THE EFFECTS OF FAIR TRADE CERTIFICATION: EVIDENCE FROM COFFEE PRODUCERS IN COSTA RICA

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Abstract
We study the effects of Fair Trade (FT) certification of coffee on producers and households in Costa Rica. Examining the production dynamics of all Costa Rican coffee mills from 1999 to 2014, we find that when global coffee prices are lower and the FT guaranteed minimum price is binding, FT certification is associated with a higher sales price, greater sales, and more revenues. We also find that certification reduces the probability of a mill closing down and exiting the industry. Looking at households, we find that certification is associated with higher incomes for farm owners. Part of this is due to a transfer of income from intermediaries whose incomes decrease due to FT. We find no effect of FT on unskilled workers, who are the more disadvantaged group within the coffee sector. (JEL: F14, F63, O13, O54)

Teaching Slides
A set of Teaching Slides to accompany this article are available online as Supplementary Data.

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1. Introduction

Fair Trade (FT) certification aims to offer ethically minded consumers the opportunity to help lift producers in developing countries out of poverty. The appeal of FT is reflected in the impressive growth of FT-certified imports over the past two decades. Since its inception in 1997, sales of FT-certified products have grown exponentially. This growth appears to be driven by socially motivated demand by Western consumers who are willing to pay more for coffee that is produced in a manner consistent with FT certification. A number of recent studies (focusing on coffee) provide convincing evidence that the demand for FT-certified products is significantly higher and less price sensitive than conventional products (e.g. Arnot, Boxall, and Cash 2006; Hiscox, Broukhim, and Litwin 2011; Hainmueller, Hiscox, and Sequeira 2015).

As of 2016, when data are last available, there are over 1,400 FT-certified producer organizations worldwide representing more than 1.6 million FT-certified farmers and workers in 73 countries across 19 product categories. Coffee is the largest product in the FT range, accounting for 46% of the total premium paid and 48% of all FT farmers (Fairtrade International 2018). Despite the rapid growth and pervasiveness of FT products, well-identified evidence of the effects of FT certification remains scarce (Dragusanu, Giovannucci, and Nunn 2014). In addition, the conclusions that have been drawn from the existing evidence have been remarkably polarized, and the positions taken are often ideologically driven. FT has been widely criticized by conservative scholars and commentators for causing distortions and inefficiencies in existing commodity markets (Henderson 2008; Sidwell 2008). At the same time, others have criticized FT for too openly embracing free markets and attempting to work within the existing market framework (Sylla 2014). Others have argued that the certification fails to help the poorest and most needy (Mohan 2010; MacAskill 2015).

Our study enters this debate by providing evidence about the effects of FT certification on multiple parts of the value chain for the coffee sector in Costa Rica. In this sector, coffee is generally grown by small-scale coffee farmers, who hire unskilled labor particularly during harvest. The ripe cherries are then sold to a mill, and the mill then removes the pulp and washes and dries the beans. The resulting parchment coffee is then sold by the mill to international or domestic buyers. Our analysis estimates the effects of FT certification on the mills, intermediaries, farmers, and hired farm workers. We also estimate potential geographic spillover effects to others who work outside of the coffee sector but live in the location of FT certification. By examining a range of potential effects of FT, our study attempts to obtain as complete a picture as possible about all of the effects of FT certification of coffee in Costa Rica.

The FT label uses two primary mechanisms in an attempt to achieve its goal of improving the lives of farmers in developing countries. The first is a *minimum price* that is guaranteed to be paid if the product is sold as FT. This is meant to cover the average costs of sustainable production and to provide a guarantee that reduces the risk faced by coffee growers. The second is a *price premium* paid to producers. This premium is in addition to the sales price and must be set aside and invested in projects that improve the quality of life of producers and their communities. The specifics of

how the premium is used must be reached in a democratic manner by the producers themselves.

The primary issue one faces when attempting to identify a causal effect is the fact that certification is endogenous. For example, mills may be encouraged or receive help to become certified when they also obtain a lucrative long-term contract from a large buyer like Starbucks. To gain a better understanding of the nature of selection into certification, in August of 2012, we interviewed several FT-certified coffee cooperatives to collect information on the factors that led co-ops to become FT certified. We found four common determinants of certification in our setting. First, many cooperatives in Costa Rica also operate stores that sell agricultural products, including certain pesticides that could not be sold if FT certified. Thus, co-ops that obtain greater revenue from selling banned chemicals are less likely to certify. Second, co-ops that forecast lower prices in the future perceived a greater benefit from FT's price floor and thus were more likely to join. Third, individual farmers who believed in environmental or socially responsible farming practices were more likely to join. Finally, access to information about the logistics of becoming certified and managerial ability was also important.

An important insight from the interviews is that the nature of selection appears ambiguous or even to be negative. In theory, positive selection could arise since those with the greatest capacity to adopt FT are also capable in other dimensions of business. However, in reality, the most common narrative during our interviews was that FT was something that producers resorted to only if they had difficulty selling their coffee otherwise. Thus, the anecdotal evidence suggests that FT-certified producers are negatively selected. This is consistent with the existing evidence, which, although scarce, suggests that selection is, in fact, negative (Ruben and Fort 2009; Saenz-Segura and Zuniga-Arias 2009; Ruben and Fort 2012).

Our analysis studies the universe of coffee mills in Costa Rica, observed annually over a sixteen-year period (1999–2014). In this panel setting, all specifications include year fixed effects and mill fixed effects. These are particularly important since they likely capture a significant proportion of the determinants of selection into FT. The mill fixed effects capture all time-invariant differences between mills, such as time-invariant managerial capacity, information, or values. The year fixed effects capture variation over time that is similar across all mills, such as the ease of access to information on FT certification, differences in the cost of certification, or differences in reporting requirements. We test this formally by estimating hazard models for the onset of FT certification. We find that once we condition on year fixed effects and mill fixed effects, baseline levels or recent changes in mill characteristics, such as exports or sales prices, do not predict the onset of FT certification.

Despite this evidence, we cannot rule out with certainty that our fixed effects estimator is not still affected by time-varying selection into certification. Thus, our estimation strategy also uses an additional source of variation by exploiting the fact that the expected benefits that accrue because of FT certification (i.e. effective FT treatment) varied significantly during our sample period. This was true for two reasons. First, the market price of conventional coffee varied significantly, which increased the difference in the price of FT coffee relative to conventional coffee. Second, the price

paid for FT-certified coffee also varied during our sample period due to changes in the FT minimum price and the FT price premium.

Both factors generate time-variation in the price difference between FT and conventional coffee and the effective treatment of FT. Given this, exactly when a mill becomes FT-certified affects the treatment they receive. To capture this, we include in our specification an interaction between an indicator that equals one if the mill is FT certified and either an indicator that equals one if the FT price floor is binding or a measure of the difference between the FT minimum price and conventional prices. While we expect an estimate of the effect of FT certification to likely be affected by selection, we expect the interaction (the exact year of certification relative to the subsequent price gaps during certification) to generate variation that is more idiosyncratic and to suffer less from selection.

Our analysis examines the effects of FT certification on prices, quantities, and revenues, both total and disaggregated by domestic sales and exports. We find that the uninteracted FT certification indicator is always statistically insignificant. However, it is generally negative, which is consistent with negative selection in FT. The coefficient on the interaction term, which we take to be our best estimate of the causal effect of FT certification, is always positive and almost always significant. Specifically, the estimates indicate that when the price floor is binding, FT-certified producers sell their products at higher prices and earn more revenues. Although the price effect is found for both domestic sales and exports, the effect is more precisely estimated for exports.[1]

Despite our finding that FT does have a positive effect, we also find that the effect of FT is far from perfect. This is because, as is well known, not all coffee that is eligible to be sold as FT can actually be sold as FT by FT-certified farmers (de Janvry, McIntosh, and Sadoulet 2015). The magnitude of our estimates is consistent with this fact and, taken at face value, indicates that only 11% of FT-eligible coffee was sold as FT over our sample period. Put differently, we find that if the effective price benefit to FT certification—that is, the difference between the FT and conventional prices—increases by 1 cent, then the average price benefit received by FT-certified mills is only 0.11 cents. Thus, FT works somewhat, but not perfectly. The extent of "over-certification" that we find in our study is consistent with that found in de Janvry, McIntosh, and Sadoulet (2015).[2]

We then turn to upstream effects and estimate the effects of FT certification on intermediaries, farmers, and farm employees. We link the certification of coffee mills to households, observed in survey data, by constructing a measure of the share of exports in a canton (an administrative region in Costa Rica) and year that are from FT-certified producers. This allows us to estimate the relationship between this measure of FT intensity and household incomes.

1. As we explain in detail, we also find a positive effect on quantities. This is most likely due to the price floor inducing FT-certified farmers to sell more of their coffee as FT through the FT-certified mills rather than as conventional through a conventional mill.

2. In their study, de Janvry, McIntosh, and Sadoulet (2015) find that from 2001 to 2004, when the potential premium available to FT-certified farmers was approximately 60 cents per pound, the actual premium that they received was about 10 cents. See their Figure 2 and their discussion on pages 571–572.

Since one of the explicit goals of FT is to set aside funds for community projects, it is possible that households not directly involved in coffee production, but living in the same canton, may also benefit from an increase in FT certification. Thus, our regressions allow for the presence of spillovers by estimating the effects of FT certification on all households in a canton, including those not employed in the coffee sector. The regressions, which examine household-level data collected annually from 2001 to 2009, include canton fixed effects, year fixed effects, canton-specific time trends, and controls for occupation, industry of employment, age, gender, and education.

We find no evidence of positive spillover effects to those in a canton but not working in the coffee sector. For those working within the coffee sector, we find sizeable but highly uneven benefits. We separately estimate the effects of FT on the incomes of three groups. The first is skilled coffee growers, who primarily comprise farm owners and are 33% of those working in the coffee sector. The second is unskilled workers, such as coffee pickers and farm laborers. This is the largest group and accounts for 61% of those who work in the coffee sector. The third is non-farm workers in the coffee sector, who are primarily intermediaries (and their employees) and are responsible for transportation, storage, and sales. This group accounts for 6% of those working in the coffee sector.

We find positive income effects for farm owners. An increase from zero to the mean FT certification intensity is associated with a 2.2% increase in average incomes. Given that this group is one-third of those working in the coffee sector, this is a sizeable benefit that affects a large number of individuals. However, we also find that for unskilled workers, the poorest and largest group within the coffee sector, there is no evidence of a positive effect of FT on incomes. The estimated effects for this group are small and always statistically insignificant. Lastly, we find that the small group of intermediaries (i.e. those in non-farm occupations) is hurt significantly by FT. For this group, the same increase in FT intensity is associated with a 2.6% decline in average incomes. Since intermediaries have incomes that are approximately 40% higher than those of farmer owners, a consequence of FT is that it decreases income inequality within the coffee sector by transferring rents from higher-income intermediaries to lower-income farmer owners.

According to our estimates, about 10% of the gains to farm owners are likely due to the losses to intermediaries, while 90% of the gains are explained by the minimum price of FT-certified coffee, assuming that about 11% of coffee sales by FT-certified producers are sold as FT. The magnitudes of our estimated effects line up very closely with expected benefits to FT based on actual sales by FT-certified producers, the difference between the world price and the FT price guarantee, and the number of coffee producers, workers, and intermediaries in Costa Rica during our sample period.

Motivated by the fact that within Costa Rica, cooperatives commonly use FT premiums for the building of schools, the purchase of materials, and the provision of scholarships, we also examine the effect of FT certification on education as measured by the enrollment of school-aged children. However, we find no evidence of positive effects for FT on schooling. There are no benefits for those who live in the same canton as FT-certified mills, nor for the children of farm owners or unskilled workers. This

is true whether we examine children who are elementary-school age, high-school age, or college age. The one effect of FT that we do find is adverse. We find that for the children of intermediaries, FT certification is associated with a 7.3 percentage-point decrease in the probability of high-school enrollment. These effects are likely due to the large negative income effects that we find for coffee intermediaries.

In the end, our household estimates paint a mixed picture. The FT appears to have helped farm owners, increasing their incomes. Part of these gains (approximately 10%) appears to have been accomplished by transferring rents from intermediaries to farm owners through the creation of farmer cooperatives that perform many of the activities that intermediaries would otherwise perform. As a consequence, FT is also associated with a significant reduction in the incomes of intermediaries in the coffee sector. By these metrics, FT appears to be accomplishing some of its stated goals. The relatively impoverished coffee farmers gain at the expense of the wealthier coffee intermediaries. However, we also find that the poorest and largest group within the coffee sector—unskilled workers—do not gain at all from FT. In addition, we find no evidence of positive spillovers of benefits to those in the local community who work outside of the coffee sector.

An important caveat of our mill- and household-level findings is that they capture the short-run contemporaneous effects of FT, which we expect work primarily through the price floor and price premium. Our estimates do not capture any longer-term benefits of FT, including those that may arise through other aspects of the certification, such as its creation of longer-term stable relationships between producers and buyers and/or the provision of credit to mills.

Our findings complement existing studies that attempt to identify the causal effects of FT.[3] The most commonly studied outcome is sales prices. Although studies tend to find a positive relationship between FT certification and sales prices, this finding is not universal. The lack of a consensus in the existing literature is potentially due to the fact that the vast majority of estimates are from moderately sized cross-sectional comparisons. A positive relationship between certification and price is found by Mendez et al. (2011), who study 469 households from 18 different cooperatives in four Latin American countries; by Bacon (2005), who studies 228 coffee farmers from Nicaragua; and by Weber (2011), who studies 845 farmers from Southern Mexico. Given the issue of causal inference when examining a single cross-section, a number of studies have used matching techniques. This includes Beuchelt and Zeller (2011), who examine 327 farmers in Nicaragua and find a positive association between certification and prices. By contrast, Ruben and Fort (2009) and Ruben and Fort (2012) study 360 farmers from six coffee cooperatives in Peru and find no statistically significant relationship between certification and prices. Our estimates complement and improve upon the existing evidence in a number of ways. First, rather than relying on cross-sectional comparisons, we provide estimates based on changes over time. For example,

3. For a description of this literature, see Dragusanu, Giovannucci, and Nunn (2014). For a systematic review that includes all products and other certification schemes, see Oya et al. (2017).

our mill-level analysis is based on panel estimates that condition on mill fixed effects and time period fixed effects. The mill fixed effects absorb average differences between the mills in our sample. Therefore, unlike existing studies, our estimates are not derived from cross-sectional differences.

Our findings of differential effects of FT for different workers in the coffee sectors contribute to a better understanding of the distributional effects of FT. At this point, we have very limited evidence on whether the poorest in the sector, unskilled workers, benefit from FT. An exception is the evidence from Valkila and Nygren (2009), who interview 94 farm owners and 64 hired workers from 11 Nicaraguan coffee cooperatives. They find that although the farmers received higher prices for their coffee, unskilled workers were still paid a minimum wage. Jaffee (2009) studies 26 FT-certified coffee farms and 25 conventional ones in Oaxaca, Mexico and finds that although the sales price of coffee for FT-certified farmers is 130% higher, the wages of workers is only 7% higher, suggesting that FT may result in increased inequality in the sector. Cramer et al. (2017) also find no evidence for an FT wage premium among workers from three locations in Uganda and three locations in Ethiopia. Consistent with these studies, we find no effect of FT certification on unskilled worker wages.

A particularly relevant study to ours is de Janvry, McIntosh, and Sadoulet (2015), which examines the economic performance of FT-certified mills belonging to an association of Guatemalan coffee cooperatives. Examining performance from 1997 to 2009, they find positive effects of FT on prices, with an average premium being 4.4 cents per pound. Their study makes the important point that many of the potential benefits of FT are competed away through entry into certification. In the end, a large proportion of the benefits of FT go toward covering certification costs. These findings highlight the importance of looking at the economic effects (if any) that are upstream of the coffee mills—namely, effects on farm owners, workers, and households in the region. Our estimates of the effects of FT on household incomes and education provide reduced-form estimates of the upstream effects of FT, taking into account all of its aspects, including costs of certification.

The findings also complement the recent qualitative analysis of Ronchi (2002) that explores the effects of FT in Costa Rica. In 1999, Ronchi (2002) conducted interviews of farmers in FT-certified cooperatives in Costa Rica. She found that while most farmers reported having higher standards of living and being able to provide more education for their children since the introduction of FT certification ten years earlier, none of the respondents identified FT as the source of this improvement. It is possible that these improvements reflect more general trends among all farmers in the coffee sector. However, it is also possible that they were due to FT but that this was not recognized by the farmers. One does not need to be aware of what has caused an effect for it to have a tangible impact. Our empirical approach complements this descriptive analysis by providing quantitative estimates of the effects of FT certification within the coffee sector in Costa Rica in the period immediately following Ronchi's (2002) study.

