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The effects of Voluntary Sustainability Standards in the economy of smallholder farmers in Latin America

An investigation of the impact pathways of sustainability standards leading to improved economic outcomes for certified coffee producers

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Politikwissenschaft

Dissertationsthema:

Effekte freiwilliger Nachhaltigkeitsstandards auf die Wirtschaftlichkeit von Kleinbauern in Lateinamerika

Eine Untersuchung der Wirkungsweisen von Nachhaltigkeitsstandards für eine verbesserte Wirtschaftlichkeit zertifizierter Kaffeeproduzenten

Inaugural-Dissertation
zur Erlangung des Doktorgrades Dr. phil.
im Fachbereich Erziehungswissenschaft und Sozialwissenschaften
der Westfälischen Wilhelms-Universität Münster

Vorgelegt von

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aus Lima

-2019-

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Tag der mündlichen Prüfung (Disputation): 16.12.2019

Tag der Promotion: .....

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Wissenschaftliche Schriften der WWU Münster

Reihe VII

Band 29

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Wissenschaftliche Schriften der WWU Münster
herausgegeben von der Universitäts- und Landesbibliothek Münster
http://www.ulb.uni-muenster.de

Bibliografische Information der Deutschen Nationalbibliothek:
Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über https://www.dnb.de abrufbar.

Dieses Buch steht gleichzeitig in einer elektronischen Version über den Publikations- und Archivierungsserver der WWU Münster zur Verfügung.
https://www.ulb.uni-muenster.de/wissenschaftliche-schriften

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„The effects of Voluntary Sustainability Standards in the economy of smallholder farmers in Latin America. An investigation of the impact pathways of sustainability standards leading to improved economic outcomes for certified coffee producers“
Wissenschaftliche Schriften der WWU Münster, Reihe VII, Band 29
Verlag readbox unipress in der readbox publishing GmbH, Dortmund
www.readbox.net/unipress

Zugl.: Diss. Universität Münster, 2019

ISBN 978-3-8405-0234-7 (Druckausgabe)
URN urn:nbn:de:hbz:6-41119437684 (elektronische Version) direkt zur Online-Version:

Satz: Andrea Estrella
Umschlag: ULB Münster

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1. Introduction

For decades, Coffee has been one of the most valuable commodities in International trade, with an export value amounting to USD 19 billion in 2016 (International Coffee Organization, 2018). It is consumed globally on a vast scale by any metric one would choose to examine it by (per capita, % of population, number of bags). This should not be surprising, as there are few people who can survive the morning without their ritual dose of caffeine. In fact, over the last 50 years, global consumption has been growing at an average rate of 1.9% (International Coffee Organization, 2016b). This is explained primarily by the increased demand from emerging markets and domestic consumption in producing countries, such as China, Indonesia, and Brazil, which has doubled over the past two decades (International Coffee Organization, 2018).

To meet this growing global demand – 151.3 million bags in 2015/2016[1] – Coffee is grown at an immense scale, most of which occur in developing countries. Some of the biggest producing regions include Central and South America; Southeast Asia, and sub-Saharan Africa. It is estimated that, at origin, Coffee production provides direct employment and income to 25 million producers (International Coffee Organization, 2018). Much of the production from these nations comes from poor, small landholders, who are responsible for around 70% of the global Coffee production (Borrella, Mataix, & Carrasco-Gallego, 2015; Caswell, Méndez, & Bacon, 2012). Therefore, any changes that occur to the International Coffee market can have a significant impact on poverty and quality of life indicators in the developing world.

The Coffee sector underwent dramatic changes during the 1990s, which saw the implementation of neoliberal policies, bringing the abolishment of the regulated quota system in 1989 as well as eliminating price control. Since then, and especially after the Coffee crisis in 1999-2004, Coffee prices have experienced an overall decline as price fluctuations have risen in an already volatile market (International Coffee Organisation, 2014; Ponte, 2002). Price volatility has translated into market vulnerability and reduced income for Coffee smallholders, therefore making rural poverty more pervasive (Kolk, 2013). Moreover, Coffee was transformed into a buyer-driven commodity chain, in which importers and

[1] 1 bag = 60 kg of green coffee beans.

roasters capture most of the welfare surplus (Kolk, 2013; Borrella et al., 2015; Ponte, 2002).

Meanwhile, the costs of production for smallholder farmers – mainly labor, fertilizers, and pesticides – continue to rise. This, in addition to the increased prevalence of Coffee pests and diseases such as the Coffee leaf rust and the cherry borer; and the effects of the changing climatic conditions in producing areas are pushing smallholder Coffee farmers beyond the limits of profitability (Lernoud et al., 2017). This combination of low Coffee prices, increasing production costs and external shocks hampers the ability of farmers to invest in best agricultural practices, therefore affecting the volume produced and quality of Coffee (International Coffee Organization, 2019). This, in turn, tends to accelerate concentration in a very small number of competitive origins – such as Brazil and Vietnam – which both exposes the Coffee sector to more supply risks (International Coffee Organization, 2019) and deprives consumers of different origins/varieties of Coffee.

In this challenging context, Voluntary Sustainability Standards have emerged as an alternative to ensure sustainability in the Coffee sector[2]. The first wave of standards starting in the 1980s, of which Fairtrade was the most important example, attempted to de-commoditize the Coffee sector (Benoit & Isabelle, 2011) by ensuring a minimum fixed price for Coffee, equivalent to a "living income" (CIFAL Flanders, 2017). In the following decades, multiplicities of standards with different goals and foci have proliferated in an effort to ensure transparency for the public and improve the livelihoods of smallholder Coffee farmers. These standards have served as a way of compensating producers for the implementation of environmentally friendly and social justice-oriented Coffee production. In this context, hundreds of thousands of Coffee farmers have decided to invest in becoming certified in order to gain access to differentiated markets and receive a price premium. It is currently estimated that 34.5% of the global Coffee area is VSS-certified (Bernstein & Cashore, 2007; Lernoud et al., 2017; Reinecke, Manning, & von Hagen, 2012).

However, as certified products have outgrown their niche segment and entered the mainstream market, VSS have become a precompetitive tool for certain supply chains. This, coupled with a supply that has vastly outpaced demand, is causing the price premiums to erode (Lernoud et al., 2017; Potts et al., 2014). More-

[2] While sustainability standards have been at the forefront of sustainability governance in the agri-food sector generally, the coffee sector in particular has been a pioneering industry for certifications (Reinecke et al., 2012), with high take-up rates.

over, it has been extensively reported that only around 50% of certified Coffee is sold as such, which means many of the producers who invested in obtaining their certification are receiving reduced to no benefit from them (C. M. Bacon, Mendez, & Flores, 2008; Blackmore et al., 2012; KPMG, 2013; Lazaro, Makindara, & Kilima, 2008; Renard, 2005).

For the above-mentioned reasons, the capacity of VSS to ensure economic sustainability at the household level has been put into question. Indeed, the numbers of studies analyzing the impacts of certification schemes – specifically related to the economic pillar – have risen in the past decades. Some initial observational studies found positive effects on producer welfare (Bacon, 2005; Bolwig et al., 2009), while the more rigorous studies have been more critical in their conclusions (Bacon, Mendez, & Flores, 2008; Ruben & Fort, 2012). Nonetheless, most of these previous studies rely on qualitative data or fail to use a robust counterfactual of non-certified producers to account for potential changes occurring had there not been a sustainability standard in place (Kuit & Waarts, 2014b).

These studies also have a strong bias towards the Fairtrade certification (Chiputwa, Spielman, & Qaim, 2015; de Janvry, McIntosh, & Sadoulet, 2015a; Dragusanu & Nunn, 2014) and Organic certification (Barham, Callenes, Gitter, Lewis, & Weber, 2011; Bolwig, Gibbon, & Jones, 2009), with very few examining NGO-driven certifications, such as Rainforest Alliance (Barham & Weber, 2012a; Ruben & Zuniga, 2011; Rueda & Lambin, 2013a; Rueda, Thomas, & Lambin, 2014) and UTZ (Kamau, Mose, Fort, & Ruben, 2010; van Rijsbergen, Elbers, Ruben, & Njuguna, 2016). With only two exceptions (Giuliani et al., 2017; Ruben and Zuniga, 2011), rigorous impact studies assessing the impacts of industry and company-led certification programs such as 4C, Nespresso AAA or Starbucks C.A.F.E. Practices are still missing. What is more, further investigation is required to identify the "mechanisms" or "pathways" leading to economic development for certified Coffee farmers, i.e. which aspects of the VSS theories of change actually "do the trick" and affect economic outcomes at the household level. These pathways, as defined by Bray and Nielsen (2017), could be: i) price premiums, ii) increased productivity, iii) lower production costs, and iv) access to credit.

Therefore, in this dissertation I intend to answer the following research questions:

RQ 1: What is the economic impact of different certifications in smallholder Coffee farmers?

RQ 2: What are the "mechanisms" or "pathways" leading to higher economic returns in certified smallholder Coffee farmers?
RQ 2.1: How are the analyzed certifications performing in these impact pathways?
To answer these questions, I develop a theoretical model about impact pathways and, in a first step, empirically test if VSS are effective in achieving them. In a second step, I pull together the quantitative and qualitative empirical data as well as secondary sources of information and analyze if the pathways influence economic outcomes. To perform this analysis, I use an original dataset comprising cross-sectional data from three Arabica-producing countries in Latin America: Colombia, Costa Rica and Honduras. These countries were selected based on their importance in Coffee production – almost a quarter of world Arabica output originates here – and because they present different institutional frameworks as well as political and economic circumstances. The final dataset consists of a random sample of over 1,900 Coffee producers, 745 of which are from three cooperatives in Colombia's Coffee Belt; 503 from five cooperatives from the Los Santos and the Western Valley area in Costa Rica; and 659 from one foundation in Honduras, encompassing farmers from three regions (North, South, and West). In order to assess and compare the economic effects of Fairtrade, Rainforest Alliance, UTZ, 4C, Starbucks C.A.F.E. Practices and Nespresso AAA standards on smallholder Coffee farmers, I employ Propensity Score Matching and regression analysis, combined with sensitivity analyses such as Rosenbaum bounds. Each certification is assessed separately against a pool of controls to arrive at the disaggregated effects of each standard.
This dissertation is structured as follows: first I introduce the VSS in the Coffee market, describe current developments in the selected sustainability standards and present the country backgrounds. In Part I, I introduce the Conceptual Framework, where I develop a model to analyze impact pathways of sustainability standards. A literature review of current impact evaluation studies conducted follows, as well as the contextual setting where the study takes place. In Part II, I present the empirical study, focusing on the economic impact of Sustainability Certifications. An in-depth description of the methodology used is outlined in this chapter. In Part III, the empirical results related to impact pathways are discussed for each of the countries studied. This chapter includes an excursus on the quality impact pathway, using Costa Rica as a case study. In Part IV, I provide theoretical insights based on the empirical evidence and the available literature.

This includes a discussion of the causal relations and trade-offs of adopting VSS, as well as a contextualization of the impacts of VSS in a rural development setting.

1.1. Certifications in the Coffee market

Voluntary Sustainability Standards (VSS) can generally be defined as agreed to criteria by which a product or service can be systematically assessed, measured and audited (Dietz et al., 2019; D. U. Gilbert, Rasche, & Waddock, 2012; Giovannucci & Ponte, 2005). Standards can communicate the environmental and social performance of a firm (D. U. Gilbert et al., 2012), and are important for determining "access to specific segments of the market…to specific countries…and the terms of participation in global value chains" (Giovannucci & Ponte, 2005, p. 286).

VSS have emerged in the absence of effective public regulations in several Coffee origins, aimed at regulating the economic, social and environmental sustainability of Coffee production (Panhuysen & Pierrot, 2018). Coffee is the sector where there is a higher prevalence of sustainability standards, as compared to other agricultural commodities (Dietz, Auffenberg, Estrella, Grabs, & Kilian, 2018). From the emergence of Coffee certifications in the late 1960s until present times, new standards have been created and proliferated, and their goals have developed and diversified over time.

The first certification to be implemented in the Coffee sector was the organic certification, with the guiding principles of environmental sustainability and personal health (Potts et al., 2014). It is based on limited use of agrochemical inputs, combined with farm practices that aim at restoring and enhancing the ecosystems (Giovannucci & Ponte, 2005). The Max Havelaar certification followed in 1988, as the first standard to directly tackle issues of farmer livelihoods. This certification eventually became the Fairtrade Labelling Organizations International (FLO) in 1997 (Potts et al., 2014). Fairtrade's main focus is on economic development and poverty alleviation, and it is expected to guarantee a minimum price and a price premium (Reinecke et al., 2012), working as an alternative approach to conventional trade (Giovannucci & Ponte, 2005). Moreover, what characterizes this certification is that it works only with Coffee cooperatives, and it requires a fixed premium to be distributed to the organization to invest in the social good (Potts et al., 2014).

The Rainforest Alliance was founded in 1987 and started the certification process in 1995. This standard has a focus on conservation and biodiversity and aimed at improving environmental and social conditions in tropical agriculture, originally concentrating on shade-grown Coffee (Giovannucci & Ponte, 2005). This certification has developed its model mostly within Latin America, focusing on sustainable farm practices related to the use of integrated pest management. Up to this point and until the end of the 1900s, these three certifications dominated the sustainable Coffee market by tapping into niche markets within the specialty Coffee sector (Potts et al., 2014).

After the 2001 Coffee crisis NGOs became very vocal about the need to commit to sustainable Coffee production. This stirred a private sector reaction that led to the creation of what Potts et al. called the "multistakeholder-mainstream paradigm" (Potts et al., 2014). One of the most remarkable of these initiatives was the Common Code for the Coffee Community or 4C Association. This standard was funded by the German Government and their development agency (GIZ) but worked side-by-side with the private sector, in this case, Kraft (now Mondelez International). 4C is a verification-based sustainability standard with the goal of reducing entry barriers to the 4C Association supply chain and facilitating the access of producers (Potts et al., 2014). Aimed at eliminating the worst practices in the Coffee industry, 4C is considered an entry-level sustainability standard, as it provides a step up from the sustainability baseline to more demanding standards (Reinecke et al., 2012). After 4C Association set the ground for mainstream certifications, new labels such as UTZ came into the picture.

UTZ was one of the first VSS to serve the mainstream market, creating transparency along the supply chain and rewarding responsible Coffee producers for the implementation of good agricultural practices at farm level (Potts et al., 2014). Its code of conduct was based on good agricultural practices promoted by the European Retailer Group (EUREP-GAP), and its social standards are based on the Social Accountability International standards (SAI 8000) (Giovannucci & Ponte, 2005). This was part of the reason why this label developed strong partnerships with European manufacturers, thereby becoming one of the largest Coffee certifications. By 2012, it had the largest sales volume of certified sustainable Coffee. At that point, the Rainforest Alliance also sought partnerships with the private sector and continued its expansion into the mainstream market (Potts et al., 2014).

In the context of mainstreaming sustainability standards, companies "which do not wish to adopt more rigorous and demanding standards" also developed their own certification system (Giovannucci & Ponte, 2005). Both Starbucks C.A.F.E. (Coffee and Farmer Equity) Practices and Nespresso AAA are company-led initiatives aimed at minimizing negative environmental impact through good social and environmental performance. Nespresso AAA focuses mostly on high-quality Coffee, sourcing it in a sustainable way that is also respectful of the environment and farming communities (Reinecke et al., 2012). It is important to note that the Nespresso AAA program incorporates the Sustainable Agriculture Network (SAN) standards of Rainforest Alliance into their training, but it only verifies compliance, instead of conducting a third-party audit (Potts et al., 2014). For Starbucks C.A.F.E. Practices, quality is a pre-condition for holding the standard (Starbucks Coffee Company, 2016). These company-led standards are rarely audited by third-party auditors (Daviron & Ponte, 2005).

The standards selected for this study are primarily those that dominate the market[3], excluding Organic certification, and the two company-led initiatives previously introduced. These are 4C, UTZ Certified, Rainforest Alliance, Fairtrade International, Starbucks C.A.F.E. Practices and the Nespresso AAA Sustainable Quality Program (Kuit & Waarts, 2014b). Appendix A summarizes the inception process of the analyzed certifications, as well as their main goals and standard-setting procedure.

These standards can broadly be divided into two categories. There are NGO-led standards, whose inception was based on a multi-stakeholder process, such as Fairtrade and Rainforest Alliance; and there are industry and company-led standards, which were developed by private actors in the Coffee industry (4C, UTZ, Starbucks C.A.F.E. Practices and Nespresso AAA). There are key differences between these types of VSS: the former are generally mission-driven (Raynolds, Murray, & Heller, 2007), while private labels are aimed at ensuring minimum quality standards for their sourced Coffee (Elder, Zerriffi, & Le Billon, 2013). These differences will also be taken into account in the analysis and discussion of the impacts of Coffee certifications.

The proliferation of sustainability standards has grown substantially in the past couple of decades. Since the 2000s, VSS have significantly increased the volume

[3] I purposely excluded the Organic certification, given that the government involvement in this standard makes it difficult to compare to the selected VSS.

of certified and verified Coffee production at the farm level. In the Coffee year 2016/17, the volume of standard-compliant production amounted to 55% of global production. As Table 1 showcases, the studied schemes play critical roles in the certification and verification of sustainably grown Coffee. This applies especially to 4C Association, which currently certifies much larger shares of standard-compliant Coffee than any of the other schemes.

Table 1: Production of standard-compliant Coffee (in metric tons)

VSS	UTZ (2015)	Rainforest Alliance/ SAN (2015)	Fairtrade Intl. (2015)	Nespresso (2012)	Starbucks C.A.F.E. Practices (2012)	4C (2015)	Organic (2015)
Production volume	821,399	522,000	561,000	247,114	457,339	2,629,339	342,000
Percent of total certified production	14.7	9.3	10	4.4	8.2	47.1	6.1
Total production volume	5,584,591						

Source: The State of Sustainable Markets 2017 for UTZ, Rainforest Alliance/SAN, Fairtrade International, 4C, Organic, The State of Sustainable Markets 2015 for Nespresso and C.A.F.E. Practices, Dietz et al., 2018.

However, as certified production volumes increase, the gap between standard-compliant Coffee produced and the volume of standard-compliant Coffee procured continues to rise. For instance, in 2017 the market uptake of 4C verified Coffee was only 23%. In the case of the Fairtrade standard, only 32% of the certified production was actually sold as such. For Rainforest Alliance and UTZ, the market uptake was 41% and 42%, respectively (Panhuysen & Pierrot, 2018). It remains unclear, then, if there is currently a stable demand for certified Coffee. Since the fieldwork was conducted in 2016/2017, there have been significant transformations in the Coffee sector. At the same time as the specialty sector is growing and taking on increasing amounts of responsibility in speaking on behalf of the industry and engaging in research and outreach efforts, the mainstream Coffee industry is consolidating rapidly, with important impacts on companies'

sustainability strategies and commitments. For instance, it is still uncertain if companies such as JDE or Kraft-Heinz will continue sourcing sustainable Coffee (Coffee Barometer, 2018).

These changes also echo in industry alliances. For one, the '4C Association' has dissolved and reorganized as the 'Global Coffee Platform', while a new organization ('Coffee Assurance Services') is operating the verification processes connected to 4C. Also, MEO Carbon Solutions acquired the 4C standard in 2018 (Coffee Barometer, 2018).

The Global Coffee Platform was formally founded in March 2016 as an effort to tackle the main sustainability challenges of the sector including the livelihoods and natural environments of Coffee farming communities. By aligning the actions of over 300 public and private sector stakeholders, including farmers and farmer organizations, traders, industry representatives, other supply chain actors, civil society individuals, donor agencies, among others, their aim is to define a global agenda that the entire Coffee sector can commit to, which is known as Vision 2020.

The idea behind Vision 2020 is to reduce fragmentation, duplication, and cross-interference of efforts and project investments and engage in a more coordinated approach that facilitates more efficient use of resources. There is also a growing recognition that voluntary certification standards and training programs, on their own, are not enough to address the deeper sustainability issues and holistic challenges the Coffee sector faces (Global Coffee Platform, 2016).

Additionally, in June 2017, UTZ and Rainforest Alliance announced a merger. This new organization carries the Rainforest Alliance name and is foreseen to present a new single standard in 2019 (Panhuysen & Pierrot, 2018). This newly formed alliance by two of the ‘mainstream’ standards that together have 30% of the market sector will tackle some of the biggest challenges of the Coffee industry, such as climate change, rural poverty, and biodiversity loss (Panhuysen & Pierrot, 2018; UTZ Certified, 2018).

1.2. Country Backgrounds

This research consists of a cross-section study on some of the most important Arabica-producing countries in Latin America, which together produce almost a quarter of the global Arabica output (International Coffee Organization, 2019). Honduras, a country where Coffee is the number one agricultural export and pro-

vides employment for over a million people (USDA, 2016); Costa Rica, where Coffee production has been historically important but lately has been declining due to competing land use for urbanization and diversified production; and Colombia, the world's third largest Coffee producer with strong government support for the sector.

These countries present different institutional frameworks as well as political and economic conditions, thus allowing for comparison and providing a broad vision of the implementation of Coffee sustainability in the Latin American region. The differences in governance are systematized in the World Bank's Worldwide Governance Indicators, which ranks the countries based on the quality of governance (The World Bank Group, 2019). I selected three governance indicators that are the most relevant for this study: Government Effectiveness, Regulatory Quality, and Control of Corruption. In every case, Costa Rica ranks the highest of the three countries, followed by Colombia, and then Honduras at much lower rankings (see depiction in Appendix B). Thus, out of the three countries analyzed, I consider Costa Rica to have 'strong' governance, Colombia 'medium' governance and Honduras 'weak' governance. In the following subsections, I present the main characteristics of each country, including select development indicators, and a general view of their Coffee sector.

1.2.1. Colombia

Colombia has a population of 47.8 million people, a GDP of USD 377.7 billion, a GDP per capita of USD 7,904 and revenues for exports of goods and services for USD 60.6 billion (International Coffee Organization, 2016a). While slower than in previous years, Colombia has been experiencing economic growth – 4.4% GDP growth in 2014 and 3.1% in 2015 – and significant progress in human development. With a Human Development Index (HDI) of 0.727, the country is now in the high human development category. Nonetheless, there is still a high incidence of poverty, with 28% of the population living below the national poverty line (The World Bank, 2015), with a large share concentrated in rural areas, where 38.6% of the population was classified as poor under national standards.

Colombia's Coffee sector

Historically, Coffee has been of paramount importance in the Colombian economy, supporting the country's economy and social development. Furthermore, the Coffee sector has strong institutional support.

Colombia is the world's fourth-largest Coffee producer and the main producer of mild washed Arabica Coffee (Biswas-Tortajada & Biswas, 2015). During the Coffee year 2015/2016, Colombia had a total production of 13.5 million 60-kg bags, exporting 12.07 million bags of green Arabica Coffee, and 0.6 million bags of processed Coffee. The total domestic consumption was 1.5 million bags (International Coffee Organization, 2016a). In the year 2015, Coffee accounted for 7.02% of their total exports, and 11.46% of traditional exports. In the year 2016, it represented 7.58% of total exports and 13.39% of traditional exports, even though there was a 5.83% decline over the value of Coffee as compared to the previous year (DANE, 2017). Colombian Coffee is exported primarily to the United States (41.7%), the European Union (32.4%) and Japan (10.5%), the latter being the main client for specialty Coffees. It is important to note that Colombian Coffee has a price premium that is added to the Coffee "C" contract, adjusting for higher quality, differentiation and also reflects supply and demand in the country (Federacion Nacional de Cafeteros, 2010).

Governmental and non-governmental institutions heavily support Colombia's Coffee sector. The Colombian Coffee Grower's Federation (FNC for its Spanish acronym) was created in 1927 as a semi-governmental organization that represents both producers and ministries and is in charge of implementing a regulatory policy for the Coffee sector (Vellema, Buritica Casanova, Gonzalez, & D'Haese, 2015; World Bank, 2002). FNC manages and also receives funding from the National Coffee Fund, a parafiscal account sustained by an export tax of USD 0.06 per pound of Coffee (Rueda & Lambin, 2013b). This institution provides a number of services to Coffee farmers – among them the provision of technical assistance, R&D, infrastructure development, quality control, sales, and marketing – but perhaps the most valued one is the guarantee of purchase. This ensures that all producers, especially smallholders, are able to sell their Coffee to the FNC through their cooperatives at an equal or higher price than the New York C price (World Bank, 2002). For this purpose, the FNC has 536 purchasing points that cover 95% of the Coffee-growing municipalities (Federacion Nacional de Cafeteros, 2015). This model corrects market failures such as asymmetric information as well as reduces transaction costs for the more than 600,000 producers that depend on Coffee for their livelihoods (Gilbert and Attaché, 2016).

Voluntary Sustainability standards

FNC was instrumental in promoting sustainability certifications in Colombia, a key pillar of their "specialty Coffee" strategy, which also included putting forward Coffee from specific origins in Colombia, aimed at obtaining higher premiums (Rueda & Lambin, 2013b). FNC plays an important role in purchasing and exporting specialty Coffee; in 2015 they acquired 2.3 million bags of Coffee, equivalent to 20% of national production, of which 70% was differentiated. This amounted to 60% of their exports being differentiated Coffee, adding to the national total of 29% of exported specialty Coffee (Federacion Nacional de Cafeteros, 2015).

Challenges to the Coffee sector

Coffee production in Colombia, as well as in other producing countries, takes place in a complex scenario that includes rising input costs, price volatility and perhaps most importantly, the effects of climate change. Evidence now unequivocally shows that climate change is having a variety of negative impacts on the Coffee sector, due to the associated increases in temperature, changes in rainfall patterns and intensification of weather events such as the El Nino phenomenon (Ramirez-Villegas, Salazar, Jarvis, & Navarro-Racines, 2012). Different climate change models show the devastating consequences to the Coffee sector in Colombia. For instance, the prevalence of the Coffee berry borer and Coffee leaf rust are expected to substantially increase in areas above 1,500 m.a.s.l. (Jaramillo et al., 2009). In addition to the loss of climatic niches and changes in Coffee weather cycles, this is predicted to result in yield reduction and increases in production costs (Ramirez-Villegas et al., 2012). Moreover, as a majority of Colombia's Coffee farmers are smallholders, they face the double challenge of coping with the impacts of climate change in an already vulnerable scenario (Watts, 2016). Similar circumstances took place during our study period, the calendar year of 2015. International Coffee prices experienced high volatility: the New York "C" Coffee price decreased 25%, reaching 1.13 USD/lb in September before partially recovering to 1.2 USD/lb by the end of the year (Federacion Nacional de Cafeteros, 2016). This was explained in part by the inaccuracy in predicting Coffee yields in Brazil – which were expected to decrease due to low rainfall. Furthermore, a strong devaluation in the currencies of Brazil and Colombia encouraged both producers and exporters to negotiate higher volumes of Coffee, leading to an increase in global Coffee supply and ultimately pushing the Coffee "C"

contract price to increasingly lower levels (Federacion Nacional de Cafeteros, 2015). Colombia was also hit with the effects of the El Nino phenomenon, which decreased the quality of Coffee beans and, in turn, affected the average price received by Coffee growers. Farmers experienced increased production costs due to the additional management practices required to help withstand plagues and diseases threatening their Coffee crops.

Regional Context

Colombia's Coffee belt is located in the central area of the country, and it is where most of the Coffee is produced (Federacion Nacional de Cafeteros, 2010). Similar to the rest of the country, this region has specific climatic and geographic conditions that make it ideal for Coffee production: mountain ranges go across the landscape creating create micro-climates, and the altitude ranges from 1,200 – 1,800 meters above sea level. There are two peak harvest periods in this area: the main one is from October to December when almost 60% of the total Coffee production takes place, and the second one, also called "mitaca" is from April to June (A. J. Gilbert & Huerta, 2015). In addition, during the months of January through March, small quantities of Coffee are collected, and this is called "traviesa" (extensionist, personal communication, July 2016).

Within Colombia's Coffee belt, I chose three cooperatives for the implementation of our study, located in the departments of Antioquia, Caldas, and Quindio. These three regions contribute to around 28.5% of national Coffee production: Antioquia with 16,5%, Caldas with 9,05% and Quindio supplied 2,92% of national production. Due to the privacy of the data collected, in order to maintain their anonymity, I refer to them as Cooperatives 1, 2 and 3.

1.2.2. Honduras

Honduras is the second poorest country in the Western Hemisphere, with 64.3% of its 7.9 million inhabitants living below the national poverty lines (The World Bank Group, 2017). It has a Human Development Index value of 0.606 for 2014, ranking the country number 131 out of 188 countries (United Nations Development Programme, 2016a). Its GDP per capita was USD 2,435 in 2014, compared to a Latin America average GDP per capita of USD 9,226 (The World Bank Group, 2017). Approximately 2.6 million Hondurans live in rural areas, where most of the farm households cultivate traditional crops on small plots (IFPRI, 2014). Their access to markets is hindered by poor roads and long distances.

Additionally, the use of traditional agricultural practices produces poor yields, depletes the soil of nutrients, and often leads to deforestation (USDA Foreign Agricultural Service, 2016b).

The Coffee sector in Honduras

Coffee production in Honduras has a history of over 150 years (Ramos, n.d.). Nonetheless, before the twentieth century, Coffee was grown only for domestic consumption or local markets. Agricultural expansion was hindered in part due to weak government institutions, poor infrastructure and low integration of national markets. Only starting in the 1950s, Honduras gained importance as a Coffee exporter, as a result of a nationwide government effort to boost Coffee production and improve infrastructure (Eakin, Tucker, & Castellanos, 2006). What is more, the government started enacting a series of laws and developing policies to promote the Coffee industry. Among them were the creation of the Honduran Coffee Institute (IHCAFE) in 1970; the provision of loans to medium-sized producers by the national development bank; the exemption of Coffee lands from the Agrarian reform laws; the subsidies for road improvement; and the National Coffee Fund law, which protected producers from price shocks. This, in addition to the programs implemented to increase productivity and quality, led to the expansion and growing importance of the Coffee sector in the country (Centro Latinoamericano para la Sostenibilidad y el Desarrollo Sostenible, 1999; Eakin et al., 2006).

The end of the regulated era triggered an excess Coffee supply, which led to an International Coffee crisis in 2000. The low International prices stirred a grassroots movement in rural areas in Honduras. The pressure exerted on the government by these well-organized Coffee farmers resulted in the privatization of support institutions and services dedicated to the sector. This change enabled grower-run political structures to have access to financial support and fund Coffee-related initiatives using taxes (Instituto Hondureño del Café IHCAFE, 2014; Sevilla-Palma, Peligros-Espada, & Uña-Juarez, 2017).

It is in this context that IHCAFE, historically the most important Coffee institution in the country, became of private control. During that same period, the National Coffee Council (NCC) was created in order to regulate the Coffee sector in the country, design Coffee policy and advise the President on related matters. The NCC is comprised of 40% of public sector actors and 60% private sector. Among other responsibilities, it is in charge of two Coffee bodies: IHCAFE and

the National Coffee Fund (Sevilla-Palma et al., 2017). IHCAFE provides guidelines, regulates the Coffee value chain, including control of Coffee production and exports. IHCAFE groups in their Board of Directors the main Coffee federations of the country, in addition to Coffee roasters, exporter associations and government. The specific support provided to the producers in the form of extension services and research aims at increasing productivity, quality, promote Honduran Coffee, diversification and provide access to finance for the sector (USDA Foreign Agricultural Service, 2016a).

The government of Honduras has, on several occasions, intervened to support and stabilize the Coffee sector. In 2003, due to low Coffee prices and fearing an increased abandonment of Coffee production, the government established a producer's saving fund in order to maintain production. The funds to support this endeavor came from a Coffee tax amounting to USD 13.25 per quintal (1 quintal = 46 kg), an amount deducted by the exporter when Coffee is sourced from producers. The distribution of this deduction is as follows: USD 9 are used to fund the Coffee trust, specifically to repay loans to banks or other financial institutions, and to pay the IHCAFE loans for agricultural inputs. The following USD 1 is used to pay outstanding loans received in 1999, 2000 and 2001; and the remaining USD 3.25 is used to repay the 2002 loan and to fund the operation of IHCAFE and the National Coffee Fund. With those resources, the National Coffee Fund builds and maintains Coffee infrastructure, and provides equipment needed to Coffee producers (USDA Foreign Agricultural Service, 2016b).

The Coffee sector currently plays an essential role in the Honduran economy. It is the main agricultural export in the country, followed by bananas and plantains. The export market is valued in USD 763 million, representing 16.9% of total exports and around 4% of their Gross Domestic Product (GDP) (Sevilla-Palma et al., 2017). In the year 2015/2016, the production estimate was 5.9 million 60kg bags, with 5.4 million bags exported. Honduran Coffee accounts for 3.1% of global Coffee production, which places the country in the first place for Coffee exports by volume in Central America, third in Latin America and sixth globally. Historically, Germany was their top export destination, but recently the United States has become their largest buyer. In 2016, 60% of total production was exported to Europe, 30% to North America, and 10% to other countries around the world (Bunn, Lundy, Laderach, Girvetz, & Castro, 2018).

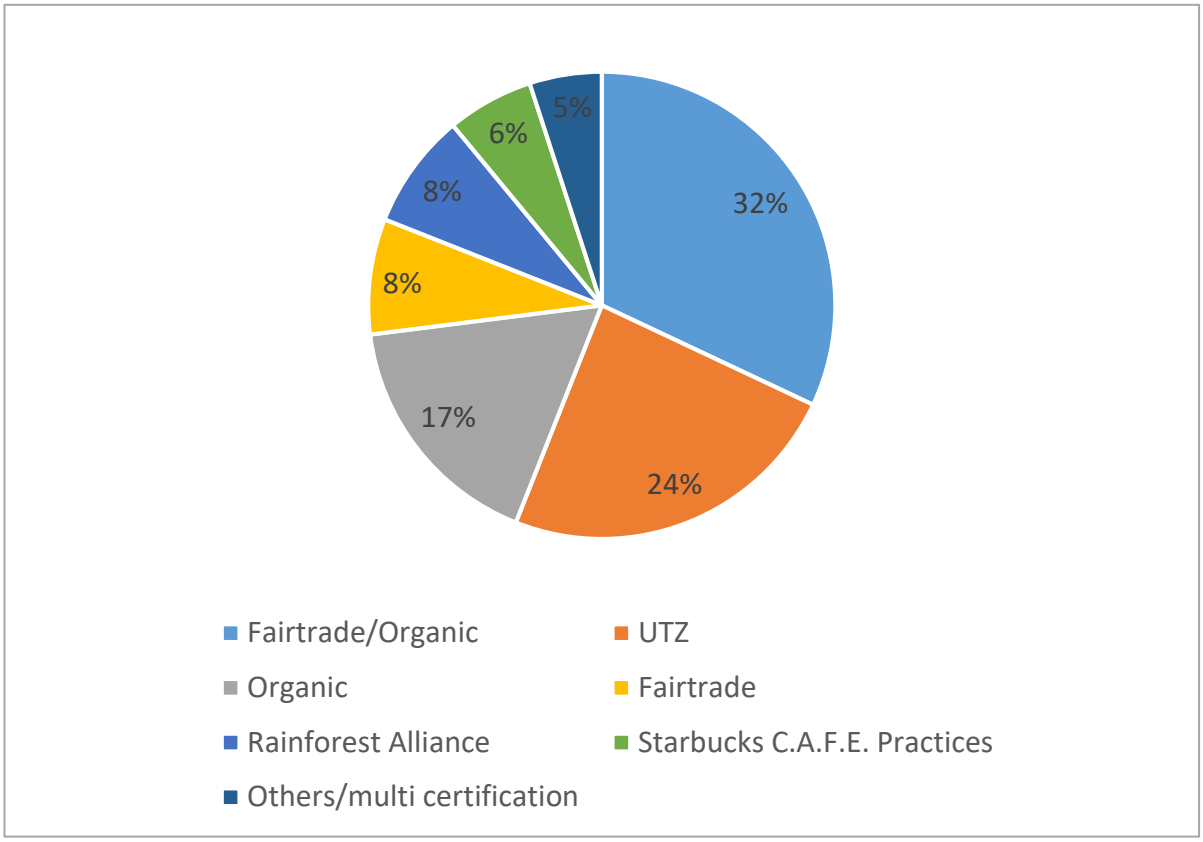
The geography of Honduras, with mountain ranges spread across the center of the country, favors Coffee farming. While there is not a specific law prohibiting

the growing of the robusta variety, historically Coffee farmers have only planted Arabica Coffee, given its higher quality and potential to obtain higher prices (Funez, 2018). Harvest season usually occurs from October to April, and the Coffee cherries are usually processed into wet parchment Coffee for trade. Coffee production is widespread: it is grown in 15 of the 18 Honduran departments, in 300,000 hectares of land and it provides direct rural employment to around 110,000 families (Bunn et al., 2018). Of them, an estimated 92% are smallholder farmers with less than 7 hectares, who collectively produce 64 percent of the national Coffee production (Feed the Future, 2018). This sector employs 30 percent of the total population, with as much as two million people involved in Coffee-related activities such as harvesting, fertilization, commerce, transportation, among others (USDA Foreign Agricultural Service, 2015). An estimated 25 percent of the gross production expenditures are passed on directly to Coffee pickers (Ramos, n.d.). Around half of the workers employed in the sector live in extreme poverty (Bunn et al., 2018).

