAM 2016). There are various Organic standards; most are based on 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 rather that the market will reward farmers for complying with Organic principles.

Possible Economic Impacts

Certification is associated with a range of possible costs and benefits. Certification can be a tool to link farmers to higher-value export markets, which can be associated with higher and more stable prices (Bolwig, Gibbon, and Jones 2009; Ruben and Zuniga 2011; Weber, 2011; Kleemann, Abdulai, and Buss 2014; Chiputwa, Spielman, and Qaim 2015; Parvathi and Waibel 2016). However, not in all cases are average prices received by certified farmers higher than those received by their non-certified colleagues (Ruben and Fort 2012; Jena *et al.* 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, Gibbon, and Jones 2009; Valkila 2009; Méndez *et al.* 2010; Handschuch, Wollni, and Villalobos 2013; Akoyi and Maertens 2016). 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, Gibbon, and Jones 2009; Jones and Gibbon 2011; Kleemann, Abdulai, and Buss 2014; Chiputwa, Spielman, and Qaim 2015). In Latin America, in contrast, studies sometimes find less positive effects of certification, especially in the coffee sector (e.g., Valkila 2009; Ruben and Fort 2012). 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.

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 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, Plastina, and Ball (2009) and Becchetti, Castriota, and Michetti (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.

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, Shrinivas, and Bezner-Kerr 2014; Sibhatu, Krishna, and Qaim 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, Castriota, and Michetti (2013) 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.

Study Context

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 percent of the country's coffee production. Robusta is grown at somewhat lower altitudes than Arabica, in regions up to 1200 meters 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 (ICO 2016).

Robusta coffee is predominantly grown by smallholder farmers with land holdings between 0.5 and 2.5 hectares (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 percent 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 percent of Uganda's total area under this crop (FiBL and IFOAM 2016). Similarly, 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).

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. In 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.

In 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. To mitigate the effects 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 additional, 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; farmers can enter or exit existing certification schemes as they wish. 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.

[Table 1 about here]

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.

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 based on the Fairtrade premium received by the organization.

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 modeling approaches used.

Measurement of Outcome Variables

We use consumption expenditures 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 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, Klasen, and Qaim 2011; Chege, Andersson, and Qaim 2015). We used local food composition tables for Uganda for these calculations (Hotz, Lubowa, and Sison 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 adult equivalent (AE). We classify households as deficient when the calculated daily consumption level remains below international recommendations (FAO, WHO, and UNO 2004).[1]

Panel Regression Models

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

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

where Y_{it} represents the different welfare measures referring to household i in year *t*. We estimate different models for each welfare indicator. Certified is the treatment dummy that takes a value of one when the household is certified under Fairtrade or Organic, 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.

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

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

where Organic and Fairtrade are two treatment dummies, which are mutually exclusive in our case because none of the farmers in our sample is certified under both standards. The models in equation (2) allow us to identify possible differences in impacts between Fairtrade and Organic.

The models in equations (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.

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. Organic and Fairtrade are the two treatment dummies, as before. All variables in equation (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.[2] 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 equation (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 A1 in the 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. On the other hand, 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 A2 in the 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.

We use altitude of the farm location as an instrument for Organic certification. Altitude has been used previously as an instrument for certification (Chiputwa and Qaim 2016). While differences in altitudes in our sample are relatively small, altitude is negatively correlated with Organic certification (table A1, appendix). This is probably related to clustering effects. On the other hand, altitude does not directly influence education (table A2, 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, household income levels, or other variables that would affect child education.

Results and Discussion

Descriptive Statistics

Table 2 provides descriptive statistics. Organic, Fairtrade, and non-certified households differ significantly in terms of various characteristics. Heads of non-certified households are significantly younger than heads of Organic and Fairtrade 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 about here]

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.

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 3. 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.

The first two columns of table 3, which are estimates of the model explained in equation (1), suggest that certification increases household welfare in terms of total consumption expenditures. Columns (3) and (4) show estimates of the model in equation (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 by 37 percent.[3] Organic certification increases expenditure by about 36 percent.

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 percent, but has no significant effect on non-food expenditures. Below, we discuss possible reasons for the dissimilar impact of Fairtrade and Organic.

[Table 3 about here]

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 farmers in our sample use more productivity-enhancing inputs than Organic certified or non-certified farmers (table 4). Better production and marketing conditions for coffee also seem to contribute to a higher degree of specialization. Figure 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).