Our findings also complement existing studies that examine the economic structure of the coffee industry in Costa Rica (Martinez 2015; Macchiavello and Miquel-Florensa 2017) as well as in other countries (Macchiavello and Morjaria 2015; Blouin

and Macchiavello 2017). Our findings also contribute to a deeper understanding of how international trade can affect income and education in developing countries, complementing previous studies exploring the effects of conventional exports (e.g. Topalova 2007; Edmonds, Pavcnik, and Topalova 2010; McCaig 2011; Brambilla, Porto, and Tarozzi 2012).

This paper is organized as follows. In the following section, we provide background information about FT certification and coffee production in Costa Rica. In Section 3, we examine effects at the mill-level. In Section 4, we then examine the effects of FT certification on households, estimating effects on adult incomes and school enrollment of children. Section 5 concludes.

2. Background

2.1. FT Certification

FT has its origins in an initiative started in the Netherlands by a church-based NGO in 1988 in response to low coffee prices. The stated aim of the initiative was to ensure growers were provided "sufficient wages". The NGO created a FT label for their products called Max Havelaar, named after a fictional character who opposed the exploitation of coffee pickers in Dutch colonies. Over the next half decade, Max Havelaar was replicated in other European countries and in North America. As well, similar organizations, such as TransFair, have emerged. In 1997, various labeling initiatives formed an umbrella association called the FT Labeling Organization International (FLO), and in 2002, the FT certification mark was launched.

The stated goal of FT is to improve the living conditions of farmers in developing countries. In practice, this is accomplished through two primary mechanisms. The first is a guaranteed *minimum price* for all coffee that is sold as FT, which is set by FLO. The minimum price is meant to cover the average costs of sustainable production and to provide a guarantee that reduces the risk faced by coffee growers. If produce is sold as FT, then the buyer must pay at least the minimum price regardless of what the market price is at the time. Currently, the minimum price (for conventional Arabica washed coffee) is set at $1.40 per pound. For organic coffee, it is $0.30 more, and for unwashed coffee, it is $0.05 less. The relationship between the minimum FT price and market prices between 1989 and 2014 is shown in Figure 1, which is taken from Dragusanu, Giovannucci, and Nunn (2014). As shown, for a significant portion of the past 25 years, the price floor has been binding. In addition, for much of our sample period (1999–2014), the price floor has been binding.

The second component of FT is a *price premium* that is paid to producers. The premium, which is currently set at $0.20 per pound, is in addition to the sales price and must be set aside and invested in projects that improve the quality of life of producers and their communities. The specifics of how the premium is to be used are supposed to be determined in a democratic manner by the producers themselves. Potential projects that could be funded with the FT premium include the building of

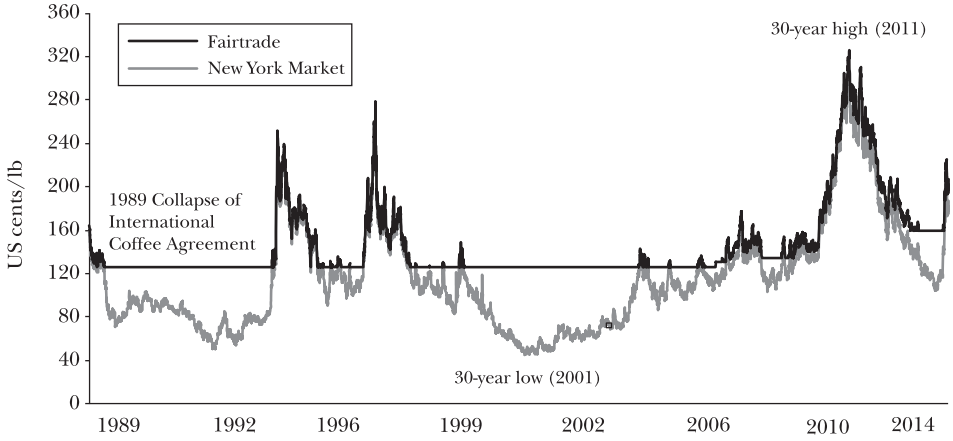


FIGURE 1. The FT minimum coffee price, 1989–2014. NB Fairtrade price = Fairtrade minimum price* of 140 cents/lb + 20 cents/lb Fairtrade premium. **When the New York price is 140 cents or above, the Fairtrade price = New York price + 20 cents. The New York price is the daily settlement price of the second position Coffee C Futures contract at ICE Futures US. *Fairtrade minimum price was increased on June 1, 2008 and April 1, 2011. ** Fairtrade premium was increased on June 1, 2007 and April 1, 2011. Source: ©Fairtrade Foundation, adapted and used with permission.

schools and health clinics, offering instruction courses to members of the community, educational scholarships, investments in community infrastructure, improvements in water treatment systems, and improved production practices, including conversion to organic production and the implementation of environmentally responsible production. Ronchi (2002, pp. 19–20) documents an example of the Costa Rican cooperative Coope Llano Bonito using the premiums to hire a full-time agricultural technician to help with such objectives. As of 2011, FLO explicitly mandates that five cents of the premium must be invested toward improving the quality and/or productivity of coffee.

For coffee to be sold under the FT mark, all actors in the supply chain, including importers and exporters, must obtain FT certification. On the production side, the certification is open to small farmer organizations and cooperatives that have a democratic structure, as well as commercial farms and other companies that employ hired labor (Fair Trade Foundation 2012). The certification entails meeting specific standards that are set and maintained by FLO. An independent certification company, FLO-CERT (which became independent from FLO International in 2004), is in charge of inspecting and certifying producers (Fair Trade Foundation 2012).

For coffee, the FT compliance criteria focus on the social, economic, and environmental development of the community. In terms of social development, the producer organization must have a democratic structure, transparent administration, and must not discriminate against its members. To satisfy the economic development criteria, organizations need to be able to effectively export their products and administer the premium in a transparent and democratic manner. The environmental development criteria are meant to ensure that the members work toward including environmental

practices as an integral part of farm management, by minimizing or eliminating the use of certain fertilizers and pesticides and replacing them with more natural biological methods that help ensure the health and safety of the cooperative members and their communities (Fair Trade Foundation 2012). In the case of commercial plantations that employ a large number of workers, the FT standards require that hired workers are not children or forced workers and are free to bargain collectively. Hired workers must be paid at least the minimum wage in their region, and they must also be given a safe, healthy, and equitable environment (Fair Trade Foundation 2012).

To obtain FT certification, producer organizations must submit an application to FLO-CERT. If the application is accepted, then the organization goes through an initial inspection process carried out by one of the FLO-CERT representatives in the region. If the minimum requirements are met, then the organization is issued a certificate that is usually valid for a year. The certificate can be renewed following re-inspection. Initially, inspection and certification were free of charge. However, beginning in 2004, producer organizations have had to pay fees associated with applications, initial certifications, and certification renewals.

2.2. Coffee Production in Costa Rica

Costa Rica is the world's thirteenth largest producer of coffee, with production totaling 1.2 million 60-kg bags of coffee in 2017–2018 (International Coffee Organization 2017). The agro-climatic conditions in many areas of the country are characterized by volcanic soils, high elevation, warm temperatures that stay relatively constant throughout the year, and climates with distinct wet/dry seasons, which have been very favorable for coffee cultivation (Instituto del Café de Costa Rica 2017b). Today, coffee tends to be cultivated on small plots in family farms: 92% of coffee farmers have plots that are less than 5 hectares, and 6% have plots that are between 5 and 20 hectares (Instituto del Café de Costa Rica 2017a).

During the harvest season, which generally lasts from December to April, coffee farmers deliver the cherries to a collection center belonging to a local mill (called *beneficio*) for processing.[4] The pulp of the cherries is removed, and the beans are washed. The resulting product is called parchment coffee. The mills then sell the parchment coffee to exporters and domestic roasters. Exporters are specialized domestic firms who aggregate purchases from multiple mills and sell them to foreign buyers. In many cases, mills and co-ops have their own export arm.[5] In addition to coffee processing services, cooperatives also provide a range of services to their members, such as the provision of agricultural supplies, technical assistance, marketing assistance, and credit.

4. Cooperative members generally take the cherries to be processed at their cooperative mill, although they are free to sell their cherries to others mills.

5. For an analysis of the determinants of the boundaries of the firm in the Costa Rican coffee sector, see Macchiavello and Miquel-Florensa (2017).

Coffee processing and sales in Costa Rica are regulated through Law No. 2762, which was adopted in 1961 and is more commonly referred to simply as the "Coffee Law" (Instituto del Café de Costa Rica 2017c). The Costa Rican government established a non-governmental agency called Instituto del Café de Costa Rica (ICAFE) to implement and enforce the provisions of the Coffee Law. Within this regulatory environment, the sales process for coffee is as follows: Farmers deliver their harvested coffee cherries to the mill; at this point, they receive an advance payment, which is determined using the world coffee prices that are prevailing at the time. Historically, the advance payment has been approximately two-thirds of the total payment that the producer eventually receives. Every 15 days, mills must report the amount of coffee received to ICAFE.

Mills then sell the parchment coffee to exporters and domestic buyers. All coffee sales are registered and must be approved by ICAFE. The contract price must be equal to or above the world coffee price, plus a differential that is set in advance by ICAFE based on four different coffee attributes (five categories, eight types, seven qualities, and six preparations). From January to October, mills make trimestrial payments to producers. These payments are defined by ICAFE according to each mill's sales.

At the end of the harvest year, after all the coffee has been sold, mills pay producers a final liquidation payment. The ICAFE Liquidation Board calculates a liquidation price for each mill, which is equal to total mill sales minus each mill's expenses and profits divided by the amount of green coffee received. The total payment to a producer is equal to the mill liquidation price times the amount of coffee received from that producer. Each mill needs to submit detailed expenses to ICAFE for approval. Historically, mill profits have been approximately 9% of total mill sales. The final liquidation prices for each mill must be published in Costa Rica's main newspapers in November, and the mill must pay producers the balance of their payment within eight days. Historically, producers have received approximately 80% of the final coffee price.

There are a number of ways that FT could affect the incomes of farmers in this setting. First, coffee that is sold as FT will have a higher sales price, particularly during periods in which the price floor is binding. In addition, farmers who belong to an FT-certified cooperative that owns its own mill will also obtain a share of the mill's profits. Furthermore, if the cooperative also registers as an exporter, then the export mark-up (which is about 2.5% of the coffee price) will also go to the cooperatives (and its members). Thus, we expect FT to potentially have two primary effects. It provides a higher final sales price, and it helps farmers to capture a larger share of the final price.

2.3. Descriptive Evidence on Selection into FT Certification

The central issue for the empirical analysis is the nature of selection into certification. To better understand this, we undertook interviews with four FT-certified cooperatives in August of 2012. The interviews revealed a number of factors that underlie the variation in certification status for Costa Rican coffee producers.[6]

6. For earlier case studies of FT-certified coffee cooperatives in Costa Rica, see Sick (2008) and Ronchi (2002).

While FT has benefits, it also has costs, and the effective costs that FT imposes vary depending on the mill. Several cooperatives mentioned that an important cost of FT is the potential loss that they would suffer due to FT requirements that prevent them from selling certain products—primarily pesticides—in their stores. Many cooperatives operate a store where they sell agricultural supplies to the community. For cooperatives that earn revenue from the sale of banned agricultural chemicals, FT imposes particularly high costs. If these and similar characteristics vary little over time, then they will be captured by the mill fixed effects in our empirical analysis.

In addition, the perceived benefits of FT certification also vary by mill. One of the primary benefits of FT sales is the existence of a guaranteed minimum price. The expected future benefit of this depends on the farmer's belief about future prices. Those farmers that expect the future price of coffee to be above the minimum price perceive lower benefits to FT certification than farmers who believe future coffee prices may drop below the minimum. We also learned that the values and beliefs of farmers play an important role. Farmers who a priori believe in the importance of environmentally sustainable or socially responsible farming practices are more willing to undertake the changes in production dictated by FT certification. Both of these factors, although important determinants of the timing of certification, are potentially time-invariant and, if so, accounted for by mill fixed effects.

The final factors that were mentioned were access to information about the certification requirements and the managerial ability that is needed to satisfy the requirements. These factors potentially vary over time and may be correlated with other factors that also affect our outcomes of interest. For example, improvements in management or in international sales connections may affect FT certification and also affect the economic outcomes of interest.

A final insight that we gained from our interviews is that the nature of selection appears ambiguous. While positive selection likely arises from the last determinant, which is being informed, the nature of selection from the first three is ambiguous. In addition, participants in the interviews typically described FT as a strategy that is often pursued by producers who would have difficulty selling their coffee otherwise. This suggests that selection might be negative. The existing evidence, although scarce, appears to suggest that, on net, selection is likely negative. Saenz-Segura and Zuniga-Arias (2009) examine a sample of 103 coffee producers in Costa Rica and find a very strong negative relationship between FT certification and experience, education, and income. Negative selection was also found by Ruben and Fort (2009, 2012) in their studies of 360 Peruvian coffee farmers. They find that farmers who are less educated and own smaller farms are more likely to become certified.

The fact that many of the determinants of certification are likely time-invariant mill-level characteristics or year-specific mill-invariant (e.g. the market price for coffee) highlights the benefit of estimates that do not rely on cross-sectional variation only but instead examine a panel of producers.

3. Producer-Level Analysis

To study the effects of FT certification on coffee producers, we use information available from ICAFE on the annual quantities received and sold, and average sales prices of each coffee mill in Costa Rica.[7] Since ICAFE does not collect information on the sales of coffee disaggregated by FT/conventional status, we are only able to identify which cooperatives are FT certified. This information is obtained from FLO certification rosters from FT USA and FLO-CERT.[8] From these, we extract the names of certified coffee producers in Costa Rica and create an FT-certification indicator variable that equals one in the years in which a mill is FT certified and zero otherwise. The number of FT-certified mills in each period of the analysis is reported in Online Appendix Figure A.1. We link the information on a mill's certification status with the ICAFE data using the name of the producer organization, which is reported in both sources of data. The matched data results in an unbalanced panel of 329 coffee mills that are observed annually from 1999 to 2014.[9] The annual share of total Costa Rican exports that are sold by an FT-certified mills is reported in Online Appendix Figure A.2.

3.1. Checking for Selection into Certification

Before turning to an examination of the effects of FT certification on producers, we first consider the issue of selection into certification.[10] To assess the importance and nature of selection, we check whether, when conditioning on time-invariant producer characteristics, time-varying producer characteristics predict the onset of FT certification. Specifically, we look for a significant increase in production, exports, or sales prices just prior to the onset of certification. If found, then this is evidence that an omitted time-varying factor, like a new contract to supply an overseas buyer, is causing the producer to become certified.

We examine this by estimating a hazard model where the dependent variable is an indicator variable for the onset of FT certification:

$$I_{i,t}^{FTOnset} = \alpha_i + \alpha_t + \boldsymbol{X}_{\boldsymbol{i},\boldsymbol{t}}'\boldsymbol{\Gamma} + \sum_{j=1}^{3} \varphi_j Duration_{i,t}^{j} + \varepsilon_{i,t}, \tag{1}$$

where i indexes a coffee mill and t years (1999–2014). An observation is a mill that was not FT-certified in period $t-1$. $I_{i,t}^{FTOnset}$ is an indicator variable that equals one if

7. The ICAFE data are recorded by harvest years (rather than calendar years), which range from October to September. In our data, an observation in year t corresponds to the harvest, which is from October in year $t-1$ to September in year t.

8. The rosters from 2011 and earlier are from Fair Trade USA, while those from after 2011 were obtained from FLO-CERT directly.

9. We code a mill as certified during a harvest year if the mill holds a valid certification for at least half of the harvest year. The estimates we report here are very similar if we alter this coding rule.

10. We do not consider the issue of selection arising due to firms' exit from FT certification. This is because FT appears to be close to an absorbing state. We only observe two instances of mills dropping their FT certification after obtaining it. In both cases, certification is dropped one year later.

the mill is FT-certified period t. α_i denotes mill fixed effects and α_t denotes year fixed effects, which are included in all producer-level analyses. Mill fixed effects control for time-invariant characteristics, like those discussed in Section 2.3, that may affect the timing of FT certification.

The vector $\boldsymbol{X}_{i,t}$ contains observable characteristics that may predict the onset of certification—namely, one or two year lags of either the level or growth of domestic sales, exports, total sales, exports as a share of total sales, domestic prices, or export prices. This checks whether the onset of certification is preceded by exceptionally high rates of growth in sales, exports, or prices.

We estimate equation (1) using a linear probability model and report standard errors clustered at the mill level.[11] The estimates are reported in Tables 1 and 2. In both tables, the column headings report the independent variable being examined. We consider the following six determinants: domestic sales, exports, total sales (domestic plus exports), the share of total sales that are exports, the average price of domestic sales, and the average price of exports. Table 1 reports estimates where the independent variable is measured in lagged levels, either a one-year lag (panel A) or a one-year and two-year lag (panel B). Table 2 reports estimates where the independent variable is measured in (log) changes, either the prior one-year growth (panel A) or the prior two-year growth (panel B).