Voluntary sustainability standards

Honduras has a high potential for specialty Coffee given the altitude at which Coffee is grown (1,100 ma.s.l. for high-quality Coffee) (Ramos, n.d.). Moreover, there is an increasing demand for specific flavor profiles, which has prompted more technical assistance provided to producers. Sustainability standards such as 4C Association, Rainforest Alliance, Fairtrade/Organic, UTZ, Starbucks C.A.F.E. Practices, Organic, and others are starting to proliferate (USDA Foreign Agricultural Service, 2015). In fact, from 2007/2008 until 2015/2016, the share of differentiated Coffee increased from 7% to 19%. As Figure 1 depicts, the Fairtrade/Organic certification has had the highest adoption rates in the country, followed by UTZ certification (Bunn et al., 2018).

Figure 1. Distribution of differentiated Coffee per certification in Honduras



Source: Bunn et al., 2018.

A downside of this push for higher quality Coffee is that the types of varieties required for specialty Coffee production, are not rust resistant, which exposes these growers to the risk of an outbreak. These risks are mitigated through the implementation of good agricultural practices to prevent Coffee leaf rust (USDA Foreign Agricultural Service, 2015).

Challenges to the Coffee sector in Honduras

As a low-income country with significant social unrest and important struggles in the agricultural sector, the development of the Coffee sector has also experienced its share of challenges (Flores, 2002; IICA, 2002; United Nations Development Programme, 2015). Some of the main issues have been the underdevelopment of Coffee processing technology, production of lower quality Coffee and uneven relationships between growers and intermediaries (IICA, 2002; Sevilla-Palma et al., 2017). Another important problem surrounding the sector is the smuggling of Coffee. For instance, in the year of this study, an estimated 153,000 bags were informally exported to Guatemala and Nicaragua. The contraband to Guatemala is of high-quality Coffee, encouraged by higher prices, while for

Nicaragua it is of lower quality, mostly for local roasters. Despite the fact that intermediaries are required by law to register with IHCAFE, the illegal market still exists, with many Coffee buyers failing to provide purchase orders to producers (USDA Foreign Agricultural Service, 2015).

In terms of the Coffee quality, despite the government efforts started after the International Coffee crisis (2000 – 2004) to maintain and improve Coffee quality, this problem still persists in the Honduran Coffee sector. The main cause seems to be the fact that until recently, Honduras had insufficient quality control after harvest. Fungus and damage to the bean are commonly found, possibly due to the high degree of moisture content in the Coffee processing (IHCAFE, 2014; Sevilla-Palma et al., 2017). In addition, it has been reported that intermediaries' control most of the internal Coffee trade and therefore they have enough power to set the domestic Coffee prices. Coffee growers, then, have a low motivation to increase the quality of their product (IHCAFE, 2014; Sevilla-Palma et al., 2017), and perhaps the low Coffee prices hamper their investment capacity.

Moreover, the production of high-quality Arabica Coffee makes the Coffee sector highly vulnerable to climate change. Even though most plantations were recently renovated, they are still exposed to climate-related diseases. Climate models show increased temperatures in Coffee areas, with associated decreases in rainfall. It is projected that around 45% of the area that is currently suitable for Coffee growing will become unsuitable without the implementation of adaptation measures. One-fifth of those areas will require significant adaptation efforts. For this reason, it remains critical to have a diversified production portfolio, in order to be able to withstand these shocks without falling into absolute poverty.

Another significant challenge to the Honduran Coffee sector is the dreaded Coffee leaf rust. In the Coffee year 2013/2014, the Coffee leaf rust ravaged 80,000 hectares in the country, representing more than 25% of the total Coffee area. The recovery efforts were estimated to cost USD 100 million (Bunn et al., 2018). Further damage was prevented because farmers had been planting rust-resistant varieties, such as IHCAFE 90, Lempira, and Parainema. The farmers that had not planted rust-resistant varieties nor had access to credit could not recover from this shock. At the moment, both International organizations and the Honduran government implement actions aimed at improving agricultural practices, promote the renovation and rehabilitation of areas affected by this pest and prevent the devastating effects of future outbreaks with an early warning system (USDA Foreign Agricultural Service, 2015).

Regional Context

Western Honduras has been historically one of the main Coffee areas in the country. The regions' various microclimates and altitude ranging from 450 to 2,850 meters above sea level make it very suitable for Coffee growing. Small family farms, with an average size of two hectares, characterize this region's Coffee economy. An estimated 35,000 families depend on Coffee for their livelihoods, and the income generated from Coffee fuels other sectors of the economy such as cattle farming, commerce and other agricultural activities (Ramos, n.d.).

1.2.3. Costa Rica

Costa Rica has been the example of a small open economy that is fairly stable, with a "high level" of human development according to the latest Human Development Index (HDI). The country has enjoyed steady economic growth during the past decades: from 1960 to 2014, the country's GDP grew at an annual rate of 4.8%, as compared to 3.7% average in the Latin American region (Food and Agriculture Organization of the United Nations, 2017). Similarly, Costa Rica has experienced significant development in life expectancy, schooling and Gross National Income (GNI) per capita since the 1990s, reflected in an 18.9 percent increase in its HDI (United Nations Development Programme, 2016b). Relative political stability and strong social policies have led the country to have one of the lowest poverty rates in the Latin American region (20.5% of the population are living under the national poverty line). Moreover, this Central American country is a leader in environmental sustainability, and perhaps its most notable example is the nationwide Payment for Environmental Services (PES), which proved successful in halting deforestation (The World Bank, 2017).

Changes in their economic structure

The structure of the Costa Rican economy has undergone significant changes during the past two decades, mainly due to a growing industry and services sector (PNUD, 2013). The country shifted from heavily depending on the export of a few primary goods, to having high-tech and manufacturing industries (Food and Agriculture Organization of the United Nations, 2017). As a consequence, the contribution of the agricultural sector to GDP declined from 13.7% in 1994 to 5.6% in 2013. Moreover, the economic crisis of the 80's shifted direction in economic policy to promote non-traditional exports – such as pineapple and palm oil – as well as to attract foreign direct investment through the establishment of a Free

Trade Zone Regime (PNUD, 2013). Traditional crops such as Coffee remained stagnant or even decreased production over the past two decades. While in 1980 more than half of the exports were traditional (Coffee, banana, meat, sugar), in 2011 these products represented only 12% of total exports. In terms of the value of agricultural products (calculated as volume produced multiplied by farm gate current prices), Coffee value decreased from 14% in 1995 to 6% in 2015. However, despite the product diversification advancements of the agricultural and service sectors, the country's exports still depend on a very small number of destination markets, mainly Central America and North America (Food and Agriculture Organization of the United Nations, 2017).

The share of agriculture in total employment was reduced by half since the 1980s, reflecting the transformation in the sector (OECD, 2017). An increasing proportion of the workforce shifted to working in the service sector, industry or hi-tech, sectors that require high levels of education. On the other hand, unskilled workers did not gain participation in these sectors. As a consequence, income inequality increased. Smallholder farmers dependent on agriculture for their livelihoods were one of the main groups lagging behind following these changes in the economy (PNUD, 2013).

Costa Rica's Coffee sector

Historically, the Coffee industry has played a pivotal role in the Costa Rican economy. Supporting institutions and regulations have been a key determinant of the sector's development (responsAbility, 2015). Admittedly, it has lost some of its importance due to the aforementioned transformation of the economy. Yet, the sector is currently very specialized and focuses mainly on high-quality Coffee.

Costa Rica exports almost exclusively green Coffee beans. Its main export markets are the United States (51%), followed by Belgium (14%), Australia (4%), Italy (4%) and Germany (3.9%) (USDA Foreign Agricultural Service, 2018). In year 2016, Coffee exports represented 3.11% of total revenues from exports, and 11.35% of total revenue from the farming sector. In terms of the Gross Domestic Product (GDP), Coffee contributed to 0.29% of the national GDP and 6.04% of the agricultural sector (Food and Agriculture Organization of the United Nations, 2017). As for its contribution to employment, this sector still supports a large number of workers: 32,000 Coffee producers depend directly on Coffee production for their livelihoods, and in turn employ almost 200,000 workers (Food and Agriculture Organization of the United Nations, 2017).

One of the main players in the sector is The Costa Rican Coffee Institute (ICAFE), a non-governmental public institution created in 1933 with the aim of regulating the country's Coffee sector. This organization groups the different actors involved in Coffee production and exports: producers, millers, exporters and roasters. Among the services provided by ICAFE are: i) to promote an equitable production model; ii) supporting production, processing, export and marketing of Costa Rican Coffee; iii) promote national and International consumption of Costa Rican Coffee; iv) research and development; and perhaps more importantly, v) to approve a minimum "fair" price to be paid to producers (ICAFE, n.d.-b).

The Coffee sector in Costa Rica is composed mainly of smallholder farmers: 92% of producers own less than 5 hectares of land and produce around 40% of the national output (ICAFE, n.d.-b). The country has three types of farmer organizations: associations, cooperatives and consortia of cooperatives (Faure et al., 2011). There are twenty-two Coffee cooperatives that process 40% of the Coffee produced in the country (Snider et al., 2017). Most of the Coffee producers are organized in cooperatives, social structures that provide them with services such as technical and marketing assistance, credit, provision of agricultural inputs and machinery, as well as Coffee processing.

Harvesting occurs typically once a year, usually from November through February (ICAFE, 2017). Coffee harvesting is done manually: a combination of hired and family labor is used for selectively picking the ripe Coffee cherries.

As opposed to many Coffee production systems, Costa Rican producers deliver the ripe Coffee cherries to the local mill or 'beneficio' for processing. There are three types of millers: independent, cooperatives and firms linked to exporters. The miller checks the quality of the Coffee fruit and issues a receipt based on the quality and differentiation of the Coffee. The Coffee cherries are then processed in the mill using a method called wet processing, which consists of removing the pulp of the fruit while the Coffee cherry is still moist, preferably the same day. After this, the Coffee is sun-dried for approximately seven days, until it is transformed into green Coffee. The mill is then in charge of selling the Coffee to either exporters or roasters based on the New York "C" price, plus a country/ quality differential (Dragusanu & Nunn, 2014; ICAFE, n.d.-a). The millers are also responsible for financing, supplying inputs, providing credit and technical assistance to producers. The roasters or 'torrefactores' roast and grind the beans and commercialize them in domestic and International markets (Food and Agriculture Organization of the United Nations, 2017; ICAFE, n.d.-a).

Coffee producers are paid in different installments. During harvesting season, the producer receives an advanced payment as soon as Coffee is delivered to the mill. Then, as the sales process advances, the millers provide producers with quarterly payment adjustments, determined by their new sales and previous advanced payments. In November, after all the green Coffee has been sold, the millers give the final payment to the farmers, which is calculated as the difference between total Coffee sales minus expenses and gains along the Coffee value chain (ICAFE, n.d.-b). The distribution of final sales price is as following: 3.3% is allocated to the exporter, 14.9% to the mill, 1.2% to the Costa Rican Coffee Institute (ICAFE), 0.5% to the National Fund for Coffee Stabilization (Fonecafe) and the remaining 80% is allocated to the producer (Dragusanu & Nunn, 2014). These stages of commercialization are closely monitored by ICAFE.

Costa Rica's agro-climatic conditions are ideal for Coffee cultivation: volcanic and low acidity soils, high altitudes, mild temperatures and well-defined dry and rainy season (Dragusanu & Nunn, 2014). In addition, significant efforts have been made to ensure the Coffee quality. For instance, in 1989 a law prohibiting the cultivation of 'robusta' Coffee was passed. Currently, 100% of the Coffee grown in the country is Arabica, specifically of the Caturra and Catuai varieties, which have desirable sensory attributes (ICAFE, n.d.-b). Moreover, Costa Rica regulates the quality by not allowing mills to accept Coffee deliveries with more than 2% unripe cherries, and the country retains the 2% lowest quality Coffee for domestic consumption (Snider et al., 2017; Varangis, Siegel, Giovannucci, & Lewin, 2003). This, coupled with rigorous picking and Coffee processing methods, allow for exceptional cup quality (ICAFE, n.d.-a). At present, 40% of the country's exports are considered high quality Coffee beans, which are sold at 40% premium as compared to traditional Arabica beans (Food and Agriculture Organization of the United Nations, 2017; ICAFE, n.d.-a).

Costa Rica's Coffee production is well-known for its extended environmental sustainability practices to avoid pollution, reduce water usage, greenhouse gas and methane emissions (ICAFE, 2018). Recently, the country has been preparing to certify Coffee production with the "Product Environmental Footprint", a sustainability label developed by the European Commission that measures the carbon, water and toxicity footprints of Coffee production (ICAFE, 2018). Moreover, in 2013 the first Nationally Appropriate Mitigation Action (NAMA) was approved for the Coffee sector, aimed at reducing carbon emissions and creating replicable solutions for other crops.

Challenges to the Coffee sector

Despite having strong institutional support, committed producer organizations and an established reputation for its specialty Coffee, the sector faces challenges characteristic to the global Coffee industry. Producers often lack financing for their endeavors, have limited market access, low bargaining power and are exposed to price volatility of the International market (responsAbility, 2015). The changing climatic conditions are also affecting Coffee production in the country: frequent and more intense droughts, floods and storms and temperature increases all have a significant impact in the sector. In addition, higher incidence rates of diseases have been associated with climate change (Carter & Tye, 2018). Models indicate that by 2030, the areas suitable for cultivation are expected to shift due to changes in productivity, with some areas gaining productive suitability and others losing it (Bouroncle et al., 2015). However, some of the areas that currently have temperatures too cold for growing Coffee and would eventually gain suitability are located in protected areas. Others are located in steep slopes, therefore precluding the expansion of Coffee farming (Carter & Tye, 2018). In sum, Coffee production in Costa Rica is highly vulnerable to climate change impacts. Other challenges specific to the country context include: i) decreasing Coffee growing area due to increased competition from urbanization, especially in the Central Valley; ii) ageing population of Coffee producers' due low margins and potential gains from working in the high-value added industries in the country. The number of Coffee growers has decreased in almost 18% in a period of ten years (2005-2015) (USDA Foreign Agricultural Service, 2018).

Voluntary Sustainability Standards in Costa Rica

Sustainability standards started in Costa Rica in 1988, with the introduction of Fairtrade certification (Luetchford, 2008). The country was well suited to adopt Coffee certifications, given its stringent environmental and social regulations, in addition to their Coffee sector structure (Snider et al., 2017). At present, Costa Rica's production of standard-compliant Coffee is around 30% of their total production (Potts et al., 2014; Snider et al., 2017).

Smallholder farmers have access to Coffee certifications mainly through cooperatives and consortia of cooperatives (Snider et al., 2017). For this research, the focus is only in producer members of cooperative organizations. Cooperatives usually hold double or multiple certifications (Quispe, 2007). More than 80% of the Coffee cooperatives in Costa Rica have at least one Coffee certification; 23%

have two certifications and 32% hold three. The most popular certification is still Fairtrade, with 63% of the cooperatives holding this sustainability standard. Starbucks C.A.F.E. Practices is held by 36% of the cooperatives, and Rainforest Alliance by 23% (Snider et al., 2017).

There are different modalities of certification for cooperative organizations: individual and collective certification. Fairtrade is the only certification that, due to its nature, requires collective certification. Every other sustainability standard allows for individual certification of their producer members. However, a small number of cooperatives choose collective certification given that it is considered to be in line with the principles of "cooperativism". As for individual certification, given that demand for certified Coffee is low, some cooperatives choose to certify as little as 5% of their members in order to satisfy demand. This reduces the burden of internal monitoring, audits, extension services and training to ensure compliance with the certification's requirements (Snider et al., 2017).

Regional context

The study areas are two of the main Coffee producing regions in the country: Los Santos and the Western Valley. In Los Santos, Coffee is the main economic activity, and it is characterized by its high quality. This is a result of well-defined dry and rainy seasons, Coffee grown in higher altitudes (1,200-1,900 m.a.s.l.) and varieties produced: Caturra and Catuai (ICAFE, n.d.-c). Most of the Coffee is shade-grown. Within Los Santos, this research focused specifically in San Marcos de Tarrazu and Santa Maria de Dota. The former contributed to 12% of total national production, while the latter with 4% (ICAFE, 2017). The Western Valley is characterized by volcanic soils, ideal for Coffee growing, and altitudes between 800-1,400 m.a.s.l. The varieties grown are also Caturra and Catuai and 75% of Coffee plantations are shade-grown Coffee (ICAFE, n.d.-d). The areas of Los Santos and the Western Valley have consistently attained the highest scores in the Cup of Excellence competition the last years (Alliance for Coffee Excellence, 2017).

During the year of our study, 2015/2016, Coffee production increased by 13.7%, reaching a total of 1,654,617 60kg bags. Good agricultural and management practices, such as appropriate fertilization, pruning, disease control, among others, explain these favorable production numbers. In Los Santos and the Western Valley, Coffee production increased in 45% and 28% respectively from the previous year harvest (ICAFE, 2017). In Los Santos, this is explained by very timely flowering and favorable weather (USDA Foreign Agricultural Service, 2016a).

Part I: Conceptual Framework

2. VSS impact pathways to economic development

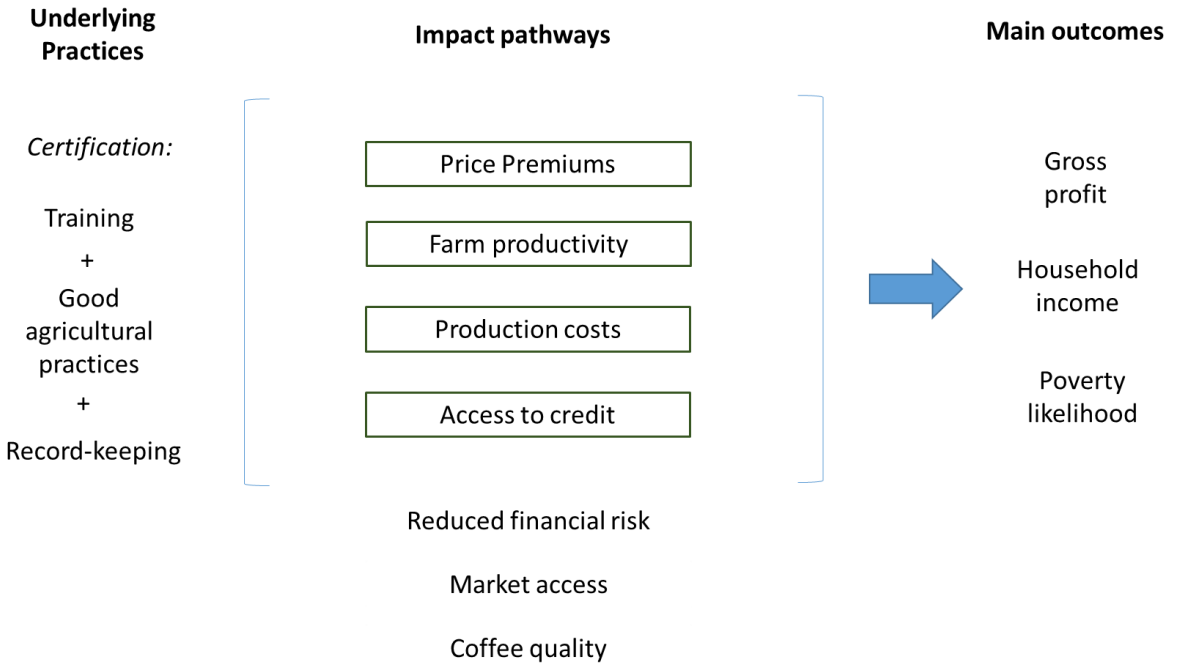
In this section, I describe and depict the theoretical model constructed to analyze the impacts of Voluntary Sustainability Standards. I then focus specifically on impact pathways of sustainability standards that potentially influence economic outcomes. For each one of the selected pathways, I lay out their underlying practices, operationalization, the theory behind their mechanism of action to improve economic conditions, as well as how certifications approach them in their theories of change.

Voluntary Sustainability Standards, as discussed previously, have different foci. They emphasize environmental, social, economic goals or, more commonly, a combination of them. A common goal among them all is improving the livelihoods of smallholder farmers. This often translates into an improved economic standing for the certified producer. Based on an in-depth review of impact evaluation literature, I decided to evaluate the following outcomes at the household level: i) gross profits, computed as Coffee revenue minus production costs; ii) household income, calculated by adding Coffee revenue to any additional income collected by the household members; and iii) probability of living in poverty, measured using the Poverty Probability Index developed by the Grameen Foundation, which captures education, access to energy, wealth, among other well-being indicators. These outcome variables are more commonly used in the impact literature, potentially making this study comparable in a broader sense with impact evaluations in other locations.

The different standards propose different ways to attain increased welfare either in their Codes of Conduct or theories of change. The literature refers to these different 'ways' as 'pathways' or 'mechanisms' (Bray & Neilson, 2017; Chiputwa et al., 2015; van Rijsbergen et al., 2016). In this study, I assess the 'pathways' of Coffee certifications leading to better economic performance, aimed at identifying the strategies and practices of VSS that yield higher returns for Coffee farmers. Based on a review of the VSS literature and the theories of change of the analyzed certifications, I have constructed a theoretical model to analyze the economic impact of Coffee certifications, which is depicted in Figure 2. In this model, certifications are considered as a 'package' for smallholder farmers. The 'underlying practices' are practices that certifications either provide (such as

technical assistance) or encourage producers to implement to improve farm performance. These underlying variables are expected to improve the economic conditions of the farmers, through a combination of 'pathways' – among them price premiums, farm productivity, lower production costs, access to credit, reduced financial risk, market access and improved Coffee quality.

Figure 2. Theoretical model of the impacts of Voluntary Sustainability Standards



Source: Own elaboration.

The interest in analyzing the 'pathways' of Coffee certifications is to unveil "what does the trick" in terms of improving household economic welfare, allowing to place more attention on this aspect of Coffee certification and/or Coffee production in general.

For the empirical analysis, I use most of the 'pathways' identified by Bray and Neilson (2017) in their review of empirical research of certification schemes: price premiums, farm productivity, production costs and access to credit (see the pathways framed in blue in Figure 2). The pathways, underlying practices, and their operationalization are described in Table 2. While reduced financial risk and market access are mechanisms identified in the literature, these two topics escape the scope of the data collection process and analysis. As for the impact pathway of Coffee quality, I conduct an empirical test in the excursus (see section 7.3).

Table 2. Impact pathways of standards leading to economic sustainability improvements

Impact pathway	Description	Underlying practices	Operationalization
i) Price premiums	Price premiums are an important catalyst to incentivize producer's adoption of certifications (Barham & Weber, 2012a; Bray & Neilson, 2017; Grabs, 2017; Rueda & Lambin, 2013c). In theory, VSS can provide a means to incorporate sustainable practices into the pricing mechanism (Potts et al., 2014).	Depending on the type of cooperative, price premiums can be administered in different ways: - Passed on directly (all or a portion of it) to the producer as compensation for the implementation of sustainable practices - Held by the cooperative to cover internal costs (audits, salaries, technical assistance) - Used for the implementation of social projects (typically the Fairtrade premium) (Snider et al., 2017).	Coffee sales revenue per unit = sales of certified and non-certified Coffee * Coffee prices / # of units sold
ii) Increased productivity	Good agricultural practices (GAP) promoted by certifications can lead to increased productivity. Several impact evaluations argue that that increased productivity has proven to have a higher economic impact than price premiums (Hughell & Newsom, 2013; Ruben & Zuniga, 2011; Whelan & Newsom, 2014).	-Training in GAP - Improved agricultural practices: pruning, removing the stems, insect & disease control, soil analysis, appropriate fertilization	Yields per hectare = Coffee production 2015 / Coffee area
iii) Lower production costs	Improved farm management practices can result in efficiency gains, i.e. lower agricultural and labor inputs in Coffee production (Bray & Neilson, 2017; Lyngbæk, Muschler, & Sinclair, 2001; Valkila, 2009).	- Training in GAP - Improved agricultural practices: soil analysis, appropriate fertilization - Record-keeping to track production expenses	Costs of production = inputs + labor + other costs
iv) Improved access to financial credit	Certifications can provide access to credit by strengthening producer organizations, facilitating access to a third-party organizations, or providing connections to downstream value chain actors (Bray & Neilson, 2017; Utting, 2009).		i) Formal credit: received a loan in 2015 (dummy variable) ii) Informal credit: agricultural inputs paid after harvest (dummy variable)

In the following sections, I provide the theoretical grounding of the impact pathways as well as an explanation of how each examined VSS addresses these pathways in their theories of change or codes of conduct.

2.1. Price premiums

Price premiums are one of the main pathways through which Voluntary Sustainability Standards (VSS) operate (Potts et al., 2014), and they are also an important catalyst to incentivize producer's adoption of certifications (Barham & Weber, 2012a; Bray & Neilson, 2017; Grabs, 2017; Rueda & Lambin, 2013c).
The pricing mechanism for Coffee is dictated by the free market, or in other words, by the laws of supply and demand. However, this pricing mechanism is not optimal - it fails to deliver optimal social welfare - when capital inputs are not properly accounted for. These inputs can be private, natural and/or social capital. VSS can provide a means to incorporate social and environmental sustainability practices into the pricing mechanism by identifying the sustainable practice (through a set of criteria) and linking the practice to the physical product through compliance mechanisms and conformity assessments (Potts et al., 2014). This enables VSS to offer the market information regarding ecosystem services provided, natural capital conserved, and other non-product related practices such as decent working conditions, which facilitates a "full-cost accounting" of Coffee production. This full-cost accounting allows for the internalization of the positive externalities of sustainable Coffee production that are otherwise not recognized in the free market (Potts et al., 2014).
The adoption of VSS and the social and environmentally sustainable production practices that they entail, thus holds the promise of improving the producers' economic situation over the short term through the provision of a price premium over conventional Coffee (Giovannucci & Ponte, 2005; IISD, n.d.). While the price premiums offered to producers vary significantly (Daviron & Ponte, 2005) and in some cases have been declining, their proliferation for decades proves that VSS have been successful in communicating the added value to industry buyers (Giovannucci & Ponte, 2005). This also acts as signaling to producing countries, which still consider price premiums as the main "selling point" to adopt certifications (Grabs, 2017). Moreover, some authors argue that price premiums are an incentive to encourage investment from risk-averse farmers (Bray & Neilson, 2017; Chiputwa et al., 2015).

Nonetheless, the effect of the price premium is still subject to the forces of the free market, as the value of these premiums fluctuates significantly over time, mostly due to the forces of supply and demand (Daviron & Ponte, 2005; Giovannucci & Ponte, 2005).

Most of the certifications under analysis do not have strict requirements in terms of offering price premiums. 4C and Rainforest Alliance have no fixed premium. Instead, prices are determined in a negotiation process between the buyer and the seller on a case-by-case (ITC, 2017; Potts et al., 2014). 4C also mentions in their Code of Conduct that the price mechanism should reflect the quality and sustainability practices used to produce the Coffee. Nespresso AAA provides a quality and certification premium and requires the producer to be familiar with the distribution chain. C.A.F.E. Practices can offer a quality premium if specific conditions are met (Potts et al., 2014; Snider et al., 2017). UTZ stipulates mandatory price premiums in their Code of Conduct, as well as keeping records of the amounts to enable more transparent transactions between the certified group and the buyer and improve the bargaining position of producers by allowing them to check prices received by comparable producers (Potts et al., 2014; UTZ, 2015). Rainforest Alliance does not mention price premiums in their theory of change, instead focusing on productivity, quality, efficiency, and access to markets as the main pathways for farmer profitability.(Newsom & Milder, 2018). However, the price premium passed on to producers for certified sales is one of their Monitoring and Evaluation indicators, intended to be assessed as part of impact studies and for sampled producers. Indeed, in their last impact report, the authors mention that independent studies recently published confirm that Rainforest Alliance is associated with higher household incomes and lower poverty rates among certified producers, and one study attributes this effect to price premiums (Newsom & Milder, 2018). This could certainly act as a signal and spur producers and producer organizations to acquire this certification. Therefore, even though price premiums are not specifically mentioned in their theory of change, I argue that these do act as a *de facto* pathway to an improved farm economy.

The Fairtrade certification is the only one that establishes a fixed price premium for farmers, dependent on location, and has a minimum floor price to ensure that basic production and living costs are included in the price (Benoit & Isabelle, 2011; IISD, n.d.). However, when the global Coffee price is above the base price, the Fairtrade premium does not have an effect at the farm level (Bray & Neilson, 2017). Furthermore, given that Fairtrade requires all the members of a producer

organization to be certified, this VSS has the lowes ratio of standard-compliant Coffee produced versus Coffee actually sold through this certification channel (Barham & Weber, 2012a) (de Janvry, McIntosh, & Sadoulet, 2015b; Snider et al., 2017). Over certification leads to an erosion of the price premiums, given that there is no guarantee that certified production will actually be sold in the Fairtrade markets (Raynolds, Murray, & Taylor, 2004; Valkila & Nygren, 2010). While the industry-led certifications Nespresso AAA and Starbucks C.A.F.E. Practices can offer above-average premiums, they both have a strong focus on high-quality Coffee, with the latter even mentioning quality as a pre-requisite to sourcing Coffee (Starbucks C.A.F.E Practices, n.d.). While Nespresso AAA does not mention quality as a precondition, they typically certify farmers from specific geographic areas and have very strict quality criteria (Alvarez, Pilbeam, & Wilding, 2010; Grabs, 2017), thereby restricting the universe of farmers that can participate in their sustainability program. Hence, with these certifications, it becomes more prominent what several authors assert: price premiums reward the quality of the Coffee rather than the sustainability practices used in its production (Ruben & Zuniga, 2011; Snider et al., 2017). This topic will be further developed in the excursus about Coffee quality in Costa Rica (see section X).
However, it is important to note that only price premiums passed on directly in cash to the producer are being analyzed. For example, this measure does not capture the 5 cents of Fairtrade social premium passed on directly to the cooperative for the implementation of social projects. Therefore, this analysis could be underestimating the effects of Fairtrade in the smallholder economy.

2.2. Higher yields

Productivity is a key factor that can affect Coffee income for smallholder farmers (Barham & Weber, 2012a; Beuchelt & Zeller, 2011). Several impact evaluations argue that increased productivity has proven to have a higher economic impact than price premiums (Barham & Weber, 2012a; Hughell & Newsom, 2013; Ruben & Zuniga, 2011; Valkila, 2009; Whelan & Newsom, 2014). VSS promote Good Agricultural Practices (GAP) that can lead to increased yields (Echavarría & Montoya, 2013).
Achieving higher yields is especially relevant for small to medium-sized Coffee farms. Given that their capacity to invest in Coffee or expand their land is limited, intensifying production is one of the most effects methods by which they can

increase their income (Barham & Weber, 2012a). Agricultural intensification can be defined as an increase in volume produced per unit of inputs. The inputs can be labor, land, fertilizer, time, etc. In practical terms, intensification occurs when: a) there is an increase in agricultural production resulting from higher productivity of inputs or b) when the volume produced remains the same as inputs decrease (FAO, n.d.). Nonetheless, it is important to note that while higher yields usually translate into higher sales revenues, this does not necessarily result in greater profits for the producer. That is because this could simply be reflecting increased use of inputs and therefore higher costs (Barham & Weber, 2012a).

Several authors identify different management practices leading to higher yields. These are, for instance, appropriate fertilizing, systematic pruning, thinning and mulching; and, to some extent, shade tree species (Barham & Weber, 2012a; Beuchelt & Zeller, 2011; Rossi, Montagnini, & de Melo Virginio Filho, 2011). However, as the Specialty Coffee Association notes, implementing these practices and increasing yields, in general, raises the production costs per hectare, especially in the short-term, and therefore could reduce farm profitability (Specialty Coffee Association, 2017). These trade-offs between pathways will be further investigated in the empirical sections.

All the certifications analyzed either directly or indirectly mention increased productivity as a means to improve farmers' profits and livelihoods. For instance, UTZ discuss in their principles that farms should achieve optimal productivity (UTZ, 2015); Rainforest Alliance includes farm productivity and profitability as one of their four outcome areas (Milder & Newsom, 2015), 4C Association's first principle is about profitability and long-term productivity at the farm level, Starbucks C.A.F.E. Practices mentions long-term productivity as one of its key criteria (Starbucks Coffee Company, 2016), and Nespresso AAA considers productivity its third driving principle, arguing that it is an essential part of an economically viable farm (Nestlé Nespresso SA, 2016). Finally, Fairtrade mentions that at least five cents of the Fairtrade premium should be invested in measures that improve productivity or Coffee quality.

In terms of GAP promoted to increase yields, some certifications put more emphasis than others in encouraging producers to implement these practices. UTZ is the standard that stresses and requires more farming practices to increase productivity. Among them are the planting of suitable varieties considering expected yields, pruning, and removal of shoots/suckers, weed control to optimize nutrient and water uptake, heavy pruning, grafting and replanting performed on

low productivity areas; and special attention and monitoring of soil fertility and crop nutrient status (UTZ, 2015). Rainforest Alliance and Nespresso AAA standards focus on farm management plans that include GAP but do not describe in detail the agricultural practices. Both Starbucks C.A.F.E. Practices and Nespresso AAA mention practices to increase productivity, such as pruning, but the emphasis is placed more on quality than on increased yields, especially the latter certification. All certifications mention appropriate fertilization and/or training in fertilization as part of their standard requirements. Except for Fairtrade certification, all standards require conducting periodic soil and/or foliar analyses by at least a sample of farmers in the group (4C Association, 2015; Fairtrade International, 2011; Nespresso AAA, 2009; Starbucks Coffee Company, 2016; Sustainable Agriculture Standard, 2014).