[Table 4 about here]

[Figure 1 about here]

Figure 1 (panel B) shows that Fairtrade farmers also receive higher average coffee prices than their Organic certified and non-certified counterparts. 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 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 5 confirm that Fairtrade certification increases expenditures on child education significantly, even after controlling for other relevant factors. In columns (1) to (4), the dependent variable is household education expenditures divided by the number of children in primary school age. In columns (5) to (8), household education expenditures are 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 (8) of table 5 suggests that Fairtrade certified households spend 146 percent more on child education than non-certified households.

[Table 5 about here]

Table 6 shows results from the cross-section models explained in equation (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 on Fairtrade in other countries by Gitter *et al.* (2012), Arnould, Plastina, and Ball (2009), and Becchetti, Castriota, and Michetti (2013).

Results in table 6 further suggest that there is no discrimination against girls in child education. On the contrary, households spend about 30 percent more on girls' than boy's education. And, on average, girls stay 0.57 years longer in school than boys. These effects are independent of certification status 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.

[Table 6 about here]

Organic Certified Households

Unlike Fairtrade, for Organic certified households we do not find significant effects on education expenditures or on years of schooling (tables 5 and 6). 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 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. Figure 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 4). Higher production diversity and a stronger focus on subsistence consumption tend to be associated with foregone benefits from specialization and lower cash incomes (Sibhatu, Krishna, and Qaim 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 7 confirm that Organic certification is associated with lower levels of energy and micronutrient 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.

[Table 7 about here]

However, the probit models in table 7 cannot be estimated with a FE estimator. In table A3 in the 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 vitamin A. Thus, while there is a clear positive association between Organic certification and dietary quality, we only have weak evidence to prove causality. The positive vitamin A effect of Organic certification is promising, because vitamin A deficiency is often particularly difficult to control without specific interventions. The reason is that the income elasticity of vitamin A consumption tends to be lower than that for many other micronutrients (Ecker and Qaim 2011). For Fairtrade certification, all diet and nutrition effects in tables 7 and A3 are statistically insignificant.

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 (Becchetti and Costantino 2008; Arnould, Plastina, and Ball 2009; Gitter *et al.* 2012; Becchetti, Castriota, and Michetti 2013; Chiputwa, Spielman, and Qaim 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, our study builds on a short panel with relatively little variation in the treatment variables. Longer panels with more variation would be useful to also look at impact dynamics and to further reduce endogeneity issues. 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.

Notes

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[1] 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.

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

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

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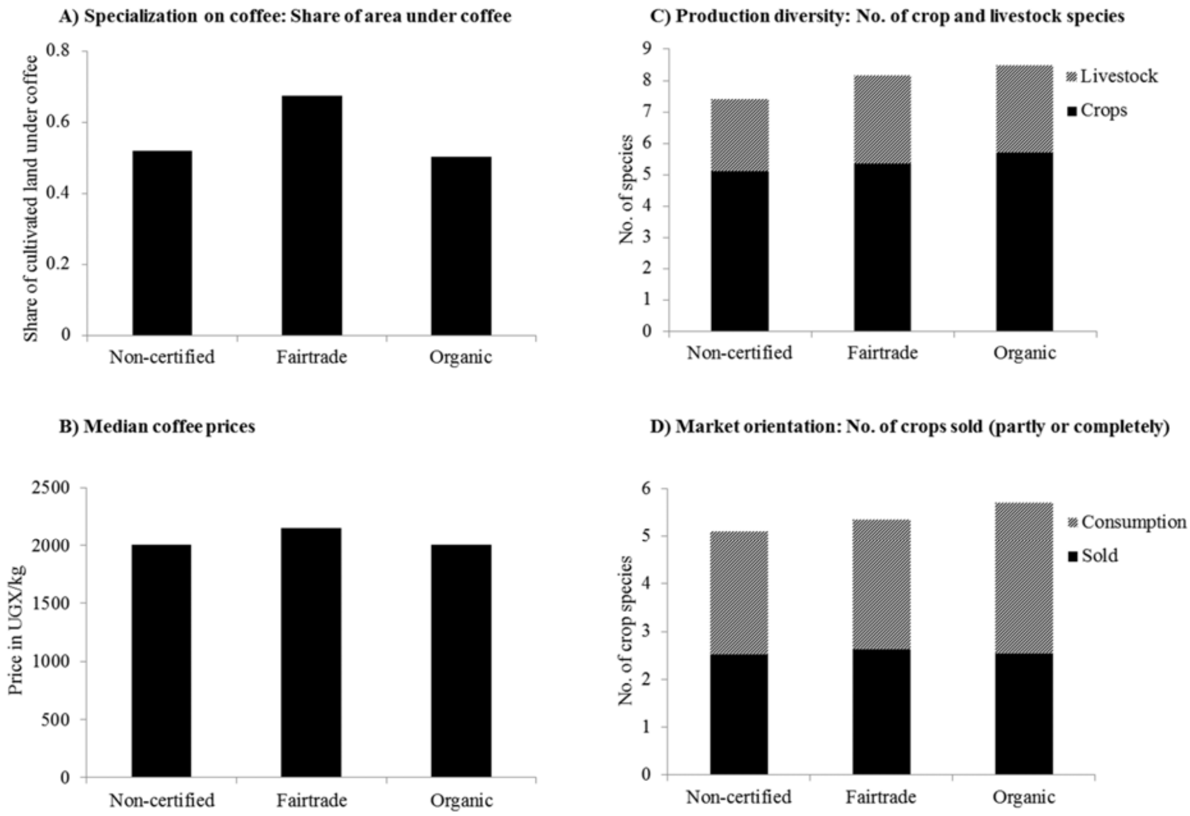
Figures