Our interest is in whether independent variables predict the onset of FT certification. We find no evidence for this. For each of the six variables examined, whether we examine levels or changes, and whether we look at the previous year or previous two years, we find no evidence of their predicting the onset of FT certification. All 36 coefficient estimates are very small and none are statistically different from zero. In addition, the coefficients are as frequently negative as they are positive. Thus, we find no evidence for positive selection of producers into FT certification.

It is important to note that our findings do not indicate that mill-level characteristics or the aggregate economic environment do not affect the decision to become FT certified. These determinants are captured by mill fixed effects and year fixed effects, which are in equation (1) and are in all our producer-level estimating equations. Thus, the findings do indicate that, consistent with anecdotal accounts, the primary determinants of FT onset are time-invariant mill-specific characteristics or mill-invariant year-specific characteristics.

3.2. Effects of FT Certification: DD Estimates

We now turn to our estimates of the effects of FT certification on coffee producers. Since the primary mandate of FT is to ensure higher and more stable prices for certified

11. We use a linear estimator rather than a non-linear estimator, like a logit model. Because of the presence of fixed effects, a large proportion of the sample is dropped because of perfect prediction when a logit model is used. The LPM estimates are known to be a very close approximation to a logit model when evaluating effects at the mean where the logistic function is very close to linear (Angrist 2001; Angrist and Pischke 2009, Ch. 3, Gomila 2021).

TABLE 1. Determinants of FT certification: prior levels of covariates.

	Dependent variable: indicator for the onset of FT certification					
	Characteristic for independent variable:					
	ln domestic sales (1)	ln exports (2)	ln total sales (3)	Exports as a share of total sales (4)	ln domestic price (5)	ln export price (6)
	Panel A: certification onset and one-year lagged characteristics					
One-year lagged characteristic	−0.00048	−0.00092	−0.00148	0.00736	0.00749	−0.00348
	(0.00132)	(0.00221)	(0.00222)	(0.00733)	(0.00938)	(0.00925)
Duration: third-order polynomial	Y	Y	Y	Y	Y	Y
Year FE, Mill FE	Y	Y	Y	Y	Y	Y
Observations	1,577	1,553	1,632	1,634	1,577	1,553
R-squared	0.154	0.155	0.153	0.153	0.154	0.155
	Panel B: certification onset and one- and two-year lagged characteristics					
One-year lagged characteristic	−0.00083	−0.00231	−0.00284	0.00749	0.00792	0.00149
	(0.00167)	(0.00323)	(0.00326)	(0.00824)	(0.01248)	(0.01249)
Two-year lagged characteristic	0.00065	0.00134	0.00097	0.00611	0.00620	−0.01789
	(0.00204)	(0.00240)	(0.00270)	(0.00783)	(0.00829)	(0.02278)
Duration: third-order polynomial	Y	Y	Y	Y	Y	Y
Year FE, Mill FE	Y	Y	Y	Y	Y	Y
Observations	1,268	1,270	1,338	1,339	1,268	1,270
R-squared	0.176	0.176	0.175	0.175	0.177	0.176

Notes: Coefficients are reported with standard errors clustered at the mill level in parentheses. All regressions include year fixed effects, mill fixed effects, and a third-order polynomial in the duration of not being FT certified. The dependent variable is an indicator variable that equals one if the mill switches to certification in that year. The sample includes all observations where a mill was not FT certified in the previous year. Once a mill becomes FT certified, they are no longer in the sample. The independent variable reported in panel A is the lag of the characteristic reported in the column heading. The independent variables in panel B are the one- and two-year lags of the characteristics in the column heading.

farmers (through the premium and price floor), our primary outcome of interest is the sales price of coffee. In addition, we examine the quantity of coffee purchased and sold by mills, as well as total revenues.

Throughout our analysis, we place particular importance on the effects of FT on price. In part, this is because the interpretation of the effects on quantities (and therefore revenues) is complicated by the fact that farmers belonging to an FT-certified cooperative are not obligated to exclusively bring their coffee cherries to the co-op's mill for processing. They can, and often do, sell to other nearby mills. (As we explain in more detail below, because coffee cherries spoil very quickly and must be processed within days, the primary consideration is the mill's proximity.) Thus, it is difficult to interpret the estimated effects of FT on the quantity of coffee sold by the mill.

Our analysis studies the universe of coffee mills in Costa Rica, observed annually over a sixteen-year period (1999–2014). To derive our estimating equation of interest, we begin with the following equation:

$$y_{i,t} = \alpha_i + \alpha_t + \beta\, I_{i,t}^{FT} + \varepsilon_{i,t}, \tag{2}$$

TABLE 2. Determinants of FT certification: prior growth of covariates.

	Dependent variable: indicator for the onset of FT certification					
	Characteristic for independent variable:					
	ln domestic sales (1)	ln exports (2)	ln total sales (3)	Exports as a share of total sales (4)	ln domestic price (5)	ln export price (6)
	Panel A: certification onset and prior one-year growth in characteristics					
Prior one-year growth (t-1 to t)	−0.00033	0.00114	0.00044	0.00363	−0.00603	0.00008
	(0.00063)	(0.00196)	(0.00174)	(0.00401)	(0.00525)	(0.00452)
Duration: third-order polynomial	Y	Y	Y	Y	Y	Y
Year FE, Mill FE	Y	Y	Y	Y	Y	Y
Observations	1,497	1,490	1,583	1,585	1,497	1,490
R-squared	0.180	0.180	0.179	0.179	0.180	0.180
	Panel B: certification onset and prior two-year growth in characteristics					
Prior two-year growth (t-2 to t)	−0.00108	−0.00030	−0.00174	0.00399	−0.00783	0.00886
	(0.00111)	(0.00265)	(0.00266)	(0.00570)	(0.00597)	(0.01187)
Duration: third-order polynomial	Y	Y	Y	Y	Y	Y
Year FE, Mill FE	Y	Y	Y	Y	Y	Y
Observations	1,242	1,244	1,311	1,312	1,242	1,244
R-squared	0.205	0.204	0.204	0.203	0.206	0.205

Notes: Coefficients are reported with standard errors clustered at the mill level in parentheses. All regressions include year fixed effects, mill fixed effects, and a third-order polynomial in duration of not being FT certified. The dependent variable is an indicator variable that equals one if the mill switches to certification in that year. The sample includes all observations where a mill was not FT certified in the previous year. Once a mill becomes FT certified, they are no longer in the sample. The independent variable reported in panel A is the growth (log change) of the characteristic from period $t-2$ to period t. The independent variable in panel B is the growth (log change) of the characteristic from period $t-2$ to period t.

where i indexes a coffee mill and t years (1999–2014); $y_{i,t}$ denotes an outcome of interest; $I_{i,t}^{FT}$ is an indicator variable that equals one if mill i is FT certified in year t; and α_i and α_t denote mill fixed effects and year fixed effects, respectively. Mill fixed effects control for time-invariant characteristics, such as time-invariant differences in the mill's managerial capabilities, which are likely important for FT certification. Time period fixed effects control for time-varying factors that are common to all mills, such as changes in FT certification requirements and costs over time.

The coefficient β provides an estimate of the effects of FT certification on the mill-level outcomes of interest. Despite the inclusion of mill fixed effects and time period fixed effects in equation (2), it is still possible that the estimate of β is biased due to time-varying selection into certification. For example, a mill's knowledge about the logistics of becoming certified could change very quickly, as could farmers' ideologies or their forecasts of future prices. Given this, our estimation strategy relies on an additional source of variation by exploiting the fact that the effective FT treatment varied over time. There are two reasons for this. First, the market price of conventional coffee, which affects the FT price premium (i.e. difference between the market price and the FT price), varied significantly during the sample period. This altered the

monetary benefit of selling FT coffee rather than conventional coffee. Second, the price paid for FT-certified coffee also varied during the sample period due to changes in the FT minimum price and the FT price premium. For non-organic arabica coffee, prior to 2006, the minimum price was $1.25/lb and the premium was 10 cents/lb. After this date, the minimum price was increased to $1.40 and the premium was increased to 20 cents/lb.

Both factors generate annual variation in the price difference between FT and conventional coffee and, thus, the effective treatment of FT. Given this, whether a mill is FT certified *and* the difference in price between FT and conventional coffee at the time determines effective treatment. To capture this, we augment equation (2) by more precisely specifying the FT treatment. The first specification of this type is

$$y_{i,t} = \mu_i + \mu_t + \gamma_1 I_{i,t}^{FT} + \gamma_2 I_{i,t}^{FT} \cdot I_t^{p<\bar{p}} + \varepsilon_{i,t}, \tag{3}$$

where $I_t^{p<\bar{p}}$ is an indicator variable that equals one if the average world price of Arabica coffee during period t is below the FT minimum price during the harvest year.[12] During our sample period, 1999–2014, the world price for Arabica coffee was below the FT minimum price for nine years, and thus $I_t^{p<\bar{p}}$ equals one during these periods. Here, we allow for the possibility that effective treatment, and the effects of FT certification, will be greater when the price floor is binding.

We also estimate a specification where we replace the indicator variable $I_t^{p<\bar{p}}$ with a continuous measure of the price gap, P_t^{Gap}. In years in which the price floor is binding, the variable is equal to the difference between the world price and the FT minimum price (inclusive of the premium). In years when the price floor is not binding, the variable takes on the value of zero. That is, $P_t^{Gap} = \max\{0, \bar{p} - p\}$, where $\bar{p}$ is the sum of the FT minimum price and price premium, and p is the market price. Thus, the variable measures the increase in price that is obtained at the time if the coffee is sold as FT. The revised estimating equation is

$$y_{i,t} = \zeta_i + \zeta_t + \varphi_1 I_{i,t}^{FT} + \varphi_2 I_{i,t}^{FT} \cdot P_t^{Gap} + \nu_{i,t}. \tag{4}$$

An alternative interpretation of equations (3) and (4) is that the coefficients of the interaction terms, γ_2 and φ_2, capture the insurance benefits of FT certification that are obtained when the world price of coffee falls below the FT floor. The coefficients γ_1 and φ_1 capture the average effect that FT provides, even when the world price is above the price floor. These should capture the benefits of the FT price premium, which producers receive whether or not the price floor is binding. However, as we have noted, we expect γ_1 and φ_1 to be more heavily biased due to selection into certification than the interaction coefficients γ_2 and φ_2. This should be kept in mind when interpreting the coefficients.

12. We construct an average price for period t by taking the average price of arabica coffee from December to July, which we take as the relevant period for sales following the harvest period, which tends to occur between December and April. (Recall that a harvest year in the sample is from October to September.) The price data are from the World Bank's "Pink Sheet" commodity data for the International Coffee Organization (ICO)'s indicator price for "other mild arabica" for coffee grown in Central America.

TABLE 3. The effect of FT certification on sales prices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable:							
	Domestic price (USD/lb)		ln domestic price		Export price (USD/lb)		ln export price	
FT certified, FTC	−0.044*	−0.035	−0.021	−0.014	−0.044	−0.030	0.005	0.012
	(0.026)	(0.024)	(0.038)	(0.037)	(0.032)	(0.029)	(0.024)	(0.024)
FTC × price gap indicator	0.055		0.062		0.075***		0.041**	
	(0.035)		(0.038)		(0.022)		(0.020)	
FTC × price gap (USD/lb)		0.105		0.180		0.113*		0.078
		(0.079)		(0.127)		(0.063)		(0.102)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Mill FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,038	2,038	2,038	2,038	2,000	2,000	2,000	2,000
Number of clusters/mills	326	326	326	326	307	307	307	307
Mean of dependent variable	1.13	1.13	−0.03	−0.03	1.47	1.47	0.30	0.30
Standard deviation of dependent variable	0.59	0.59	0.61	0.61	0.61	0.61	0.43	0.43

Notes: The table reports OLS estimates of equations (3) and (4). An observation is a mill-year. Each specification contains mill and year fixed effects. The dependent variable in columns (1) and (2) is the domestic price, calculated as the average price obtained by a mill in a given year for the domestic coffee sales transactions and expressed in USD/lb. The domestic price was winsorized at the 99th percentile. The dependent variable in columns (3) and (4) is the natural logarithm of the non-winsorized domestic price. The dependent variable in columns (5) and (6) is the export price calculated as the average price obtained by a mill in a given year in export coffee sales transactions and expressed in USD/lb. The export price was winsorized at the 99th percentile. The dependent variable in columns (7) and (8) is the natural logarithm of the non-winsorized export price. The price gap indicator equals one in years in which the world price for Arabica coffee is below the FT minimum price. The price gap variable equals zero when the price gap indicator is zero and equals the difference between the FT minimum price plus the premium and the world price for years when the price gap indicator is equal to one. The price gap variable ranges from 0 to 0.66 USD/lb. The FT minimum price for washed Arabica coffee was increased from \$1.20/lb to \$1.25/lb in June 2008 and to \$1.40/lb in April 2011. The FT premium was increased from \$0.05/lb to \$0.10/lb in June 2007 and to \$0.20/lb in April 2011. Coefficients are reported with standard errors clustered at the mill-level in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Given that the primary goal of FT is to provide higher prices to certified producers, especially when the world price is low, our primary outcome of interest is the average prices obtained by the mill from coffee sales in a given harvest year. We measure prices in two ways. The first measure is the average price winsorized at the 99th percentile. Due to coding/reporting errors in the primary data, a small number of observations have extremely high prices, which are certainly incorrect and, at the same time, highly influential. The second is the natural log of price. This facilitates a convenient interpretation of the coefficients and reduces the effect of the extreme observations mentioned above.

Estimates of equations (3) and (4) are reported in Table 3. In columns (1)–(4), the dependent variable is the average price of domestic coffee sales, and in columns (5)–(8), it is the average price of coffee exports. Columns (1), (2), (5), and (6) report estimates using winsorized prices, while columns (3), (4), (7), and (8) report estimates using the natural log of prices. Examining domestic sales price, we find the interaction terms of interest, γ_2 and φ_2, are positive and sizeable in magnitude, but not statistically

significant. Thus, for domestically sold coffee, there are additional effects of FT certification when the price floor is binding, but these effects are imprecisely estimated and not statistically different from zero. When we estimate the effect of FT on export prices, we find that the interaction terms are positive, large in magnitude, and significant in all specifications but one. Thus, for exported coffee, there are additional effects of FT certification when the price floor is binding that are statistically different from zero. The greater precision of the estimates for exports than domestic sales is consistent with the fact that coffee which is sold domestically by FT-certified producers is less likely to be sold as FT certified than coffee that is exported by FT-certified producers.

The estimate from column (6) is particularly informative. If FT worked perfectly, and all exported coffee sold by an FT-certified producer could be sold as FT, then we would expect the estimate of φ_2 to be close to one. That is, a one-cent increase in the price gap should result in a one-cent benefit to being FT certified. In reality, it is difficult for FT-certified producers to sell all of their product as FT, and this becomes even more difficult when FT coffee is being sold at significantly higher prices than conventional coffee.[13] The estimate of φ_2 in column (6) suggests that each one-cent of potential benefit due to the difference between the FT price floor and the world price of coffee results in 0.11 cents of actual benefit to FT-certified exporters. Put differently, when the FT price insurance mechanism can deliver up to one cent of benefit, our estimates indicate that, in reality, the benefit is 0.11 cents.[14]

The magnitude of our effects is actually quite similar to those found by de Janvry, McIntosh, and Sadoulet (2015) in their study of FT-certified coffee cooperatives in Guatemala. During their period of analysis, from 2001 to 2004, when the potential premium available to FT-certified farmers was approximately 60 cents per pound, the actual premium that they received was only about 10 cents per pound.[15]

In all specifications of Table 3, the estimates of γ_1 and φ_1 are insignificant, and they are actually negative in six of the eight specifications. The coefficients provide estimates of the effect of FT when the price floor is not binding (and the only difference between the FT and conventional price is the price premium). Therefore, if we had confidence that these estimates were causal, then we would expect these estimates to be positive and small in magnitude (i.e. less than 0.20). However, as we have noted, the estimates likely suffer from a downward bias that is due to selection into FT (despite the controls for mill fixed effects and year fixed effects). The negative and insignificant estimates are consistent with the negative selection of mills into FT certification. As noted, it is only the interaction of FT certification with the effective benefit of FT, measured by the difference in FT and conventional prices, that we interpret as likely causal.

13. For a discussion and example of over-certification and free entry into FT and its effects, see de Janvry, McIntosh, and Sadoulet (2015).

14. An important caveat is that classical measurement error in the independent variables will cause this estimate to be biased toward zero. Thus, this estimate is potentially a worst-case-scenario assessment of the effectiveness of FT price support for producers.