2.3. Costs of production

Reduction in production costs is another one of the common pathways claimed by sustainability standards that lead to higher profitability or greater incomes (Bray & Neilson, 2017; Kuit & Waarts, 2014a). This is usually achieved through farm management improvements and increasing on-farm efficiency (Kuit & Waarts, 2014a). The standards analyzed have different ways to address this pathway.
The certifications with greater emphasis in decreased production costs are Rainforest Alliance and Nespresso AAA. Both certifications require in their Codes of Conduct record-keeping and analysis of production cost data to evaluate achievements and allow the producer to make financial decisions. Rainforest Alliance requires additional records of input use efficiency (ratio of production output to production inputs), and Nespresso AAA requires that annual planning include costs and investments on the farm. UTZ mandates record-keeping of workers and to identify and implement measures to optimize farm efficiency. 4C requires the following actions for this pathway: i) record-keeping of the main Coffee costs and income; ii) training of producers to understand their use of records on costs and income; and iii) an analysis of costs and income at farm level conducted by the management entity. Fairtrade and Starbucks C.A.F.E. Practices do not reference decreasing costs of production or increasing efficiency in their standards (4C Association, 2015; Fairtrade International, 2011; Hughell & Newsom, 2013; Milder & Newsom, 2015; Nespresso, 2013; Starbucks Coffee Company, 2016; Sustainable Agriculture Standard, 2014; UTZ, 2015).

While increasing efficiency should translate into higher profitability, it must be noted that decreasing production costs by lowering input use will generally decrease yields, resulting in reduced farm income (Specialty Coffee Association, 2018). Basically, there are two types of production systems, which in turn affect production costs: i) high-input, high-yield system, with associated higher production costs and generally higher income; ii) low-input, low-yield system, with lower production costs, smaller income but potentially more profitability (Specialty Coffee Association, 2018).

2.4. Access to credit

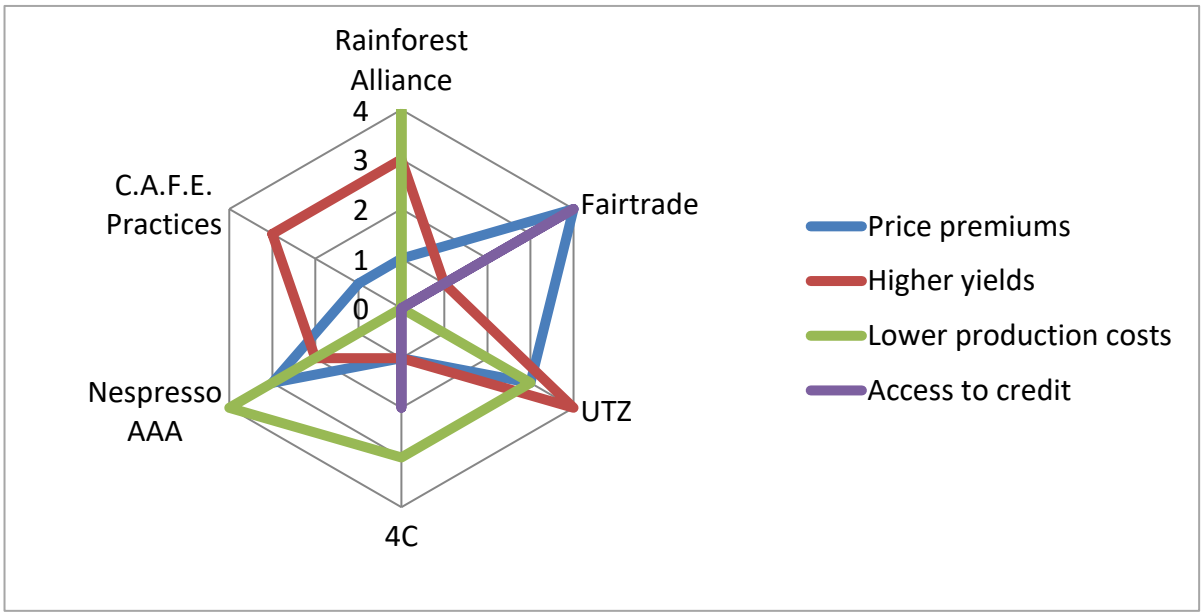
This pathway is mentioned in the literature as a potential outcome of certifications, ultimately leading to the eradication of extreme poverty and financial inclusion of smallholder farmers (International Finance Corporation, n.d.; The World Bank, 2018). Access to credit could be the result of i) indirectly by a strengthened producer organization, ii) directly by a downstream value chain actor; iii) through the facilitation of access to a third-party financial institution (Bray & Neilson, 2017).
Access to financial services is critical for farmers, as it enables them to realize farm investments to increase productivity, such as the application of agricultural inputs and implementation of farm management practices, resulting in improved farm performance and increased economic efficiency (International Finance Corporation, n.d.). Moreover, having access to sufficient funding can improve post-harvest practices, smooth household cash flow, foster better risk management, and enable better market access (The World Bank, 2018). This is especially important for Coffee farmers, given that, for the most part, farm investments such as fertilizer, improved seeds, and agrochemicals, are made months before receiving payment for their Coffee. Furthermore, with the increasing threat of climate change, having access to finance can facilitate climate adaptation and increase the resilience in the agricultural sector (The World Bank, 2018). For example, rigorous research has shown that increasing access to credit for smallholder farmers can help them invest in climate-resistant technologies, such as improved seeds, fertilizer, and insecticides, among others. This is especially effective if the disbursement of funds and repayment timeline matches the harvest and planting cycles. That is, if producers can pay for the loan after the harvest, and if they save between harvest and planting, they can increase their spending in agricultural inputs. Additionally, financial services can provide disadvantaged farmers

with the necessary capital to invest in environmentally friendly practices, fostering environmental protection (Innovations for Poverty Action, n.d.).

Although providing access to financial credit has been the focus of countless development efforts, generally with positive results, of all the certifications analyzed, only the Fairtrade standard tackles this issue directly and with concrete mandatory actions. This certification requires buyers of this certified Coffee to provide credit to producer organizations, in order to finance production (Kuit & Waarts, 2014a). Specifically, the Fairtrade standard requires that on request of the producer, the buyer provide up to 60% of the value of the contract available as pre-finance to the producer (Fairtrade International, 2011). 4C mandates an assessment of the types of services needed by producers and mentions that business partners should have access to credit (4C Association, 2015). However, providing access to credit to the certification holders is not mandatory.

To summarize, Figure 3 provides a visual depiction of how each of the analyzed standards addresses the impact pathways.

Figure 3. Level of importance of impact pathways for each VSS



Codes	Description
0	No reference to the pathway in their theory of change (ToC) or code of conduct
1	References pathway in ToC, code of conduct or annual reports; does not require action
2	Specific mention of the pathway and requirement of at least one action to attain it
3	Specific mention of the pathway and requirement of at least two actions to attain it
4	Detailed actions required to achieve it/and or full compliance

In the case of Fairtrade, access to credit and price premiums are major priorities, whereas higher yields and lower production costs are essentially ignored. Rainforest Alliance focuses on higher yields and lower production costs. UTZ places an importance on all the pathways except for access to credit, which it makes no reference to. The only priority for 4C is lower production costs, while Nespresso AAA also places an importance on price premiums. Starbucks C.A.F.E. practices is primarily concerned with higher yields, with little to no attention paid to credit access or production costs.

3. Impact of VSS on smallholder Coffee farmers: Current state of knowledge

3.1. Do VSS improve the economy of smallholder Coffee farmers?

In this section, I present a review of the relevant impact evaluation literature of Coffee certifications, focusing on economic improvements at the farm level. Then, I examine the few studies that address the impact evaluation pathways.

Most of the available impact literature relies on qualitative, descriptive and anecdotal data and fails to use a counterfactual of non-certified producers to account for potential changes occurring had there not been a sustainability standard in place (Kuit & Waarts, 2014). Blackman and Rivera (2011) conducted an extensive review of the literature on the benefits of sustainability certifications and identified 20 peer-reviewed studies focused on Coffee, of which 5 of them were classified as "rigorous", defined as having used quantitative ex-post analysis and credible counterfactuals. Similarly, Kuit & Warts (2014) carried out an overview of certification schemes and private standards, identifying 110 papers, with only 14 of those having proper counterfactuals. More recently, Bray and Neilson (2017) examine empirical studies of the impacts of third-party Coffee certifications, and of the 51 peer-reviewed studies they found, only 23 fell into the "rigorous" category. DeFries at al. (2017) conduct a similar effort, finding only 13 papers with low risk of bias, out of the 811 initially screened papers for the Coffee sector.

As mentioned, these reviews found a strong bias towards the study of Fairtrade certification, followed by Organic certification. Only a handful of rigorous papers focused on the effects of other third-party certifications, for instance Rainforest Alliance and UTZ, and even fewer on private labels such as Starbucks C.A.F.E. Practices (see Ruben and Zuniga, 2011). Some of these studies were also commissioned or funded by certification organizations themselves, putting into question the reliability of the results (see Arnould, Plastina, & Ball, 2009; Hughell & Newsom, 2013). There have been very few efforts to assess the impact of NGO-driven and company-led standards, such as the COSA initiative, but the impact of each certification is not disaggregated and the full results of the study are not publicly available (see CRECE, 2013b; Giovannucci and Potts 2008).

Examination of these papers reveals a lack of consensus regarding the economic impact of Coffee certifications, with the same certification having a positive, negative or ambivalent effect depending on the study. For example, Bray & Neilson (2017) found that over 50% of the reviewed studies reported neutral/ mixed and negative effects in farmer's financial capital. Blackman & Rivera (2011) only find positive social and economic effects in two of the five rigorous studies examined, while DeFries, Fanzo, Mondal, Remans, & Wood (2017) found positive economic outcomes for 36% of the response variables, with most impacts (59%) displaying no significant difference between certified and non-certified farmers.

For instance, studies on the impact of Fairtrade certification on household income and net profits of smallholder farmers point to neutral to negligible effects of this certification (see Jena et al., 2012 for studies in Ethiopia; Ruben, Fort and & Zúñiga-Arias, 2009 for studies in Peru and Costa Rica; and Rijsbergen et al., 2016 for an impact evaluation in Kenya), while sustainability standards showed a very low impact on reducing the incidence of poverty among cooperative members (Jena, Chichaibelu, Stellmacher, & Grote, 2012).

Impact evaluations on Rainforest Alliance certification show significant changes in net revenue in certified Colombian farmers, as compared to their non-certified counterparts (Hughell & Newsom, 2013). Other studies find positive – although minor – effects in terms of pricing, as well as improved yields/productivity and quality (see Ruben and Zuniga, 2011 for studies in Nicaragua; and Rueda and Lambin, 2013b for studies in Colombia). Similarly, a study on Starbucks C.A.F.E. Practices also found positive effects in terms of productivity/yields and quality, as well as a more diversified production portfolio (Ruben & Zuniga, 2011).

The existing literature of industry and company-led standards such as 4C and Nespresso AAA consists on impact studies commissioned by the sustainability standards themselves. For instance, Kuit et al. (2016) described the limited effects of 4C label on smallholders' livelihoods, while a monitoring and evaluation study reports significant additionality of Nespresso AAA farmers in social, environmental and economic indicators (CRECE, 2013a). The very few rigorous studies conducted on company-led standards point to positive effects of certification in the environmental realm, but do not find substantial effects in the social realm (Giuliani et al., 2017). However, these studies fail to display the certifications being analyzed, and aggregate the results. In short, there is gap in the liter-

ature regarding independent and rigorous research on the economic impact of now pivotal industry and company led VSS in global Coffee production.
Bray & Neilson (2017) argue that a consensus on the impacts of Coffee certifications has not yet been reached due to the complexity of rural livelihood strategies. This is explained by the fact that Coffee is usually part of a broader livelihood portfolio, which encompasses both on-farm and off-farm activities. Moreover, Coffee-specific income is dependent on several factors, such as farm-gate prices, productivity and costs of production – all confounding factors that are rarely considered into these studies. Also, the majority of these studies focus only on income from Coffee rather than household income; a number of them do not disaggregate the effects of each certification, or focus on a single standard (Jena, Platz, & Grote, 2012; Valkila, 2009; Valkila & Nygren, 2010).
The few evaluations that assess the impact of certifications on household income – for instance Fairtrade and UTZ - conclude that while standards can increase Coffee income, the effects on household income are either non-significant or negative. This is potentially a result of substitution effects, understood as the reallocation of resources from other activities such as wage labor and on-farm agricultural activities to prioritize Coffee production (Ruben & Fort, 2012; van Rijsbergen et al., 2016; Vellema et al., 2015). This effect is explained in part because household labor is fixed, and higher returns to one activity – such as Coffee – can cause farmers to substitute labor and land from other activities that they do not consider as profitable (Chayanov, 1966). Therefore, evidence shows that further specialization in Coffee production and more engagement in the Coffee process can lead to forgone economic opportunities and income. Conversely, a diversified activity pattern, including investment in other crops and livestock can result in significantly higher household income (van Rijsbergen et al., 2016).

3.2. Which pathway 'does the trick'?

3.2.1. Price premiums

While it has not been the main focus of research, a few studies on the economic impact of Coffee certifications explore the "pathways" or "mechanisms" that lead to economic profit (see Chiputwa et al., 2015; Vellema et al., 2015). Several impact studies have indeed found a positive, but rather small effect on farm-gate prices (Bray and Neilson, 2017). In a case study in Colombia the Rainforest Alliance premium amounted to only a 5% higher price over the base value (Rueda

and Lambin, 2013a). Similarly, for Fairtrade/organic and Rainforest Alliance certifications, impact evaluations in Mexico and Peru found that price premiums for certified Coffee accounted for a relatively low share of the household income – around 5 to 10% – and could be even lower if the cooperative was unable to place the certified Coffee in the market (Barham and Weber, 2012). From the reviewed literature, only one paper concludes that price differentials were the most important cause of additionality in income from Coffee between certified and non-certified farmers (Vellema et al., 2015). However, they also determined that it failed to translate into higher household income.

A study by Rueda and Lambin (2013) analyses the value captured by farmers selling mainstream Coffee and certified and high-quality Coffee on the final consumer price paid, and the results showed that for mainstream Coffee, farmers captured 23% of the value, while for certified Coffee producers capture 25% of the value perceived by consumers. Roasters keep by far the largest amount of value captured. This, in the case of Rainforest Alliance certification, amounted to a price 5% higher than the base price (from the period of 2006-2010). Considering that in order to comply with certification requirements farmers need to investment in machinery, equipment, changes in practices and technology, it is hard to imagine that a 5% premium can compensate for these costs.

Another study also by Rueda and Lambin (2013b) compared Rainforest Alliance certified farmers with non-certified farmers and concluded that while the price premium was the initial motivation for farmers to adopt the certification, the reasons to remain were considerably different. They valued, for example, organization of household activities, awareness of environmental conservation, technical assistance, and management skills, among others. Price premiums – for the farmers who received them – amounted only to an additional 2% over the price paid for standard non-certified Coffee.

3.2.2. Higher yields

Most impact evaluations argue that that increased productivity has proven to have a higher economic impact than price premiums (Whelan & Newsom, 2014; Hughell & Newsom, 2013; Ruben & Zuniga, 2011). For instance, studies in Mexico have identified that yield differences in the south of the country "account for two-thirds of the net revenue per hectare gap that FT/organic growers make above conventional growers, who participate in neither" (Barham & Weber, 2012, p. 1273). For Rainforest Alliance certification, a study in Colombia found

that productivity in certified farms was twofold than in non-certified farms, leading to a net revenue almost 2.5 times higher (Hughell & Newsom, 2013).
Similarly, Ruben and Zuniga (2011) compared the impact of voluntary and private Coffee standards in the welfare of Nicaraguan smallholder families, using a matched sample of 315 farmers producing under Rainforest Alliance, Fairtrade and Starbucks C.A.F.E. Practices labels. The authors analyze the impact in production, yields, prices and delivery contracts, finding that farmers with Rainforest Alliance certification and C.A.F.E. Practices labels, as well as independent farmers (non-certified), outperformed Fairtrade certified farmers in terms of yields. Moreover, Rainforest Alliance and C.A.F.E. Practices present a larger share of producers with high quality performance. These studies, then, found that higher yields led to increased profitability at the farm level.
A question that still remains to be answered is which of this improved management practices is most responsible for increased yields. On this matter, anecdotal data from growers and extensions agents points to the following practices: pruning and appropriate fertilizing (Barham & Weber, 2012a).

3.2.3. Costs of production

The evidence for how certifications contribute to decreases in production costs is less clear. Some studies have found an overall reduction of production costs for certified farms (see COSA, 2008; COSA, 2013), while others associated higher production costs for certified Coffee, especially when accounting for the implementation costs borne by the farmer to become certified (see Kuit & Waarts, 2014; Weber, 2011; Bolwig et al., 2007)
The impact evaluation evidence for this pathway is not clear-cut. UTZ and Rainforest Alliance/Nespresso AAA certifications have been associated with lower production costs in studies conducted in Vietnam and Colombia, respectively (see Kuit & Waarts, 2014; COSA, 2013). However, these studies do not take into account the costs borne by the farmer to become certified and therefore are likely to be underestimating production costs. More comprehensive research found neutral to negative effects of certifications on production costs (see Kuit & Waarts, 2014; Weber, 2011; Bolwig et al., 2007).
Rainforest Alliance conducted an analysis of the costs and revenues of their certification in Brazil, Colombia, Guatemala, El Salvador and Peru (n=197), focusing mostly on compliance costs. Due to the heterogeneity of Coffee production in those countries and in an effort to make the estimation comparable, they ana-

lyzed the cost data per kilogram of green Coffee and per hectare. For this purpose, they device a tool that allows to create sales scenarios for the different regions analyzed under different circumstances, including certification costs. The results show the following: in the analyzed regions of Brazil and some regions of El Salvador, the economies of scale and satisfactory price premiums made adopting the certification scheme a profitable option. In Colombia and Guatemala, the standard premium did not cover costs of compliance with the standard, and to achieve a breakeven point there would need to be either an increase of the premium price, a reduction of the costs of implementing the standard on the farm and/or increased productivity. In Peru, high costs on the farm took a toll on the overall profitability of the certification (Tunistra & Deugd, 2011).
Overall, despite the relevance of this topic, only a few rigorous studies about the costs of Coffee production (both certified and non-certified) have been conducted. In addition, several of these studies have been conducted by the certification agency and therefore are potentially not an unbiased estimate of the cost-effectiveness of adopting certifications.

3.2.4. Access to credit

In terms of this economic pathway, certifications could provide more access to credit by strengthening producer organizations; facilitating access to a third-party organizations or providing connections to downstream value chain actors. Nonetheless, the relation between VSS and access to credit has not been studied sufficiently; the authors could only find one study addressing these issues, which reported evidence that a Fairtrade cooperative had facilitated access to credit for its producer members (see Utting, 2009; Bray & Neilson, 2017).

4. Sustainable Livelihoods in a rural development context

4.1. New rurality and rural development

This research takes place in an ever-changing and evolving rural landscape in the Global South, with significant changes being felt in agricultural communities in Coffee producing countries. In the past decades, Latin America has experienced profound political and economic transformations, which have reshaped the rural and agricultural landscape in the region. With the economic crisis of the 1980s and the structural adjustment reforms implemented in the same decade, the agricultural sector underwent a severe contraction, going from an average annual growth rate in the of 3.5% during the period of 1950-1980, to two percent during the 1980s (Kay, 2008). The resulting export-oriented market-driven economy after the structural adjustment policies translated into an agricultural sector more linked to the global market. This brought an increase in exports, but mostly in raw materials and non-traditional agricultural exports, such as flowers, vegetables, and fruits, among others. Traditional commodities such as Coffee did not benefit from this boost (David, 2001). In broad terms, globalization and the neoliberal economy favored farmers supplying the export market, while smallholders and peasants supplying the domestic market lagged behind as competition from developed markets increased.

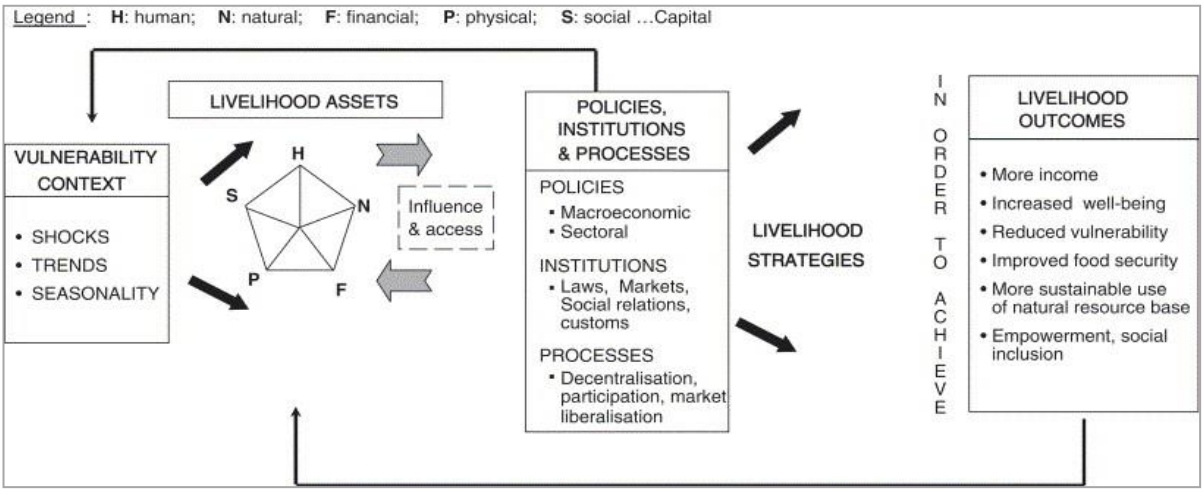
This changing context altered the dynamics in the rural setting, giving rise to what academics and development agencies call "the new rurality" (World Bank & FAO, 2003). The main characteristics of this "new rurality" are the increased diversification of productive activities and the importance of off-farm employment and non-agricultural income for peasants and smallholder's livelihoods (Kay, 2008). Some authors state that by the end of the 1990s, non-agricultural rural income in Latin America constituted half of the total rural income (Berdegue, Reardon, Escobar, & Echeverria, 2000). Those rural non-farm activities have the potential of generating higher income, being more dynamic and fighting poverty (Ambrosio-Albalá & Bastiaensen, 2010), or could also be of a precarious kind due to dispossession and inability to access productive resources (Akram-Lodhi and Kay, 2009), reinforcing the poverty cycle and contributing to further marginalization.

Other characteristics of this "new rurality" include the increased linkages with urban areas (Schejtman, 1999), including the higher fluidity between urban and rural labor markets, the importance of International migration and remittances, which sometimes surpass the value of agricultural exports, and the inclusion and intensification of female labor in rural labor markets (Kay, 2008).
Despite these changes, in developing countries, 75% of the poorest populations live in rural areas and are still dependent on agriculture for their livelihoods (The World Bank Group, 2015). The development and policy agenda for combating rural poverty has also shifted. Currently, it focuses on new strategies as new sources of employment and income, such as: the promotion of off-farm activities as alternative sources of income (Ellis & Biggs, 2001), remittances and value chain insertion (Ambrosio-Albalá & Bastiaensen, 2010).

4.2. Household economy

The social and economic unit of analysis is the household, understood as "a coresident group of persons who share most aspects of consumption, drawing on and allocating a common pool of resources (including labor) to ensure their material reproduction" (Schmink, 1984, p. 89). A conceptual framework that allows analyzing the household's assets and activities as well as how they interact and interplay to attain development outcomes is known as the sustainable livelihoods' framework, depicted in Figure 4.

Figure 4. Depiction of the Sustainable Livelihoods Framework



Source: Allison & Horemans, 2006

This framework allows organizing and assessing the livelihood strategies in a particular context and the institutional setting in which they are embedded – in terms of policies, institutions, and processes – as well as their vulnerability situation, understood as shocks, seasonalities and critical trends (Scoones, 1998; Serrat, 2010). A *livelihood* entails the "capabilities, assets, and activities required for a means of living" (Serrat, 2010, p. 1), and it is considered *sustainable* "when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities, assets, and activities both now and in the future, while not undermining the natural resource base" (Serrat, 2010, p.1).

Under this framework, livelihood strategies for rural populations can be classified in: i) agricultural intensification (more output per unit area as a result of farm investment) and/or extensification (increase area under cultivation); ii) livelihood diversification and adopting off-farm income earning strategies; iii) migration, either temporary or permanent (Scoones, 1998). Households adopt the two latter strategies for the following reasons: reducing income risk, ensuring food security in the event of low productivity or shocks such as droughts, and obtaining additional income for farm investment, in the case of insufficient of access to credit (Reardon, 1997). In this research, I focus on Coffee production as part of the rural livelihood strategies adopted by smallholders.

Part II: Empirical Study: Economic Impact

5. Methodology

This study is designed as a quasi-experimental evaluation, which consists of an analysis of the average impacts of the program for a group of farmers that participated in a specific intervention (treatment group) against the control group, a group of farmers with similar and comparable characteristics to the treatment group but did not participate in the intervention. This evaluation design enables the researcher to obtain a reliable impact evaluation of program effects, by allowing one to control for preexisting differences or selection bias to the best possible extent (Duflo & Udry, 2004). In this case, the treatment group are the certified farmers, and the control group, or the counterfactual – i.e. 'What would have happened had the intervention not been implemented' – are non-certified farmers.

Following, I explain the fieldwork/ data collection process and specify the methods used. In detail, I lay out the strategies that were undertaken to select the research organizations that were included in the study, the sample selection and the implementation of the survey. Moving to the analytical part, I describe the operationalization of variables and the specificities of the econometric techniques and models utilized. I also explain the particularities of the analysis conducted in each of the three countries.

5.1. Selection of Coffee organizations

Having selected the standards and countries to be studied, the next step consisted of deciding on the study areas within each country and find Coffee organizations holding the chosen certifications. First, based on a review of secondary sources and interviews from experts from the Coffee industry in each country, the study regions were chosen. The main selection criteria were: i) their importance for Coffee production in the country (volume produced as a share of national production); ii) the presence of both certified and non-certified farmers, in order to be able to construct the treatment and control groups.

In Colombia and Costa Rica, the Coffee sector is cooperative-driven (Grabs, Kilian, Hernández, & Dietz, 2016; Snider et al., 2017). For this reason, it was decided to partner with cooperatives located in the selected Coffee regions in

these countries. In Honduras, a large trader was chosen as a research partner, and all the sampled units belonged to this organization. The cooperatives were selected as follows:

In Colombia, around 90% of the cooperatives in the country hold the Fairtrade certification (extensionist, personal communication, July 2016), so I opted to use this certification as a baseline standard to compare the impact of additional standards. Then, to assess the specific impact of Fairtrade in Colombia, I pre-selected non-certified cooperatives within the same geographic area. In Costa Rica, I was able to find non-certified cooperatives as well as cooperatives holding additional certifications in the same Coffee regions.

Then, I interviewed the cooperative managers of the short-listed cooperatives in the study areas and made a final selection based on geographic proximity, similarities in the management and organizational structures, and agro-ecological and socio-economic conditions. In Colombia, the selected non-certified cooperative was beginning the process of applying for the Fairtrade certification by FLO-CERT, making them an appropriate control group. This cooperative met two key criteria: i) they satisfied the required characteristics to adopt the Fairtrade certification, so they were similar to the treatment groups; ii) a large group of farmers had not been exposed to any training regarding certification requirements/compliance.

The final selection of Coffee organizations included including three cooperatives in Colombia's Coffee Belt, five cooperatives from the Los Santos region and Western Valley in Costa Rica, and one foundation/ large trader in Honduras, comprising farmers from the North, South and Western regions of the country. The last step was to randomly select certified and non-certified farmers from the membership lists of each Coffee organization. In the case of Colombia, given that the membership lists had more information available, I was able to conduct pre-propensity score matching using available criteria from these lists (gender and Coffee area in most cases). In Costa Rica, where possible, total Coffee production was taken into account for the sample selection, to account for farm size and productivity. The final sample includes 1,907 Coffee-producing households, 745 of which are from three cooperatives in Colombia's Coffee Belt; 503 from five cooperatives from the Los Santos and the Western Valley area in Costa Rica; and 659 from one foundation in Honduras, encompassing farmers from three regions (North, South, and West). See Table 3 for sample design. To avoid undue

influence of outliers, sample farmers in the top and bottom 1% of the distribution of productivity (yields per hectare) were dropped from this analysis.

Table 3. Sample design

Sustainability Standard	Colombia	Honduras	Costa Rica
Fairtrade	237	95	94
Rainforest Alliance	79 (+AAA & FT)	76	152
UTZ	0	94	0
4C	74 (+FT)	135	0
Starbucks C.A.F.E. Practices	81 (+FT)	0	118
Nespresso AAA	141 (+FT)	0	0
Non-certified	90	259	139
Total	702	659	503

5.2. Sampling strategy

The sample size was calculated following these steps: i) picking a central variable of interests with a level of variation within the population; in this case yield; ii) analyze farm-level data collected for the areas of interest to assess the variation of the target sample; in this case an average variation coefficient of 0.49; iii) choosing a margin of error and a confidence level, for these purposes 10% and 95% (Grabs, 2015). This results in an average sample of 80 Coffee farmers per certification/treatment group (Starbucks C.A.F.E. Practices, Rainforest Alliance, Nespresso AAA, UTZ, 4C Association and Fairtrade), with a large pool of non-certified producers to be used as controls[4].

Data collection

Original data from sampled countries in these countries was collected through a farm-household survey and in-depth interviews with Coffee cooperatives and key stakeholders along the value chain. The fieldwork was carried out from March 2016 through the end of 2017. More specifically, in Honduras the data collection took place from between March 2016 – December 2016; in Colombia from July until October 2016; and in Costa Rica from February 2017 until December 2017. In every case, local enumerators, whom I trained and supervised during the implementation of the study, implemented the surveys. Moreover, the survey was piloted in each organization with at least two Coffee producers, and

[4] In the case of Colombia, Fairtrade only farmers were employed as controls for the additional certifications of Nespresso AAA, Rainforest/Nespresso AAA, Starbucks C.A.F.E. Practices and 4C.

adjustments were made subsequently to clarify the questions. The primary data was then collected through one-time visits to the household head, using the app Survey CTO, which allowed implementing the survey offline and uploading the completed questionnaires in real time.
The survey consisted of 290 questions on detailed socio-economic and environmental indicators at the plot, farm, and household level. Key data allowing to calculate the costs of production, Coffee yields, prices for standard and certified Coffee, sales through certified channels and income from other on-farm and off-farm activities (including remittances and subsidies) were collected. Moreover, demographic data and indicators regarding the farm and plot characteristics (including altitude) were collected in order to be able to fully explain the effects of Coffee certifications. Given that, for the purpose of the research, data needed to be recorded for a full Coffee year, the recall period is the Coffee year 2015/2016. In the specific case of Colombia, since Coffee is collected year-round in the areas of the study, the recall period was the calendar year 2015.

5.3. Operationalization of variables

The main variables of interest used to assess the economic impact of Coffee certifications are gross profits, household income, probability of living in poverty (for the cases of Colombia and Honduras) and wealth (for Costa Rica). The gross profit is defined as the Coffee revenue received by the farmer minus the farmer's production cost. Then, in order to be able to calculate gross profits, the cost of Coffee production and Coffee revenue are calculated for each producer. The household income variable will testing if certifications have an overall positive impact on the household economy – not only on income derived from Coffee.
For this specific analysis, only the cash production costs (variable production costs) are considered. This includes the costs of maintaining the plantation, in addition to harvesting costs. These costs comprise, then, material inputs and labor for fertilizing, weed control, pest control, pruning, Coffee processing, and transportation, among others. The mentioned cash costs are usually what the farmers consider relevant when they think about their profitability (International Coffee Organization, 2019). The production costs for each farmer, then, can be expressed in the following way:

Variable costs of production = Agricultural inputs + Labor costs + Other costs

Where agricultural inputs include any organic and chemical inputs utilized in Coffee production; labor costs include paid labor used in the production cycle (fertilizing, weeding, spraying, pruning, harvesting, shade management, renovation) and other costs include transportation, processing costs, and cost of trees planted. I did not include fixed costs such as capital resources, equipment, machinery, and land, as in most of the cases these were acquired years ago, and no records of these expenses were kept. In addition, these resources are not used exclusively for Coffee, and would, therefore, require a more detailed and elaborated questionnaire focusing solely on costs of production in order to determine how they are distributed, which was not the specific focus of our research. In the excursus, unpaid labor will be accounted for in the case of Colombia, calculated based on the literature of shadow wages (Skoufias, 1994).

For certified farmers, the costs of certification were recorded and included improved farm management practices, infrastructure improvements, occupational health supplies, and additional expenses incurred in the implementation of the certification schemes adopted. Given that investment in obtaining the certification is usually a one-off investment, I did not include these costs in the main analysis. However, I did estimate the effects for the main economic outcomes including certification costs as a sensitivity analysis. The results remained similar.

The Coffee revenue equals the price paid for Coffee times the volume sold. The price received by the farmers differed according to the sales channel, i.e. if the Coffee was being sold to the cooperative, or to a trader, or directly to an exporter. In the cases of Colombia and Costa Rica, the price variable also accounts for the differences in the quality of the Coffee. That is, individual growers received different prices if they sold the Coffee through a certified channel, or if they sold it as conventional, or defected or unripe Coffee (low quality). Where possible, I used the prices provided by the cooperative itself, given that this would enable a higher degree of accuracy. Otherwise, farmer-reported prices were used. In the case of Costa Rica, the volume sold to the cooperative was provided in advance, therefore allowing to contrast the reported values with the official records.

I then calculated gross profits in the following way:

Gross profit = Coffee revenue – variable costs of production

I divided this variable by the number of hectares to calculate gross profits per hectare, and by total production, for an estimate of the gross profit per unit of Coffee sold.

The total household income was calculated using Coffee sales revenue plus any additional income reported by the producer, such as other agricultural activities, livestock production, salaried work, government subsidies, remittances and income from renting property. Income from other sources is also used as a proxy for diversification, given that it allows calculating how dependent a household is from Coffee. This calculation does not include the costs of production. It can be depicted in the following way:

Household income = Coffee sales revenue + revenue other sources

In addition, using the production costs estimates, I will calculate a breakeven point, i.e. the point of zero loss or profit, for Coffee sold per pound, both for certified and non-certified farmers. This will allow computing at which price point, on average, farmers would meet their cash expenditures and be able to sustain Coffee production at least in the short-term.

It is important to note that gross profits are an incomplete metric of the impact of certification programs in smallholders' welfare. Cash returns fail to capture other potential direct and indirect benefits of sustainability standards such as educational attainment, ecosystem services conserved as a result of the implementation of the standard norms, or the Fairtrade social premium that gets passed directly to the cooperative to be reinvested in social projects. Nonetheless, this measure is useful when assessing the economic viability of producers' participation in certification programs, and it can capture other benefits of sustainability standards that affect yields, costs of production and prices (Barham & Weber, 2012a). In addition, to complement this analysis, other measures such as access to credit, savings, poverty likelihood and wealth (encompassing education, access to energy, assets, among others) are incorporated to provide a broader picture of the smallholders' economy.