Figure 1. Differences by certification status



Tables

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	

Table 2. Descriptive Statistics by Certification Status (Pooled Data for 2012 and 2015)

	(1) Full sample	(2) Not 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 expenditures (UGX)				
Food and non-food expenditures /AE/day	4938.65	4535.90***	5611.70***	4836.32
	(2679.73)	(2651.40)	(2808.67)	(2383.49)
Non-food expenditure /AE/day	1659.65	1420.29***	2368.51***	1187.63*
	(1659.25)	(1554.91)	(1966.63)	(975.51)
Food expenditure /AE/day	3279.00	3115.61**	3243.19	3648.70***
	(1794.33)	(1758.57)	(1725.29)	(1907.95)
Total expenditure on education	3202.34	2079.83***	5276.91***	2652.63*
	(5120.05)	(3848.00)	(6931.11)	(3377.05)
Household nutrition				
Energy deficiency (1/0) [d]	0.37	0.38	0.44	0.25***
	(0.48)	(0.49)	(0.50)	(0.43)
Iron deficiency (1/0) [e]	0.48	0.51	0.57	0.29***
	(0.50)	(0.50)	(0.50)	(0.45)
Zinc deficiency (1/0) [f]	0.78	0.79	0.84	0.66***
	(0.42)	(0.41)	(0.37)	(0.47)
Vitamin A deficiency (1/0) [g]	0.39	0.42*	0.49	0.19***
	(0.49)	(0.50)	(0.50)	(0.39)
Observations	740	339	229	172

Standard deviations in parentheses.

[a] Significance level in this column refers to the difference between scheme participants (all certification schemes) and the control group.

[b] Significance level in this column refers to the difference between Fairtrade participants and the control group.

[c] Significance level in this column refers to the difference between Organic participants and the control group.

[d] Energy consumption < 2400 kcal/AE/day

[e] Iron consumption < 18.27 mg/AE/day

[f] Zinc consumption < 15 mg/AE/day

[g] Vitamin A consumption < 625 µg RE/AE/day

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. Effects of Certification on Household Expenditure (Panel Data Models)

	Total expenditure				Non-food expenditure				Food expenditure			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
Certified (1/0)	0.21***	0.31***			0.36***	0.49***			0.14***	0.31***		
	(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	0.10***	-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)	(0.03)	(0.02)	(0.04)
Household size squared	0.01***	0.00**	0.01***	0.00**	0.00	0.00	0.00	0.00	0.01***	0.00**	0.01***	0.00*
	(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	-0.52***	-0.07	-0.41***
	(0.05)	(0.18)	(0.05)	(0.18)	(0.10)	(0.48)	(0.09)	(0.46)	(0.05)	(0.18)	(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)	(0.01)	(0.01)	(0.02)
Household head age (yrs.)	0.00**	-0.01*	0.00**	-0.01*	-0.00	-0.02	-0.00	-0.02	0.00***	-0.01*	0.00***	-0.01*
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
Distance to road (km)	0.00	-0.00	0.00	-0.00	0.00	-0.00	0.01**	-0.00	0.00**	-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***	9.52***	8.15***	8.95***
	(0.10)	(0.33)	(0.11)	(0.33)	(0.20)	(0.64)	(0.20)	(0.64)	(0.10)	(0.33)	(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***		18.72***		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**	

Cluster 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.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. Farming Practices by Certification Status (Pooled data for 2012 and 2015)