15. See their Figure 2 and their discussion on pages 571–572.

TABLE 4. The effect of FT certification on quantities received and sold by mills.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable:					
	ln total quantity received		ln total quantity sold		Fraction of quantity received that is sold	
FT certified, FTC	−0.065	−0.011	−0.164	−0.093	0.002	−0.004
	(0.139)	(0.126)	(0.156)	(0.139)	(0.008)	(0.008)
FTC × price gap indicator	0.400**		0.381*		−0.016**	
	(0.161)		(0.199)		(0.007)	
FTC × price gap (USD/lb)		0.829*		0.589		0.044
		(0.438)		(0.427)		(0.113)
Year FE	Y	Y	Y	Y	Y	Y
Mill FE	Y	Y	Y	Y	Y	Y
Observations	1,740	1,740	2,108	2,108	1,740	1,740
Number of clusters/mills	306	306	328	328	306	306
Mean of dependent variable	12.55	12.55	12.85	12.85	0.97	0.97
Standard deviation of dependent variable	2.18	2.18	2.19	2.19	0.09	0.09

Notes: The table reports OLS estimates of equations (3) and (4). An observation is a mill-year. Each specification contains mill and year fixed effects. The dependent variable in columns (1) and (2) is the natural logarithm of the total quantity received by the mill from coffee farmers. This variable is only reported in the sample years from 2003 to 2014. The dependent variable in columns (3) and (4) is the natural logarithm of the total quantity (expressed in lbs) sold by a mill on the export market and domestic market. The dependent variable in columns (5) and (6) is equal to the ratio of the total quantity sold and the total quantity received. Note that this variable is only reported in the sample years from 2003 to 2014. The price gap indicator equals one in years in which the world price for Arabica coffee is below the FT minimum price. The price gap variable equals zero when the price gap indicator is zero and equals the difference between the FT minimum price plus the premium and the world price for years when the price gap indicator is equal to one. The price gap variable ranges from 0 to 0.66 USD/lb. The FT minimum price for washed Arabica coffee was increased from $1.20/lb to $1.25/lb in June 2008 and to $1.40/lb in April 2011. The FT premium was increased from $0.05/lb to $0.10/lb in June 2007 and to $0.20/lb in April 2011. Coefficients are reported with standard errors clustered at the mill-level in parentheses. * and ** indicate significance at the 10% and 5% levels, respectively.

We now turn to an examination of quantities sold by each mill. Estimates of equations (3) and (4) with various quantity measures as dependent variables are reported in Table 4. In columns (1) and (2), we examine the total quantity received by FT-certified mills from farmers.[16] After receiving the coffee, the mills process the coffee, and it is then sold on domestic or international markets. The estimates show evidence that FT-certified mills receive more coffee from farmers in years when the price floor is binding. Because only farmers who are members of an FT cooperative are able to sell to the cooperative, this likely arises because members find it more attractive to sell their coffee to the cooperative rather than a conventional mill. (While FT-certified farmers generally sell to their cooperative, they often also sell their coffee to other third

16. Note that this information is only reported in the sample years from 2003 to 2014.

parties.)[17] When world prices are low and the FT minimum price becomes binding, then FT-certified mills have the potential to pay higher prices relative to non-FT mills (if the coffee is sold as FT). According to the estimates from column (2), FT-certified mills receive $0.40 - 0.06 = 34\%$ more coffee relative to non-certified mills in years when the price floor is binding. When it is not binding, similar quantities are received.

Columns (3) and (4) show that the total quantities sold by the mill (both domestically and internationally) follow the same pattern as the total quantities received by the mill. Thus, we see that when the price floor is binding, FT-certified mills both receive more coffee (columns (1) and (2)) and sell more coffee (columns (3) and (4)). Comparing the two sets of coefficients, we see that the interaction coefficients for the quantity-sold regressions are lower than the interaction coefficients for the quantity-received regressions: 0.40 versus 0.38 (column (1) versus column (3)) and 0.89 versus 0.64 (column (2) versus column (4)). This raises the question of whether FT-certified mills are less able to sell all coffee received when the price floor is binding. Thus, in columns (5) and (6), we report estimates of equations (3) and (4) with the fraction of the quantity received that is sold as the dependent variable. We find mixed evidence of more coffee being unsold by certified mills when the price floor is binding. In column (5), the coefficient on the interaction term is negative and significant, but in column (6), it is positive and insignificant. The negative coefficient, although significant, is small in magnitude and very close to zero. The coefficient suggests that 1.6% less of the coffee received can be sold by FT-certified mills when the price floor is binding.

Next, we turn to a closer examination of the quantity of coffee sold and estimate effects separately for domestic and international sales. The estimates are reported in Table 5. Columns (1) and (2) report estimates with the quantity of domestic coffee sales as the dependent variable, while columns (3) and (4) report estimates with the quantity of exports as the dependent variable. We find that the effects on total sales appear to be mainly due to domestic sales. The coefficients on the interaction terms for domestic sales are larger in magnitude and more precisely estimated than for exports. This suggests that at times when the price floor is binding, although some of the additional coffee received by FT-certified mills is exported, most appears to be sold domestically. This is consistent with it being easier for a mill to sell excess coffee domestically than internationally. In columns (5) and (6), we test for a differential effect on domestic sales versus exports for certified mills when the price floor binds. As reported, while FT-certified mills export more, when the price floor binds, the export share of FT-certified mills tends to decrease, although this estimated effect is not statistically different from zero.

The final outcome that we examine is the total revenue received by mills. Estimates of equations (3) and (4) with the natural log of total revenues as the dependent variable are reported in columns (1) and (2) of Table 6. The estimates show large and significant effects of FT certification on the revenues of FT-certified mills when the price floor

17. Although the policy of FT cooperatives is that members should not sell their products to other mills or third-party intermediaries, in reality, farmers typically do (Ronchi 2002, p. 16).

TABLE 5. The effect of FT certification on quantity sold domestically and internationally.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable:					
	ln domestic quantity sold		ln export quantity sold		Export quantity as a fraction of total quantity sold	
FT certified, FTC	−0.357	−0.238	−0.085	−0.024	0.056*	0.047
	(0.225)	(0.207)	(0.178)	(0.162)	(0.033)	(0.031)
FTC × price gap indicator	0.737***		0.289		−0.060	
	(0.203)		(0.198)		(0.044)	
FTC × price gap (USD/lb)		1.474***		0.327		−0.121
		(0.430)		(0.420)		(0.075)
Year FE	Y	Y	Y	Y	Y	Y
Mill FE	Y	Y	Y	Y	Y	Y
Observations	2,038	2,038	2,000	2,000	2,110	2,110
Number of clusters/mills	326	326	307	307	329	329
Mean of dependent variable	10.9	10.9	12.8	12.8	0.79	0.79
Standard deviation of dependent variable	2.3	2.3	2.1	2.1	0.25	0.25

Notes: The table reports OLS estimates of equations (3) and (4). An observation is a mill-year. Each specification contains mill and year fixed effects. The dependent variable in columns (1) and (2) is the natural logarithm of the total quantity (expressed in lbs) sold by a mill on the domestic market. The dependent variable in columns (3) and (4) is the natural logarithm of the total quantity (expressed in lbs) sold by a mill on the export market. The dependent variable in columns (5) and (6) is equal to the ratio of export quantity sold over total quantity sold. The price gap indicator equals one in years in which the world price for Arabica coffee is below the FT minimum price. The price gap variable equals zero when the price gap indicator is zero and equals the difference between the FT minimum price plus the premium and the world price for years when the price gap indicator is equal to one. The price gap variable ranges from 0 to 0.66 USD/lb. The FT minimum price for washed Arabica coffee was increased from \$1.20/lb to \$1.25/lb in June 2008 and to \$1.40/lb in April 2011. The FT premium was increased from \$0.05/lb to \$0.10/lb in June 2007 and to \$0.20/lb in April 2011. Coefficients are reported with standard errors clustered at the mill-level in parentheses. *and *** indicate significance at the 10% and 1% levels, respectively.

is binding. Disaggregating revenues between domestic revenues (columns (3) and (4)) and export revenues (columns (5) and (6)), we find that similar effects are found for both, but that the magnitude of the estimated effect is noticeably larger for domestic revenues.

Taken together, a clear picture emerges from the estimates in Tables 3–6. When the price floor binds, FT-certified farmers have potential access to a market that offers significantly higher prices than the conventional market (Table 3). FT-certified farmers recognize the benefit of selling their coffee as FT-certified through their local FT-certified cooperative, to which they are a member, rather than through other conventional mills. Thus, the amount of coffee that is sold by farmers to FT-certified cooperatives increases (columns (1) and (2) of Table 4). The FT cooperative then attempts to sell more coffee in the domestic and export markets. While we see that nearly all of the extra coffee is sold (columns (3) and (4) of Table 4), more of the extra

TABLE 6. The effect of FT certification on revenues.

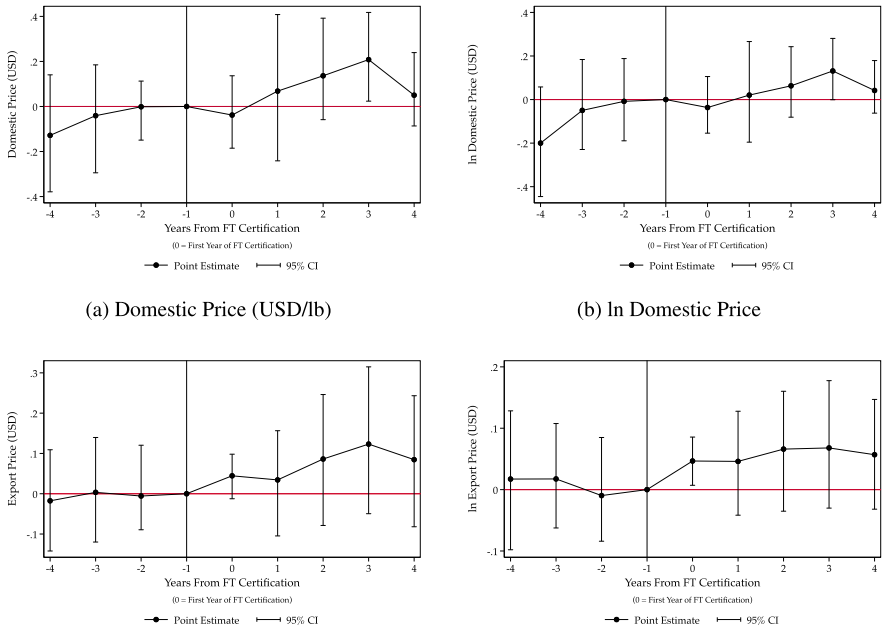
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable:					
	ln total revenue		ln domestic revenue		ln export revenue	
FT certified, FTC	−0.163	−0.088	−0.378	−0.252	−0.081	−0.013
	(0.156)	(0.139)	(0.239)	(0.222)	(0.174)	(0.158)
FTC × price gap indicator	0.400**		0.799***		0.329*	
	(0.201)		(0.215)		(0.199)	
FTC × price gap (USD/lb)		0.618		1.654***		0.405
		(0.437)		(0.467)		(0.431)
Year FE	Y	Y	Y	Y	Y	Y
Mill FE	Y	Y	Y	Y	Y	Y
Observations	2,110	2,110	2,038	2,038	2,000	2,000
Number of clusters/mills	329	329	326	326	307	307
Mean of dependent variable	13.12	13.12	10.83	10.83	13.10	13.10
Standard deviation of dependent variable	2.02	2.02	2.17	2.17	1.95	1.95

Notes: The table reports OLS estimates of equations (3) and (4). An observation is a mill-year. Each specification contains mill and year fixed effects. The dependent variable in columns (1) and (2) is the total revenue (expressed in USD) obtained by a mill in a given year and equals the sum of domestic and export revenue. The dependent variable in columns (3) and (4) is the natural logarithm of domestic revenue (expressed in USD) obtained by a mill in a given year. The dependent variable in columns (5) and (6) is the natural logarithm of export revenue (expressed in USD) obtained by a mill in a given year. The price gap Indicator equals one in years in which the world price for Arabica coffee is below the FT minimum price. The price gap variable equals zero when the price gap indicator is zero and equals the difference between the FT minimum price plus the premium and the world price for years when the price gap indicator is equal to one. The price gap variable ranges from 0 to 0.66 USD/lb. The FT minimum price for washed Arabica coffee was increased from $1.20/lb to $1.25/lb in June 2008 and to $1.40/lb in April 2011. The FT premium was increased from $0.05/lb to $0.10/lb in June 2007 and to $0.20/lb in April 2011. Coefficients are reported with standard errors clustered at the mill level in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

coffee ends up being sold in the domestic market than in the export market (Table 5). Because FT-certified mills receive a higher price when the price floor is binding and they sell greater quantities, their total revenues are also greater; this is true for both domestic and export revenues (Table 6).

3.3. Event Study Analysis

We next turn to an event study analysis of the effects of FT. The analysis provides added insight into mill dynamics before and after the onset of FT certification. This is particularly helpful in assessing whether we observe pre-trends prior to certification, which would provide evidence of selection into certification. It also provides added information about how quickly the effects of FT emerge and the nature of their persistence over time.



(a) Domestic Price (USD/lb)

(b) ln Domestic Price

(c) Export Price (USD/lb)

(d) ln Export Price

FIGURE 2. Event study plots for prices. Figures report the estimated μ_t's from equation (5) and their 95% confidence intervals. The x-axis denotes the year relative to certification, which is defined to be year 0. The sample is comprised of mills that switched into FT status during the sample period.

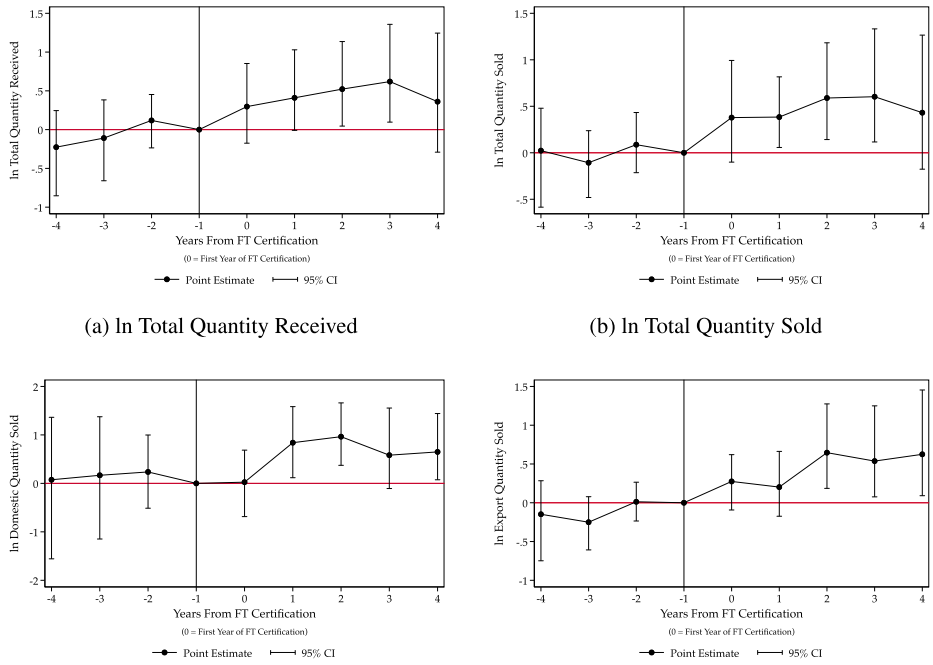
The analysis relies on the following specification:

$$y_{i,t} = \mu_i + \mu_t + \sum_{j=-4}^{4} \tau_j \, I_{i,t}^{j} + \varepsilon_{i,t}, \tag{5}$$

where i indexes mills and t indexes years. The index j denotes years relative to the onset of FT certification, where $j \in \{-4, -3, -2, -1, \ 0, \ 1, \ 2, \ 3, \ 4\}$ and $j = 0$ is the first year that mill i is FT certified. $I_{i,t}^{j}$ is an indicator that equals one when the year relative to onset is j for mill i. $y_{i,t}$ is an outcome of interest, μ_i denotes mill fixed effects, and μ_t denotes year fixed effects. The sample is comprised of the 15 mills that became FT certified during the sample period, 1999–2014.[18]

The estimates are reported in Figures 2–4 for our measures of prices, quantities, and revenues, respectively. We complement our export revenue estimates by looking also at the extensive margin of trade, which is estimated using an indicator variable that equals one if the mill exports in a year. These estimates are reported in Figure 4(d).