In order to measure the likelihood of living in poverty, I used the Poverty Probability Index (PPI), which is a poverty measurement tool developed by the Grameen Foundation and currently operated by Innovations for Poverty Action (IPA). This simple tool is comprised of ten questions about household characteristics and assets, which arrive at a score that can be used to calculate the probability that a sampled household will fall below a particular poverty line. In this case, I use the national poverty lines as a reference point. The questions differ per country, but in general assess household composition, education of family members, salaried work (if any), construction material of the house, the source of water,

access to electricity, and assets such as television, car, washing machine, etc. (Innovations for Poverty Action, 2010, 2012). This tool was only available for Colombia and Honduras, given that Costa Rica is a high-income country.

For the case of Costa Rica, I constructed a Wealth Index using Principle Component and Factor Analysis. These are both methods for data reduction. As described by Hamilton (1992): "They seek a few underlying dimensions that account for patterns of variation among the observed variables. Underlying dimensions imply ways to combine variables, simplifying subsequent analysis. For example, a few combined variables could replace many original variables in a regression" (p. 249). The advantage of this method is that it allows for models with a lower number of variables, and in addition, it reduces the possibility of multicollinearity.

For this specific analysis, I wanted to be able to combine in one variable, assets owned, along with schooling and additional income. The first step for conducting Principle Component Factor Analysis is to test the correlation of the variables. Ideally, the correlation should be above 0.80. With this data, I managed to construct an asset index with variables highly correlated between each other (alpha = 0.80), but the more comprehensive wealth index had a 0.72 correlation. The variables included were means of transportations owned (cars, trucks, and motorcycles), number of the property, household assets (fridge, washing machine, and computer), additional income to Coffee and years of schooling.

Finally, as described in previous sections, I expect to find that farm productivity has an important effect on Coffee gross profits. There is a gap in the literature in terms of which agricultural/farm management practices drive increased productivity. With the following equation, I will estimate the impact of different agricultural/farm management practices on farm productivity:

$$Productivity = a_0 + a_1 Fert + a_2 Prun + a_3 Pest + a_4 Shade + a_5 Stems + \beta + \varepsilon$$

Where $Productivity$ is farm productivity, a_1, a_2, a_3, a_4 are coefficients to be estimated and $Fert$, $Prun$, $Pest$, $Shade$, $Stems$ are dummy variables signifying farm management practices of fertilizing, pruning, pest and shade management, while ε is the error term.

5.4. Propensity Score Matching and regression analysis

Quasi-experimental evaluation designs such as this one, present certain threats to internal validity, as they are not as methodologically rigorous as a randomized experiment. These are the observed and unobserved characteristics (selection bias) between the treatment and control groups since the evaluator does not have control over the assignment of the treatment (in this case, Coffee certifications). In addition to this, issues arising from the collection of cross-sectional data, such as measurement error and simultaneity (Wooldridge, 2002), can create endogeneity. In order to correct it, several methods can be used, such as the Heckman selection model, endogenous switching regression models, instrumental variable models and Propensity Score Matching (PSM) (Jena, Platz, et al., 2012). For this research, PSM will be used to create a valid counterfactual for our sample and estimate average treatment effects.

The PSM method allows measuring the impact of the treatment(s) given to a group of households - compared to a control group - through the construction of a counterfactual that controls for other factors except for the treatment, addressing the issue of self-selection bias.

Matching methods such as PSM focus their attention on a variable of interest and treat the other covariates as potential confounding variables. The influence of these variables is reduced by introducing them in the matching model, with the method of covariate balance, thus matching the confounding variables present in the treatment and control groups (DiPrete & Gangl, 2004).

The PSM method, then, allows measuring the impact of sustainability standards on the treated (i.e. certified) farmers, as compared to a control group comprised of non-certified farmers with similar characteristics. In order to construct the comparison groups for the six specified certifications and arrive at a robust estimation of their additionality, the first step of the PSM method is to estimate the likelihood of each farmer to participate in the certification scheme. Thus, I estimated binary probit models for each mutually exclusive certification or treatment group. Each treatment group holds one certification unless otherwise specified. The decision to participate in the VSS could be driven by individual characteristics, such as gender, age, education, household size, land tenure, farm area, Coffee area, altitude, distance to the nearest school/mill/health center, group membership and participation in cooperative programs, therefore I include these variables in the model.

This first-stage regression estimates the propensity score for each observation, understood as the tendency of each farmer to join certification (the magnitude of a propensity score is between 0 and 1), with a higher value indicating a greater likelihood of being certification. I used the following estimation for each certification scheme:

$$p(x) = \Pr(T = 1|X = x)$$

In the second stage, two balanced groups are formed based on their estimated propensity scores – farmers in each group should have similar propensity scores (Jena et al., 2012). Only the observations in both the treatment and control group that overlap in the propensity score, also known as "area of common support", will be considered for the analysis and model. This allows estimating the Average Treatment Effect on the Treated (ATET).

$$TOT_{PSM} = \frac{1}{N^T}\left[\sum_{i\epsilon T} Y_i^T - \sum_{j\epsilon C} \omega(i,j) Y_j^C\right]$$

For this study, I use Nearest Neighbor Matching, which is arguably the most straightforward matching estimator. A control farmer is chosen as a match for a treated producer that is close in terms of the propensity score (Becker & Caliendo, 2007; Caliendo & Kopeinig, 2005). For the analysis, I use two nearest neighbors in order to decrease the variance, and I impose a caliper of width equal to 0.2 of the standard deviation of the propensity score to decrease bias. Furthermore, I allow for matching 'with replacement', which means that an untreated or control individual can be used as a match multiple times. The advantage of using Nearest Neighbor matching with replacement is that the average quality of the matching improves, and bias is reduced (Caliendo & Kopeinig, 2005). The disadvantage is that it can potentially increase variance in the estimator (Caliendo & Kopeinig, 2005), but this is in theory addressed by the inclusion of more than one nearest neighbor.

I chose to use the *teffects psmatch* command in STATA for estimating treatment effects, as it takes into account (Abadie & Imbens, 2016) adjustment that takes into account estimated propensity scores rather than true ones, which improves the calculation of standard errors.

Changing the number of the nearest neighbors and caliper, obtaining similar results, checked the robustness of the results. These checks did not yield significantly different results.

In addition, Ordinary Least Squares (OLS) regression was conducted for the main outcome variables. The decision to implement OLS in addition to the matching estimation is to add credibility to the results, given that with PSM there are several steps that depend on the researcher's judgment and are not standardized. This could lead to different researchers arriving at differing results even when using the same dataset and covariates (Angrist, 2009). OLS regression can also be considered a matching estimator, if there are proper covariates used as controls. The main difference between OLS regression and matching estimators is in "the weights used to sum the covariate-specific effects… into a single effect. In particular, matching uses the distribution of covariates among the treated to weight covariate-specific estimates into an estimate of the effect of treatment on the treated, while regression produces a variance-weighted average of those effects" (Angrist, 2009, p. 54). Therefore, I expect the coefficients of the OLS regression and PSM to vary, but the two estimation strategies should generally present the same picture.

The estimation model used to assess the impact of the different certifications on the economy of the farms/households, similar to Mitiku et al. (2017), is as follows:

$$Y_i = a_0 + \beta T_i + \gamma X_i + \varepsilon_i$$

Where Y_i measures the economic impact of certifications on individual households i; a is the constant; T_i are the Treatment variables for each certification (dummy variables); X_i is a vector of control variables (for instance age, sex, schooling, household size, distance to the market, altitude, membership, etc.) and ε_i is the error term. The four outcome indicators to be estimated are the following: i) Coffee sales revenue, measured as income from Coffee (sales of certified and non-certified Coffee multiplied by Coffee prices); ii) Coffee gross profit, calculated as Coffee sales revenue minus variable costs of production; iii) household income, measured as revenue from Coffee and other sources (on farm and off-farm income); and iv) poverty, estimated by using the Progress out of Poverty Index (PPI), or the Wealth Index for the Costa Rica case. The model is estimated separately for each of the outcome variables and treatments/certifications in each country.

Robustness checks

Matching methods such as Propensity Score Matching are based on the conditional independence or unconfoundedness assumption. This assumption states that the evaluator "should observe all variables simultaneously influencing the participation decision and outcome variables" (Becker & Caliendo, 2007, p. 2). This is evidently a very strong assumption; therefore, it is critical to assess the sensitivity of the estimated results to deviations from this assumption. For instance, if there is a presence of unobserved variables which simultaneously affect the selection into treatment and the outcome variable, 'hidden biases can arise, compromising the robustness of the matching estimator (Becker & Caliendo, 2007).

With non-experimental data, one approach to determining the strength that unmeasured variables would need to have to make our conclusions questionable is the Rosenbaum Bounds approach (DiPrete & Gangl, 2004). This approach allows to test the sensitivity of significant results to bias, therefore providing evidence of the robustness or lack thereof of the estimations (Becker & Caliendo, 2007). I implement these robustness checks and include the results in Chapter 9.

5.5. Specificities of the analysis for each country

Colombia

Cooperatives 1 and 2, as mentioned, are both Fairtrade certified (all producers hold the Fairtrade certification) and some of their producer members hold additional certification. Cooperative 3 is non-certified. Three certifications were present in both cooperatives (Nespresso AAA, Starbucks C.A.F.E. Practices and Fairtrade), while Rainforest Alliance and 4C were only present in Cooperative 1 and 2, respectively (see Table 4 for the Colombia-specific sample design). It is important to note that all Rainforest Alliance certified producers also held the Nespresso AAA label. Therefore, for this specific label I will be assessing the effects of multi-certification.

Table 4. Sample design Colombia

Cooperative	Nespresso*	C.A.F.E. Practices*	4C*	Rainforest Alliance/ AAA*	Fairtrade^	Non-certified^
1	100	46	-	79	94	-
2	41	35	74	-	143	-
3	-	-	-	-	-	90

Notes. * denotes Treatment group and ^ denotes Control group.

The data allowed me to conduct a two-step analysis of the effects of certifications. In the first step, I compare the effects of each certification (for instance Nespresso AAA, n=141) against the pool of controls from the three cooperatives (n=327). This gives us an estimate of the effect of each certification for the full sample. In the second step, I assess the effects of each certification within each cooperative. For instance, I measure the effect of Starbucks C.A.F.E. Practices (n=46) in Cooperative 1, by comparing it to the baseline standards, Fairtrade (n=90). This micro analysis for each cooperative, as well as the fact that three of the standards are present both in Cooperatives 1 and 2, enables us to disentangle the effects of certifications from the impacts of cooperative membership, therefore allowing us to identify and report "cooperative effects" (see Jena et al., 2012). After this, and in order to assess the impact of the Fairtrade certification, I compare Fairtrade-only certified farmers from Cooperatives 1 and 2 against non-certified growers from Cooperative 3.[5]

Honduras

For this analysis, the sample of certified and non-certified farmers in Honduras was drawn from only one Coffee organization (a large trader). The sample includes farmers from six different departments. I control for the region of Western Honduras, given its importance for Coffee farming. Tables 5 and 6 include the distribution of sampled farmers in each region, per geographic region and certification. Overall, the sample is balanced between farmers from Western Honduras and other regions.

[5] See Appendix E for the covariates used in the Propensity Score Matching model.

Table 5. Sample design Honduras: distribution of observations per region

Department	# of observations	Western Honduras
Copan	171	Yes
El Paraiso	250	No
Lempira	56	Yes
Ocotepeque	85	Yes
Yoro	96	No

Table 6. Sample design Honduras: distribution of certified farmers

Certification	Western Honduras	Other regions
Fairtrade	49	46
UTZ	54	40
Rainforest	42	34
4C	47	88
Non-certified	118	141
Total	310	349

Costa Rica

Cooperatives 4, 6 and 8 hold collective certifications in addition to some individual standards, while cooperative 5 only holds individual certifications for some of its producer members, and the rest are non-certified. The sustainability labels being analyzed (Fairtrade, Starbucks C.A.F.E. Practices and Rainforest Alliance) were each present in at least two cooperatives, and the non-certified farmers used to construct the control groups were also from two different cooperatives (see Table 7 for Costa Rica-specific sample design). This allows disentangling the effects of certifications from the impacts of cooperative membership.

Table 7. Sample design Costa Rica

Cooperative	Fairtrade*	C.A.F.E. Practices*	Rainforest Alliance*	Non-certified^
4	-	52	49	-
5	-	-	32	78
6	48	32	71	-
7	-	-	-	61
8	46	34	-	-
Total	94	118	152	139

Notes. * denotes Treatment group and ^ denotes Control group.

It is important to note that in Costa Rica, usually more advanced certifications are adopted in addition to prior sustainability standards. That is, Starbucks C.A.F.E. Practices was taken up in addition to the Fairtrade standard; and Rainforest Alliance was adopted on top of C.A.F.E. Practices. Moreover, in cooperative 6 all Rainforest Alliance farmers hold the Nespresso AAA certification. For this reason, for the case of C.A.F.E. Practices, the analysis will be of the double-certification C.A.F.E. Practices and Fairtrade. For Rainforest Alliance, the analysis will be of multiple certifications: C.A.F.E. Practices, and Fairtrade or Nespresso AAA in some cases. Given the nature of certification adoption in the country, and in order to ensure the robustness of the results, different treatment groups and counterfactuals were constructed and analyzed. A detailed explanation is provided in the robustness checks sub-section.

6. Descriptive statistics and cooperative characteristics

6.1. Colombia

As Table 8 showcases, certification groups differ in certain household characteristics, with C.A.F.E. Practices farmers, for instance, having a higher share of female household head and 4C Association having no gender balance. Rainforest/ Nespresso AAA farmers display lower levels of education, a smaller household size and a higher rate of participation in cooperative programs. As for farm characteristics, 4C displays a lower farm area and higher altitude, and Nespresso AAA farmers had lower productivity and, along with Rainforest Alliance/ Nespresso AAA, a higher share of low-quality Coffee sold. Where possible, I am including these different attributes as controls in the PSM and OLS regression. Our data also shows that Nespresso AAA farmers have lower margins per farm and household income, and a higher probability of living under the country's poverty line.

Table 8. Descriptive statistics per certification in Colombia

Summary statistics	CAFE (n=81)	AAA (n=141)	RA/AAA (n=79)	4C (n=74)	Controls (n=237)
Household characteristics					
Female household head (dummy)	0.52***			0***	0.27
Age of household head (years)	53.79		55.76	56.62*	53.48
Years of schooling of household head	5.67		3.77**		4.86
Household size (number of people)	3.23		2.78**		3.28
Full tenure (dummy)	0.96				0.95
Distance to market (minutes)	46.81		48.73	33.88***	44.45
Participates in cooperative programs (dummy)	0.33	0.71***	0.91***	0.55***	0.29
Farm characteristics					
Total farm area (hectares)	5.68			2.88*	4.70
Coffee area (hectares)	3.24	2.00***			3.00
Farm altitude (m)	1,709.81		1,694.30		1,687.86
Coffee production 2015 in # of cargas (a)	40.96	22.56***	31.86		39.18
Share of low-quality Coffee	0.29	0.35***	0.39***	0.11***	0.25
Grows other crops (dummy)	0.73				0.72
Household income and poverty					
Coffee gross margins per farm	3,105.47	1,671.94*	2,420.74		2,905.11
Coffee gross margins per hectare	971.38			1,228.56*	816.20
Revenue all sources per farm	10,436.96	6,070.83***	8,172.12		10,449.76
Share of income from Coffee	0.95				0.94
Poverty Probability Index (PPI)	45.23	43.15**	45.17		45.52
PPI probability of living under National Poverty Line	0.18	30%**	0.18	0.18	0.18

Notes. (a) 1 carga = 125 kg. Exchange rate used from Colombian pesos to US dollars: 2,734 (average exchange rate for the year 2015)

In addition, there are some differences between producers from each cooperative, namely education, household size, tenure security, Coffee area, productivity and share of income from Coffee. This translates into differences in household income, with non-certified farmers in Cooperative 3 doing better off than sampled farmers in Cooperatives 1 and 2. This is partly a result of their further diversified activity pattern. Producers in Cooperative 2 display much higher gross profit per farm and per hectare, associated with higher productivity, better prices for their standard Coffee and a lower amount of low-quality Coffee than Cooperative A farmers. Cooperative A farmers have both lower Coffee gross profit and lower household income as well as a higher probability of living under the national poverty line (see Appendix C for descriptive statistics per cooperative).

There are also some differences in terms of how the cooperatives function, their focus and development strategy. Cooperative 1 was founded in 1966 and currently has around 1,550 associates. They have been pioneers in sustainability certifications, starting with the Fairtrade certification in 1997, followed by Rainforest Alliance in 2003, then Nespresso AAA in 2005 and Starbucks C.A.F.E. Practices in 2014. This cooperative has been able to capitalize from its early uptake of sustainability certifications, benefitting from the Fairtrade premium when demand was soaring. This allowed them to leverage funds from International cooperation for improvements in individual and collective Coffee processing facilities.

Cooperative 1 has currently several social and environmental programs, such as the registry of migratory birds (in association with Rainforest Alliance); Mucafe, an association of Coffee-growing women; and a traditional handmade hats program. They provide technical assistance and extension services program to their members, with approximately 1 technical assistant for every 200 farmers, and they subsidize the cost of first aid kits. Furthermore, the cooperative reached an agreement between Nespresso AAA and Fairtrade, which allows all sales of Nespresso-certified Coffee to receive Fairtrade's social premium. This significant source of revenue is used to fund the farmer's pension program and to cover the expenses of technical assistance and extension services.

This differs from the situation in other Colombian cooperatives, where Coffee farmers are only able to sell their Coffee through one certification channel, thus they cannot obtain double premiums even if they hold multi-certifications. For this reason, Coffee farmers try to sell their Coffee with the highest-paying certification they hold. Yet, they must meet the strict quality standards demanded by certification bodies. For example, Nespresso AAA requires less than 2% of Cof-

fee berry borer per batch of Coffee, and Rainforest Alliance less than 4.5%. Nespresso-certified farms must meet specific geographic and climatic conditions (from 600-3,500 m.a.s.l.), and the certification body closely monitors the certified farms, including Coffee cup quality tests. If the farms fail to meet the requirements, they are excluded from the sustainability program.

Cooperative 1 also has a strong emphasis in quality, with several awards won in quality contests in their department, and a cupping lab where they usually test the quality for Nespresso-certified Coffee and other certifications. Nonetheless, during year 2015 the Coffee quality was low, with a high quantity of withered beans and presence of the Coffee cherry borer. Those are believed to be the impacts of El Nino phenomenon according to the FNC, which in turn had an impact in national exports.

Cooperative 2 is one of the largest and most advanced in the country. With almost 3,600 members (over 1,000 of them women) and 200 employees that work under an innovative and highly involved manager, they stand out for having several value chain partners and for their progressive economic and social programs with their member-farmers. For instance, they have the program “Buen Precio” (good price), which guarantees that enrolled farmers get a price of COP 800,000 (USD 292) per Coffee “carga” (1 carga = 125 kg), even when the market price is lower. This program acts as a buffer when price fluctuations increase, as was the case in 2015. This cooperative also has a micro-lot program, an incentive program for the younger generation of Coffee farmers and a Coffee futures program. They also implement a government pension program, provide personalized technical assistance and extension services to their producers and offer soil and foliage analysis at a subsidized price for their associates. These latter activities are aimed at increasing productivity, one of the main focus of the cooperative.

Cooperative 2 has a strong International reputation as a result of their participation in Coffee trade fairs abroad. This has led to direct green Coffee exports to 12 countries around the world. Antioquia cooperative is Fairtrade-certified (this means that every producer that joins the cooperative will be Fairtrade-certified) and holds the following certifications for individual producers: S&D, Nespresso AAA, Starbucks C.A.F.E. Practices, UTZ and 4C verification. This cooperative owns two Coffee processing plants and has specialty Coffee shops, where they feature Coffee produced in micro-lot Coffee.

Cooperative 3 was founded 50 years ago and currently has 5,400 associated Coffee farmers and 32 employees. The cooperative has recently created a Depart-

ment of Specialty Coffees, with the main goal of promoting high quality and differentiated Coffee, focused on micro-lot production and sustainability certifications. This cooperative is currently part of the supply chain of Rainforest Alliance and UTZ, and over 600 of their producers also hold the 4C standard. They also have their own origin Coffee certification, which has a premium of around USD 4.40 per carga. This premium is still lower than the 4C (around USD 5.50 per carga) and Rainforest Alliance (around USD 9 per carga), but any member producer can sell their Coffee with this certification if they meet the quality standard. Some of the farmers in this cooperative have ventured into the export business, though still rather unsuccessfully due to lack of legal knowledge and information.

Cooperatives are by definition a social institution, and therefore transfer most of the revenue to the producers. Cooperative 3 is no exception, keeping only 1% of the revenues to cover operational costs and invest in social infrastructure of the cooperative members. Under this circumstances and seeing what other cooperatives had accomplished with sustainability certifications, they decided to apply for Fairtrade certification. Their main motivation is to use the Fairtrade premium to further their social programs and provide more benefits to their members. When this study took place, they were at the beginning of this process, by compiling all the required documentation and had conducted trainings for some producers.

6.2. Honduras

Table 9 shows descriptive statistics of sampled farmers disaggregated by certification in Honduras. As displayed on this table, certification groups differ in certain household characteristics, with Fairtrade and Rainforest Alliance farmers having higher education levels than the non-certified farmers, including higher levels of literacy. Fairtrade farmers also have more land security than the controls and other certification groups. As form farm characteristics, Rainforest Alliance farmers have much larger farm area than the other groups, and also their production volume surpasses that of the other certification groups and controls. This leads to them, on average, being much more profitable than other certification holders, and having a lower probability of living under the poverty line. On the other hand, Fairtrade farmers have lower productivity levels than the other certification groups and controls, but they are also more diversified in their production portfolio.

Table 9. Descriptive statistics per certification in Honduras

Summary statistics	Fairtrade (n=95)	UTZ (n=94)	RA (n=76)	4C (n=135)	Controls (n=259)
Household characteristics					
Female household head (dummy)	0.11**	0.17	0.16	0.19	0.20
Age of household head (years)	47.07	49.95***	45.28	47.85**	44.16
Years of schooling of household head	7.72***	4.88	8.49***	5.50	5.15
Literacy	0.94	0.93	0.99**	0.90	0.90
Household size (number of people)	4.48	4.04	4.16	4.39	4.44
Full tenure (dummy)	0.87**	0.77	0.78	0.77	0.77
Distance to market (minutes)	42.89*	46.33	44.87	45.41	49.58
Farm characteristics					
Total farm area (hectares)	6.76*		13.79***	5.29	4.84
Coffee area (hectares)	3.29	4.18	9.26***	4.30	3.78
Farm altitude (m)	1,164.93***	1,174.65***	1,182.23***	1,058.84	1,041.67
Coffee production 2015 in # of qq (a)	56.00	112.07	430.55***	94.40	117.64
Productivity 2015 (yields per hectare, kg)	16.90***	29.71	41.04***	23.95	26.47
Grows other crops (dummy)	0.4***	0.22	0.13	0.11	0.16
Crop characteristics					
Shade cover < 25%, 25-50%, 50-75%	0.32***, 0.75*, 0.22*	0.19, 0.68, 0.13	0.30*, 0.53**, 0.16	0.13, 0.75*, 0.12	0.20, 0.65, 0.14
Tree age 5-8 years, > 8, < 5	0.2, 0.24***, 0.46	0.29, 0.12, 0.51	0.24, 0.30***, 0.41**	0.19, 0.13, 0.63	0.24, 0.12, 0.55
Shade native species	0.62***	0.57***	0.62***	0.40	0.35
Tree strata	0.68	0.73	0.76	0.78	0.66
Soil erosion	0.22***	0.51	0.39**	0.51	0.53
Crop density	0.57	0.62	0.67**	0.45	0.53
Crop healthiness	0.65*				
Presence of 1 or + plagues	0.56	0.53*	0.45***	0.71	0.64

Summary statistics	Fairtrade (n=95)	UTZ (n=94)	RA (n=76)	4C (n=135)	Controls (n=259)
Household income and poverty					
Coffee gross margins per farm (in lempiras)	60,611.57	131,313.7*	355,378.7***		
Coffee gross margins per hectare (in lempiras)	17,251.52	35,561.68***	48,049.55***	21,865.81	23,188.15
Household income (in lempiras)	136,625.00	220,391*	624,417.4***	161,973.50	171,585.10
Share of income from Coffee	0.85**	0.94	0.88	0.96**	0.91
Poverty Probability Index (PPI)	53.15*	52.11	62.91***	51.48	50.60
Total below the national poverty line	57%	57%	38%	57%	57%

Notes. T-test results. ***p < 0.01; **p < 0.05; *p < 0.1.

6.3. Costa Rica

Table 10 shows descriptive statistics of sampled farmers disaggregated by certification. As is showcased, certification groups and controls differ in certain household characteristics. Non-certified farmers, for instance, have a higher share of female household heads. Fairtrade only farmers display lower levels of education, and all certification groups show higher tenure security than the controls. As for farm characteristics, Rainforest Alliance farmers display a larger farm area, higher Coffee production and yields than the other certification groups and controls. Fairtrade only farms are located at a lower altitude, on average, and their Coffee production is also smaller than the other groups. However, they report growing other crops at higher rates and are less dependent on Coffee for their livelihoods. As for crop characteristics, Fairtrade only farmers display a larger number of farms with less than 25% of shade, while most of the Rainforest Alliance farmers have 25 to 50% of shade in their Coffee plantations. Non-certified farmers, however, presented the largest share of farms with 50 to 75% of shade cover. Tree age is correlated with farm productivity, and specifically in Costa Rica it is common to find Coffee plants older than 20 years, causing a steep decrease in yields (ICAFE, n.d.-c). While there are no significant differences in terms of farms with older Coffee plants, Fairtrade only farmers have a higher rate of farmers reporting to have younger Coffee plants (< 5 years), which also correlates with lower productivity levels. Where appropriate, these different attributes are included as controls in the PSM and OLS regression. The data also shows that Fairtrade only farmers have lower margins per farm and household income.

Table 10. Descriptive statistics per certification in Costa Rica

Summary statistics	Fairtrade (n=94)	CAFE (n=118)	RA (n=152)	Controls (n=139)
Household characteristics				
Female household head (dummy)	0.13***	0.13***	0.14***	0.33
Age of household head (years)	58.46	53.88	56.10	56.34
Years of schooling of household head	6.98***	8.21*	9.28	9.15
Household size (number of people)	5.44	5.52	5.42	5.24
Full tenure (dummy)	0.91***	0.98***	0.97***	0.78
Distance to market (minutes)	13.57***	14.53***	16.13**	19.08
Farm characteristics				
Total farm area (hectares)	6.07	6.36	10.64**	6.65
Coffee area (hectares)	4.32	4.45	6.50	5.57
Farm altitude (m)	998.36***	1,401.17***	1,509.74**	1,607.67
Coffee production 2015 in # of fanegas (a)	99.24***	139.00*	218.99	180.38
Productivity 2015 (yields per hectare, in fanegas)	28.77	37.21**	43.18***	32.43
Grows other crops (dummy)	0.79***	0.67***	0.61***	0.41
Crop characteristics				
Shade cover < 25%, 25-50%, 50-75%	0.28**, 0.48, 0.24	0.19, 0.70, 0.10***	0.13, 0.69**, 0.16**	0.15, 0.57, 0.25
Tree age > 20, < 5	0.19, 0.18**	0.24, 0.05	0.17, 0.09	0.19, 0.08
Shade native species	0.83***	0.68	0.58	0.67
Soil erosion	0.60***	0.66***	0.62	0.42
Crop healthiness	0.67***	0.63***	0.64	0.85
Household income and poverty				
Coffee gross margins per farm (in CRC)	1,939,584.00***	4,332,555.00	6,287,899.00	5,610,241.00
Coffee gross margins per hectare (in CRC)	413,921.50***	1,120,848.00	1,511,721.00	1,089,474.00
Household income (in CRC)	9,707,094.00**	13,300,000.00	19,400,000.00	15,300,000.00
Share of income from Coffee	0.74***	0.81	0.82	0.87

Notes. T-test results. ***p < 0.01; **p < 0.05; *p < 0.1. (a) 1 fanega = 258 kg of Coffee cherries

The different cooperatives analyzed also have some distinguishing characteristics. Three of the cooperatives would be considered “medium” sized based on their number of members (800-1,400) and the remaining two would be “large” (> 1,400) based on Snider et al. (2017) categorization of Coffee cooperatives in Costa Rica. Producers from the two cooperatives in Los Santos grow Coffee at much higher elevation than Coffee farmers in the West Valley cooperatives (see Table 11). In terms of individual certifications, the cooperatives in Los Santos certify less members as compared to cooperatives in the West Valley. Moreover, cooperatives 4 and 5 have a strong emphasis in quality, demonstrated in their microlot programs. Likewise, cooperative 7, the non-certified cooperative in the West Valley, has also a microlot program.

In cooperative 4, 60 members of the cooperative have microprocessing plants. Cooperative 5 has its own carbon-neutral certification. Cooperative 6 has its own label as well, and is also part of the Nespresso AAA cluster, implemented by Volcafe. In cooperative 7, 40% of producer members are women, and they use clean energy in the processing of Coffee due to their hydropower plant. Cooperative 8 offers credit (in cash and in agricultural inputs), subsidies, and offers English and computer classes in the facilities of the cooperative through an agreement with a learning institute.

Table 11. Characteristics of case study cooperatives in Costa Rica

	Region	# of members	Average altitude	Collective certification	Individual Certification
Cooperative 4	Los Santos	5,000	> 1,600 m.a.s.l.	Fairtrade, C.A.F.E.	Rainforest Alliance
Cooperative 5	Los Santos	900	> 1,600 m.a.s.l.	None	C.A.F.E., Rainforest Alliance
Cooperative 6	West Valley	1,296	> 1,200 m.a.s.l.	Fairtrade	C.A.F.E., Rainforest Alliance, Nespresso AAA
Cooperative 7	West Valley	2,338	< 1,200 m.a.s.l.	None	None
Cooperative 8	West Valley	1,300	< 1,200 m.a.s.l.	Fairtrade	C.A.F.E.

Source: author's elaboration

7. Economic impact of Coffee certifications

In this section I display the results of the economic impact of certifications. First, the analysis per country is presented, and then a comparison across countries is made. As mentioned in section 6.3., the main economic outcomes considered are: i) Coffee gross profits, ii) household income, and iii) probability of living under the poverty line.

For key indicators, a bar graph is constructed to graphically display the amount of the effect of each certification. The interpretation of the graphs is as follows. The different colored bars show the mean for the variable analyzed, for every certification. In the graphs where the Average Treatment Effect on the Treated (ATET) is shown, it means the effect of the certification, when compared to the controls, is statistically significant (the asterisk follow the convention of ***p < 0.01; **p < 0.05; *p < 0.1). A positive effect is symbolized with a blue arrow, and a negative effect with a red arrow. If the graph does not show "ATET", only the mean for the analyzed indicator is shown for each certification. In this case, the average gives an estimate of how the group is performing, but the fact that the results are not statistically significant indicates that there are observable factors that I am controlling for in the model that explain the reported differences.

7.1. Colombia

As previously mentioned, for the specific case of Colombia, the data allowed to conduct a two-step analysis of the effects of certifications. In the first step, the full sample from both cooperatives was used to compare the effects of each certification against the pool of controls. In the second step, I conduct a microanalysis of the impact of certifications within each cooperative (Cooperatives 1 and 2). The results for the complete sample are displayed in Table 12, and the within cooperative analysis is shown in Tables 13 and 14. Fairtrade results are displayed in Appendix F.

Table 12. Economic impact Colombian certified farmers vs. controls in 1,000s COP (2015)

Economic impact variables	C.A.F.E. Practices (n=81)		AAA (n=141)		4C (n=78)		RA/AAA (n=79)		C (n=237)
	OLS	PSM	OLS	PSM	OLS	PSM	OLS	PSM	Mean
Income indicators									
Coffee sales revenue per farm	(1,043.95)	(827.72)	9,600.77*** (3,214.69)	-8,437.94*** (2,656.38)	98.42	(296.72)	(3,334.58)	(3,733.39)	26,422.94
Coffee sales revenue per hectare	599.13	215.25	(778.40)	(634.23)	796.20	184.74	(302.38)	(194.93)	8,587.19
Coffee gross profit per farm	856.62	300.49	(3,417.86)	(2,696.52)	1,678.68	(614.41)	75.02	542.32	7,942.58
Coffee gross profit per hectare	830.40	623.95	(179.35)	(234.28)	664.14	(66.60)	105.15	53.86	2,231.50
Coffee gross profit per carga (a)	26.27	70.62	(5.44)	12.28	62.80	9.40	65.73	50.36	6.96
Other income per farm	1,419.71* (771.51)	(1,618.94)	(764.89)	(919.14)	(551.91)	(1,053.63)	(386.92)	(66.27)	2,146.71
Household income	(2,463.68)	(2,446.65)	-10,365.66*** (3,374.55)	-9,357.06*** (2,951.27)	(1,418.59)	(453.46)	(3,721.47)	(3,799.65)	28,569.64
Social outcomes									
Reported savings (dummy)	-0.002	0	-0.01	0.04	0.015	-.02	0.04	0.03	0.147
Reported food shortage	0.01	0.01	0.02	0.03	0.10*** (0.04)	0.1*** (0.03)	0.01	0.01	0.004
PPI	-1.01	-1.57	-1.55* (0.81)	-1.61* (0.94)	0.02	0.04	0.25	1.08	45.52

Table 13. Economic impact Cooperative 1 Colombian certified farmers vs. controls in 1,000s COP (2015)

Economic impact variables	**C.A.F.E. Practices (n=46)**		**Nespresso AAA (n=100)**		**Rainforest/AAA (n=79)**		**C (n=94)**
	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Income indicators							
Coffee sales revenue per farm	29,695.15	3,335.32	11,770.17	-7,868.89** (3,123.51)	21,330.22	325.18	22,740.24
Coffee sales revenue per hectare	8,027.91	605.26	6,846.45	-237.61	7,644.88	1,183.08* (713.16)	7,395.95
Coffee gross margins per farm	8,639.31	4,681.95	1,886.54	-3,348.99* (1,983.16)	6,618.30	3,856.58	4,242.60
Coffee gross margins per hectare	2,030.15	400.86	1,455.74	-63.63	1,982.34	1,446.61** (715.00)	1,502.12
Coffee gross margins per carga (a)	-41.72	-68.72	-9.53	-4.40	42.87	149.99** (68.35)	-45.36
Other income per farm	2,900.35	-3,455.99	779.72	-394.39	1,012.36	-686.40	3,043.10
Household income	32,595.51	-120.66	12,549.89	-8,947.15*** (3,317.27)	22,342.58	-361.21	25,783.34
Social outcomes							
Reported savings (dummy)	0.15	-0.08	0.09	0.03	0.17	0.03	0.14
Reported food shortage during the year	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Poverty Probability Index (PPI)	46.67	-1.37	41.03	-3.62** (1.50)	45.17	-0.76	45.22

Table 14. Economic impact Cooperative 2 Colombian certified farmers vs. controls in 1,000s COP (2015)

Economic impact variables	C.A.F.E. Practices (n=35)		Nespresso AAA/4C (n=41)		4C (n=74)		C (n=143)
	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Income indicators							
Coffee sales revenue per farm	23,163.20	3,344.57	24,538.51	-4,399.57	24,021.77	1,158.34	28,843.73
Coffee sales revenue per hectare	9,745.56	1,289.44	10,199.43	-808.55	9,591.06	197.86	9,370.24
Coffee gross margins per farm	8,294.57	2,600.94	11,118.71	-1,805.57	9,466.19	2,044.24	10,374.74
Coffee gross margins per hectare	3,478.01	1,768.38	4,526.08	-901.65	3,358.88	461.36	2,710.95
Coffee gross margins per carga (a)	130.79	169.59	232.38	0.60	134.75	68.45	41.36
Other income per farm	34.28	-921.44** (413.27)	1,931.71	456.00	1,731.24	-1,819.01* (1,084.22)	1,557.48
Household income	23,197.47	337.39	26,470.22	-2,219.24	25,753.01	-3,048.35	30,401.23
Social outcomes							
Reported savings (dummy)	0.11	-0.16	0.27	-0.23	0.16	-0.12	0.15
Reported food shortage during the year	0.03	0.03	0.15	0.15*** (0.05)	0.11	0.01	0.01
Poverty Probability Index (PPI)	43.34	-2.21	48.45	-1.42	46.57	-1.72	45.71

In Colombia, the disaggregated analysis of VSS shows significant negative effects for Nespresso AAA farmers: these producers display lower Coffee revenue and household income, as well as a higher probability of living under the poverty line (see Table 12). The size of the negative impact in household income for Nespresso AAA farmers is quite large, as shown in Figure 6. In US Dollars, it would be the equivalent of making USD 3,422 less per year than their Fairtrade paired matches. This certification holders also have, on average, the lowest household income of all the analyzed certifications. Furthermore, as depicted in Figure 5, Nespresso AAA farmers make, on average, much lower profits per farm than farmers holding other certifications, as well as the Fairtrade controls. These results were not replicated within Cooperative 2, though, where the indicators analyzed were non-significant (see Table 14).