	(1) Not 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

[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.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5. 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	(5) RE	(6) FE	(7) RE	(8) FE
Certified (1/0)	0.58***	0.73			0.61***	0.69		
	(0.14)	(0.45)			(0.15)	(0.43)		
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	0.68***	0.68***	0.65***	0.67***	0.64***	0.67***	0.60***	0.67***
	(0.12)	(0.16)	(0.12)	(0.17)	(0.12)	(0.14)	(0.12)	(0.15)
No. of children primary school age	-0.24***	-0.14	-0.22***	-0.14*	-0.03	-0.01	-0.02	-0.01
	(0.05)	(0.09)	(0.05)	(0.09)	(0.05)	(0.08)	(0.05)	(0.08)
No. of household members [a]	0.18***	0.08	0.19***	0.08				
	(0.03)	(0.06)	(0.03)	(0.06)				
No. of children secondary school age					-0.08	-0.24**	-0.06	-0.25**
					(0.06)	(0.11)	(0.06)	(0.11)
No. of household members [b]					0.17***	0.11**	0.18***	0.11**
					(0.04)	(0.05)	(0.04)	(0.05)
Female headed household (1/0)	-0.05	-1.85	0.01	-1.84	-0.09	-1.96*	-0.04	-1.96*
	(0.19)	(1.14)	(0.18)	(1.14)	(0.20)	(1.03)	(0.20)	(1.03)
Household head schooling (yrs.)	0.09***	-0.03	0.07***	-0.03	0.09***	-0.03	0.07***	-0.03
	(0.02)	(0.06)	(0.02)	(0.06)	(0.02)	(0.05)	(0.02)	(0.05)
Household head age (yrs.)	-0.00	0.00	-0.00	0.00	-0.00	-0.03	-0.01	-0.03
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
Distance to primary school (km)	-0.02	-0.10	-0.01	-0.10	-0.04	-0.10	-0.04	-0.09
	(0.06)	(0.08)	(0.06)	(0.08)	(0.06)	(0.08)	(0.06)	(0.08)
Distance to secondary school (km)	-0.00	-0.00	0.00	-0.00	-0.00	-0.02	0.00	-0.01
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
Constant	5.08***	6.54***	5.16***	6.46***	4.76***	7.89***	4.87***	7.86***
	(0.34)	(1.57)	(0.35)	(1.57)	(0.39)	(1.42)	(0.40)	(1.42)
No. of observations	596	596	596	596	643	643	643	643
No. of households	358	358	358	358	374	374	374	374
F-value		5.85***		6.73***		3.65***		3.83***
Wald χ^2	141.62***		164.59***		107.82***		132.59***	
Hausman test χ^2	18.20**		17.43*		18.76**		18.05*	
Sargan-Hansen test χ^2	16.82*		16.61*		17.37*		16.59	

Cluster 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 6. Effects of Certification on Individual Child Education (Cross-Section Data Models)

	Education expenditure (log)		Years of schooling	
	(1) OLS	(2) IV	(3) OLS	(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 modeled 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).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.0$

Table 7. Effects of Certification on Energy and Micronutrient Deficiency (Probit Panel Data Models)

	Energy deficiency		Iron deficiency		Zink deficiency		Vitamin A deficiency	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RE	RE	RE	RE	RE	RE	RE	RE
Certified (1/0)	-0.06		-0.07**		-0.04		-0.07	
	(0.04)		(0.04)		(0.03)		(0.04)	
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	-0.04	-0.05	0.09***	0.08**	0.04	0.03	0.14***	0.12***
	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)
Household size (AE)	0.07***	0.07***	0.07***	0.07***	0.07***	0.06***	0.02	0.02
	(0.02)	(0.02)	(0.02)	(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
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Female headed household (1/0)	-0.04	-0.03	-0.05	-0.03	0.01	0.02	-0.04	-0.02
	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)
Household head schooling (yrs.)	0.01*	0.00	0.02***	0.01**	0.01*	0.00	0.01**	0.00
	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Household head age (yrs.)	-0.00	-0.00	-0.00	-0.00*	-0.00**	-0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to all-weather road (km)	-0.00	-0.00	-0.00	-0.00	-0.01***	-0.00**	-0.00*	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
No. of observations	740	740	740	740	740	740	740	740
No. of households [a]	409	409	409	409	409	409	409	409
Wald χ^2	47.25***	59.97***	59.12***	62.72***	63.66***	70.82***	25.84***	41.05***

Marginal effects are shown with cluster robust standard errors in parentheses. RE, random effects.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix

Table A1. Predicated Probabilities of Participation in Fairtrade and Organic Certification