18. For a summary of the annual variation in aggregate FT certification, see Online Appendix Figures A.1 and A.2.



(a) ln Total Quantity Received (b) ln Total Quantity Sold

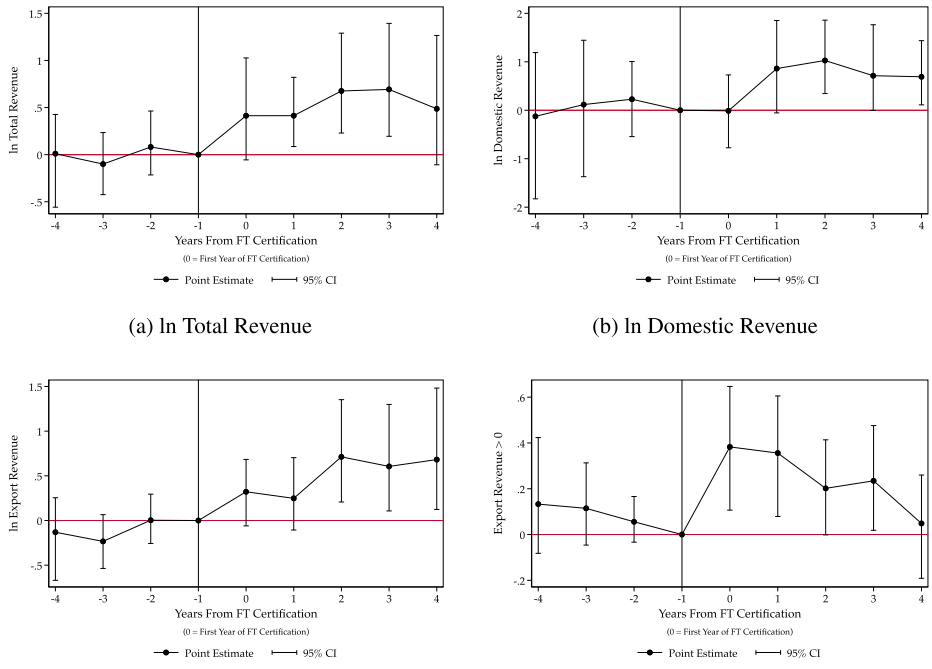
(c) ln Domestic Quantity Sold (d) ln Export Quantity Sold

FIGURE 3. Event study plots for quantities. Figures report the estimated μ_t's from equation (5) and their 95% confidence intervals. The x-axis denotes the year relative to certification, which is defined to be year 0. The sample is comprised of mills that switched into FT status during the sample period.

Each subfigure plots the estimated τ_j's from equation (5) along with 95% confidence intervals calculated from block bootstrap standard errors that are clustered at the mill level. Reassuringly, we find no evidence of systematic pre-trends. In the years prior to the onset of certification, the estimated coefficients are very close to zero. As well, other than slight changes in the coefficient estimates between periods $t = -4$ and $t = -3$ for domestic price and total quantity received, there is no year-to-year change in the coefficient estimates prior to the onset of FT certification.[19]

After certification, we see immediate (i.e. in period $t = 0$) increases in export prices, exports, and export revenues. We then tend to see additional, but smaller, increases for the next couple of years. By contrast, we see slightly different dynamics for domestic sales. While effects are eventually felt on domestic prices, sales, and

19. For the domestic price plots, visual inspection raises the possibility that pre-trends are present. Given this, we formally test for pre-trends in two ways. First, we test the null hypothesis that the pre-FT certification coefficients are jointly equal to zero. Second, we test the null hypotheses that the difference between the $t = -4$ and $t = -1$ coefficients are equal to zero. For all outcomes, including the domestic price measures, we fail to reject the null hypotheses.



(a) ln Total Revenue

(b) ln Domestic Revenue

(c) ln Export Revenue

(d) Export Indicator

FIGURE 4. Event study plots for revenues. Figures report the estimated μ_t's from equation (5) and their 95% confidence intervals. The x-axis denotes the year relative to certification, which is defined to be year 0. The sample is comprised of mills that switched into FT status during the sample period.

revenues, these are not felt immediately but in period $t = 1$ and after. For both markets, the effects of FT appear persistent over the five years examined.

3.4. Effects of FT Certification on Mill Exit

In this section, we examine the effects of FT certification on the death of mills. The results in Tables 3–6 highlight that FT-certified mills receive higher prices when the price floor is binding, sell greater quantities, and have higher total revenues. In short, the economic health of mills appears to be improved due to FT certification. Therefore, we also examine whether certification lowers the chances that a mill shuts down and exits our sample.

To examine the effects of FT certification on mill exit, we estimate a hazard model, where the dependent variable is an indicator variable for a mill exiting and no longer reporting production amounts to ICAFE:

$$I_{i,t}^{Exit} = \alpha_i + \alpha_t + \beta\, I_{i,t-1}^{FT} + \boldsymbol{X'_{i,t-1}\Gamma} + \sum_{j=1}^{3} \varphi_j Duration_{i,t}^{j} + \varepsilon_{i,t}, \qquad (6)$$

TABLE 7. The effect of FT certification on mill exit.

	Dependent variable: indicator for leaving the sample					
	(1)	(2)	(3)	(4)	(5)	(6)
One-year lagged FT certification	−0.05326***	−0.03270***	−0.03561***	−0.03206***	−0.03191***	−0.03385**
	(0.01349)	(0.01187)	(0.01156)	(0.01218)	(0.01168)	(0.01335)
One-year lagged ln total quantity sold		−0.03541***				0.01147
		(0.01169)				(0.05883)
One-year lagged ln domestic quantity sold			−0.01006*			−0.00145
			(0.00559)			(0.00739)
One-year lagged ln export quantity sold				−0.03619***		−0.00715
				(0.01164)		(0.01830)
One-year lagged ln total revenue					−0.03405***	−0.05376
					(0.01163)	(0.05438)
Duration: third-order polynomial	Y	Y	Y	Y	Y	Y
Year FE, Mill FE	Y	Y	Y	Y	Y	Y
Observations	1,962	1,899	1,835	1,811	1,901	1,745
Number of clusters/mills	313	312	308	291	313	286
Mean dependent variable	0.0505	0.0390	0.0381	0.0381	0.0389	0.0372
Standard deviation dependent variable	0.219	0.194	0.192	0.191	0.193	0.189

Notes: Coefficients are reported with standard errors clustered at the mill level in parentheses. All regressions include year fixed effects, mill fixed effects, and a third-order polynomial in the duration of being in the sample. The dependent variable is an indicator variable that equals one if the mill leaves the sample that year. The sample includes all observations where a mill was in the sample in the previous year. Once a mill leaves the sample, they are no longer in the sample the following year. The lagged FT certification variable is the lag of the FT certification status indicator variable (which is undefined once a mill leaves the sample). *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

where i indexes a coffee mill and t years (1999–2014). An observation is a mill that is observed in the ICAFE data in period $t-1$. $I_{i,t}^{Exit}$ is an indicator variable that equals one if the mill exits the industry (i.e. is not observed in the sample in period t). $I_{i,t-1}^{FT}$ is an indicator variable that equals one if the mill was FT certified in $t-1$, which is the most recent year for which we observe FT certification status, including mills that exit in period t. α_i denotes mill fixed effects, and α_t denotes year fixed effects.

Our coefficient of interest is β: the effect of FT certification in year $t-1$ on a firm's exit from the industry in year t. We estimate equation (6) using a linear probability model and report standard errors clustered at the mill level.

In some specifications, we will also include a vector of observable characteristics, $\boldsymbol{X_{i,t-1}}$, that may be proximate determinants of the onset of mill exit, namely, total sales, domestic sales, exports, and total revenues. By including these economic factors, which we have shown are affected by FT certification, we are able to assess whether any effects of certification on mill exit are beyond the effect of certification on these economic factors.

The estimates are reported in Table 7. Column (1) reports estimates without controls for the economic characteristics of mill i in period $t-1$. The probability of firm exit

is 5.3 percentage points lower for FT-certified mills. Thus, consistent with our findings of the effects of FT certification on prices, sales, and revenues, we also find that certification reduces the probability of a mill exiting the industry.

Columns (2)–(6) report estimates that condition on economic factors. The estimates provide evidence for whether the FT certification effect found in column (1) is primarily due to its effects on sales, prices, and revenues obtained by mills. We include the measures either one at a time (columns (2)–(5)) or all together (column (6)). We find that in all specifications, the effect of FT certification remains, with a coefficient of about −0.032. Thus, while a sizeable portion of the effect of certification on lower mill exit is due to its effect on greater prices, sales, and revenues, the evidence indicates that the effects of FT may also work through other channels. Of course, it is possible that the finding is explained by the fact that prices, sales, and revenues in periods prior to $t-1$ also matter. However, the finding is also consistent with FT certification offering additional benefits, such as expectations of greater economic stability in the future, greater training and know-how, or stronger connections with international buyers, all of which are benefits that certification is intended to offer by the developers of the FT label.

3.5. Robustness and Sensitivity Checks

We now turn to an analysis of the robustness of our mill-level findings.

Robustness to Alternative Coffee Price Data: ICE Coffee C Future Prices. We first check the robustness of our estimates to using alternative coffee price data. The results presented in Section 3.2 rely on arabica coffee prices from the ICO. The measure is a composite price for arabica coffee that is calculated as the average price for arabica beans grown in Central America at the trading markets of New York, Hamburg, and Marseille.[20] The ICO data have the advantage of reporting prices specifically for coffee from Central America. An alternative price measure for arabica coffee that does not have this feature is the Coffee C futures contract price on the NYC ICE commodity exchange.[21] We test the sensitivity of our findings to the use of Coffee C futures prices by re-estimating the specifications reported in Tables 3–6 using these price data. The estimates, which are reported in Online Appendix Tables A.5–A.8, show that the results are qualitatively identical to the baseline estimates reported in Tables 3–6. This is not surprising given that the two price series are highly correlated, with a correlation coefficient of 0.987 for our sample period.

20. The measure is the "Other Mild Arabica Indicator Price." For more information, see https://www.ico.org/coffee_prices.asp.

21. The contract prices the physical delivery of arabica beans, with standardized premiums/discounts depending on the country of origin and the delivery location. To be included in the contract, the traded arabica coffee beans must be from a set of licensed exporters, originate from one of 20 authorized countries, and be delivered to a select set of ports in the U.S. and Europe. For more information, see https://www.theice.com/products/15/Coffee-C-Futures.

Accounting for Other Certifications. Within the Costa Rican coffee industry, FT is, by far, the most common certification. However, there are two other certifications that are also present: Rainforest Alliance (RA) certification and USDA Organic certification. The RA certification verifies compliance with sustainability standards that focus on ecosystem conservation, wildlife protection, and ensuring fair working conditions. Organic certification requires that products be grown without the use of prohibited substances, including most synthetic fertilizers and pesticides. In the Costa Rican coffee sector, seven mills had RA certification and three mills had Organic certification at some point between 1999 and 2014.

Here, we attempt to gain a better understanding of how FT certification is associated with RA or Organic certifications, and we also check the sensitivity of our findings to account for these alternative certifications. We begin by examining whether the presence of one certification affects the adoption of another. To examine this, we estimate versions of equation (1) where the outcome is the onset of one type of certification and the independent variables of interest are the pre-existing presence of the other certifications. The estimates, which are reported in Online Appendix Table A.10, show that RA and Organic certifications are positively associated with subsequent FT certification. However, although the estimated effects are sizeable, they are underpowered and insignificant at conventional levels. Interestingly, we find that, by contrast, FT certification is negatively associated with the subsequent certification of RA, and we find no association with the Organic certification. Although there are many possible explanations for these patterns, they are consistent with RA being dominated by FT. If a mill is FT certified, then there appears to be less incentive to become RA certified. But, RA serves as a stepping stone to FT certification. If a mill is first RA certified, then this increases the likelihood of the mill subsequently becoming FT certified.

The relationships between the certifications highlight the potential importance of accounting for the other certifications when estimating the effects of FT. Thus, we next check the robustness of our findings to account for the other certifications by re-estimating the specifications reported in Tables 3–6 while controlling for indicators for the presence of other certifications. The estimates, which are reported in Online Appendix Tables A.11–A.14, show that our estimates of interest are nearly identical when we condition on the other certifications.[22]

22. Interestingly, we find that the estimated direct effects of RA or Organic certification are generally positive and significant for quantities sold, similar to the impacts of FT certification on quantities sold. However, unlike FT certification, these other certifications are not associated with higher prices, either domestically or internationally. This is consistent with RA or Organic certifications improving a mill's market access without meaningfully affecting the sales price of the coffee. This is expected since, unlike FT, neither certification has as its goal to increase the price of coffee sold by mills. Although the estimates for the other certifications must be treated with caution due to their infrequent occurrence, the estimates do suggest that FT certification seems to offer distinct benefits compared to other certifications in the coffee sector in Costa Rica.

Sensitivity to Initial Exporting Intensity. Time-invariant mill characteristics, even if unobservable, are captured by our mill fixed effects. Beyond this, any time-varying mill characteristics that are correlated with FT certification will be captured in the direct effect of FT certification, that is, γ_1 and φ_1 in equations (3) and (4). However, if there are unobservable mill characteristics that affect the extent to which mills are able to innovate and respond to low coffee prices, then this could potentially bias our estimates of interest: γ_2 and φ_2 in equations (3) and (4).

Given this concern, we also test the sensitivity of the mill-level results to controlling for proxies of initial mill quality interacted with the price gap measures. Specifically, we control for an interaction between a mill's export share in their initial year and one of our two price gap measures. The presumption here is that the initial export share is an observable proxy of a mill's underlying quality and ability to weather lower coffee prices. The estimates with the additional control are reported in Online Appendix Tables A.16–A.19. We find that the estimated effects of interest are qualitatively identical and quantitatively very similar to our baseline estimates reported in Tables 3–6. Although not reported here, we also obtain very similar results if we use total exports as an alternative proxy for mill quality rather than the export share.

Sensitivity to Influential FT-Certified Mills. A total of 24 mills in Costa Rica had FT certification at some point during our sample period. Given the modest number of mills that were ever FT-certified in the sample, we checked the extent to which our findings are driven by specific mills. To do this, for each main outcome, we re-estimate equations (3) and (4) after iteratively dropping each of the twenty-four mills that have ever been FT-certified. This allows us to assess the extent to which the estimates rely on any particular mill. The estimates are summarized in Online Appendix Table A.20, which reports the baseline estimates and standard errors for the interaction terms of interest, γ_2 and φ_2, along with the minimum and maximum coefficient estimates (in terms of magnitude) and their standard errors. We do this for each specification reported in Tables 3–6. We find that the range of estimates is quite similar to our baseline estimates.

4. Effects of FT Certification on Households

4.1. Estimated Effects for the Subperiod 2001–2009

We now turn to an examination of the effects of FT certification on the incomes of coffee farmers, their workers, and intermediaries in the industry. Due to data limitations, the analysis is only possible for 2001–2009, which happens to be a period when the price floor was almost continuously binding (see Figure 1).[23] In anticipation of this, we check that our mill-level findings of the effects of FT certification hold for this more restricted

23. The price floor was binding for the beginning of the sample period until February 2008.

TABLE 8. Price of coffee sold by mills, 2001–2009.

	(1)	(2)	(3)	(4)
	Dependent variable:			
	Domestic price (USD/lb)	ln domestic price	Export price (USD/lb)	ln export price
FT certified, FTC	−0.007	0.008	0.062***	0.087***
	(0.03)	(0.07)	(0.02)	(0.03)
Year FE	Y	Y	Y	Y
Mill FE	Y	Y	Y	Y
Observations	977	977	972	972
Number of clusters/mills	209	209	201	201
Mean of dependent variable	0.80	−0.36	1.08	0.02
Standard deviation of dependent variable	0.37	0.56	0.34	0.34

Notes: The table reports OLS estimates of equation (2). An observation is a mill-year. Each specification contains mill and year fixed effects. The dependent variable in column (1) is the domestic price, calculated as the average price obtained by a mill in a given year for the domestic coffee sales transactions and expressed in USD/lb. The domestic price was winsorized at the 99th percentile. The dependent variable in column (2) is the natural logarithm of the non-winsorized domestic price. The dependent variable in column (3) is the export price, calculated as the average price obtained by a mill in a given year in export coffee sales transactions and expressed in USD/lb. The export price was winsorized at the 99th percentile. The dependent variable in column (4) is the natural logarithm of the non-winsorized export price. Coefficients are reported with standard errors clustered at the mill-level in parentheses. *** indicates significance at the 1% level.

time period. Because the period is one where the price floor was always in effect, we report estimates of the average effect of FT certification using equation (2).[24] As we will see, this average effect is what is estimated and relevant for our household-level regressions. The estimates are reported in Table 8. Reassuringly, during this shorter period, we also find positive effects of FT certification on the price of coffee sold for export (columns (3) and (4)) and we find no effect on the price of coffee sold domestically (columns (1) and (2)).[25]

4.2. Data and Estimating Equations

Having examined the effects of FT certification on producers, we now turn to an examination of the effect of FT certification on households. We do this by linking the matched ICAFE-FLO data, which was used in the previous section, with household

24. We make no claims that these estimates are representative of the average effect of FT in general. Because it is a period in which the price floor is binding, the effects here might be larger than the true average effect. However, if negative selection is present, which our previous estimates seem to suggest, then the estimates will be smaller than the true effect. These caveats should be kept in mind when interpreting the individual-level estimates.