Figure 5. Coffee gross profit per farm in Colombia (in 1,000s COP)

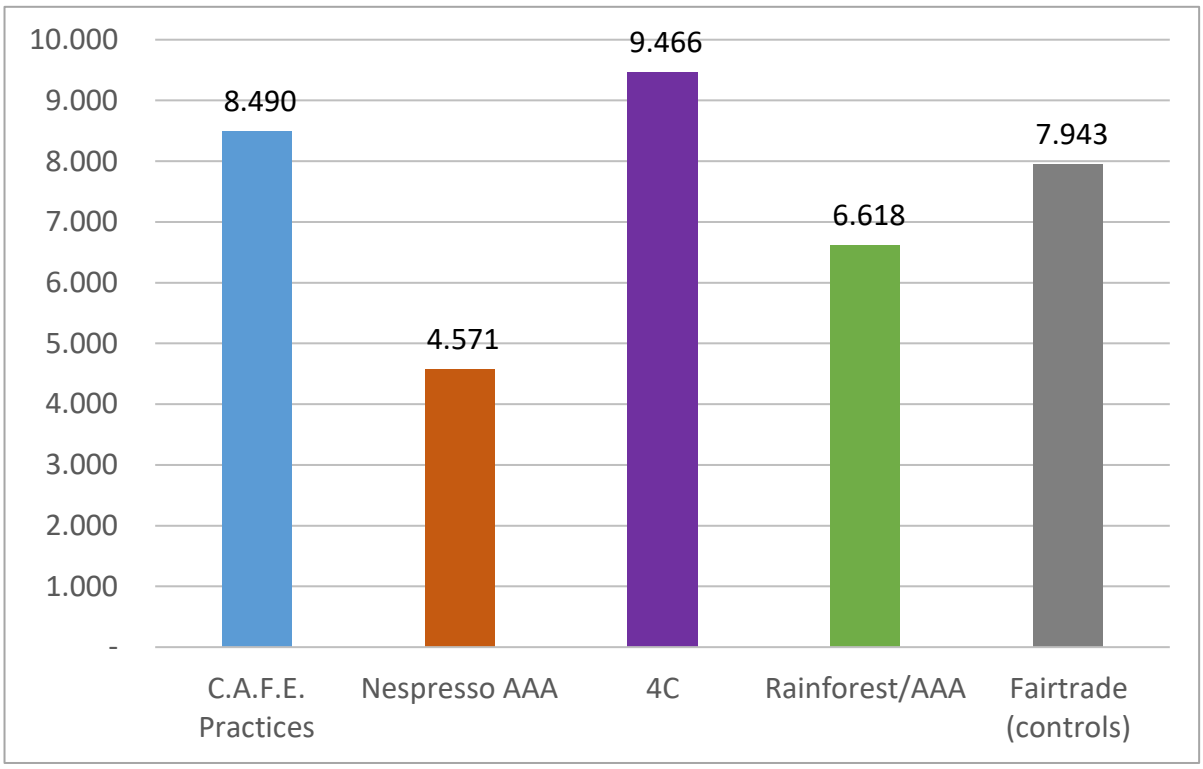
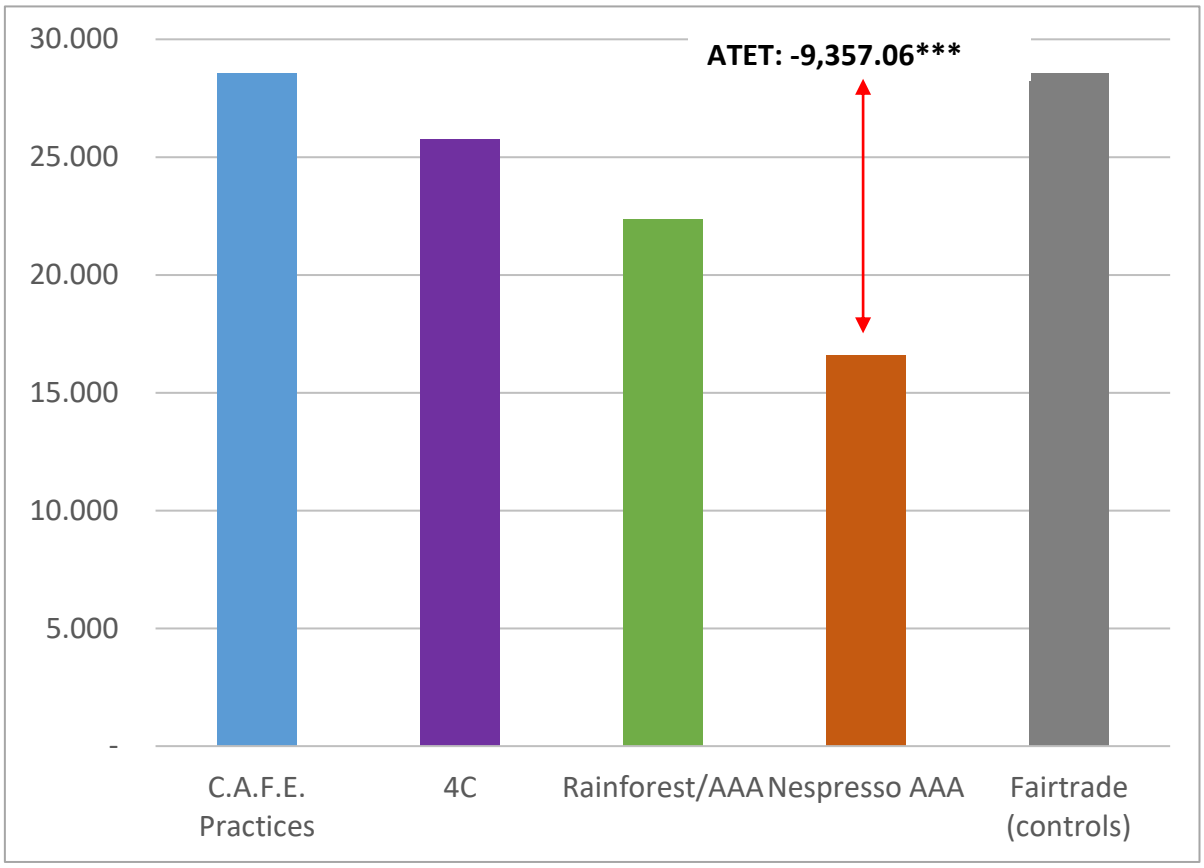


Figure 6. Household income in Colombian farmers (in 1,000s COP)



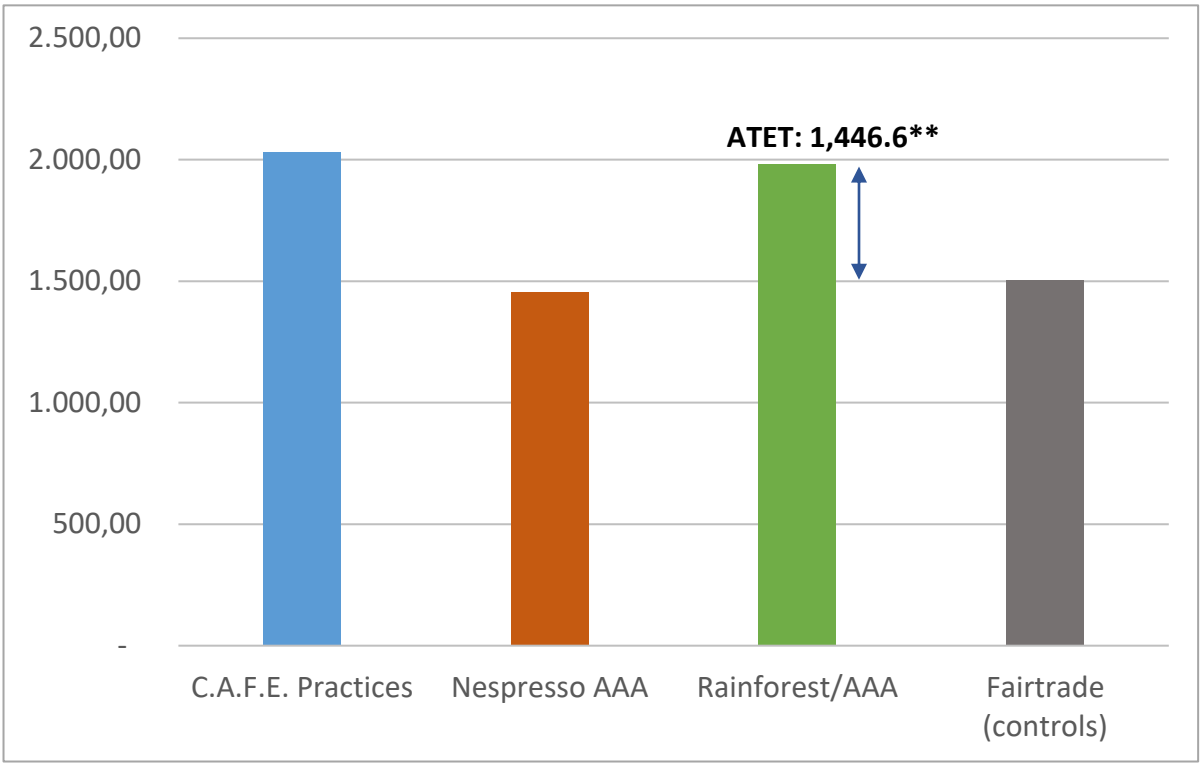
Other industry-oriented standards such as Starbucks C.A.F.E. Practices and 4C Association have non-significant effects on the studied economic outcomes (see Table 12). While they do have, on average, higher profits than the controls, the Propensity Score Matching results point to the fact that there are observable differences that explain these outcomes. Furthermore, for both of these standards there is indication that holding the certification leads to lower additional income from other sources (in the case of 4C Association, this result is found only within Cooperative 2 – see Table 14), and 4C Association farmers also exhibited higher rates of self-reported food shortage than their counterparts.

The NGO-led standards Rainforest Alliance/ Nespresso AAA and Fairtrade perform better than private labels and industry-oriented labels in Colombia. Within Cooperative 1, Rainforest Alliance/ Nespresso AAA certification holders have significantly higher Coffee revenue and gross profits per hectare than their controls (see Table 13). As depicted in Figure 7, the size of the effect is quite relevant, and would amount to making US 529 dollars more in profit than the Fairtrade controls. Given the average Coffee area for Rainforest Alliance/ Nespresso AAA farmers in Colombia (see Table 8), it would be equivalent of making US 1,400 dollars more in profits per year. Considering that the minimum salary

in Colombia in year 2015 was around US 3,030 dollars, such an increase in income is substantial.

Fairtrade-certified farmers in Colombia also displayed higher revenues than non-certified farmers. However, this failed to translate into increased profits. In fact, these farmers have a lower gross profit per unit of Coffee sold. In terms of social outcomes, the evidence points to the fact that Fairtrade is delivering on its proposed goals. These farmers report having savings at higher rates than their counterparts, experienced less food shortage than non-certified farmers and had a lower probability of living under the poverty line (see Appendix F).

Figure 7. Gross profit per hectare Cooperative 1 in Colombia (in 1,000s COP)



7.2. Honduras

In Honduras, Rainforest Alliance had a positive and significant effect in smallholder's economy, as depicted in Table 15. These certified farmers had higher revenues per farm than their non-certified controls, as well as a much higher household income. The regression analysis (OLS) also indicated a positive effect in gross profits per farm and per hectare.

Table 15. Economic impact Honduran certified farmers vs. controls in HNL (2015/2016)

Economic impact variables	**Fairtrade (n=95)**		**UTZ (n=94)**		**RA (n=76)**		**4C (n=135)**		**C (n=259)**
	OLS	PSM	OLS	PSM	OLS	PSM	OLS	PSM	Mean
Income indicators									
Coffee sales revenue per farm	-29,344.63	-5,980.17	-32,180.72	25,276.27	147,864.7*** (49,275.44)	97,037.37** (45,023.47)	-14,722.32	-3,992.51	162,966.30
Coffee sales revenue per hectare	-3,378.90	747.84	-69.98	2,457.96	22,752.98*** (7,279.78)	16,968.97	-1,132.45	-1,705.65	45,387.40
Coffee gross profit per farm	-3,257.64	-9,507.92	-12,272.54	-727.41	111,340.8*** (37,619.39)	74,051.53	-19,695.95	-16,663.76	91,060.08
Coffee gross profit per ha	4,321.02	-696.87	2,795.53	783.34	15,318.98** (6,820.53)	7,946.95	-4,699.79	-4,568.23	23,188.15
Coffee gross profit per qq (a)	355.73** (170.28)	-12.77	107.68	-16.63	8.80	(87.26)	-130.76	-113.79	745.84
Additional income	2,886.96	22,585.91*** (6,160.95)	-1,086.61	2,456.16	6,423.49	53,912.34* (30,779.48)	-4,617.93** (2,175.04)	-4,508.78	8,648.70
Household income	-26,573.17	16,583.01	-33,115.75	20,440.47	152,929.9*** (49,313.03)	111,454.4** (45,927)	-19,665.8	-8,994.69	171,585.10
Social outcomes									
Reported savings (dummy)	-0.17	0.32*** (0.06)	-0.42	-0.03	0.34	0.18* (0.1)	-0.46	-0.01	0.27
Reported food shortage	0.43	0.09	0.08	-0.07	-0.70	-0.09	-0.24	-0.01	0.47
Progress out of Poverty Index (PPI)	-2.47	1.40	0.17	0.96	6.55*** (2.03)	11.41*** (2.36)	-0.10	1.80	50.60

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 quintal = 46 kg.

To get an idea of the amount of the effect of this certification in the Honduran sampled farmers, I present Figures 8, 9, and 10. Figure 8 shows that, on average, these certified farmers almost quadruple the gross profits of non-certified farmers. However, this could just be a function of the Coffee area, given that these farmers have on average an area under Coffee that is almost 2.5 times larger than their non-certified controls. A more accurate/robust measure of profits is gross profits per hectare, given that it allows for a comparison under similar terms. As shown in Figure 9, holding the Rainforest Alliance certification is associated with the equivalent of US 682 dollars more in annual profits per hectare than the non-certified farmers. Considering that the average gross profit per hectare for non-certified farmers is around US 1,030 dollars, holding the Rainforest Alliance certification represents a 66% increase in gross profits per hectare.

Figure 8. Coffee gross profit per farm in Honduras (in Lempiras)

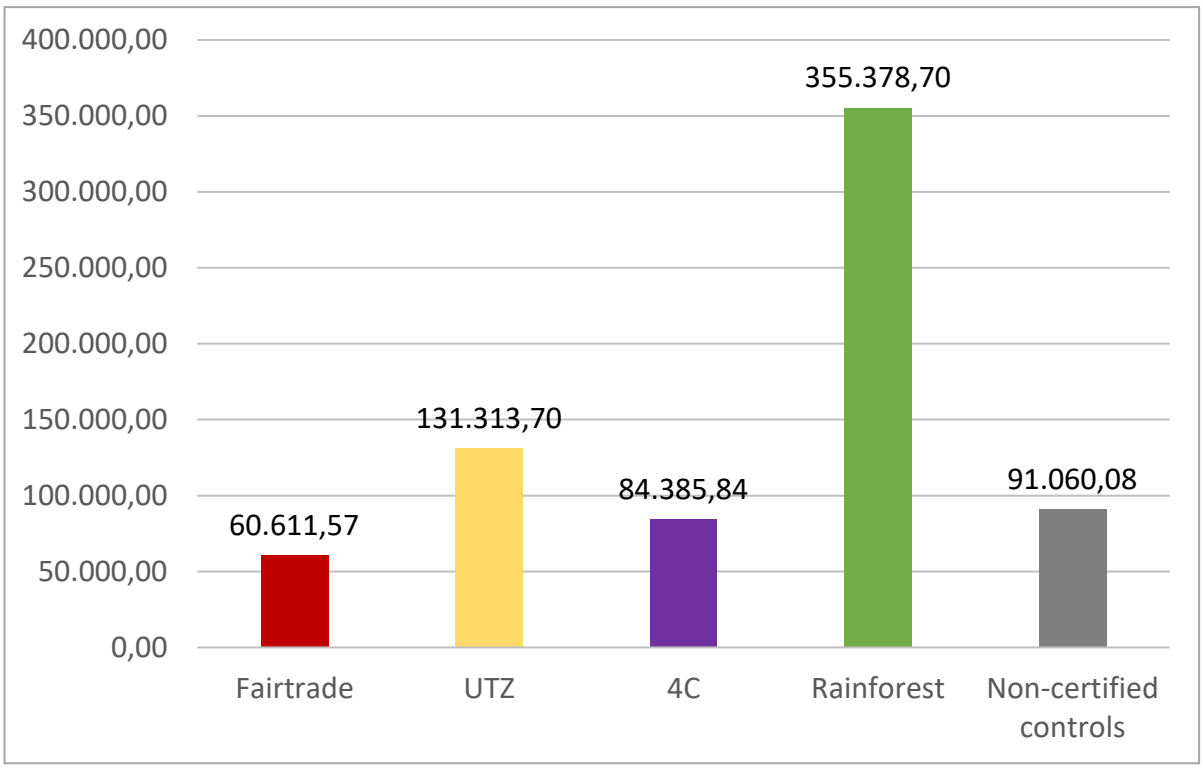


Figure 9. Coffee gross profit per hectare in Honduran farmers (in Lempiras)

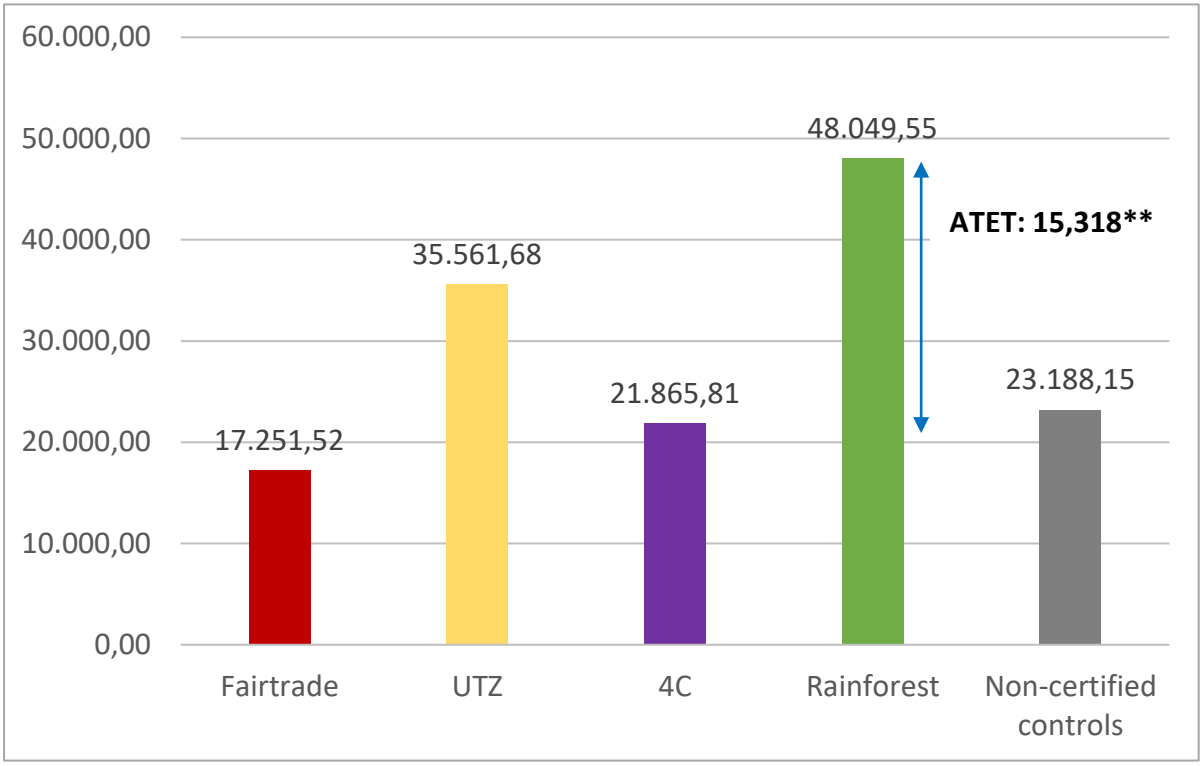
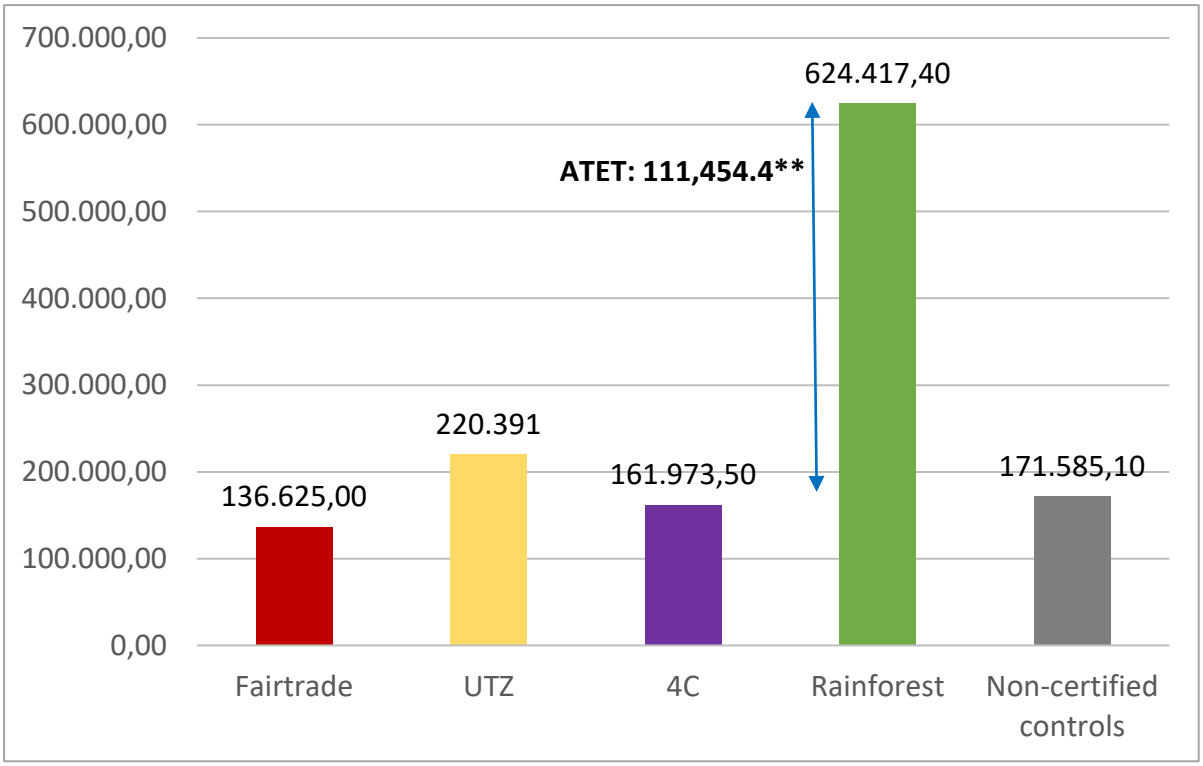


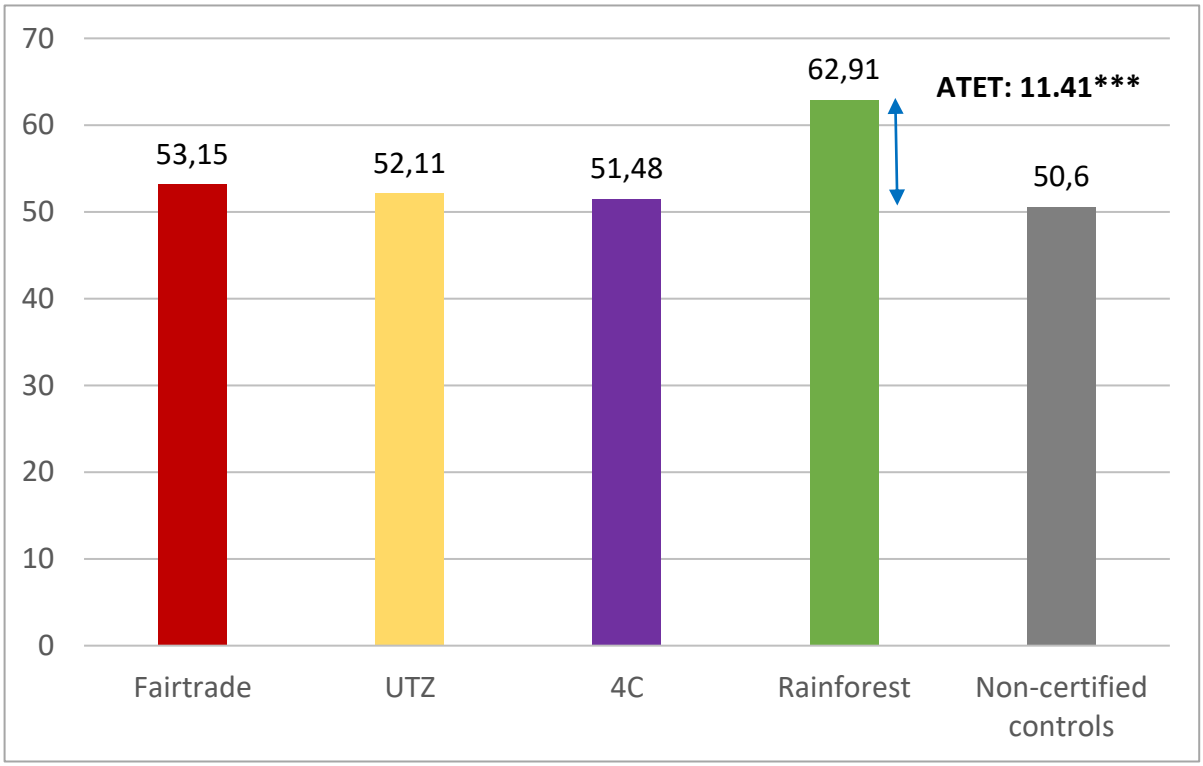
Figure 10 displays the effect of the Rainforest Alliance certification in household income, which is equivalent to making US 5,000 dollars more per year than non-certified paired controls.

Figure 10. Household income in Honduras (in Lempiras)



In addition, these farmers are more diversified than their paired controls: they had higher additional income from other sources besides Coffee. Also, in terms of the social outcomes, Rainforest Alliance farmers reported having savings at higher rates than their counterparts (18% increase), and they have a score 11.41 points higher than the non-certified controls in the Progress out of Poverty Index (refer to Table 15). When analyzed against the national poverty line, it signifies that Rainforest Alliance farmers have a 38% probability of living in poverty, compared to a 57% probability for the non-certified group (see Figure 11).

Figure 11. Poverty Probability Index results in Honduras



Fairtrade, UTZ and 4C certified farmers, on the other hand, do not appear to be in a good economic standing in Honduras. When considering only profits from Coffee, Fairtrade certified farmers are not even making the minimum salary established for agriculture. These farmers make, on average, an annual gross profit per farm of 60,611 HNL, which is equivalent to USD 2,698 dollars (see Figure 8). The minimum salary per person in Honduras is 68,172 HNL, or USD 3,035 dollars. Given that I measured income and profits at the household level, and Fairtrade households in Honduras have on average more than four members (see Table 9), it is safe to conclude that these farmers are cash constrained. In terms of gross profits per hectare, Fairtrade farmers perform the worst compared to the non-certified controls and the other certification groups. Fairtrade-certified farm-

ers have significantly higher income from other sources, though, pointing to a higher diversified production pattern. Nonetheless, their mean household income is the lowest of the non-certified and certified groups (see Figure 10).

UTZ certified farmers have, on average, higher profits (per hectare and per farm) and a greater household income than their non-certified controls (see Figures 8 & 9). However, given that these indicators are non-significant when conducting the Propensity Score Matching and OLS regression analysis, it is implied that there are observable differences that I am controlling for (for example farm size, age or education) that explain the changes in economic outcomes. If their income from Coffee is analyzed in detail, though, it shows that these farmers make, on average, USD 16 dollars a day, with which they sustain a family of approximately four members. While this does not fall under extreme poverty for International standards, it can be asserted that these farmers are barely getting by.

4C verified farmers had lower mean gross profits per farm and per hectare than their non-certified controls (see Figures 8 & 9). Their household income was also lower (see Figure 10). In general, the evidence points to the fact that holding the 4C label in Honduras does not make a positive difference in the smallholder's economy.

In terms of social outcomes in Honduras, Fairtrade farmers reported having savings at higher rates than their non-certified controls (32% more farmers reported having savings, see Table 15). 4C and UTZ standards did not seem to provide any additionality the analyzed social variables – namely savings, reported food shortage or poverty reduction (see Table 15). Fairtrade, UTZ and 4C farmers scored very similarly in the Progress out of Poverty Index, with Fairtrade farmers having slightly better scores (on average, see Figure 11). However, all three of these certified groups had a 57% probability of living under the national poverty line according to this index, which is consistent with their above-described economic situation (refer to Table 9).

7.3. Costa Rica

In Costa Rica, as shown in Table 16, the Rainforest Alliance positive results found in Colombia and Honduras are replicated. That is, they have significantly higher revenue from Coffee, higher gross profits per hectare than their paired matches, and on average make greater profits per farm than the non-certified controls and the other two certification groups. Rainforest Alliance certified

farmers made an additional 453,427 CRC in gross profits per hectare than the non-certified controls, or the equivalent of USD 848 dollars (see Figure 13). In other words, holding the Rainforest Alliance certification is associated with a 40% increase in gross profits per hectare.

Table 16. Economic impact Costa Rican certified farmers vs. controls in CRC (2015/2016)

Economic impact variables	**Fairtrade (n=94)**		**CAFE (n=118)**		**RA (n=152)**		**C (n=139)**
	OLS	PSM	OLS	PSM	OLS	PSM	Mean
Income indicators							
Coffee sales revenue per farm	-4,806,267.00*** (1,307,897)	-7,369,914.00	-1,848,901	-1,780,478.00	658,592.70	326,132.00	13,000,000.00
Coffee sales revenue per hectare	-574,393.6** (262,198.4)	-625,763.5* (375,704.2)	308,943.00	548,540.7* (287,035.3)	831,482*** (255,633.5)	894,028.6*** (251,839.1)	2,659,437.00
Coffee gross profit per farm	-3,007,027*** (734,936)	-4,114,884*** (1,557,984)	-1,121,166	-531,147.5	344,694.90	-55,116.31	5,610,241.00
Coffee gross profit per hectare	-585,938*** (203,223.2)	-803,444.3*** (264,128.7)	70,711.38	271,086.90	601,206.3*** (227,541.9)	453,427.2** (203,962.2)	1,089,474.00
Coffee gross profit per fanega (a)	-11,322.80	-21,590.91** (10,079.86)	17,031.52	23,452.63	19,261.39* (10,041.03)	4,579.72	16,359.33
Additional income	-59,006.62	389,478.30	-225,936	-1,249,322.00	-119,842.7	1,078,676* (589,702.3)	2,374,048.00
Household income	-4,865,273.00*** (1,847,874)	-6,980,435.00	-2,074,837	-3,029,800.00	538,750.10	1,404,808.00	15,300,000.00
Social outcomes							
Reported savings (dummy)	-0.43	-0.10	0.88*** (0.34)	0.23***	0.54* (0.30)	0.15** (0.07)	0.28
Reported food shortage	-0.00	-0.01	-0.99	-0.08	-0.50	-0.04	0.06
Wealth Index	0.30*** (0.11)	0.48*** (0.13)	0.37*** (0.1)	0.31** (0.12)	0.43*** (0.09)	0.54*** (0.11)	

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 fanega = 258 kg of Coffee cherries.