	(1) Fairtrade	(2) Organic
Distance to Fairtrade organization building (km)	-0.02***	
	(0.00)	
Altitude (m)		-0.00***
		(0.00)
Children primary school age	-0.01	0.02
	(0.01)	(0.02)
Children secondary school age	0.00	0.05***
	(0.01)	(0.02)
Household members not school age	0.01	0.01
	(0.00)	(0.01)
Female headed household (1/0)	0.02	0.00
	(0.03)	(0.05)
Household head schooling (yrs.)	0.00	-0.00
	(0.00)	(0.01)
Household head age (yrs.)	0.00	0.00**
	(0.00)	(0.00)
Distance to primary school (km)	0.00	-0.01
	(0.01)	(0.02)
Distance to secondary school (km)	-0.00	-0.00
	(0.00)	(0.01)
Female (1/0)	-0.02	-0.01
	(0.01)	(0.02)
Age (yrs.)	0.00*	0.00
	(0.00)	(0.00)
No. of individuals	1122	1122
No. of households (clusters)	329	329
Wald χ^2	62.12***	46.93***

Average marginal effects are shown with cluster robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2. Regressions for Subsample of Non-Certified Households

	(1) Expenditure	(2) Yrs. schooling
Distance to Fairtrade cooperative building (km)	-0.00	-0.00
	(0.01)	(0.00)
Altitude (m)	-0.00	0.00
	(0.01)	(0.00)
Children primary school age	0.11	0.07
	(0.10)	(0.07)
Children secondary school age	0.17	-0.09
	(0.12)	(0.07)
Household members not school age	0.06	-0.01
	(0.10)	(0.05)
Female headed household (1/0)	0.16	0.09
	(0.34)	(0.17)
Household head schooling (yrs.)	0.09^{**}	0.03
	(0.04)	(0.02)
Household head age (yrs.)	-0.02	0.00
	(0.01)	(0.01)
Distance to primary school (km)	-0.16	-0.04
	(0.15)	(0.07)
Distance to secondary school (km)	0.01	0.01
	(0.02)	(0.01)
Female (1/0)	0.11	0.55^{***}
	(0.19)	(0.13)
Age (yrs.)	0.04	0.57^{***}
	(0.04)	(0.02)
Constant	12.47^{*}	
	(6.52)	
No. of individuals	545	543
No. of households (clusters)	161	161
F-value	2.30^{**}	
Wald χ^2		31137.09^{***}

Cluster robust standard errors in parentheses. The expenditure model was estimated with OLS. The years of schooling model with a Poisson, for which marginal effects are shown.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3. Effects of Certification on Energy and Micronutrient Deficiency (Linear Probability Models)

	Kcal		Iron		Zinc		Vitamin A	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RE	FE	RE	FE	RE	FE	RE	FE
Fairtrade (1/0)	0.05	-0.04	0.06	0.11	0.03	-0.16	0.05	0.04
	(0.04)	(0.14)	(0.05)	(0.15)	(0.03)	(0.10)	(0.04)	(0.15)
Organic (1/0)	-0.16***	0.06	-0.21***	0.15	-0.13***	-0.07	-0.22***	-0.31**
	(0.04)	(0.10)	(0.04)	(0.11)	(0.04)	(0.12)	(0.05)	(0.13)
Year=2015	-0.04	-0.02	0.11***	0.15***	0.03	0.03	0.09**	0.08**
	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)
Household size (AE)	0.06***	0.09***	0.02	0.09**	0.09***	0.13***	0.07***	0.12***
	(0.02)	(0.04)	(0.02)	(0.04)	(0.02)	(0.03)	(0.02)	(0.04)
Household size (AE) squared	-0.00	-0.00	-0.00	-0.00*	-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 household (1/0)	-0.02	0.38**	-0.01	0.30	0.02	0.37***	-0.03	0.53***
	(0.04)	(0.16)	(0.05)	(0.19)	(0.04)	(0.10)	(0.04)	(0.15)
Household head schooling (yrs.)	0.00	-0.00	0.00	0.00	0.00	0.00	0.01**	-0.01
	(0.00)	(0.02)	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)	(0.02)
Household head age (yrs.)	-0.00	0.00	0.00	0.00	-0.00***	0.00	-0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to all-weather road (km)	-0.00	0.00	-0.00	0.00	-0.00**	-0.01**	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.16	-0.37	0.24*	-0.39	0.65***	0.13	0.24**	-0.74**
	(0.11)	(0.26)	(0.12)	(0.36)	(0.09)	(0.27)	(0.10)	(0.33)
Observations	740	740	740	740	740	740	740	740
No. of households	409	409	409	409	409	409	409	409
F-value		6.10***		3.44***		5.46***		6.64***
Wald χ^2	113.52***		57.60***		134.90***		160.93***	
Hausman test χ^2	18.89**				26.83***		30.03***	
Sargan-Hansen test χ^2	18.73**				26.28***		30.00***	

Cluster robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$