25. These patterns are similar when we use ICE coffee prices (Online Appendix Table A.9) or when we condition on RA and USDA Organic certifications (Online Appendix Table A.15).

survey data from *Encuesta Hogares de Propositos Multiples* (EHPM). The survey, which has been carried out in July of each year since 1981, contains information on household members' age, gender, occupation, industry of employment, income, and education. The sample of individual-level analysis begins in 2001, the first year that the survey data record the canton of the household, and it ends in 2009, which is the last year for which the survey records detailed occupation and industry-of-employment data. Thus, the full sample period is from 2001 to 2009.

We link the matched ICAFE-FLO mill-level data to the EHPM household survey data using the canton of the mill and the canton of the household.[26] The canton is the secondary administrative level in Costa Rica, and there are 81 cantons in total. Because harvested coffee cherries immediately begin to decompose and ferment, compromising the quality of the coffee, processing must occur within 24 hours of the cherries being harvested. Given this, the locations of farms and mills will almost always be within the same canton.

Our treatment variable is a measure of FT-certification intensity in a canton c in year t, which we denote with $FTI_{c,t}$. The measure we construct is the fraction of total exports from a canton that are sold by FT certified mills.[27] More precisely, let $X_{k,c,t}$ denote total coffee exports in year t by mill k located in canton c, and let $I^{\text{FT}}_{k,c,t}$ be an indicator variable that equals one if mill k is FT certified in year t. Then, our measure of FT intensity of canton c in year t, $FTI_{c,t}$, is given by

$$FTI_{c,t} = \sum_{k} \frac{X_{k,c,t} \cdot I^{\text{FT}}_{k,c,t}}{X_{c,t}}. \tag{7}$$

When there is no coffee production in a canton and year, that is, $\sum_k X_{k,c,t} = 0$, we assign $FTI_{c,t}$ the value of zero. That is, we assume the populations in the canton experience no treatment. As we show, our estimates are nearly identical if we restrict our sample to include only cantons that produce coffee. The benefit of examining a larger sample of households, including those that live in cantons that do not produce coffee, is that the coefficients for the covariates in the regression, including industry and occupation fixed effects, are more precisely estimated.

The individual-level analysis is analogous to the mill-level analysis, where we examine individuals over time. However, because the EHPM household survey does not follow the same households over time, we are unable to include household fixed effects in our analysis. We instead include canton fixed effects and canton-specific time trends. The first estimating equation that we consider estimates the average effect

26. We obtain information on the canton of each mill from the address recorded by ICAFE. In the few cases where the address of the mill is not available from ICAFE, we obtained the information by contacting the mill directly. We are able to identify the canton of mills for 90% of all exports between 2001 and 2009.

27. It is important to emphasize that our measure is not a measure of the share of exports that are sold as FT certified. Because we do not know sales of FT-certified coffee and non-FT-certified coffee by mill, we are unable to construct this measure. Among the four cooperatives that we interviewed in 2012, the share of their total sales in the previous year that was sold as FT was 80, 53, 40, and 10%.

of FT certification on the income of all individuals in a canton:

$$\ln y_{j,i,c,t} = \alpha_i + \alpha_c + \alpha_t + \varphi_c Time_t + \theta FTI_{c,t} + \boldsymbol{X}'_{j,t}\boldsymbol{\Gamma} + \varepsilon_{j,i,c,t}, \quad (8)$$

where j denotes individuals, i industries (480), c cantons, and t years (2001–2009). The sample includes all employed individuals over the age of twelve.[28] The dependent variable, $y_{j,i,c,t}$, denotes income in the past month, measured in the current local currency (colones). $FTI_{c,t}$ is our measure of the extent of FT certification in canton c in year t.

Equation (8) includes survey-year fixed effects α_t, industry fixed effects i, and canton fixed effects α_c. As noted, because the EHPM survey samples a new set of households each year rather than resampling the same households each year, we are unable to account for household fixed effects. To help alleviate concerns regarding the coarseness of the canton fixed effects (relative to household fixed effects), we also include canton-specific time trends, $\varphi_c Time_t$, which account for differential (linear) paths of development across cantons. Lastly, equation (8) also includes a vector of individual-level covariates $\boldsymbol{X}'_{\boldsymbol{j,t}}$ that comprises: educational-attainment fixed effects,[29] age, age^2, gender, gender × age, and gender × age^2.

The coefficient θ is an estimate of the effect of FT certification on all individuals living within a canton. Although it is possible that some effects of FT are felt by all individuals within a canton, it is likely that the effects are greatest for individuals working directly within the coffee industry. We allow for this by estimating the following equation, which allows for a differential effect of FT certification on those who work in the coffee industry:

$$\ln y_{j,i,c,t} = \alpha_i + \alpha_c + \alpha_t + \varphi_c Time_t + \mu_1 FTI_{c,t} + \mu_2 FTI_{c,t} \cdot I_j^{i=\text{coffee}} + \boldsymbol{X}_{\boldsymbol{j,t}}\boldsymbol{\Gamma} + \varepsilon_{j,i,c,t}, \quad (9)$$

where $I_j^{i=\text{coffee}}$ is an indicator variable that equals one if individual j's reported primary industry of employment is the "cultivation of coffee."[30] The inclusion of $FTI_{c,t} \cdot I_j^{i=\text{coffee}}$ in equation (9) allows for a differential effect of FT certification for those who work in the coffee sector. The coefficient μ_2 measures the additional effect that FT certification has on these individuals. The total effect of FT certification for these individuals is given by $\mu_1 + \mu_2$. The coefficient μ_1 measures the effect of increasing FT intensity within a region on individuals not working in the coffee industry. Thus, it can be interpreted as the average spillover effect of FT certification for all individuals within the region.

It is possible that, even within the coffee industry, workers benefit differentially from FT certification. For example, farm owners may benefit more than unskilled

28. To be included in the sample, an individual must be employed and also report an income, an occupation, and an industry of employment. As we show, our estimates are similar if we vary this criterion.

29. The categories are no education, preparatory, special education, primary education, high-school (academic), high-school (technical), parauniversity, and university.

30. Specifically, the indicator equals one if the observation's primary employment is in industry 01140.

coffee pickers who are hired seasonally. In addition, one of the implicit goals of FT is to transfer rents from large intermediaries to small-scale farmers. Motivated by this, we examine the distribution of benefits of FT certification with an estimating equation that distinguishes between three different occupations within the coffee industry: skilled agricultural workers, unskilled agricultural workers, and non-farm occupations. Skilled workers are primarily farm owners, while unskilled workers are hired laborers. Those working in non-farm occupations are primarily those involved in the sales, storage, transport, or processing of coffee (e.g. intermediaries, mills, and their employees).

The next estimating equation augments equation (9) with an occupation dimension and allows for a differential effect of FT certification on those in the coffee industry depending on their occupation:

$$\begin{aligned}\ln y_{j,i,o,c,t} = {} & \alpha_{i,o} + \alpha_c + \alpha_t + \varphi_c Time_t \\ & + \gamma_1 FTI_{c,t} + \gamma_2 FTI_{c,t} \cdot I_j^{i=\text{coffee},o=\text{skilled}} \\ & + \gamma_3 FTI_{c,t} \cdot I_j^{i=\text{coffee},o=\text{unskilled}} + \gamma_4 FTI_{c,t} \cdot I_j^{i=\text{coffee},o=\text{nonfarm}} \\ & + \boldsymbol{X_{j,t}\Gamma} + \varepsilon_{j,i,o,c,t}, \end{aligned} \tag{10}$$

where o indexes a worker's self-reported occupation (413 in total), and $\alpha_{i,o}$ indicates occupation-industry fixed effects. The variable $I_j^{i=\text{coffee},o=\text{skilled}}$ is an indicator variable that equals one if individual j works in the coffee sector and has a "skilled" occupation (which includes categories such as "farmer or skilled worker"); $I_j^{i=\text{coffee},o=\text{unskilled}}$ is an indicator that equals one if individual j works in the coffee sector and has an unskilled occupation (which consists of "agricultural laborers" and "coffee pickers");[31] and $I_j^{i=\text{coffee},o=\text{nonfarm}}$ is an indicator variable that equals one if individual j works in the coffee sector but is in non-farm occupations. The residual category primarily consists of individuals involved in the management, sales, storage, transport, and/or processing of coffee. (See Online Appendix Table A.3 for more details on the composition of each occupational group.) The three interaction terms allow the effects of FT certification in a canton to be different for those working in coffee in each of the three different occupation groups. Thus, the coefficients γ_2, γ_3, and γ_4 measure the additional effect of FT on those working in the coffee industry and in each of the occupational groups.

In equation (10), the spillover effect of FT to those in a canton, which is given by γ_1, is assumed to be the same for all individuals independent of their occupation. An alternative strategy is to allow these effects to vary depending on an individual's occupation. This can be done by including the following double interactions in the estimating equation: $FTI_{d,t} \cdot I_j^{i=\text{skilled}}$, $FTI_{d,t} \cdot I_j^{o=\text{unskilled}}$, and $FTI_{d,t} \cdot I_j^{o=\text{nonfarm}}$.

31. Skilled agricultural occupations are given by category 61 of the "primary occupational group" variable in the household survey. The categories are based on the *Classification de Ocupaciones de Costa Rica*, which was published by the Costa Rica Statistical Institute. Unskilled agricultural occupations are given by category 92. Non-farm occupations comprise all the other categories.

Doing this results in the following equation:

$$\begin{aligned}\ln y_{j,i,o,c,t} = {} & \alpha_{i,o} + \alpha_c + \alpha_t + \varphi_c Time_t \\ & + \beta_1 FTI_{c,t} \cdot I_j^{o=\text{skilled}} + \beta_2 FTI_{c,t} \cdot I_j^{o=\text{unskilled}} + \beta_3 FTI_{c,t} \cdot I_j^{o=\text{nonfarm}} \\ & + \beta_4 FTI_{c,t} \cdot I_j^{i=\text{coffee},o=\text{skilled}} + \beta_5 FTI_{c,t} \cdot I_j^{i=\text{coffee},o=\text{unskilled}} \\ & + \beta_6 FTI_{c,t} \cdot I_j^{i=\text{coffee},o=\text{nonfarm}} + \boldsymbol{X_{j,t}\Gamma} + \varepsilon_{j,i,o,c,t}. \end{aligned} \tag{11}$$

The coefficient β_1 measures the spillover effect of FT certification on skilled individuals within a canton, while β_4 measures the additional effect of FT certification on skilled individuals who work in the coffee industry. Thus, the total effect of FT certification for skilled workers in the coffee industry is given by $\beta_1 + \beta_4$. Similarly, the total effect of FT certification for unskilled workers who are not in the coffee industry is given by β_2, while the total effect for unskilled workers in the coffee industry is given by $\beta_2 + \beta_5$. Analogously, for non-farm workers, the spillover effect is given by β_3, and the total effect for non-farm workers in the coffee industry is given by $\beta_3 + \beta_6$.

4.3. Estimated Effects of FT on Incomes

Estimates of equations (8)–(11) are reported in Table 9. Column (1) reports estimates of equation (8), which allows for an average effect of FT certification for all individuals within a canton in a year. We find no evidence of a positive overall average effect. The estimated effect is not statistically different from zero. In column (2), we report estimates of equation (9), which allow the effect of FT to differ for those that work in the coffee sector. We find some evidence of a positive effect of FT intensity within the coffee sector. The effect, although sizable, is imprecisely estimated and not statistically different from zero.

We next turn to estimates of equation (10), which allows for heterogeneous effects within the coffee sector. The estimates, which are reported in column (3), show that the average effect for those within the coffee sector masks significant heterogeneity. According to the estimates, the benefits of FT to those working in the coffee sector are not evenly distributed across occupations. In fact, the effects are fully concentrated among skilled coffee growers. According to the column (3) estimates, the total benefit of FT certification for this group ($\hat{\gamma}_1 + \hat{\gamma}_2$) is $-0.031 + 0.275 = 0.244$. The mean of the FT intensity measure is 0.091.[32] Thus, the presence of FT is associated with an average increase in farm owners' incomes of $0.244 \times 0.091 = 0.0222$ or 2.22%.

The estimates of γ_3 show that unskilled workers in the coffee sector receive no additional benefit from FT certification. For this group, the combined effect ($\hat{\gamma}_1 + \hat{\gamma}_3$) is $-0.031 - 0.085 = -0.116$, which translates into a statistically insignificant decrease

32. The standard deviation of the FT intensity measure is 0.270. Full summary statistics are reported in Online Appendix Table A.2.

TABLE 9. The effect of FT on incomes by industry and occupation.

	Sample: all individuals 12 or older Dependent variable: ln (monthly income)			
	(1)	(2)	(3)	(4)
FT Intensity, FTI	−0.018	−0.029	−0.031	
	(0.066)	(0.064)	(0.057)	
FTI × coffee		0.086		
		(0.089)		
FTI × skilled				−0.106
				(0.067)
FTI × unskilled				−0.031
				(0.057)
FTI × nonfarm				−0.025
				(0.061)
FTI × coffee × skilled			0.275*	0.347**
			(0.156)	(0.156)
FTI × coffee × unskilled			−0.085	−0.089
			(0.082)	(0.091)
FTI × coffee × nonfarm			−0.251**	−0.258***
			(0.096)	(0.094)
Age, age^2, gender, and interactions	Y	Y	Y	Y
Education FE	Y	Y	Y	Y
79 canton FE	Y	Y	Y	Y
9 year FE	Y	Y	Y	Y
Canton-specific time trends	Y	Y	Y	Y
9,793 industry × occupation FE	N	N	Y	Y
461 industry FE	Y	Y	N	N
Observations	143,364	143,364	143,364	143,364
Clusters	79	79	79	79
R-squared	0.522	0.522	0.612	0.612

Notes: The unit of observation is an individual. The sample includes all individuals, who are 12 or older, and report positive income and an industry and occupation of employment. The dependent variable is the natural log of monthly income. The variable *Coffee* is equal to one if the individual's primary industry of employment is coffee cultivation. The variables *Skilled*, *Unskilled*, and *Nonfarm* equal one if an individual's primary occupation is a skilled agricultural worker, an unskilled agricultural worker, or other nonfarm occupation, respectively. All regressions include education FE, canton FE, year FE, and controls for age, age-squared, gender, gender × age, and gender × age-squared. Coefficients are reported with standard errors clustered at the canton level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

of $0.116 \times 0.091 = 0.0106$ or 1.06% due to FT. Those in non-farm occupations working in the coffee sector, who are primarily intermediaries and their employees, are estimated to lose their FT certification. The additional effect on this group is negative and highly significant. In addition, the total effect of FT certification for this group ($\hat{\gamma}_1 + \hat{\gamma}_4$) is also negative and significant: $-0.031 - 0.251 = -0.282$. According to the estimates, the presence of FT is associated with an average decrease in intermediaries' incomes of $0.282 \times 0.091 = 0.0257$ or 2.57%.

The finding of a large benefit from FT certification for skilled coffee growers (who are mainly the farm owners) but not for unskilled workers is confirmed by the estimates

of equation (11), which are reported in column (4). The estimates, which allow the spillover effects of FT certification to differ depending on an individual's occupation, are consistent with the estimates of equation (10). According to the estimates, there are no statistically significant spillover effects for those in all occupations. We also find a positive addition effect for skilled coffee growers, an additional effect that is negative but not different from zero for unskilled coffee growers, and a large negative effect for non-farm coffee workers.[33]

Overall, the estimates show that while FT significantly increases the incomes of those working in skilled occupations in the coffee sector (e.g. farm owners), it has a large negative effect on the incomes of those working in non-farm occupations within the coffee sector.[34] Thus, it appears as if FT redistributes money from intermediaries to the farm owners. Given that this redistribution is a goal of FT, the result is not surprising.[35] In practice, this likely occurs because when cooperatives obtain the FT certification and are offering higher prices, coffee growers are more likely to take their coffee cherries for processing at the cooperative mill. Stand-alone mills and exporters (i.e. intermediaries) will tend to lose as a result. Part of the FT initiative is aimed at helping farmers market and sell their own coffee, thus removing the need to use external intermediaries (Podhorsky 2015). This is done by not only requiring that farmers form cooperatives that process and sell the coffee, but the FT organization also tries to connect farmers to FT-certified purchasers of coffee. In addition, knowledge and technical training are also provided to farmers to help them better understand the market.