Figure 12. Coffee gross profit per farm in Costa Rica (in CRC)

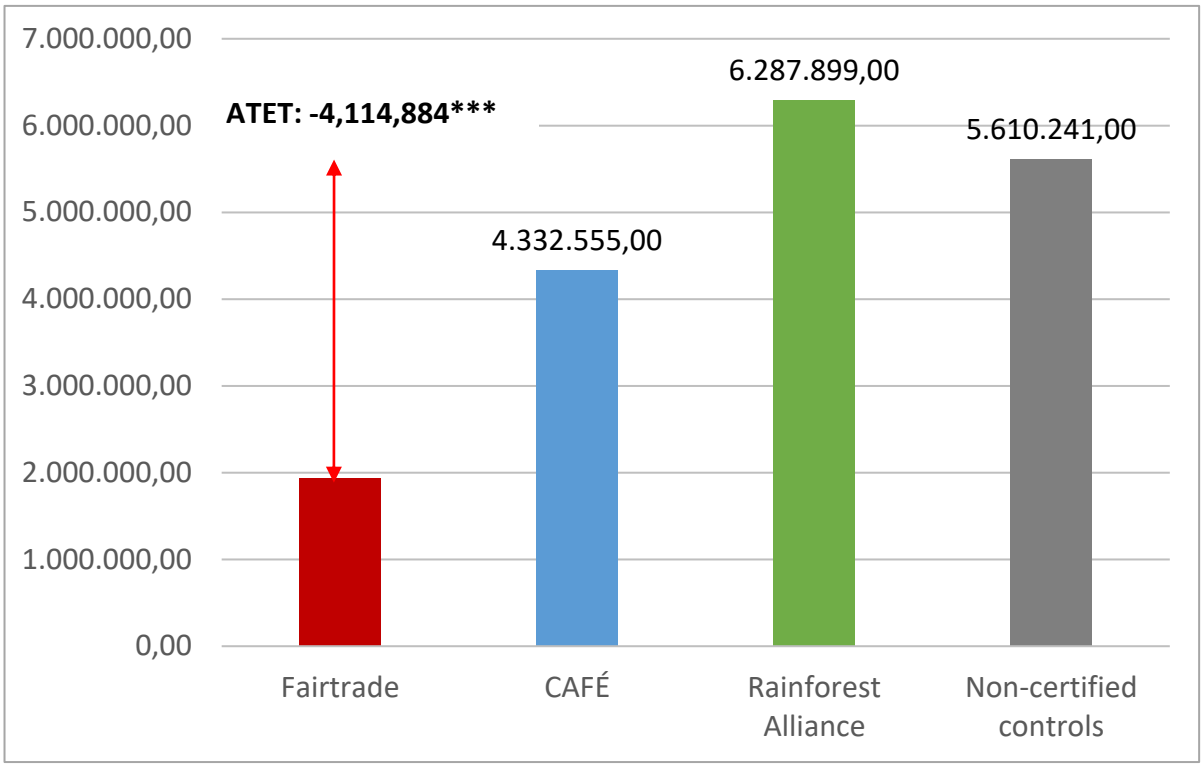
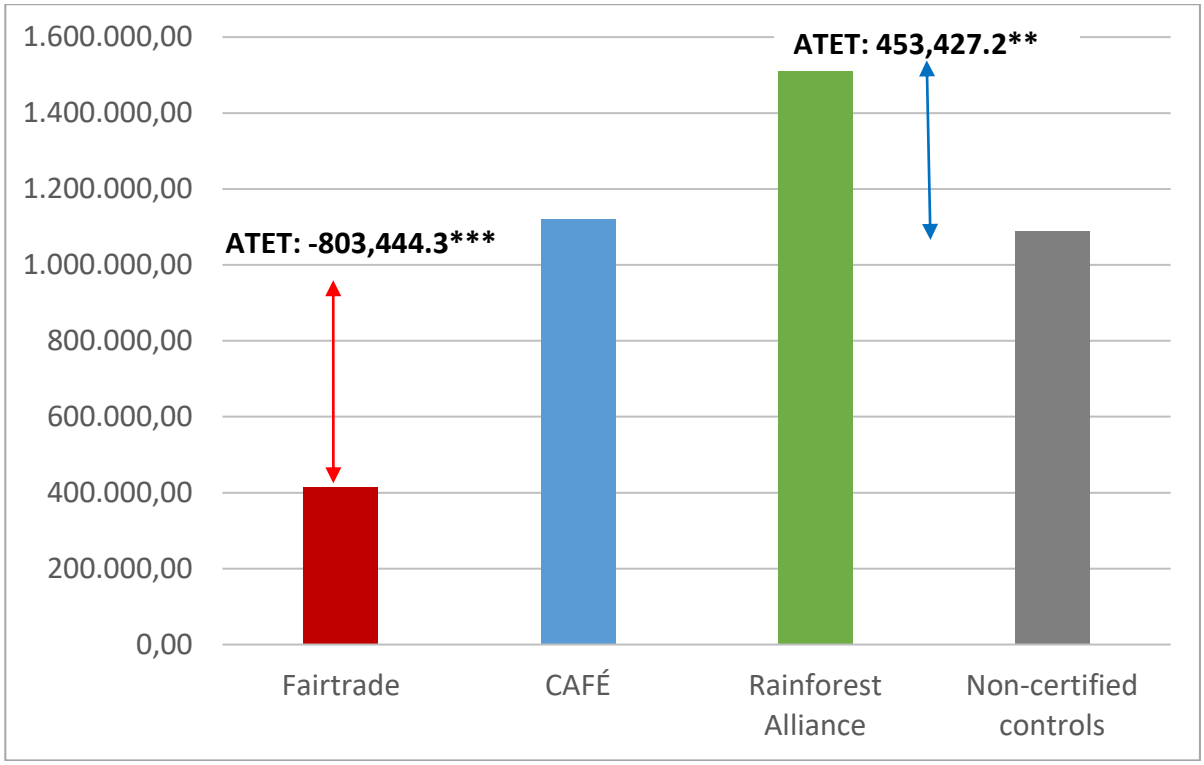


Figure 13. Coffee gross profit per hectare in Costa Rican farmers (in CRC)



Rainforest Alliance farmers also have higher household income on average, though this effect is non-significant (see Figure 14). These producers also display higher additional income from Coffee than their counterparts; an indication of a

more diversified production portfolio. This is corroborated when I analyze the percentage of income derived from Coffee. While Rainforest Alliance farmers are indeed more diversified than their non-certified counterparts, they are still highly dependent on Coffee for their livelihoods. As depicted in Figure 15, Rainforest Alliance farmers depend on Coffee for 82% of their income, while for non-certified controls it is 87%.

Figure 14. Household income in Costa Rican farmers (in CRC)

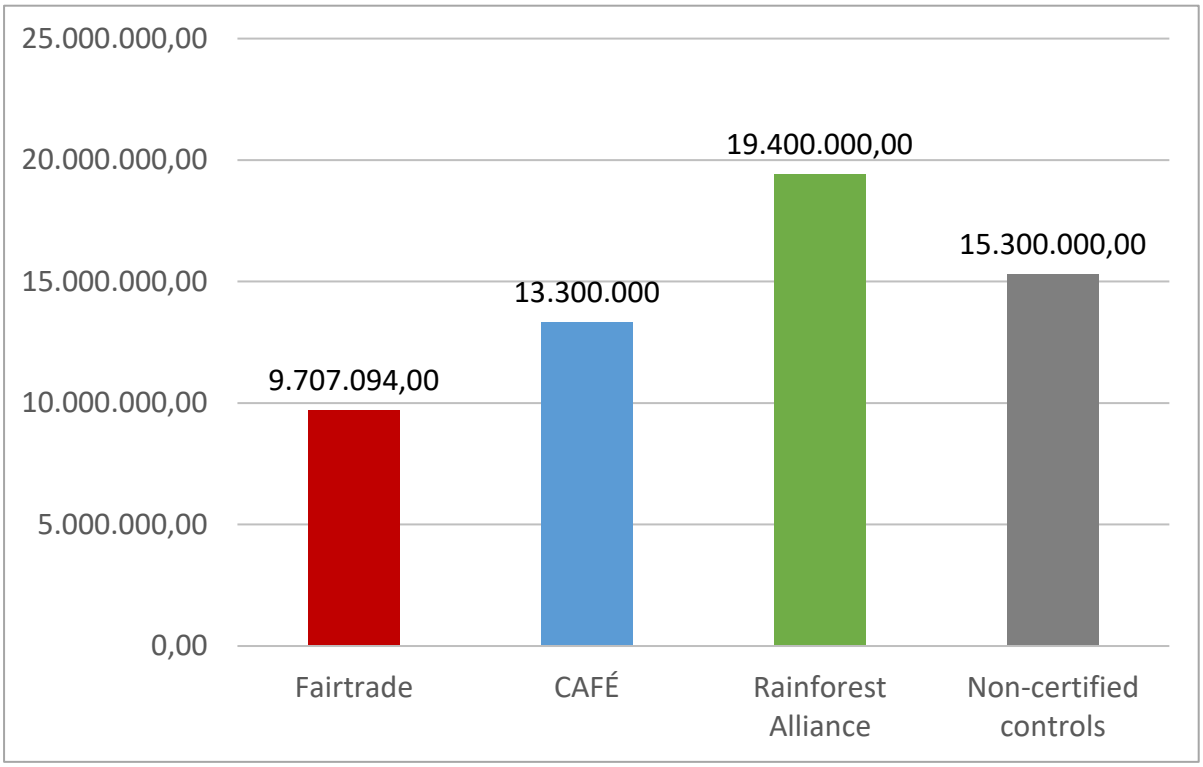
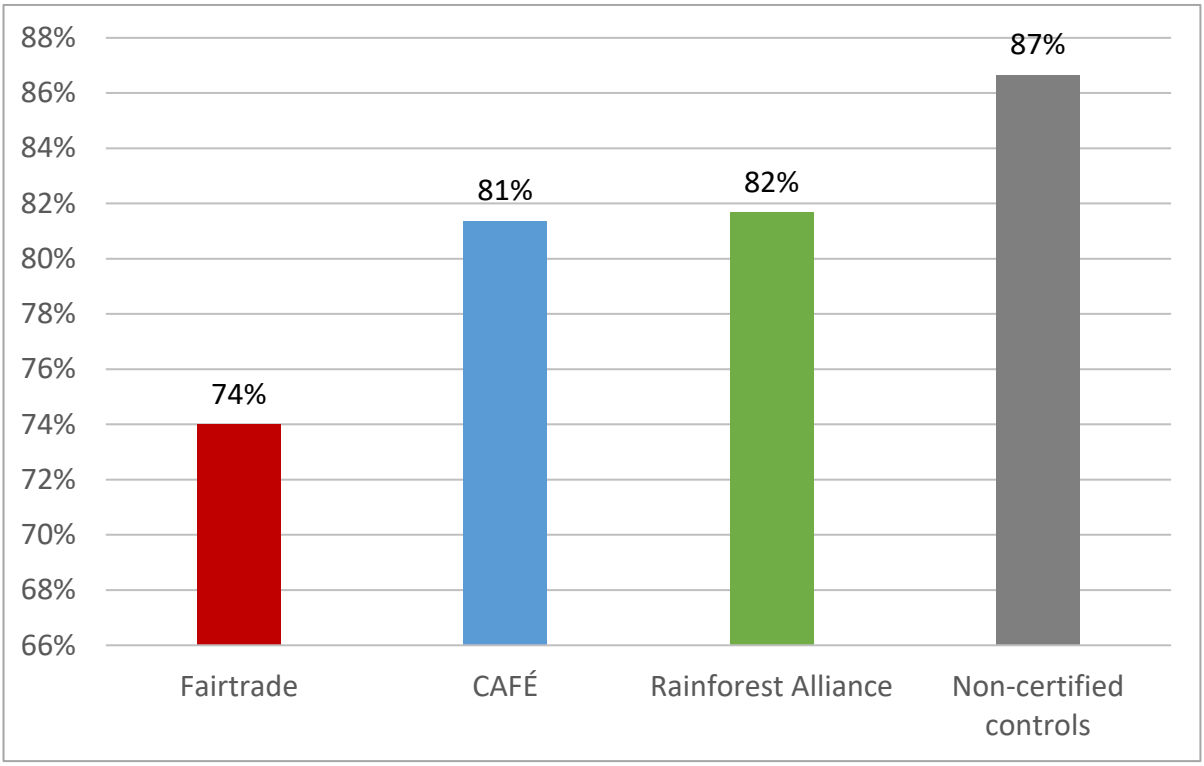


Figure 15. Percentage of income from Coffee in Costa Rican farmers



The data shows that Starbucks C.A.F.E. Practices farmers in Costa Rica have gross profits per farm and per hectare that are at similar levels than the non-certified controls. None of these indicators are significant, which suggests that holding this certification fails to provide additionality in terms of increased profits. As for household income, these farmers make, on average, 2 million CRC less per year than their matched controls, which is equivalent to USD 3,745 dollars (see Figure 14). This indicator is non-significant, though, which means there are observable factors explaining these differences.

The Fairtrade certification in Costa Rica is the lowest performing one in terms of economic indicators (see Table 16). These certified farmers earn a third of the gross profits per farm made by the non-certified farmers, or the equivalent of USD 7,696 dollars less profits per year (this indicator is statistically significant at a 99% confidence level). The difference in gross profits per hectare is similar: non-certified controls have gross profits per hectare that are 2.6 times higher than those of Fairtrade farmers (see Figures 12 & 13). Their mean household income is also much lower: Fairtrade farmers make around USD 10,500 dollars less than non-certified farmers. This, even though Fairtrade smallholders are the most diversified of all certified and non-certified groups, with 26% of their income coming from sources different than Coffee.

As for the social outcomes, a positive impact in savings is found for the Rainforest Alliance certification and the Starbucks C.A.F.E. Practices label. Holding the Rainforest Alliance certification is associated with a 15% increase in the rate of self-reported savings. These results are statistically significant with a confidence level of 95%. The Starbucks C.A.F.E. Practices certification is associated with an increase of 23% in the rate of self-reported savings. These results have a confidence level of 99% (see Table 16). None of the analyzed certifications had a significant impact on self-reported food shortage, but in general this was not an issue for the sample in Costa Rica, with only 6% reporting experiencing food shortage at all during the Coffee year 2015/2016.

In general, it is observed that Costa Rican Coffee producers have a better economic situation than Colombian and Honduran farmers. Non-certified producers in Costa Rica, for example, make the equivalent of USD 28,615 in household income (though the median is USD 14,501), while Honduran non-certified farmers make the equivalent of USD 7,639 dollars, and Colombian controls (Fairtrade only farmers) USD 10,500 per year (see Figures 6, 10 & 14). That is, Costa Rican farmers almost triple the household income of Colombian farmers, and nearly quadruple that of Honduran producers. This is a factor both of the level of development of the Coffee sector, as well as the living standards of each country.

7.4. Major takeaways

Overall, the disaggregated analysis of VSS shows positive and significant effects for the Rainforest Alliance certification: across the three countries, these producers display higher revenue; in Colombia and Costa Rica they display higher gross profits per hectare and in Honduras, these farmers have a higher household income than the non-certified farmers. Furthermore, both in Costa Rica and Honduras, Rainforest certified farmers display higher additional income than their counterparts, which points to a more diversified production portfolio. In terms of social outcomes, Rainforest Alliance farmers reported savings at higher rates than their counterparts, and in Honduras, these farmers have a higher score in the Progress out of Poverty Index, which signifies a lower probability of living under the poverty line. In sum, positive effects on smallholder's economic conditions are found for Rainforest Alliance certified farmers across the three countries.

Fairtrade is another NGO-led standard present in all three countries. The results for this certification are not as positive, though. While in Colombia they display

higher revenues, this does not translate into increased profits. In fact, both in Costa Rica and Colombia, the results indicate that Fairtrade farmers have a lower gross profit per unit of Coffee, and in Costa Rica, these farmers have lower gross profits per hectare than comparable non-certified farmers. On a more positive note, the evidence points to the fact that Fairtrade is delivering on its social goals. For instance, in all three countries, these farmers report having savings at higher rates than their counterparts. In Colombia, Fairtrade farmers experienced less food shortage than non-certified farmers and had a lower probability of living under the poverty line.

Moving on to more industry-oriented standards, it is observed that the effects of the 4C Association standard on the key economic indicators analyzed are non-significant. Moreover, in Colombia, there is an indication that holding this certification leads to lower additional income from Coffee, as well as higher food shortage than their controls. Similarly, the UTZ certification does not seem to result in any significant changes in the economy of smallholder farmers in Honduras, nor in the select social indicators.

As for the company-led standards Starbucks C.A.F.E. Practices and Nespresso AAA, the results fall far from what is expected based on their sustainability claims. For Starbucks C.A.F.E. Practices, while in Costa Rica this certification is associated with a positive effect in revenue per hectare, this fails to translate into higher profits. In Colombia, these certification holders had significantly lower additional income than their counterparts. The only positive result was found in their reported savings, but only for farmers in Costa Rica. Nespresso AAA farmers in Colombia (the only country where this certification was analyzed) have a significantly worse economic situation than their controls: these producers display lower Coffee revenue and household income, as well as a higher probability of living under the poverty line. Overall, I find ambivalent to negative effects of industry and company-led standards on smallholder economic conditions.

Part III: Empirical study: Impact Pathways

8. Pathways to economic improvements

In this chapter, I will examine which pathway variables may explain these outcomes. The results per country while be described, emphasizing the causal relations between these pathways and farm profitability; and finally, I analyze how each certification is performing in the mentioned pathways and relate it to their theories of change and the impact literature available.

8.1. Price premiums

This section will display the results of the analysis on the impact of sustainability standards on Coffee prices. First, the results for each of the countries analyzed will be described in full, and then the results will be analyzed in the light of the certification's theories of change. As depicted in Table 2, this indicator is constructed by multiplying the sales volume of each certification group times their specific Coffee prices and dividing it by the number of units sold. It is important to remark that I am only analyzing the premium that gets passed on to the producer. The cooperatives retain part of the premium to cover the costs of audits, implement social projects for members and manage their operation (Snider et al., 2017). The social projects can indeed have positive effects on the livelihoods of producers, but that is beyond the scope of this research.

8.1.1. Colombia

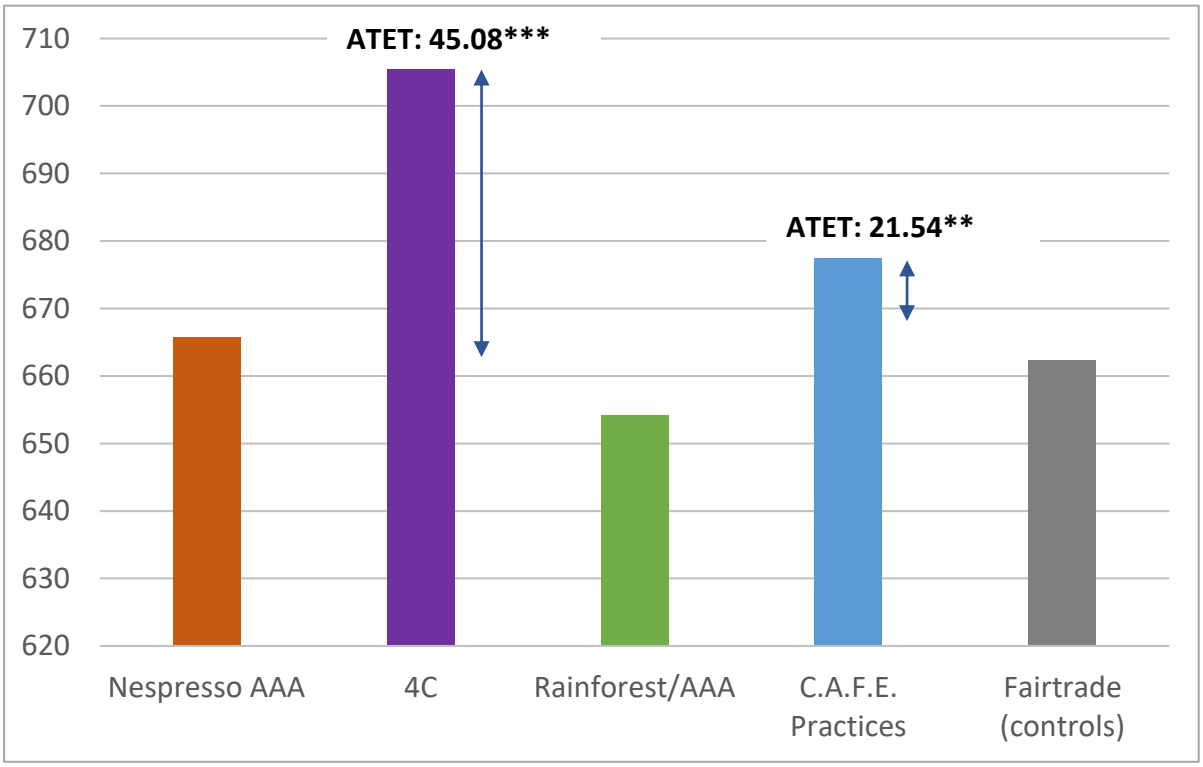
For the case of Colombia, Table 17 shows the effects of certifications in price premiums across for the full sample. This indicator is positive and significant only for Starbucks C.A.F.E. Practices and 4C Association. The statistically significant increases in prices for the 4C label are equivalent to USD 16.50 dollars per "carga" or 125 kg, compared to Fairtrade controls from both cooperatives. These results are significant at the 99% confidence level. The effects on the Starbucks C.A.F.E. Practices certification amount to USD 7.90 dollars per 125 kg of dry parchment sold. The amount of the effect is depicted in Figure 16.

Table 17. Impact pathways Colombian certified farmers vs. controls in 1,000s COP (2015)

Impact pathway variables	C.A.F.E. (n=81)		AAA (n=141)		4C (n=78)		RA/AAA (n=79)		C (n=237)
	Mean	ATET	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Price premiums									
Coffee sales revenue per carga (a)	677.46	21.54* (12.66)	665.73	18,563.86	705.47	45.08*** (10.72)	654.10	2.11	662.28
Productivity									
Production 2015	40.96	-0.96	22.56	-13.84** (4.38)	33.11	-2.88	31.86	-5.88	39.18
Yields per hectare (in kg)	1,635.46	(6.63)	1,438.02	(155.42)	1,625.35	-95.58	1,451.90	-20.95	1,604.12
Costs of production									
Cost of agricultural inputs per farm	3,950.00	(342,597.54)	2,454.18	-1,241.65** (545.41)	3,095.96	181,592.28	2,655.27	-1,439.28** (676.67)	3,922.52
Labor costs per farm	13,731.05	(1,028,968.24)	8,067.39	-4,428.97*** (1,570.38)	10,994.99	(164,368.08)	11,568.47	-1079.28	14,082.67
Others costs per farm	576.04	163,219.80	267.29	(68.60)	449.83	144,819.98	435.10	38.02	374.33
Production costs per farm	18,382.36	(1,128,212.44)	10,911.88	-5,741.43*** (2,137.17)	14,784.15	317,690.80	14,711.92	-4,275.70* (2,407.94)	18,480.36
Production costs per hectare	6,114.34	(408,705.66)	5,472.89	(399.98)	6,116.90	251,336.62	5,662.54	-91.00	6,355.69
Access to credit									
Received formal credit	0.54	0.15*	0.42	0.04	0.44	0.09	0.36	0.04	0.43
Received informal credit	0.17	-.01	0.14	0.02	0.24	0.01	0.13	-0.05	0.16

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 carga = 125 kg.

Figure 16. Price premiums per "carga" (125 kg) in Colombia, in 1,000s COP



In the analysis within cooperatives, Rainforest Alliance/ Nespresso AAA also displays a positive and significant impact in Cooperative 1, in addition to the positive effect found for Starbucks C.A.F.E. Practices in the full sample analysis. The positive impact of Rainforest Alliance/ Nespresso AAA is equivalent to USD 13.27 dollars per "carga"; and the effect of Starbucks C.A.F.E. Practices is associated with an additional USD 18.50 dollars for each 125 kg. Within Cooperative 2, only Nespresso AAA shows a positive effect, while for Starbucks C.A.F.E. Practices and 4C Association this indicator is non-significant (see Appendix D for cooperative-specific results). As for the Fairtrade certification, when these standard holders are compared to non-certified controls, I do not find a significant difference in Coffee prices. Overall, the results fall short of the expected benefits of Voluntary Sustainability Standards.

Here, I offer two potential explanations for these findings. First, holding a certification and implementing the sustainability practices required does not guarantee sales through a certification channel. Table 18 displays the market uptake of certified Coffee reported by our sample. On average, Nespresso AAA and Rainforest Alliance producers were able to sell about half of their certified production

as such[6]. Starbucks C.A.F.E. Practices and 4C labels had a much lower uptake, especially in Cooperative 2. In this cooperative, producers holding the Starbucks C.A.F.E. Practices certification were only able to sell 15% of their certified production through this marketing channel, and 4C farmers sold 22% of their verified production as such. The remainder of their certified production was sold either as Fairtrade (the baseline standard), conventional or low-quality Coffee.

Table 18. Market uptake of certified Coffee in Colombia

Certifications	All	Coop 1	Coop 2
C.A.F.E. Practices	26.2%	35.1%	14.6%
Nespresso AAA	52.1%	47.2%	64.1%
Rainforest Alliance	50.6%	50.6%	--
4C	22.1%	--	22.1%
Fairtrade	56.4%	57.8%	55.4%

Note. Data reported by sampled certified producers. The values represent the percentage of certified Coffee production sold through each certification channel.

In Cooperative 1, while producers managed to sell a higher share of their certified production through these marketing channels, they sold most of the remaining production as low-quality Coffee, which has a value 25% lower than that of the conventional Coffee price. For example, Starbucks C.A.F.E. Practices farmers in Cooperative 1 reported to have sold 41.1% of their production as low quality, and Nespresso AAA producers sold 47.6% of their Coffee at a discounted price. Rainforest Alliance/ Nespresso AAA were on a similar situation, selling 38.8% of their Coffee as low-quality Coffee. This was not the case for Cooperative 2, which sold a much lower share of Coffee at discounted prices; from 10% to 14% depending on the certification.

As it has been mentioned in the context section, during the Coffee year analyzed (2015), Colombia suffered the effects of the El Nino phenomenon, which affects weather patterns. The extensionists in Cooperative 1, for instance, reported an increase in the number of sunny days, which led to an augmentation of the share of defected Coffee produced. Given that Colombia has different microclimates, even though Cooperative 1 and Cooperative 2 were part of the same Coffee region and their distance was about 50 km (in a straight line), it could have been

[6] For the 'Rainforest Alliance' category, I added the sales made as double-certification coffee (Rainforest Alliance/ Nespresso AAA) to the sales made only as Rainforest Alliance certified, which did not meet the Nespresso AAA quality standard. Nespresso AAA requires that less than 2% of coffee per batch is affected by the coffee berry borer (CBB) pest, while Rainforest Alliance has a requirement of less than 4.5% of CBB.

the case that a weather shock affected only Cooperative 1. An alternative explanation is that considering that Cooperative 2 is more advanced in terms of Coffee processing, they could have withstood this shock better, by implementing improved farming practices.

The second part of the explanation is that the prices for conventional and certified Coffee vary across cooperatives[7]. Table 19 displays the average prices for conventional, Fairtrade and further differentiated Coffee, as well as the percentage of conventional prices that the premiums represent for each cooperative. The base price for Coffee in Cooperative 2 was 8% higher than the price in Cooperative 1. For this reason, the additionality of price premiums for the former cooperative is much smaller. Within Cooperative 1, however, the price premiums received by Starbucks C.A.F.E. Practices and Rainforest Alliance/ Nespresso AAA do translate into significantly higher average prices received for their Coffee than their pairs.

Table 19. Average prices for parchment Coffee (USD) per quintal for year 2015 in Colombia

Type of Coffee	Coop 1	Premium as % of market price	Coop 2	Premium as % of market price
Conventional	90.07		97.35	
Fairtrade	99.47	10.4%	97.91	0.6%
Rainforest Alliance/AAA	104.60	16.1%	--	--
C.A.F.E. Practices	104.96	16.5%	98.76	1.4%
Nespresso AAA	102.65	14.0%	104.08	7.0%
4C	--	--	99.07	1.8%

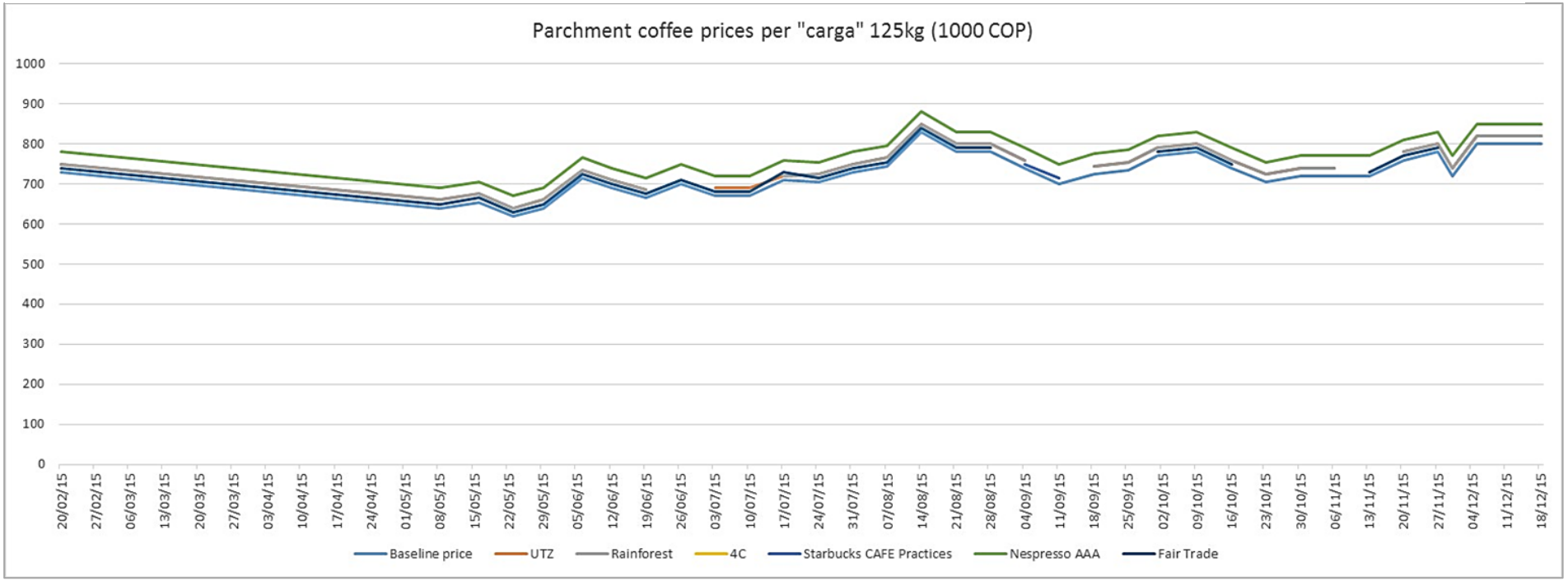
Note. Prices are provided in pounds to facilitate comparison with the New York Coffee "C" market prices. The price information was provided by the cooperatives.

As depicted in Table 19, price premiums in Cooperative 2 represent only a small percentage above conventional Coffee prices – from 0.6% to 7% for the highest-paying certification, Nespresso AAA. This is based on the average prices for year 2015, as provided by the cooperative. To corroborate that this trend is followed throughout the year, Figure 17 displays time series data with bi-monthly Coffee prices for 2015 as reported by the cooperative, disaggregated per certification.

[7] The certifications under analysis do not have strict requirements in terms of offering price premiums. For 4C and Rainforest Alliance there is no fixed premium; prices are determined in a negotiation process between the buyer and the seller (ITC, 2017). Nespresso AAA provides a quality and certification premium, and C.A.F.E. Practices can offer a quality premium (Snider et al., 2017).

To summarize, then, Voluntary Sustainability Standards in Colombia pay only a small fraction above market prices, and for just a share of producer's certified production – an average of 40% market uptake for all analyzed certifications.

Figure 17. Parchment coffee prices per "carga" (125 kg) in Colombia, in 1,000s COP



Source: Adapted from Grabs, J. (2017). The Rise of Buyer-Driven Sustainability Governance: Emerging Trends in the Global Coffee Sector (SSRN Scholarly Paper No. ID 3015166). Rochester, NY: Social Science Research Network. Retrieved from https://papers.ssrn.com/abstract=3015166

8.1.2. Honduras

In the case of Honduras, as shown in Table 20, three out of the four analyzed sustainability standards are associated with statistically significant increases in Coffee prices. As opposed to the case of Colombia, the Rainforest Alliance certification does not have a positive effect on Coffee prices. While these certified producers do receive higher mean prices than their non-certified controls, the fact that this indicator is not statistically significant in the PSM analysis, and the coefficient is even negative, signifies that there are observed characteristics explaining the differences in average prices.

Table 20. Impact pathways Honduran certified farmers vs. controls in HNL (2015/2016)

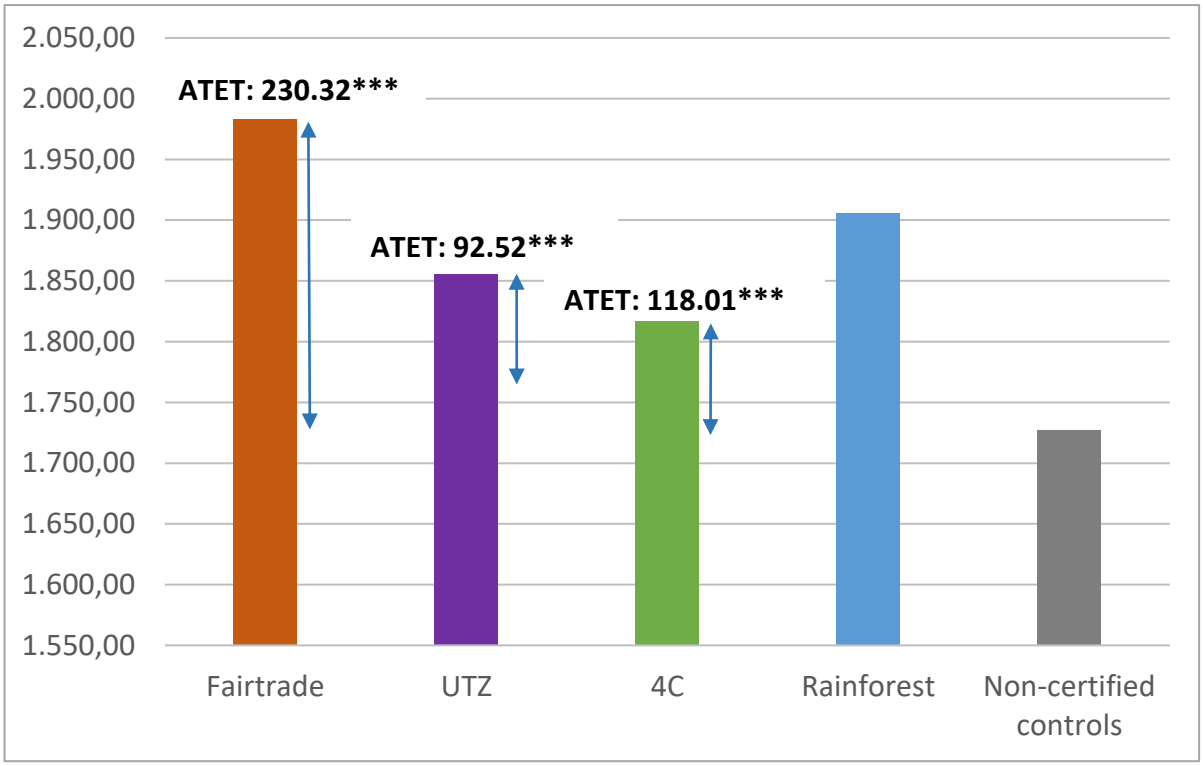
Impact pathway variables	**Fairtrade (n=95)**		**UTZ (n=94)**		**RA (n=76)**		**4C (n=135)**		**C (n=259)**
	Mean	ATET	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Price premiums									
Coffee sales revenue per qq (a)	1,983.38	230.32*** (68.66)	1,855.78	92.52*** (31.25)	1,905.87	-6.69	1,816.92	118.02*** (39.07)	1,727.00
Productivity									
Yields per hectare (in qq)	16.90	-1.09	29.71	1.22	41.04	9.70** (4.43)	23.95	-0.43	26.47
Costs of production									
Production costs per farm	49,462.55	3,527.76	78,527.80	18,541.32	165,431.10	22,985.85** (9,329.95)	73,251.31	12,671.25	71,906.25
Production costs per ha	15,835.09	1,444.70	19,735.65	1,674.62	28,468.90	9,022.02*** (3,014.24)	21,151.93	2,862.58	22,199.25
Production costs per qq	1,371.32	243.09	808.71	109.15	972.25	80.57	1,040.94	231.81	981.16
Access to credit									
Received formal credit (dummy)	0.65	0.03	0.64	0.11	0.74	0.22*** (0.01)	0.56	0.03	0.48

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 quintal = 46 kg.

The industry-oriented standards 4C and UTZ, in the case of Honduras, have a positive impact in Coffee prices: these smallholders get significantly higher prices per quintal than non-certified farmers. As depicted in Figure 18, holding the UTZ certification translates into 92.52 HNL more per quintal, or the equivalent of around USD 4 dollars. Considering that the average production per farm for UTZ certified farmers is 112 quintales (refer to Table 9), the resulting effect would be around USD 470 dollars in farm revenue. For the 4C verified farmers, the associated increase amounts to around USD 5.25 per quintal, which would signify an increase in revenue per farm of around USD 495 (5.25 * 94.4 quintales produced per farm).