Our finding that there are no benefits for unskilled workers in the coffee sector is not surprising once one considers the structure of FT. Unless the members of the cooperative, who will tend to be the "skilled workers" in our sample, decide to allocate some of the premium to increase the wages of coffee pickers and other hired workers (unskilled workers in the sample), then we should not expect to see any income effects for this group of workers from increasing FT production. These findings are consistent with descriptive evidence from Valkila and Nygren (2009), which shows that hired coffee workers in Guatemala do not appear to benefit from FT.

Given the uneven benefits of FT within the coffee sector, it is important to understand the relative sizes of the different groups, as well as their relative levels of prosperity. Table 10 provides this information. It reports average monthly incomes over the sample period (2001–2009), which, for ease of interpretation, has been

33. Note that while these results suggest that there is an average difference across groups in the impact of FT certification, there is a fair amount of within group variation in incomes. Online Appendix Figure A.3 presents the full distributions for each group.

34. Although we do not know with certainty that intermediaries comprise the majority of workers in the non-farm category, as we report below in Table 10, we do observe that their average income is approximately 42% higher than that of skilled coffee workers and 100% higher than non-skilled workers. In addition, the number of individuals in this sector is very small. While there are 1,388 individuals in skilled occupations in the coffee sector, there are only 171 individuals working in non-farm occupations in the coffee sector.

35. For a theoretical examination of this, see Podhorsky (2015).

TABLE 10. Average annual incomes by industry and occupation.

	All occupations	Skilled agriculture only	Unskilled agriculture only	Non-farm occupations
		All of Costa Rica		
All industries	\$4,457	\$3,029	\$2,193	\$4,886
	$n = 143{,}364$	$n = 8{,}554$	$n = 16{,}942$	$n = 117{,}868$
Coffee industry only	\$2,019	\$2,432	\$1,592	\$4,047
	$n = 2{,}837$	$n = 943$	$n = 1{,}723$	$n = 171$
		Coffee producing cantons only		
All industries	\$4,450	\$2,718	\$1,915	\$4,862
	$n = 71{,}747$	$n = 4{,}253$	$n = 6{,}943$	$n = 60{,}551$
Coffee industry only	\$2,008	\$2,385	\$1,594	\$4,115
	$n = 2{,}557$	$n = 867$	$n = 1{,}542$	$n = 148$
		Rural parts of coffee producing cantons only		
All industries	\$3,884	\$2,638	\$1,896	\$4,428
	$n = 42{,}627$	$n = 3{,}777$	$n = 6{,}485$	$n = 32{,}365$
Coffee industry only	\$1,920	\$2,327	\$1,578	\$3,392
	$n = 2{,}436$	$n = 822$	$n = 1{,}495$	$n = 119$

Notes: The table reports average monthly income (converted to U.S. dollars per year) and the number of observations. For the conversion, it was assumed that 500 Costa Rican colones are equal to approximately one U.S. dollar.

converted to annual income measured in U.S. dollars. The first panel of the table looks across all households in the sample and, for each industry and occupation category, reports the number of individuals in our sample and average monthly income. For the full sample, the average annual income is \$4,457.[36] For individuals working in the coffee industry, the average is significantly lower at about \$2,019. Within this industry, incomes are higher than average for skilled coffee workers (\$2,432), lower than average for unskilled workers (\$1,592), and significantly higher than average for non-farm occupations (\$4,047). Non-farm occupations account for about 6% of all workers in the coffee industry, unskilled occupations account for 60.7%, and skilled occupations account for 33.2%. The lower panels in Table 10 show that similar patterns are observed if we restrict the sample to households that are in coffee-producing cantons or households in the rural regions of coffee-producing cantons.

These statistics suggest that for the vast majority of workers in the coffee industry (93.9%), FT either has positive or non-existent effects on incomes. The group that is hurt (those in non-farm occupations) comprises a very small proportion of all workers in the coffee sector, and they have incomes that are more than 100% higher than the incomes of those in unskilled occupations and 38% higher than the incomes of those in skilled occupations. Although the group that benefits significantly from FT has higher incomes than those in unskilled occupations, their incomes are still much lower than

36. The average exchange rate from 2001 to 2009 was approximately 500 Costa Rican colones per U.S. dollar.

the average for all of Costa Rica. While the average income in the full sample is the equivalent of $4,457, the average for those in skilled occupations in the coffee sector is $2,432. Thus, the primary beneficiaries of FT are economically disadvantaged, even if they are not the very poorest group.[37]

4.4. Comparison of Estimated Magnitudes to Calculated Magnitudes

We now turn to the question of the plausibility of the estimates by comparing them against calculated benefits that arise given our knowledge of the volume of FT-certified sales in the Costa Rican coffee sector, as well as assumptions about how the price premium and price gap are distributed. We first consider the plausibility of our calculated effects of FT for farm owners. To do this, we assume that the farm owners do not receive the price premiums, but do receive a higher price from the FT minimum price. We then calculate the average increase in incomes for all coffee farm owners if these increased revenues were distributed equally among all FT-certified farmers.

The calculations depend on our assumption of the share of FT eligible coffee (coffee produced by FT-certified farmers) that is actually sold as FT. For our calculations, we make three conservative assumptions about this figure, assuming that 12, 20, or 30% of FT-eligible coffee is sold as FT. According to the calculations, farm owners in Costa Rica would receive an average of $45.45, $82.64, or $123.97 per year, which is equal to 1.92, 3.58, or 5.51% of annual income.[38] Recall that the estimated effect of FT (movement from zero to the mean) for the coffee owners was 2.22% of income. Thus, under plausible assumptions, the estimated effect can be explained by additional revenues arising from the guaranteed minimum price of FT.

It is important to also recognize that part of the benefit to farm owners may arise from a transfer of incomes from intermediaries. We now turn to this effect and calculate the predicted total income loss due to FT for all intermediaries. The total average annual loss from FT for all coffee intermediaries is $95,195.42. This figure is 10.6% of the calculated total average annual gain from FT for all coffee farm owners, which is $897,773. Thus, the total estimated benefits of FT to farm producers are about ten times greater than the loss to intermediaries.

The last issue that we consider is certification costs and how these compare to the magnitude of the estimated benefits from FT. We are able to obtain actual amounts paid by cooperatives. As an example of the magnitude of certification costs, consider CoopeAgri, which paid $5,800 in their first year of certification and $3,800 in subsequent years. Coocafé paid $8,000 in its first year and $5,100 in subsequent years. CoopeVictoria paid $6,100 in its first year and $4,100 in subsequent years. Differences

37. Alternative indicators, like educational attainment, also show a similar pattern (see Online Appendix Table A.4). The most educated group of workers are the non-farm occupations (8.2 years), followed by skilled farmers (6.3 years), and then unskilled workers (5.7 years).

38. All calculations are based on the estimates from column (3) of Table 9. The figures are very similar if the column (4) estimates are used.

in certification costs primarily reflect differences in the size of the cooperatives. If we look across FT-certified cooperatives and normalize the costs by the number of farmer members in each cooperative, then we find that the average cost of certification is $2 per farmer per year. This is a small fraction of the calculated benefits reported above, which range from approximately $50–124 per year. In addition, the certification costs are generally paid by the cooperative using funds obtained from the FT price premium, which is not part of these calculated benefits. Thus, even accounting for the cost of certification, there remain sizeable benefits for FT-certified farmers.

4.5. Robustness and Sensitivity Checks

We now turn to an examination of the robustness of the income estimates reported in Table 9. Given the potentially small number of observations within occupation, canton, and year cells, we check to make sure our estimates are not driven by a small number of influential observations. To do this, for each specification, we identify influential observations by calculating the leverage of each using Cook's distance. We then omit those deemed to be influential using Cook's threshold. The estimates with the influential observations omitted are reported in Online Appendix Table A.21. As shown, the estimates are very similar. We continue to estimate a large positive effect on income for skilled coffee farmers and a large negative effect for nonfarm occupations.[39]

We next check the sensitivity of our findings to restricting the sample to only including individuals who are the head of a household. Although this restriction reduces the sample by about 50%, the estimates are nearly identical to the baseline estimates. Estimates of equation (11) for this subsample are reported in column (2) of Table 11. Column (1) reproduces the baseline estimates for comparison.

We also test the sensitivity of our estimates to the use of restricted samples that only include: (i) cantons that produce coffee (36 in total), and (ii) the rural areas of these coffee-producing cantons. The argument for including observations that are not in coffee-producing cantons is that they help to more precisely estimate the control variables and fixed effects that are important for the analysis. However, one could also argue that the cantons in the restricted samples are more comparable. Estimates using these two subsamples are reported in columns (3) and (4). The estimates remain very similar when we use the restricted samples.

The last check that we perform tests the sensitivity of our results to a more stringent specification where we include canton-year fixed effects. The estimates, which are reported in column (5), yield findings that are qualitatively identical to our baseline estimates.[40]

39. Interestingly, we estimate a small positive effect on unskilled coffee workers once we omit the influential observations.

40. Because the sum of the interactions of FT intensity measure with the skilled, unskilled, and non-farm indicators is equal to $FTI_{c,t}$, which is absorbed by the canton-year fixed effects, one of the three interactions must be omitted and serve as the baseline category.

TABLE 11. The effect of FT on incomes: robustness to alternative subsamples and specifications.

	Dependent variable: ln (monthly income)				
	All cantons		Coffee producing cantons only	Rural parts of coffee producing cantons	All cantons
	All individuals	Household heads only			Canton-year fixed effects
	(1)	(2)	(3)	(4)	(5)
FTI × skilled	−0.106	−0.075	−0.094	−0.064	−0.084
	(0.067)	(0.072)	(0.074)	(0.078)	(0.056)
FTI × unskilled	−0.031	0.018	0.016	0.087	−0.005
	(0.057)	(0.063)	(0.065)	(0.059)	(0.040)
FTI × nonfarm	−0.025	0.004	−0.015	0.031	–
	(0.061)	(0.059)	(0.066)	(0.066)	
FTI × coffee × skilled	0.347**	0.365**	0.328*	0.339*	0.335**
	(0.156)	(0.159)	(0.164)	(0.167)	(0.160)
FTI × coffee × unskilled	−0.089	−0.120	−0.117	−0.138	−0.113
	(0.091)	(0.089)	(0.103)	(0.099)	(0.092)
FTI × coffee × nonfarm	−0.258***	−0.158	−0.239**	−0.270**	−0.284***
	(0.094)	(0.106)	(0.112)	(0.113)	(0.101)
Age, age^2, gender, and interactions	Y	Y	Y	Y	Y
Education controls	Y	Y	Y	Y	Y
79 canton FE	Y	Y	Y	Y	Y
9 year FE	Y	Y	Y	Y	Y
Canton-specific time trends	Y	Y	Y	Y	N
9,793 industry × occupation FE	Y	Y	Y	Y	Y
Canton-year FE	N	N	N	N	Y
Observations	143,364	74,590	71,747	42,627	139,508
Clusters	79	79	36	35	79

Notes: The unit of observation is an individual. The sample includes all individuals, who are 12 or older, and report an income and an industry and occupation of employment. Coefficients are reported with standard errors clustered at the canton level. The variable *Coffee* is equal to one if the individual's primary industry of employment is coffee cultivation. The variables *Skilled*, *Unskilled*, and *Nonfarm* equal one if an individual's primary occupation is a skilled agricultural worker, an unskilled agricultural worker, or other nonfarm occupation, respectively. All regressions include canton FE, industry-occupation fixed effects, year fixed effects, and controls for age, age-squared, gender, gender × age, and gender × age-squared. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Next, we check the sensitivity of our estimates to the use of different FT intensity measures. The estimates are reported in Table 12. Column (1) reproduces the baseline estimate, which uses an export-weighted measure of FT intensity. In column (2), we report estimates that use production weights. As shown, the estimates are nearly identical. Next, we use time-invariant export weights. That is, in equation (7), we use $\bar{X}_{kc}$ rather than X_{kct}, where $\bar{X}_{kc}$ is average exports of mill k in canton c from 2001 to 2009. One may be concerned with the variation in FT intensity that is due to the year-to-year change in exports across mills. This measure, by using a time-invariant measure of exports, is purged of this variation. As shown in column (3), the estimates remain robust. In column (4), we report similar estimates but using exports in the initial period of 2001 rather than average exports as weights. Again, the estimates remain robust.

TABLE 12. The effect of FT on incomes: Robustness to using alternative FTI measures.

	Dependent variable: ln (monthly income)			
	FT intensity measure:			
	Baseline: Export weights (1)	Production weights (2)	Time invariant export weights, 2001–2009 (3)	Initial export weights, 2001 (4)
FTI × skilled	−0.106	−0.091	−0.079	−0.069
	(0.067)	(0.066)	(0.058)	(0.058)
FTI × unskilled	−0.031	−0.016	−0.015	−0.006
	(0.057)	(0.055)	(0.040)	(0.038)
FTI × nonfarm	−0.025	−0.009	−0.013	−0.004
	(0.061)	(0.056)	(0.038)	(0.035)
FTI × coffee × skilled	0.347**	0.343**	0.296**	0.280**
	(0.156)	(0.161)	(0.125)	(0.121)
FTI × coffee × unskilled	−0.089	−0.085	−0.071	−0.065
	(0.091)	(0.093)	(0.084)	(0.084)
FTI × coffee × nonfarm	−0.258***	−0.260***	−0.192**	−0.182**
	(0.094)	(0.096)	(0.073)	(0.072)
Age, age^2, gender, and interactions	Y	Y	Y	Y
Education controls	Y	Y	Y	Y
79 canton FE	Y	Y	Y	Y
9 year FE	Y	Y	Y	Y
Canton-specific time trends	Y	Y	Y	Y
9,793 industry × occupation FE	Y	Y	Y	Y
Observations	143,364	143,364	143,364	143,364
Clusters	79	79	79	79

Notes: The unit of observation is an individual. The sample includes all individuals, who are 12 or older, and report an income and an industry and occupation of employment. Coefficients are reported with standard errors clustered at the canton level. The variable *Coffee* is equal to one if the individual's primary industry of employment is coffee cultivation. The variables *Skilled*, *Unskilled*, and *Nonfarm* equal one if an individual's primary occupation is a skilled agricultural worker, an unskilled agricultural worker, or other nonfarm occupation, respectively. All regressions include canton fixed effects, industry-occupation fixed effects, year fixed effects, and controls for age, age-squared, gender, gender × age, and gender × age-squared and education. ** and *** indicate significance at the 5% and 1% levels.

Our baseline and auxiliary FT intensity measures all share a common logic: They are measures of the fraction of exported coffee that is eligible to be sold as FT. That is, they measure the prevalence of FT within the coffee sector. This is the relevant measure for those individuals who are working within the coffee sector, which is the focus of our estimates of interest. However, for the spillover measures, one could argue that a more appropriate measure is the importance of FT in the local economy as a whole (not just in coffee). To examine this, we created the following alternative measure of FT intensity:

$$\widetilde{FTI}_{c,t} = \frac{L_{c,2001}^{coffee}}{L_{c,2001}^{total}} \cdot \sum_{k} \frac{X_{k,c,t} \cdot I_{k,c,t}^{\mathrm{FT}}}{X_{c,t}}, \tag{12}$$

where $L_{c,2001}^{coffee}$ and $L_{c,2001}^{total}$ denote the number of individuals working in the coffee industry (and the total number of individuals in all industries) in canton c in

2001.[41] This FT intensity measure, $\widetilde{FTI}_{c,t}$, differs from our baseline measure in that it accounts for the importance of coffee in a canton. Intuitively, it captures the fraction of individuals who are employed in the production of coffee that is certified as FT.

We then check whether the measure of the aggregate importance of FT (rather than its importance in coffee), which is potentially a more appropriate measure for estimating aggregate spillover effects, yields different spillover estimates. To do this, we re-estimate equations (8)–(11) and reproduce Table 9 but using $\widetilde{FTI}_{c,t}$ as our measure for FT intensity. The estimates, which are reported in Online Appendix Table A.22, show that our finding of no significant effect of FT outside of the coffee sector continues to hold (columns (1)–(3)). This is helpful since this measure is particularly suited to picking up the out-of-coffee spillover effects. In addition, we find that our findings of a positive effect of FT for skilled coffee farmers and a negative effect for non-farm coffee occupations remain, although estimated with less precision, remains (columns (3) and (4)). This is true despite the fact that this measure of FT intensity is not the appropriate measure when estimating effects for those within the coffee sector.

The last test that we undertake examines the robustness of our estimates to accounting for RA certification and Organic certification. We construct analogous canton-level intensity measures for the two other certifications in the coffee sector and include the corresponding FTI-equivalent variables and interactions as controls when estimating each specification in Table 9. The estimates are presented in Online Appendix Table A.23. We find that the estimates are robust to controlling for the intensity of other coffee certifications.

Overall, our sensitivity checks confirm the robustness of the findings from Table 9. In all specifications, the estimates remain similar to the baseline estimates. They continue to show that within the coffee sector, skilled workers (e.g. farm owners) benefit significantly, while those in non-farm occupations (e.g. intermediaries) are hurt. We continue to find no evidence of spillover effects to individuals in the same canton who are working outside of the coffee sector.

4.6. Estimated Effects of FT on School Enrollment

We next turn to an investigation of the effects of FT certification on the education of children. There are three main channels through which FT production could affect education. First, by increasing household incomes, FT certification could increase educational attainment. As we have seen, FT certification is associated with higher payments to skilled occupations in the coffee industry. Second, FT certification, by making coffee production a more profitable endeavor, may increase the opportunity costs of going to school.[42] Third, FT could affect educational attainment through an enhanced provision of public goods in a region. In Costa Rica, part of the FT premium is directed toward the building of schools and roads, the provision of books,

41. We use individuals over the age of 12 who report an industry and occupation of employment.

42. Evidence for such an effect has been found in Mexico (Atkin 2016).

equipment, and other materials, as well as the provision of scholarships for students to attend school. For example, since CooCafé's creation of the Children of the Field Foundation (*Fundación Hijos del Campo*) in 1996, they have provided scholarships to 2,598 students and financial support to 240 schools. CooCafé estimates that over 5,800 students have been helped by their foundation.[43]

To examine the effects of FT certification on education, we estimate a version of equation (11), where the unit of observation is a child and the dependent variable is an indicator variable that equals one if the child is enrolled in school at the time of the survey. We examine three different samples: children aged 7–12 years old (potential elementary school students); children aged 13–17 (secondary school students); and children aged 18–25 (university students). Since children do not have an identified industry and occupation, we use the industry and occupation of the household head. Thus, the estimates report how school enrollment of children varies with FT certification for households in different occupations within and outside of the coffee sector.

Estimates are reported in Table 13. Column (1) reports estimates for elementary-school-aged children, column (2) reports estimates for secondary-school-aged children, and column (3) reports estimates for university-aged children. FT certification is estimated to have no effect on enrollment in elementary schools (column (1)). This is consistent with the fact that elementary school enrollment rates are very high in Costa Rica, and thus there is little scope for improvement. For example, in our sample, 98.9% of eight-year-old children are enrolled in school.

For high-school aged children, we find that FT has a negative effect on the enrollment of the children of those working in non-farm coffee occupations (column (2)). This effect is potentially explained by the large negative effects of FT on the incomes of this group of parents. Evidence from similar developing-country contexts shows that low incomes can prevent parents from being able to send their children to school, resulting in lower enrollment rates (Edmonds, Pavcnik, and Topalova 2010). We also find some evidence of a negative effect of FT on the enrollment of the high-school-aged children of unskilled workers in the coffee sector (column (2)). This estimated effect, which is more difficult to understand, is marginally significant and much smaller than the estimated magnitude of the effect of FT on the high-school-aged children of those working in non-farm coffee occupations. The estimates suggest no effect of FT certification on the enrollment of university-aged children of parents in the coffee sector, regardless of their occupation (column (3)). All coefficients are small in magnitude and statistically insignificant. These findings are consistent with a relatively small proportion of the premiums being allocated to post-secondary education. In addition, the funds that are allocated to this tend to be focused on adult education and skills upgrading, which primarily affect those older than 25.[44]

43. For an examination of the impacts of the foundation in the years immediately following its inception, see Ronchi (2002). From 1997 to 1999 alone, the foundation provided funding to 71 elementary schools, donating approximately $360 per school, benefiting 5,061 students.

44. The coefficient for unskilled workers not within the coffee sector is negative and significant. The reason for this is not obvious. However, the magnitude of the estimated effect, despite being highly significant, is small in magnitude. It is possible that the finding is a "false positive".

TABLE 13. FT certification and school enrollment.

	Dependent variable: indicator for school enrollment		
	Ages 7–12 (1)	Ages 13–17 (2)	Ages 18–25 (3)
FTI × skilled	−0.011	0.117	−0.079
	(0.012)	(0.080)	(0.075)
FTI × unskilled	−0.008	0.055	−0.153***
	(0.016)	(0.093)	(0.056)
FTI × nonfarm	−0.009	0.025	−0.103
	(0.008)	(0.073)	(0.063)
FTI × coffee × skilled	−0.006	−0.005	−0.074
	(0.022)	(0.076)	(0.113)
FTI × coffee × unskilled	0.027	−0.170*	−0.101
	(0.034)	(0.098)	(0.079)
FTI × coffee × nonfarm	−0.009	−0.801***	0.084
	(0.011)	(0.183)	(0.104)
Age, age^2, gender, and interactions	Y	Y	Y
Canton FE	Y	Y	Y
Year FE	Y	Y	Y
Canton-specific time trends	Y	Y	Y
Industry × occupation FE (of hh head)	Y	Y	Y
Observations	45,755	39,271	51,765
Clusters	79	79	79
R-squared	0.096	0.251	0.297

Notes: The unit of observation is an individual. Coefficients are reported with standard errors clustered at the canton level. The dependent variable is an indicator variable if a child attends school. The variable *Coffee* is equal to one if an individual belongs to a household where the household head reports coffee production as the main industry of employment. The variables *Skilled*, *Unskilled*, and *Nonfarm* equal one if an individual belongs to a household where the household head reports the main occupation as a skilled agricultural worker, unskilled agricultural worker, or any other nonfarm occupation, respectively. All regressions include canton fixed effects, year fixed effects, fixed effects for the household head's industry × occupation, and controls for age, age-squared, gender, gender × age, and gender × age-squared. * and *** indicate significance at the 10% and 1% levels, respectively.

5. Conclusions

We have examined the effect of FT certification on coffee producers in Costa Rica. We began the analysis by examining the impact of FT certification on the universe of coffee mills from 1999 to 2014. We found that FT certification is associated with higher prices, more sales, and more revenues when the FT minimum sales price is higher than the market price of coffee. The positive effect on prices is more precisely estimated for exports but is apparent for domestic sales as well. Consistent with the benefits, we also find that FT certification reduces the probability of a mill closing down and exiting the industry. Event study analysis shows that the benefits of FT are felt in the first year of certification for exports and a year later for domestic sales. The benefits increase slightly over the first few years of onset and are fairly persistent afterward.

Despite our finding that FT has positive economic effects, we also found that the effect of FT is far from perfect. This is due to the well-known fact that, in general, not

all coffee that is eligible to be sold as FT is able to be sold as FT. The magnitude of our estimates, taken literally, indicates that only 11% of FT-eligible coffee was sold as FT during our period of analysis. Thus, while FT works, it does not work perfectly.

Turning to the upstream effects of FT on households, we found no evidence of income benefits from FT certification for those not working in the coffee sector. For those in the coffee sector, we found benefits, but they were concentrated among farm owners only. We found no evidence that unskilled hired workers benefit from FT. In addition, non-farm occupations in the coffee sector, which are primarily intermediaries, are actually hurt by FT. The gains to the farm owners and the losses to the intermediaries are likely linked. According to our calculations, about 10% of the gains to farm owners are from rents transferred from intermediaries due to the creation of farmer cooperatives that perform many of the activities that intermediaries would otherwise perform. Since those working in coffee in non-farm occupations have average incomes that are close to 40% higher than the skilled coffee growers, consistent with its stated goals, FT certification results in a decrease in inequality within the coffee sector. In addition, the skilled coffee farmers who benefit comprise a much larger proportion of those in the coffee sector (33.2%) than the intermediaries that are hurt by FT (6%). While we found that the larger group of relatively impoverished coffee farmers gained at the expense of the wealthier coffee intermediaries, we also found that the largest and poorest group in the coffee sector—unskilled workers—do not gain at all from FT. In addition, we also found no evidence of positive spillover benefits to those in the local community who work outside of the coffee sector.

Motivated by the fact that Costa Rican coffee mills often use FT premiums to build schools, purchase school supplies, or provide scholarships, we also checked for effects of FT certification on the enrollment of school-aged children. We found no evidence for pro-education effects of FT and even evidence of adverse effects for the children of the parents working in the non-farm occupations that were adversely affected by FT.

An important caveat of our study is that we have only examined the short-run contemporaneous effects of FT, which we expect to work through the price floor and price premium. Our analysis was not designed to test for longer-term benefits of FT that may arise through other aspects of the certification, such as its creation of longer-term, stable relationships between producers and buyers or the provision of credit to mills. We view these as important questions for future research.

References

Angrist, Joshua D. (2001). "Estimation of Limited Dependent Variable Models with Dummy Endogenous Regressors." *Journal of Business & Economic Statistics*, 19, 2–28.

Angrist, Joshua D. and Jörn-Steffen Pischke (2009). *Mostly Harmless Econometrics*. Princeton University Press, New York.

Arnot, Chris, Peter C. Boxall, and Sean B. Cash (2006). "Do Ethical Consumers Care about Price? A Revealed Preference Analysis of Fair Trade Coffee Purchases." *Canadian Journal of Agricultural Economics*, 54, 555–565.

Atkin, David (2016). "Endogenous Skill Acquisition and Export Manufacturing in Mexico." *American Economic Review*, 106(8), 2046–2085.

Bacon, Christopher (2005). "Confronting the Coffee Crisis: Can Fair Trade, Organic, and Specialty Coffees Reduce Small-Scale Farmer Vulnerability in Northern Nicaragua." *World Development*, 33, 497–511.

Beuchelt, Tina D. and Manfred Zeller (2011). "Profits and Poverty: Certification's Troubled Link for Nicaragua's Organic and Fairtrade Coffee Producers." *Ecological Economics*, 70, 1316–1324.

Blouin, Arthur and Rocco Macchiavello (2017). "Strategic Default in the International Coffee Market." CEPR Working Paper No. DP12307.

Brambilla, Irene, Guido Porto, and Alessandro Tarozzi (2012). "Adjusting to Trade Policy: Evidence from U.S. Antidumping Duties on Vietnamese Catfish." *Review of Economics and Statistics*, 94, 304–319.

Cramer, Christopher, Deborah Johnston, Bernd Mueller, Carlos Oya, and John Sender (2017). "Fairtrade and Labor Markets in Ethiopia and Uganda." *Journal of Development Studies*, 53, 841–856.

de Janvry, Alain, Craig McIntosh, and Elisabeth Sadoulet (2015). "Fair Trade and Free Entry: Can a Disequilibrium Market Serve as a Development Tool?" *Review of Economics and Statistics*, 97, 567–573.

Dragusanu, Raluca, Daniele Giovannucci, and Nathan Nunn (2014). "The Economics of Fair Trade." *Journal of Economic Perspectives*, 28, 217–236.

Edmonds, Eric, Nina Pavcnik, and Petia Topalova (2010). "Trade Adjustment and Human Capital Investment." *American Economic Journal: Applied Economics*, 2, 42–75.

Fair Trade Foundation (2012). "Fair Trade Certification and the FAIRTRADE Mark." http://www.fairtrade.org.uk/what_is_fairtrade, retrieved 30 June 2014.

Fairtrade International (2018). "Monitoring the Scope and Benefits of Fairtrade. Monitoring Report 9th Edition." Working paper, Fairtrade International.

Gomila, Robin (2021). "Logistic or Linear? Estimating Causal Effects of Experimental Treatment on Binary Outcomes Using Regression Analysis." *Journal of Experimental Psychology*, 150, 700–709.

Hainmueller, Jens, Michael J. Hiscox, and Sandra Sequeira (2015). "Consumer Demand for Fair Trade: Evidence from a Multistore Field Experiment." *Review of Economics and Statistics*, 97, 242–256.

Henderson, David R. (2008). "Fair Trade is Counterproductive—and Unfair." *Economic Affairs*, 28, 62–64.

Hiscox, Michael J., Michael Broukhim, and Claire S. Litwin (2011). "Consumer Demand for Fair Trade: New Evidence from a Field Experiment using eBay Auctions of Fresh Roasted Coffee." Working paper, Harvard University.

Instituto del Café de Costa Rica (2017a). "Estructura del Sector." http://www.icafe.cr/nuestro-cafe/estructura-del-sector/, retrieved 9 July 2018.

Instituto del Café de Costa Rica (2017b). "Historia Del Café en Costa Rica." http://www.icafe.go.cr/nuestro_cafe/historia.html, retrieved 9 July 2018.

Instituto del Café de Costa Rica (2017c). "Ley 2762 del 21/06/1961. Régimen Relaciones de Productores, Beneficiadores y Exportadores Cafe." http://www.icafe.cr/wp-content/uploads/leyes_y_reglamentos/Ley-2762.pdf, retrieved 9 July 2018.

International Coffee Organization (2017). "Historical Data on the Global Coffee Trade." http://www.ico.org/new_historical.asp?section=Statistics, retrieved 9 July 2018.

Jaffee, Daniel (2009). "'Better, But Not Great': The Social and Environmental Benefits and Limitations of Fair Trade for Indigenous Coffee Producers in Oaxaca, Mexico." In *The Impact of Fair Trade*, edited by Ruerd Ruben. Wageningen Academic Publishers, Wageningen, pp. 195–222.

MacAskill, William (2015). *Doing Good Better: How Effective Altruism Can Help You Make a Difference*. Random House, London.

Macchiavello, Rocco and Ameet Morjaria (2015). "Competition and Relational Contracts: Evidence from Rwanda's Coffee Mills." Working Paper No. 431, Society for Economic Dynamics.

Macchiavello, Rocco and Josepa Miquel-Florensa (2017). "Vertical Integration and Relational Contracts: Evidence from the Costa Rica Coffee Chain." CEPR Working Paper No. DP11874.
Martinez, Octavio Jose (2015). "Market Competition and Vertical Contracting: Evidence from the Trade of Coffee Beans." *Academy of Management Proceedings*, 2015, 15712.
McCaig, Brian (2011). "Exporting Out of Poverty: Provincial Poverty in Vietnam and U.S. Market Access." *Journal of International Economics*, 85, 102–113.
Mendez, V. Ernesto, Christopher M. Bacon, Meryl Olson, Seth Petchers, Doribel Herrador, Cecilia Carranza, Laura Trujillo, Carlos Guadarrama-Zugasti, Antonio Cordon, and Angel Mendoza (2011). "Effects of Fair Trade and Organic Certifications on Small-Scale Coffee Farmer Households in Central America and Mexico." *Renewable Agriculture and Food Systems*, 25, 236–251.
Mohan, Sushil (2010). *Fair Trade Without the Froth*. The Institute of Economic Affairs, London.
Oya, Carlos, Florian Schaefer, Dafni Skaligou, Catherine McCosker, and Laurenz Langer (2017). "Effects of Certification Schemes for Agricultural Production on Socio-economic Outcomes in Low- and Middle-Income Countries: A Systematic Review." *Campbell Systematic Reviews*, 13, 1–346.
Podhorsky, Andrea (2015). "A Positive Analysis of Fairtrade Certification." *Journal of Development Economics*, 116, 169–185.
Ronchi, Loraine (2002). "The Impact of Fair Trade on Producers and Their Organizations: A Case Study with Coocafe in Costa Rica." PRUS Working Paper No. 11, University of Sussex.
Ruben, Ruerd and Ricardo Fort (2009). "The Impact of Fair Trade Certification on Coffee Producers in Peru." In *The Impact of Fair Trade*, edited by Ruerd Ruben. Wageningen Academic Publishers, Wageningen, pp. 75–98.
Ruben, Ruerd and Ricardo Fort (2012). "The Impact of Fair Trade Certfication for Coffee Farmers in Peru." *World Development*, 40, 570–682.
Saenz-Segura, Fernando and Guillermo Zuniga-Arias (2009). "Assessment of the Effect of Fair Trade on Smallholder Producers in Costa Rica: Comparative Study in the Coffee Sector." In *The Impact of Fair Trade*, edited by Ruerd Ruben. Wageningen Academic Publishers, Wageningen, pp. 117–135.
Sick, Deborah (2008). "Coffee, Farming Families, and Fair Trade in Costa Rica: New Markets, Same Old Problems?" *Latin American Research Review*, 43, 193–208.
Sidwell, Marc (2008). *Unfair Trade*. Adam Smith Institute, London.
Sylla, Ndongo (2014). *The Fair Trade Scandal: Marketing Poverty to Benefit the Rich*. Ohio University Press, Athens, Ohio.
Topalova, Petia (2007). "Trade Liberalization, Poverty, and Inequality." In *Globalization and Poverty*, edited by Ann Harrison. University of Chicago Press, Chicago, pp. 291–335.
Valkila, Joni and Anja Nygren (2009). "Impacts of Fair Trade Certification on Coffee Farmers, Cooperaties, and Laborers in Nicaragua." *Agriculture and Human Values*, 27, 321–333.
Weber, Jeremy (2011). "How Much More Do Growers Receive for Fair Trade-Organic Coffee?" *Food Policy*, 36, 678–685.

Supplementary data

Supplementary data are available at *JEEA* online.