Fairtrade farmers in Honduras benefit the most from price premiums, although the increase in prices is influenced mostly by the Fairtrade/Organic farmers, rather than the ones holding only the Fairtrade (conventional) certification. The increase in prices received by these certified farmers amount to USD 10.25 dollars per quintal, more than doubling the effect of UTZ and almost doubling the 4C one. Given their mean Coffee production per farm (56 quintales), their increase in farm revenue would be around USD 575 dollars (see Figure 18).

Figure 18. Price premiums per quintal (46 kg), in HNL



8.1.3. Costa Rica

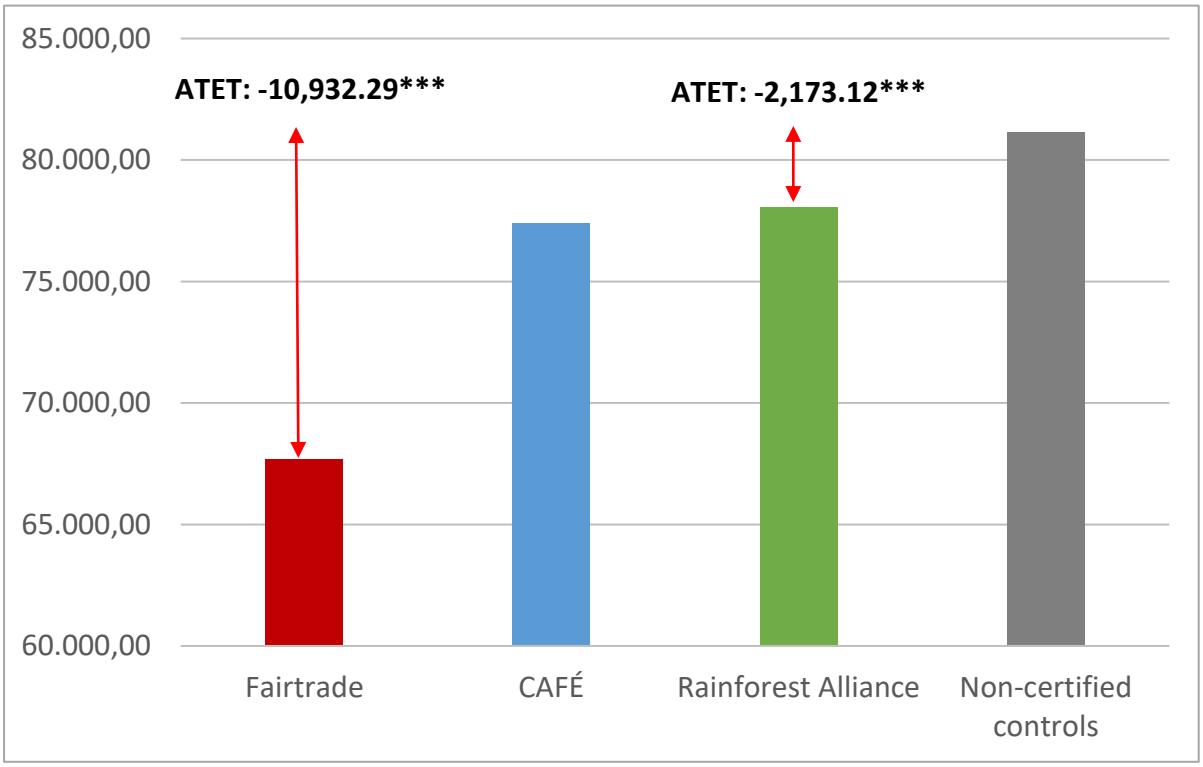
In Costa Rica, in terms of Coffee prices, the results in Table 21 show this indicator is negative for the NGO-led certifications Fairtrade and Rainforest Alliance, and non-significant for Starbuck C.A.F.E. Practices. These results mean that non-certified farmers are outperforming Fairtrade and Rainforest Alliance certified farmers in terms of prices obtained per unit. The Fairtrade certification is associated with CRC 10,932, or the equivalent of USD 20.50 dollars less per "fanega" (258 kg) of Coffee cherries, as depicted in Figure 19. The Rainforest Alliance certification is associated with a price of around USD 4 dollars lower per "fanega". Non-certified farmers receive, on average, higher prices than producers holding any of the three certifications. Indeed, these results fall short of the anticipated gains of VSS.

Table 21. Impact pathways Costa Rican certified farmers vs. controls in CRC (2015/2016)

Impact pathway variables	Fairtrade (n=94)		CAFE (n=118)		RA (n=152)		C (n=139)
	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Price premiums							
Coffee sales revenue per fanega (a)	67,681.38	-10,932.29*** (1,245.33)	77,368.97	-1,897.78	78,064.80	-2,173.12*** (489.27)	81,144.35
Productivity							
Yields per hectare (in fanegas)	28.62	-1.12	37.19	7.58** (3.36)	43.14	11.78*** (3.28)	32.43
Costs of production							
Production costs per farm	5,150,245.00	-3,255,029	6,325,391.00	-1,249,330	10,000,000.00	381,248.30	7,357,384.00
Production costs per hectare	1,502,696.00	177,680.90	1,716,498.00	286,400.4* (150,937.7)	1,856,040.00	440,601.4*** (112,687.5)	1,569,963.00
Production costs per fanega	65,892.32	10,658.62	49,447.47	-25,350.41	50,296.42	-6,752.84	64,785.02
Access to credit							
Received formal credit (dummy)	0.31	-0.04	0.58	-0.03	0.54	0.03	0.47

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 fanega = 258 kg.

Figure 19. Price premiums Costa Rican farmers (in CRC)



Two potential explanations are offered for these findings. First, the prices for conventional and certified Coffee vary across cooperatives. In some cases, even within cooperatives prices vary according to the elevation at which the Coffee was grown, with high altitude Coffee having a higher value. Even within the West Valley, the prices offered by each cooperative for certified and non-certified Coffee varies significantly. For instance, in cooperatives 6 and 8, the price offered to producers for Starbucks C.A.F.E. Practices certified Coffee is lower than the price for conventional Coffee in cooperative 7, the non-certified cooperative. Similarly, the price for Rainforest Alliance/ Nespresso AAA certified Coffee grown at medium altitude is also lower non-certified Coffee grown at high elevation in Cooperative 7. In Los Santos, prices received for conventional Coffee in cooperative 5 are considerably higher than prices offered in cooperative 4.

The second explanation is the strong correlation between Coffee quality and prices. Indeed, a number of authors assert that certification premiums reward the quality of the Coffee rather than the sustainability practices used in its production (Ruben & Zuniga, 2011; Snider et al., 2017). The Coffee quality, then, is considered a precondition to receive price premiums (Kilian, Pratt, Jones, & Villalobos, 2004), which means farmers implement sustainability practices without a clear

compensation (Giovannucci et al., 2008). Other studies state that the final price received by farmers is a function of several variables: the marketing channel of their choice (differentiated or conventional), product quality and access to market prices (Wollni & Zeller, 2007). This explains, then, why non-certified farmers get higher prices than certified farmers. The hypothesis would be that these non-certified farmers produce higher quality Coffee than certified farmers. This topic will be explored and tested in the excursus on quality, in section 7.3.
As for market uptake of certified production, the situation in Costa Rica is different than for the other two case studies. In this country, given that cooperatives are in charge of Coffee processing, if the producer holds a certification the cooperative usually accepts all of their certified production as such, provided they meet the quality standards. The producer is then paid a price premium (if any) for their Coffee deliveries/sales. Only in Cooperative 6, producer members had annual quotas for Nespresso AAA and C.A.F.E. Practices certified Coffee they could sell to the cooperative. I did not have access to the data on the quantity of certified Coffee sold by the cooperative to buyers, but the intuition is that the quantity and price of Coffee sold affects the price premiums passed on directly to the farmer.

8.1.4. Major takeaways

Summarizing the results across the three countries, the NGO-led standard Rainforest Alliance is associated with a positive impact on Coffee prices in Colombia, while in Costa Rica the difference between prices for these certified farmers and their controls is negative. In Honduras, this indicator is non-significant for these certification holders. Fairtrade certification has differentiated impacts in the countries analyzed: in Costa Rica, Fairtrade only farmers receive on average lower prices for their Coffee than non-certified farmers, while in Honduras these certification holders do receive a price premium. In Colombia, there is not a significant difference in Coffee prices between Fairtrade and non-certified farmers. The industry-oriented standards 4C and UTZ have both a positive impact in Coffee prices in Honduras: these smallholders get higher prices per quintal than non-certified farmers. For 4C verified farmers in Colombia, the impact of this label in prices was unclear. Starbucks C.A.F.E. Practices and Nespresso AAA both resulted in higher prices for their certification holders in Colombia, compared to their counterfactual. In Costa Rica, the impact of Starbucks C.A.F.E. Practices in Coffee prices was non-significant.

These results point to the following: i) the pricing mechanism for each certification varies across different countries; ii) in many cases, the price does not seem to be reflecting the sustainability practices implemented, associated with each certification. These statements are unpacked in the subsequent paragraphs, and then I provide an in-depth explanation of the impact of each of the studied VSS on price premiums.

The fact that the pricing mechanism for each certification varies depending on the country is related to the fact that, for the most part, cooperatives have some autonomy on how to allocate the price premiums. Depending on the type of cooperative, they can be administered/managed in different ways: i) passed on directly (all or a portion of it) to the producer as compensation for the implementation of sustainable practices; ii) held by the cooperative to cover internal costs (audits, salaries, technical assistance); iii) used for the implementation of social projects (typically the Fairtrade premium) (Snider et al., 2017). The decision on how to allocate the price premiums usually depends on the nature of the certification (if it is individual or collective), and the value system of the cooperative. Some cooperatives, for example, choose not to differentiate the price paid for certified and non-certified Coffee, therefore distributing the economic benefits amongst all producer members. Table 22 summarizes how the price premium is allocated per organization for individual certifications.

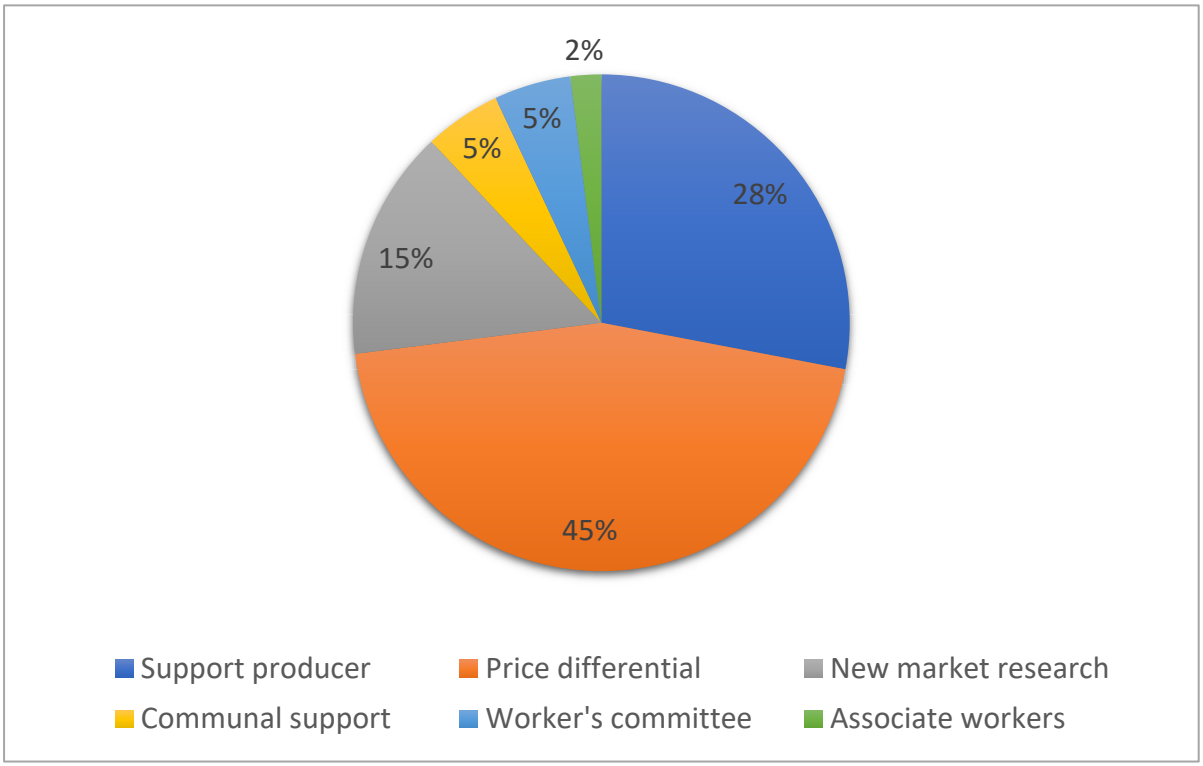
Table 22. Allocation of price premium per Coffee organization

Case study cooperative	Individual Certification	Allocation of price premium
Cooperative 1	Nespresso AAA C.A.F.E. Practices Rainforest Alliance	Price premium is passed directly to producers.
Cooperative 2	Nespresso AAA C.A.F.E. Practices 4C Association	Price premium is passed directly to producers.
Cooperative 3	None	No premium.
Cooperative 4	Rainforest Alliance	Premium is not passed to the producer.
Cooperative 5	C.A.F.E. Practices Rainforest Alliance	C.A.F.E. Practices farmers do not receive a premium. Premium for RA is passed directly to producer.
Cooperative 6	C.A.F.E. Practices Rainforest Alliance/Nespresso AAA	Price premium is passed directly to producers. Price premium is passed directly to producers.
Cooperative 7	None	No premium.
Cooperative 8	C.A.F.E. Practices	Price premium is passed directly to producers.
Trader/Foundation	UTZ Rainforest Alliance 4C Association	Price premium is collected directly by the producers.

Source: Own elaboration based on personal interviews with cooperative extensionists.

Collective certifications such as Fairtrade provide more guidelines on how to allocate the price premiums. This certification establishes that out of the USD 20 cents/lb of the social premium, at least 5 cents should be invested in quality and/or productivity (Fair World Project, 2011). The organizations analyzed allocated the premiums into direct price differentials and the implementation of social projects. Figure 20 depicts how one of the sampled cooperatives distributes the Fairtrade premium.

Figure 20. Distribution of the Fairtrade premium (example from Cooperative 6)



Source: Training material from cooperative 6.

In addition, the prices of Coffee are highly dependent on the marketing power of the cooperatives/organizations and the quality of the Coffee, not only on the certification itself. For this reason, prices for conventional and certified Coffee vary across regions and social organizations. As was shown in the cases of Costa Rica and Colombia, the prices received by farmers varied from cooperative to cooperative, and in Costa Rica even within cooperatives based on altitude and quality differences.

Regarding the second statement, as the results show, price premiums do not adequately compensate producers for the implementation of sustainable practices. As was shown with the time series data from Cooperative 2 in Colombia, sustainability standards pay merely a small percentage above market prices – equiva-

lent to a few cents if one thinks on a per pound basis. This means that certifications fail to protect Coffee farmers against price volatility, which is one of the main causes of their economic vulnerability. In this regard, a study by Snider et al. (2017) on the impact of VSS in Costa Rica noted that Rainforest Alliance premiums typically remain stable with market fluctuations, while Starbucks C.A.F.E. Practices has shown to pay a lower premium when there is an oversupply of Coffee, and Nespresso AAA is assumed to have a similar price dynamic. Furthermore, their research shows that at times of low Coffee prices, buyers have demonstrated to be more willing to respect the Fairtrade minimum price and pay the quality differential and premium. In our time series data, however, Fairtrade premiums remained fairly stable, but their additionality over the market price was quite low (see Grabs, 2017, p.21).

Based on the evidence displayed, I can assert that VSS fail to provide a means to internalize the positive externalities of sustainable Coffee production into the price mechanism (Potts et al., 2014). The lack of compensation for the implemented practices – which require investment, labor and agricultural inputs – leads to a socially suboptimal allocation of resources. That is, the farmer is absorbing the cost of implementing the sustainable practice, instead of it being passed to the buyer, exporter or consumer. While the certification is effectively communicating the market information regarding the sustainability practices implemented and associated benefits for society (Potts et al., 2014), either the value is being captured at an upper step in the Coffee value chain, or there is not enough demand to absorb all the certified Coffee produced. Therefore, in many cases, VSS do not deliver their promise to improve the livelihoods of smallholder farmers in the short-term (through increased incomes).

Now I move on to the detailed analysis of the impact of the selected sustainability standards in Coffee prices.

Rainforest Alliance

Rainforest Alliance only displayed a positive impact in prices in cooperative 1 in Colombia (see Appendix D for cooperative-specific results). In Costa Rica, on the other hand, non-certified farmers received on average higher prices than these certification-holders. Being one of the most stringent certifications, it definitely draws attention that producers have to implement all the sustainability practices to comply with the requirements without getting a direct monetary compensation for doing so. However, as mentioned in the theory section, Rainforest Alliance

certification is cautious not to include price premiums in their theory of change, even though they do include this indicator in their Monitoring and Evaluation framework and measure it through third-party impact studies.
The positive price differences in Colombia found in this research support other studies conducted in the country, which found that certified Rainforest Alliance farmers received a price premium of around two percent above the price of conventional Coffee in that harvest season (Rueda & Lambin, 2013c), and a value chain analysis that shows these certified producers capture more value than non-certified farmers (two percentage points) (Rueda & Lambin, 2013a). Research conducted in Uganda also concluded that higher profitability for Rainforest Alliance farmers was explained by a price premium averaging 20% (Mitiku, Mey, Nyssen, & Maertens, 2017; Mitiku, Nyssen, & Maertens, 2018).

Fairtrade
Fairtrade is the only certification that establishes a minimum price in addition to the collective price premium. For Arabica washed, for instance, the minimum price for green Coffee is 1.40 USD/lb, plus a 0.20 USD/lb premium that gets passed on directly to the cooperative. In this sample, however, Colombian producers are receiving an average price of 1.10 USD/lb for their Fairtrade Coffee (see Figure 21). In Costa Rica, the average price Fairtrade only farmers received for their Coffee was 1.28 USD/lb (Figure 23). In Honduras, Fairtrade-certified farmers received on average a price of 1.10 USD/lb for their Coffee, a significantly higher price than non-certified Coffee (0.95 USD/lb) (Figure 22). Nonetheless, in this country most of the price difference came from the Fairtrade/Organic certification, with an average price of 1.14 USD/lb, compared to 1.06 USD/lb received by conventional Fairtrade farmers.

Figure 21. Average prices (green beans) per certification in USD/lb, Colombian farmers (2015)

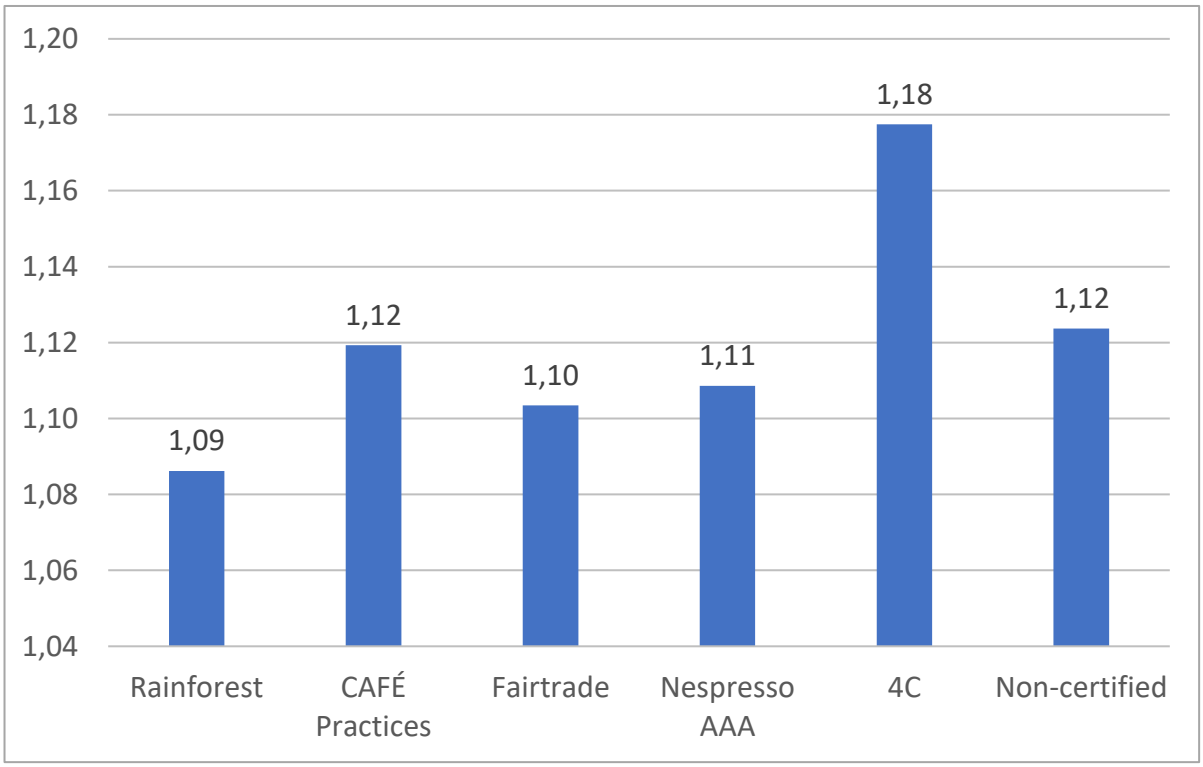


Figure 22. Average prices (green beans) per certification in USD/lb, Honduran farmers 2015/16

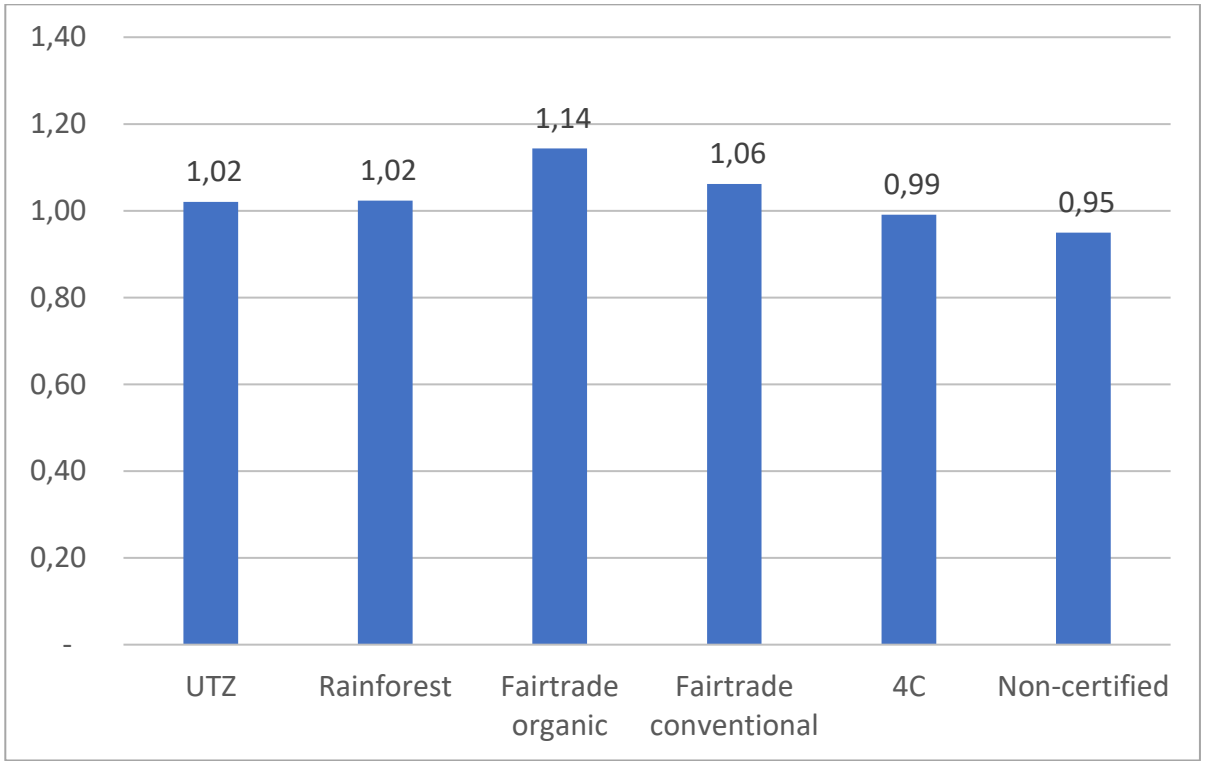
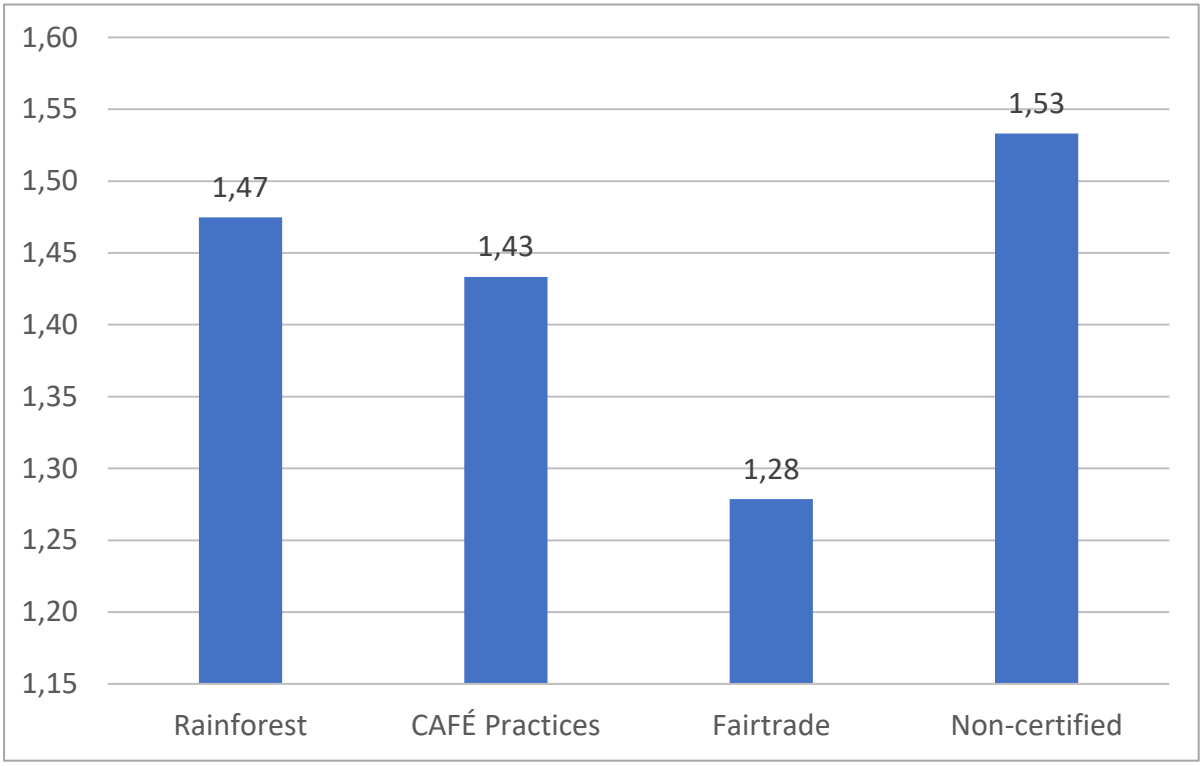


Figure 23. Average prices (green beans) per certification USD/lb, Costa Rican farmers 2015/16



Thus, the Fairtrade price for all three countries fell well below the Fairtrade minimum price established for Arabica washed Coffee. However, it must be noted that the Fairtrade minimum price refers to the contract between the cooperative and the buyer, not the price paid directly to the producer. Indeed, the Fairtrade minimum price as well as the premium are often used to fund cooperative internal services. In addition, the minimum price applies to Freight on Board (FOB), which translates into additional administration and logistical costs to the cooperatives. However, given that the main goal of Fairtrade's minimum price is to ensure that production costs and living expenses for smallholder farmers are met (Benoit & Isabelle, 2011; IISD, n.d.), it is safe to say that with the price producers are receiving, these conditions are not being met. In terms of how the price received by Fairtrade farmers compared to the price received by non-certified farmers, the evidence is mixed across countries. The significant price differentials found for Fairtrade farmers in Honduras is supportive of the literature that reports higher average prices received by Fairtrade and Organic certified farmers than conventional ones (C. Bacon, 2005; Méndez et al., 2010; Weber, 2011). In Costa Rica and Colombia, where there is not a positive price difference between Fairtrade farmers and non-certified ones, two conclusions are inferred, based on

the available literature and empirical evidence: i) there is excess certification in the Fairtrade market, which causes rents to dissipate (de Janvry et al., 2015a); ii) the Fairtrade only Coffee does not meet the quality standards demanded by the market to pay for price premiums. The topic of quality will be explored in the excursus about Coffee quality (section 7.3).

As for overcertification in the Fairtrade market, de Janvry et al. (2015) explain that while the Fairtrade certification allows cooperatives to sell under the Fairtrade rules/market, there is no guarantee of a market. Furthermore, far from controlling supply, the in-country officers in charge of certifying organizations get paid "piece-rate" for each certification performed, which creates an incentive towards overcertification. As a result, in 2017 only 34% of the Coffee produced under the Fairtrade certification was actually procured as standard-compliant; and the gap between certified volume produced and certified volume sold continues to widen (Panhuysen & Pierrot, 2018).

Industry-oriented standards: 4C Association and UTZ

Industry-oriented standards such as UTZ had a positive and significant impact on price premiums in Honduran producers. This is in line with their Code of Conduct, which calls for mandatory premiums for UTZ certified Coffee, as well as improving the bargaining position of producers (Potts et al., 2014; UTZ, 2015). 4C verified producers in Honduras also receive significantly higher prices for their Coffee than their non-certified counterparts. Therefore, in this case, the price mechanism is reflecting the quality and sustainability practices used for the production of 4C Coffee (4C Association, 2015). In Colombia, however, when comparing 4C farmers to their controls from the same cooperative, the difference was not significant.

The positive price impact for UTZ certified farmers is in line with previous impact studies conducted in Colombia and Kenya, which record significantly higher prices per unit of Coffee for these certification holders, as compared to their controls (Garcia, 2014; Kamau et al., 2010). The evidence, then, points to significant price differentials for this certified Coffee. Yet, qualitative studies report that this premium has been decreasing (Riisgaard et al., 2009). As for 4C, previous evaluations in Vietnam have found that while these farmers have better access to market information and report quality improvements, this does not translate into higher prices, compared to the control groups (Kuit, van Rijn, &

Jansen, 2010). A similar outcome is found in Ugandan farms: price differences due solely to being 4C verified are not significant (Kuit et al., 2016).

Private standards: Starbucks C.A.F.E. Practices and Nespresso AAA

The private standards Starbucks C.A.F.E. Practices and Nespresso AAA had mixed effects across countries and cooperatives. In Colombia, both certifications only had a positive and significant impact on prices in one of the cooperatives. As mentioned, while both of these certifications offered significantly higher prices for Coffee sold under these sales channels, farmers were not able to sell all their certified production as such. The market uptake of these certifications was incomplete, and much lower for Starbucks C.A.F.E. Practices. As mentioned, in this country, certified Coffee can be rejected at the selling point if it does not meet the quality standards[8], which could explain the incomplete market uptake for these industry-led standards (although in cooperative 2, Nespresso had more than 60% uptake). This is actually in line with their theories of change and Codes of Conduct, which focus on sourcing high quality Coffee and offer price premiums if specific conditions are met (Potts et al., 2014; Snider et al., 2017). These standards, then, reward the quality of the Coffee instead of the sustainability practices used in its production (Ruben & Zuniga, 2011; Snider et al., 2017).

A factor that also influences Coffee prices is the country of origin. As shown in Figures 21, 22 and 23, when comparing the prices of conventional Coffee in the converted equivalent measure of green Coffee beans, it becomes clear that Honduras is trading well below the New York "C" price for that year, which was 157.54 USD/lb for other milds (ICO, 2018). While that is the FOB price and the price I am reporting is the farm-gate price, usually the FOB price is around 30 cents higher than the farm-gate price, as opposed to 62 cents higher, which is the case in Honduras that analyzed Coffee year. The lower prices received by Honduran producers could have several explanations. The first one is that they indeed produce lower quality Coffee and their processing technology is still underdeveloped. The second one is that the Coffee sector still suffers from high level of informality, which fosters uneven relationships between producers and intermediaries (IICA, 2002; Sevilla-Palma et al., 2017). As opposed to their counterparts in Costa Rica and Colombia, Honduran Coffee producers are not protected by their government and cooperative organizations: more often than

[8] Nespresso AAA requires that less than 2% of coffee per batch is affected by the coffee berry borer (CBB) pest, while Rainforest Alliance has a requirement of less than 4.5% of CBB.

not, they are at the mercy of intermediaries, who control most of the internal Coffee trade and have the power to set domestic Coffee prices (IHCAFE, 2014). In Colombia, conventional Coffee prices received at farm-gate for the sampled farmers were almost 40 cents lower than FOB prices that year – 1.51 USD/lb (ICO, 2018). But, as previously explained, these price differences are mostly explained by the large amounts of low-quality Coffee produced that year, especially in Cooperative 1. As mentioned, the low quality produced could have been due to a weather shock affecting specific groups of farmers.

In Costa Rica, prices for conventional, non-certified Coffee were significantly higher than in the other two countries. The high prices are a result of the specialized Coffee market that focuses mostly on high-quality Coffee. The prices could also be reflecting the more developed economy of the country, which has shifted from being dependent on a few primary goods, to having high-tech and manufacturing industries (Food and Agriculture Organization of the United Nations, 2017). A more diversified economy – with work opportunities in different sectors – means the opportunity costs of producing Coffee become higher, and therefore only those farmers with higher mark-ups stay in business.

Based on the empirical evidence analyzed and the impact literature available, I conclude that price premiums are not a very strong mechanism leading to farm profitability and improved economic conditions. Furthermore, two of the three certifications that require price premiums in their theories of change (Fairtrade and Nespresso AAA) had differing effects across countries and cooperatives, with Fairtrade farmers even receiving lower prices than conventional farmers in Costa Rica. UTZ certified farmers did receive significant price premiums, but, same as the other two certifications, this did not translate into an improved economic situation for smallholder farmers.

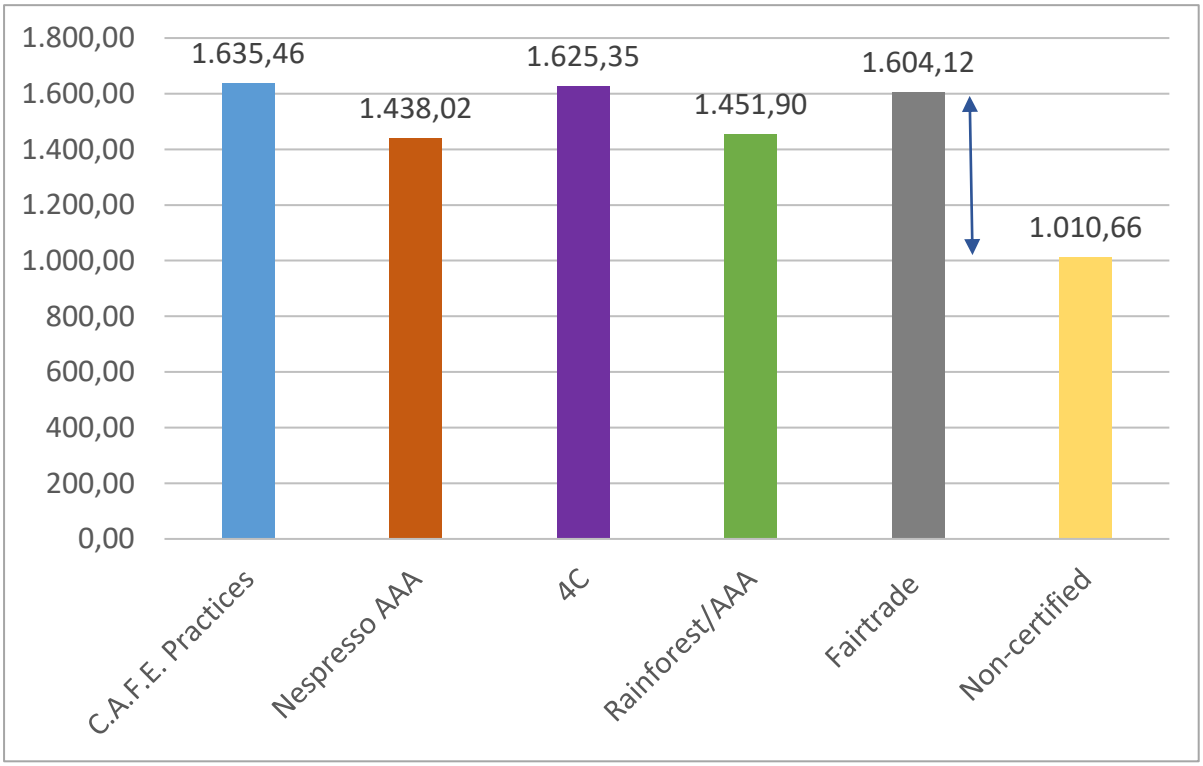
8.2. Farm productivity

8.2.1. Colombia

In terms of yields, the certifications also display different effects across countries. In the case of Colombia, the field results in Table 17 reveal that for most of the analyzed certifications, their impact on yields is non-significant. The exception is the NGO-led Fairtrade certification, which is indeed associated with higher yields than non-certified farmers (see Appendix F for Fairtrade results). However, it must be noted that this control group was an entirely different coop-

erative with much lower average yields, therefore this effect could also be explained by "cooperative effects" rather than due to the certification itself. The effect itself is significant though: holding the Fairtrade certification is associated with producing 329 kg more of dried Coffee parchment per hectare than the non-certified farmers. That is the equivalent of 2.6 "cargas" or 125 kg of Coffee. Considering that each "carga" of Fairtrade Coffee is sold for an average of 662,280 COP, the gain in Coffee revenue per hectare from the increased productivity would amount to 1,743,120 COP, or the equivalent of US 637 dollars. Figure 24 depicts average yields per hectare for all the analyzed VSS.

Figure 24. Yields Colombian farmers in kg/hectare of dried parchment



In terms of the non-significant results of all the other analyzed certifications in the increased productivity pathway, I hypothesize that this could be explained by an implementation gap in Good Agricultural Practices (GAP). This hypothesis is tested using the variables mentioned in underlying practices in Table 2, and the results are displayed in Table 23. However, in terms of trainings, Starbucks C.A.F.E. Practices and Rainforest Alliance farmers display higher attendance rates than their controls. Nespresso AAA producers, on the other hand, show a lower rate of implementing the content learned in trainings.

Concerning the implementation of good agricultural practices amongst Colombian producers holding additional VSS to Fairtrade, the results show that certi-

fied farmers implement some of these practices at higher rates than their Fairtrade controls. For instance, pruning is performed at significantly higher rates by all certification-holders than their respective controls, both for the full sample and at the cooperative level (see Table 23 and Appendix D). As for insect control, only Rainforest Alliance/ Nespresso AAA farmers display positive results, while 4C Association shows significantly negative results. These certification holders, though, are the only group that reports implementing disease control at higher rates than their matched pairs. In terms of soil analysis, all certifications except for C.A.F.E. Practices report having soil analysis at higher rates. Soil analysis informs fertilization decisions, which for the case of Rainforest Alliance/ Nespresso AAA farmers translates into significantly less fertilizer use than their respective controls (this is in line with their core principles).

Table 23. Underlying practices Colombian certified farmers vs. controls (2015)

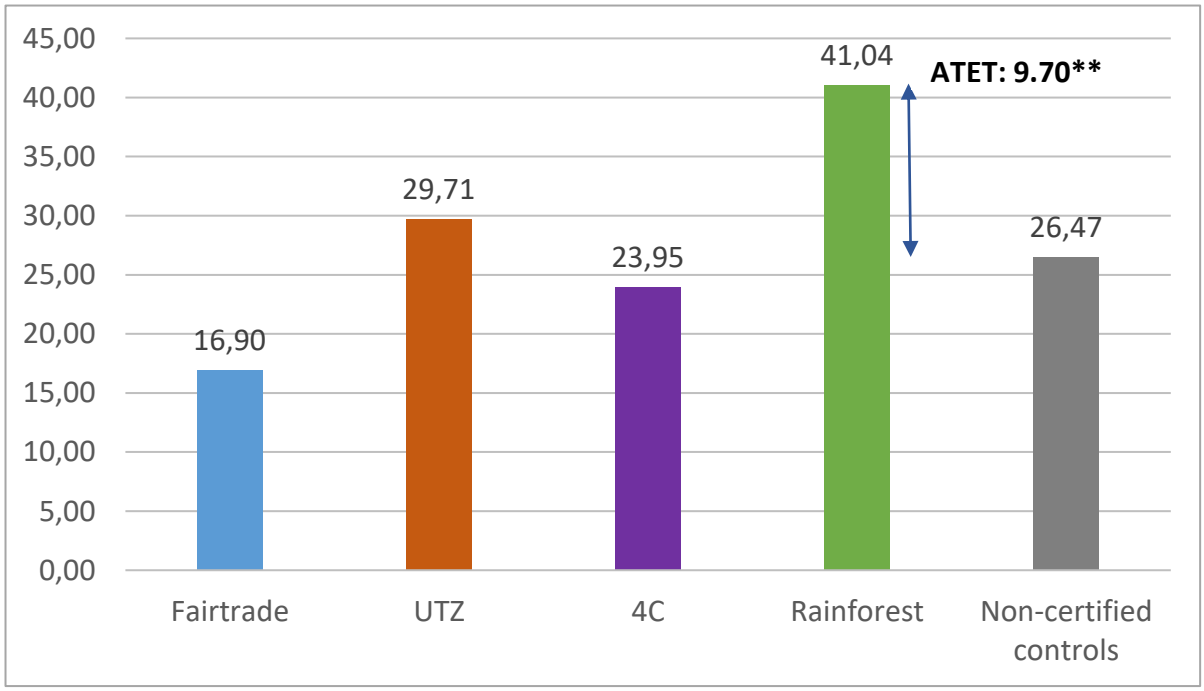
Underlying practices	**C.A.F.E. (n=81)**		**AAA (n=141)**		**4C (n=74)**		**RA/AAA (n=79)**		**C (n=237)**
	Mean	ATET	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Training									
Always attends trainings (dummy)	0.85	0.081* (0.05)	0.89	-0.05	0.82	0	0.95	0.087* (0.04)	0.82
Always implements learned in trainings (dummy)	0.85	0.04	0.9	-0.07*** (0.03)	0.93	0.04	0.94	0.23	0.87
Agricultural practices									
Prunes Coffee plants (dummy)	0.43	0.13** (0.06)	0.44	0.16** (0.06)	0.31	0.04	0.53	0.27*** (0.07)	0.22
Practices removing the stems (dummy)	0.74	-0.03	0.67	0.01	0.65	-.05	0.71	0.74	0.71
Implements insect control (dummy)	0.86	-0.02	0.89	0	0.74	-0.11* (0.06)	0.97	0.1** (0.04)	0.85
Utilises disease control (dummy)	0.11	-0.05	0.18	0.06	0.55	0.43*** (0.06)	0.01	-0.21*** (0.04)	0.18
Access to soil analysis (dummy)	0.12	-0.04	0.23	0.06	0.27	0.18*** (0.06)	0.30	0.15** (0.06)	0.14
Input fertilisers per hectare	466.26	-81.17	450.94	-3.39	533.83	108.83* (58.58)	367.11	-90.22* 46.80)	479.59
Record keeping & knowledge									
Record keeping (dummy)	0.43	0.13* (0.07)	0.44	0.033	0.33	0.05	0.48	0.18** (0.07)	0.30
Spend 5+ hours in record keeping (dummy)	0.05	-0.05	0.03	-0.03	0	-0.06* (0.03)	0.05	-0.02	0.04

These results, therefore, do not confirm an association between the implementation of GAP and increased yields (Barham & Weber, 2012a), and differ with other impact evaluations that show significant yield improvements for certified farmers (see Hughell and Newsom, 2013; Whelan and Newsom, 2014). These counterintuitive results could have a potential explanation: since the FNC provides technical assistance and extension services to certified and non-certified farmers equally (World Bank, 2002), both types of farmers benefit from learning improved agricultural practices and already present high yield levels, leading to the additional VSS to have non-significant effects on productivity.

8.2.2. Honduras

In the case of Honduras, the only VSS that displays a positive impact in yields is the Rainforest Alliance certification. Holding this certification is associated with an increase in production of 9.7 quintales (46 kg) per hectare (see Figure 25). Bearing in mind that one quintal of Rainforest Alliance Coffee is sold at 1,905.9 HNL, or the equivalent of US 84.9 dollars, the increased production linked to this certification would translate into US 823 dollars more in revenue per hectare than for the non-certified farmers. This represents quite a significant impact for Honduran Coffee producers. The other analyzed VSS do not seem to translate into increased yields when compared to similar controls. However, UTZ farmers have on average higher yields than their non-certified controls.

Figure 25. Yields Honduran farmers in quintales/hectare of wet parchment



Like the Colombia case, I analyze if the effects in yields are explained by attendance to trainings and the implementation of GAP. The results are depicted in Table 24. Rainforest Alliance farmers in Honduras attend and implement trainings at similar levels than their non-certified counterparts. The main differences between these certified farmers and their controls are the agricultural practices: Rainforest Alliance producers implement insect and disease control at higher levels than their controls; they access soil analysis at higher rates and apply significantly higher amounts of fertilizer per hectare. A negative result associated with this certification is that they implement cherry control at lower levels than their counterparts. This practice prevents the spread of plagues and ensures the quality of the Coffee, but according to the literature and the empirical results, it does not have a direct effect in yields.

Table 24. Underlying practices Honduran certified farmers vs. controls (2015)

Underlying practices	Fairtrade (n=95)		UTZ (n=94)		RA (n=76)		4C (n=135)		C (n=259)
	Mean	ATET	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Training									
Always attends trainings (dummy)	0.96	0.10*** (0.04)	0.63	0.01	0.82	0.07	0.61	-0.05	0.68
Always implements learned in trainings	0.95	0.04	0.59	0.06	0.81	0.04	0.67	0.12	0.63
Agricultural practices									
Sanitary pruning (dummy)	0.49	-0.01	0.60	0.05	0.82	0.07	0.44	0.01	0.48
Productivity pruning (dummy)	0.73	0.24	0.70	0.01	0.64	-0.24** (0.11)	0.62	-0.02	0.61
Practices removing the stems (dummy)	0.65	0.15	0.55	0.01	0.68	-0.09	0.47	-0.06	0.54
Implements insect control (dummy)	0.44	-0.03	0.46	-0.04	0.78	0.19*** (0.06)	0.40	-0.11	0.55
Utilizes disease control (dummy)	0.56	0.39*** (0.06)	0.59	0.01	0.76	0.15*** (0.00)	0.56	0.11	0.56
Access to soil analysis (dummy)	0.36	0.32*** (0.06)	0.11	-0.03	0.58	0.31*** (0.09)	0.14	0.02	0.08
Input fertilizers per hectare	5,405.32	289.70	7,161.44	262.35	11,229.77	2,859.55** (1,240.12)	6,340.84	214.49	7,011.91
Record keeping & knowledge									
Record keeping (dummy)	0.84	0.04	0.37	0.07	0.62	0.28** (0.12)	0.43	0.04	0.34

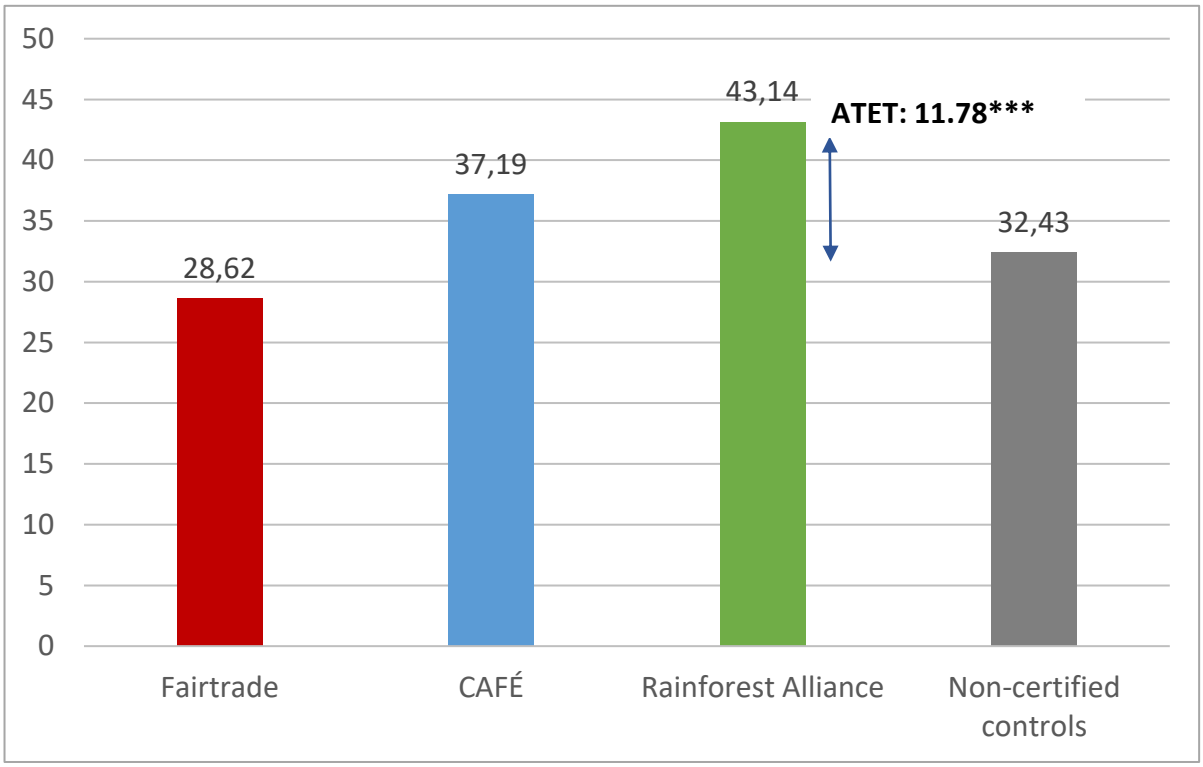
Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients.

The only VSS in Honduras that seems to have an effect in trainings is the Fairtrade certification. This certification is associated with an increase of 10% in participation in trainings. In terms of the rest of the practices, though, Fairtrade farmers only present differences in a few of the analyzed variables. For instance, they utilize disease control at higher levels than non-certified farmers, and also have significantly higher rates of access to soil analysis. This does not translate into differences in the application of fertilizer per hectare, though. The industry-led standards of UTZ and 4C do not impact attendance to trainings or implementation of GAP in any significant way in Honduras (see Table 24). The mostly non-significant results in underlying practices of these certifications could explain why they do not have a significant effect on productivity.

8.2.3. Costa Rica

In Costa Rica, the field results displayed in Table 21 reveal that the Rainforest Alliance and Starbucks C.A.F.E. Practices certifications have a positive impact in Coffee yields. The effect in productivity is quite significant: being Rainforest Alliance certified is associated with an increase in per hectare production of 11.8 fanegas, or 258 kg (see depiction in Figure 26). Given that each Rainforest fanega is sold at 78,064 CRC, or USD 146 dollars, the increase in Coffee revenue per hectare would be around USD 1,720 dollars per hectare. As for the Starbucks C.A.F.E. Practices certification, the associated increase of 7.58 fanegas per hectare translates into approximately USD 1,095 dollars higher Coffee revenue per hectare. The Fairtrade certification in Costa Rica does not have a significant impact on yields.

Figure 26. Yields Costa Rican farmers in fanegas/hectare of Coffee cherries



Like the cases of Colombia and Honduras, I tested if the positive results of the two certifications could be explained by higher attendance to trainings and the implementation of GAP. However, in terms of training, Starbucks C.A.F.E. Practices and Rainforest Alliance farmers display a lower attendance rate than their controls, and lower rate of implementing the content learned in trainings, respectively (see Table 25). As for the specific implementation of GAP, the results for these two certifications are similar: lower implementation of cherry control, less use of chemical control methods and higher use of organic control methods. The only difference in implementation of GAP is that Rainforest Alliance farmers perform pruning at lower rates than the controls. Soil analysis informs fertilization decisions, which for the case of Rainforest Alliance and C.A.F.E. Practices farmers translates into significantly more fertilizer use per hectare than their respective controls. Fairtrade certified farmers report lower attendance levels to trainings, as well as lower implementation rates. These farmers also use less chemical control methods than the controls but perform trap control at lower rates. They do not have higher access to soil analysis, and they do apply more fertilizer than their counterparts. Given that this does not translate into increased yields, it could be reflecting inefficiency in the production cycle.

Table 25. Underlying practices Costa Rican certified farmers vs. controls (2015/2016)

Underlying practices	**Fairtrade (n=94)**		**CAFE (n=118)**		**RA (n=152)**		**C (n=139)**
	Mean	ATET	Mean	ATET	Mean	ATET	Mean
Training							
Always attends trainings (dummy)	0.46	-0.32*** (0.08)	0.64	-0.17*** (0.07)	0.72	-0.02	0.61
Always implements learned in trainings	0.65	-0.17** (0.08)	0.61	-0.33 (0.05)	0.71	-0.18*** (0.05)	0.83
Agricultural practices							
Pruning (dummy)	0.89	-0.05	0.92	0.01	0.91	-0.07** (0.03)	0.96
Implements cherry control (dummy)	0.60	-0.09	0.34	-0.38*** (0.07)	0.40	-0.38*** (0.05)	0.61
Utilizes trap control (dummy)	0.10	-0.24*** (0.08)	0.38	0.10	0.24	-0.06	0.26
Uses chemical control methods (dummy)	0.86	-0.12*** (0.04)	0.87	-0.11*** (0.03)	0.84	-0.14*** (0.03)	0.81
Uses organic control methods (dummy)	0.05	-0.04	0.47	0.37*** (0.05)	0.32	0.26*** (0.04)	0.06
Access to soil analysis (dummy)	0.21	-0.02	0.57	0.15* (0.08)	0.83	0.40*** (0.07)	0.39
Input fertilizers per hectare (in kg)	1,514.67	779.98*** (233.85)	3,028.27	2,229.098** (924.21)	2,552.04	1,770.08*** (259.28)	769.28
Record keeping & knowledge							
Record keeping (dummy)	0.26	-0.54*** (0.07)	0.57	-0.28*** (0.07)	0.64	-0.13* (0.08)	0.72

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients.

8.2.4. Major takeaways

To summarize the results for each of the analyzed VSS, the Fairtrade certification only displayed positive effects in Colombia, although the control group was an entirely different cooperative, therefore this could be explained by cooperative characteristics rather than the certification itself. In Costa Rica and Honduras, Fairtrade did not have a significant effect on yields. The Rainforest Alliance certification had a positive and significant impact on yields in Costa Rica and Honduras. In Colombia, the difference between Rainforest farmers and their controls was not significant. Being certified with UTZ and 4C standards was not associated with higher yields in the analyzed countries. As for the industry-led standards Starbucks C.A.F.E. Practices and Nespresso AAA, only the first one had a positive and significant impact in yields in Costa Rica, while in Colombia the yield levels were similar for these certification-holders and their controls.

As mentioned in the theory section, there are different strategies that lead to increased revenue/profits, using yields as a pathway. The analyzed certification groups have adopted these strategies as follows: Rainforest Alliance farmers in Costa Rica and Honduras use a high input, high volume approach, reflected in the significantly higher amount of fertilizer used in Coffee production per hectare. Starbucks C.A.F.E. Practices farmers in Costa Rica embrace a similar approach, and in both cases, it leads to significantly better yields and higher revenues. Nonetheless, only Rainforest Alliance farmers enjoy higher profits as a result. This will be further developed in the trade-offs section. Nespresso AAA farmers, on the other hand, use a low input, low volume approach, which leads to them having significantly lower production per farm than their counterparts, and ultimately results in lower revenues (Specialty Coffee Association, 2017).

As explained in the theory section, a critical question that remains to be answered in the literature is the association between GAP and yields – i.e. which practices are conducive or not to higher yields. Following, I present some insights aimed at shedding light on this topic. First, an association between attending trainings and implementing the content learned in trainings and higher productivity is not found. Pruning and removing the stems do not seem to have a positive impact in productivity either, but this could be explained by the fact that those agricultural practices can take several months to show a positive effect on yields. In Colombia, for instance, the most common types of pruning practiced took between one harvest season and 18 months to produce Coffee (Arcila Pulgarín, 2013). There

is indication that implementing insect and disease control at higher rates is correlated with higher productivity – which is the case for the Fairtrade certification in Colombia. Moreover, in Costa Rica, certified farmers holding the Rainforest Alliance and Starbucks C.A.F.E. Practices certification who reported using organic control methods at higher rates than non-certified farmers also displayed higher yields. Furthermore, there is indication that having access to soil analysis and appropriate fertilization can lead to higher productivity and/or more farm efficiency. This holds especially for Rainforest Alliance certified farmers, as well as C.A.F.E. Practices producers in Costa Rica.

In order to test these initial inferences, I conducted linear regressions (OLS) of different Good Agricultural Practices against yields, for each of the analyzed countries. Since the goal was to determine which good practices were associated with higher yields, the full sample for each country was used, without disaggregating per certification. In Colombia, the only positive and significant effect was found for fertilizer application. In Honduras, the OLS regression results confirm the importance of having access to soil analysis and therefore appropriate fertilization to obtain increased agricultural output. In Costa Rica, the OLS regression results confirm the importance of having access to soil analysis and therefore appropriate fertilization to obtain increased agricultural output. For instance, having access to soil analysis is associated with producing 5 more quintales per hectare. In Costa Rica, the positive results found in Honduras for soil analysis and fertilizer application were replicated. In addition, the results suggested a positive association between pruning and productivity, as well as a negative effect of chemical control on yields. Having access to soil analysis is associated with producing more than 4 additional fanegas per hectare, and performing pruning is associated with 6 additional fanegas. Tables 26, 27 and 28 display the linear regression results, with and without controls.

Table 26. Effects of Good Agricultural Practices on Yields in Colombia (OLS regression)

GAP	Productivity per hectare in kg (2015)	
Use of organic fertilizer	106.99	112.02
Pruning	-107.5	-12.31
Insect control	8.24	126.99
Disease control	40.67	3.43
Removes the stems	138.45	42.26
Soil analysis	103.90	40.34
Input fertilizer per ha	0.81*** (.10)	0.79*** (.10)
Input pest control per ha	-0.13	-0.707
Input weed control per ha	1.21	1.52
Constant	1,042.04	1,537.32
R-squared	0.12	0.20
Number of observations	607.00	600.00
Controls	NONE	ALL

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Standard errors displayed in parenthesis for significant coefficients.

Table 27. Effects of Good Agricultural Practices on Yields in Honduras (OLS regression)

GAP	Productivity per hectare in quintales (2015)	
Pruning	1.24	2.10
Thinning	0.19	-0.02
Pest control	1.48	0.59
Disease control	0.18	1.03
Soil analysis	4.99*** (1.70)	5.50*** (1.69)
Input fertilizer per ha	0.002*** (0.00)	0.002*** (0.00)
Keeping records	-4.47*** (1.15)	-3.28
Constant	12.80	20.36
R-squared	0.36	0.38
Number of observations	647	647
Controls	NONE	ALL

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Standard errors displayed in parenthesis for significant coefficients.

Table 28. Effects of Good Agricultural Practices on Yields in Costa Rica (OLS regression)

GAP	Productivity per hectare in fanegas (2015)	
Cherry control	2.76	2.64
Trap control	0.07	0.08
Chemical control	-7.49** (2.24)	-7.76** (2.04)
Organic control	3.01	2.21
Pruning	5.81* (2.24)	6.41* (2.48)
Soil analysis	4.18** (1.25)	4.33** (1.31)
Input fertilizer per ha	0.0002*** (0.00)	0.0002*** (0.00)
Keeping records	1.68	2.36
Constant	22.81	34.47
R-squared	0.08	0.09
Number of observations	489.00	489.00
Controls	NONE	ALL

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Standard errors displayed in parenthesis for significant coefficients.

Now I move on to the detailed analysis of the effects on each analyzed VSS in this impact pathway, also contrasting it to the theory of change of the certifications and existing impact evaluation literature.

Rainforest Alliance

The Rainforest Alliance certification, though not having a strong focus on productivity in their guidelines, is associated with higher yield levels in two of the three countries analyzed: Costa Rica and Honduras. This certification fails to detail the specific GAP to be implemented as part of their Code of Conduct, but it does require compliance with appropriate fertilization and soil and/or foliar analysis. Indeed, this standard is the only one that is associated with higher rates of access to soil analysis in all the countries analyzed, proving that they are delivering some results on the ground. In terms of fertilization, in Colombia, Rainforest Alliance farmers use significantly lower amounts of fertilizer per hectare, whereas in Costa Rica and Honduras the volume of agricultural inputs used per unit is higher.

This evidence for Rainforest Alliance supports previous findings in studies in Latin America that report increased yields for these certification holders. For instance, a non-academic study in Colombia found that productivity in certified farms was twofold than in non-certified farms (Hughell & Newsom, 2013). Similarly, research conducted in Nicaragua showed that Rainforest Alliance farmers

outperformed Fairtrade and independent farmers in terms of yields (Ruben & Zuniga, 2011).

Fairtrade certification

Fairtrade does not provide specific recommendations to achieve higher yields; they limit their guidelines to requiring that at least 5 cents of the Fairtrade premium are invested in productivity or quality improvements. This is reflected in the outcomes at the farm level: the effects of this certification in yields are non-significant, except for the Fairtrade certification in Colombia, where the differences are explained by "cooperative effects". In terms of fertilizer application, Fairtrade farmers utilize more fertilizer per hectare than non-certified farmers in Colombia and Costa Rica, while in Honduras this indicator is non-significant.

Though the literature on the impacts of Fairtrade usually focuses on prices and revenues, a study by Ruben and Zuniga (2011) in Nicaragua found that Fairtrade farmers had significantly lower yields than independent farmers, Rainforest Alliance and C.A.F.E. Practices certified producers. There is one study by Arnould et al. (2009) that compares productivity in Fairtrade versus non-Fairtrade farmers, finding significant gains for Fairtrade producers. However, the specific analysis is conducted by comparing TransFair USA cooperative participants and non-participants, and while the certification has indeed similar principles, it is not affiliated to Fairtrade International. Moreover, as Barham and Weber (2012) point out, this study has serious methodological limitations, given that they limit their analysis to ANOVA comparisons, and their productivity analysis does not take into account pre-existing differences in yields between comparison groups.

Industry-led standards: 4C Association and UTZ

Of all the analyzed certifications, UTZ is the one that places more emphasis on increased productivity as a pathway to higher economic returns and provides detailed guidance in their Code of Conduct of the farm practices needed to increase productivity. Yet, these certification holders did not experience increased yields as a result of this certification. It is quite astounding that UTZ certification does not seem to make a difference in the implementation of GAP. That is, these producers perform pruning, removal of shoots/suckers, grafting and paying attention to soil fertility and crop nutrient status at similar levels than comparable non-certified farmers. The available literature on the impact of UTZ certification in yields seems to be inconclusive. On the one hand, there is peer-reviewed literature that found that the UTZ standard holders in Nicaragua were 36% less pro-

ductive than their matched non-certified farmers (Haggar, Soto, Casanoves, & Melo, 2017). On the other hand, evidence from an impact evaluation in Colombia reported significantly higher yields for UTZ certified farmers, associated with the implementation of GAP (Garcia, 2014).

4C Association does not place emphasis on productivity as a pathway to increase Coffee income. This verification mentions long-term productivity in their first principle, but then fails to develop specific recommendations of GAP to be implemented at the farm-level. This, with the exception of appropriate fertilization and conducting periodical soil and/or foliar analysis. The non-significant outcomes of this standard in terms of yields reflect this. In Colombia, however, 4C farmers perform some GAP at higher rates/levels than their counterparts, such as pruning, disease control and fertilization. On this matter, it draws attention that these positive practices fail to translate into significant positive effects on yields or income. These results align with the findings of Kuit et al. (2016) in Uganda and Vietnam, showing that despite having more access to training on GAP, 4C verified farmers do not show significant improvements in productivity or nutrient management.

Private standards: Starbucks C.A.F.E. Practices and Nespresso AAA

Starbucks C.A.F.E. Practices certification mentions long-term productivity as one of their key criteria. The results on the ground show an impact for these certification holders in terms of yields in Costa Rica, yet in Colombia the yield levels were similar to the control group. Nespresso AAA fails to have an effect in productivity, despite the fact that this certification considers this pathway as its third driving principle. Both certifications are associated with higher levels of pruning than their controls in Colombia – one of the practices mandated in their Codes of Conduct – although in Costa Rica this indicator is non-significant for Starbucks C.A.F.E. Practices farmers. As for soil analysis, the results vary by country, with Colombian farmers holding the C.A.F.E Practices certification reporting lower access to soil analysis than their counterparts, whilst in Costa Rica these farmers report a positive effect in this indicator and also report higher input of fertilizers per hectare. Nespresso AAA farmers display a positive effect in access to soil analysis and significantly lower levels of fertilizer application per hectare.

The results of Starbucks C.A.F.E. Practices in Costa Rica are in line with the literature that reports positive effects on productivity for these certified farmers,

due to improved production management strategies (Ruben & Zuniga, 2011). The divergent results for this certification in Costa Rica and Colombia sheds light on how context-specific the impacts of certifications are. This could point to differences in the successful implementation of the standard, which is dependent on the organization holding the certification standard. For instance, in Colombia only 12% of Starbucks C.A.F.E. Practices certified farmers reported having access to soil analysis (lower rate than the control farmers – 14%), while in Costa Rica 57% of these certified farmers had had access to soil analysis, a much higher number than the control group (39%).

On the other hand. the results for Nespresso AAA greatly differ with the reported positive impact on productivity levels found in the commissioned monitoring and evaluation study in the same area in Colombia (CRECE, 2013a). The results for this certification also vary significantly by cooperative: in Cooperative 1, only 11% of these certified farmers reported having access to soil analysis, while this number was much higher for Cooperative 2 (54 % of farmers had access to soil analysis).

In general, the results for this impact pathway support the literature that asserts that the positive economic effects of sustainability standards such as Rainforest Alliance are explained by differences in farm productivity rather than farm-gate prices. The increase in productivity as a result of improved agricultural management practices, then, is of high importance for farm profitability (Barham & Weber, 2012a; Hughell & Newsom, 2013; Ruben & Zuniga, 2011; Whelan & Newsom, 2014). It is important to note, though, that certifications such as UTZ – the one that emphasizes more the pathway of increased productivity – do not seem to be delivering the promised results on the ground. These certified farmers have comparable yield levels as non-certified farmers.

8.3. Costs of production

8.3.1. Colombia

The results displayed show, again, mixed effects of the analyzed certifications across countries. In Colombia, the results displayed in Table 17 show that Nespresso AAA and Rainforest Alliance/ Nespresso AAA farmers have significantly lower costs of production per farm. The implied effect of the Nespresso AAA standard is a reduction in costs of around US 2,100 dollars per farm. The impact of the Rainforest Alliance certification is also large, amounting to a reduction in

costs per farm of around US 1,565 dollars. See Figures 27 and 28 for a depiction of the amount of the effects per farm and per hectare.

Figure 27. Production costs per farm in Colombia, in 1,000s COP

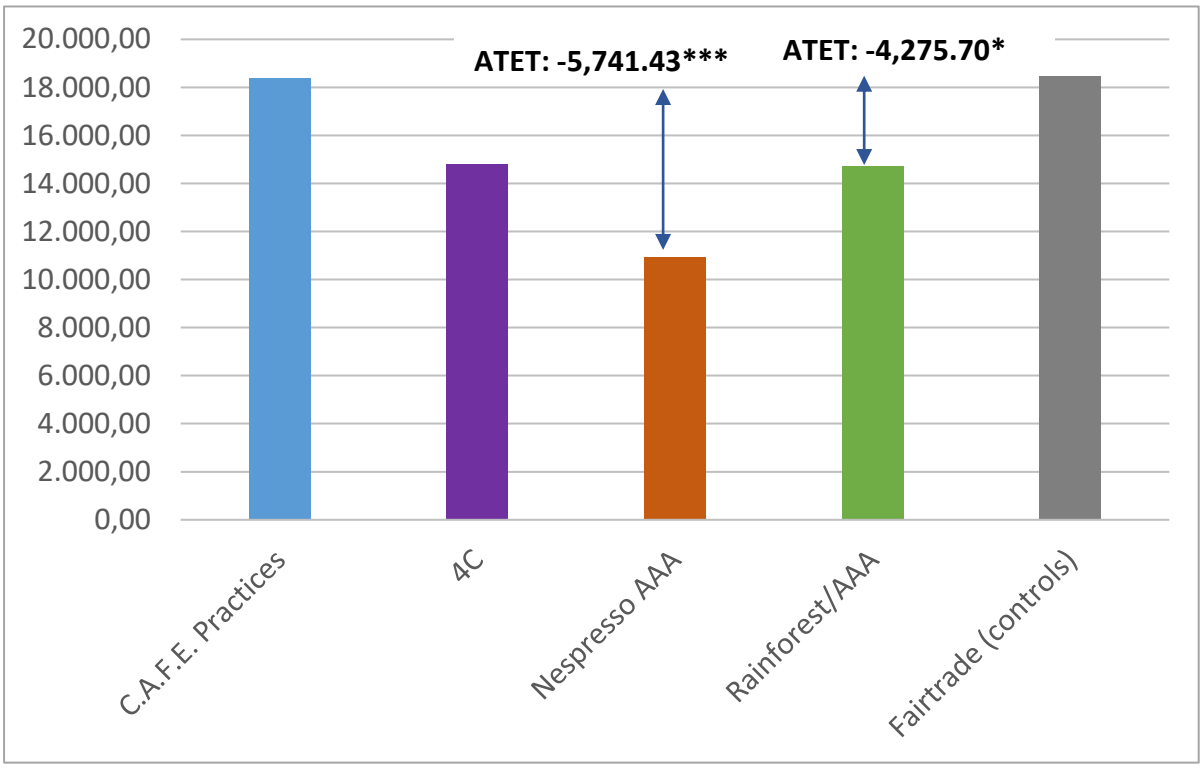
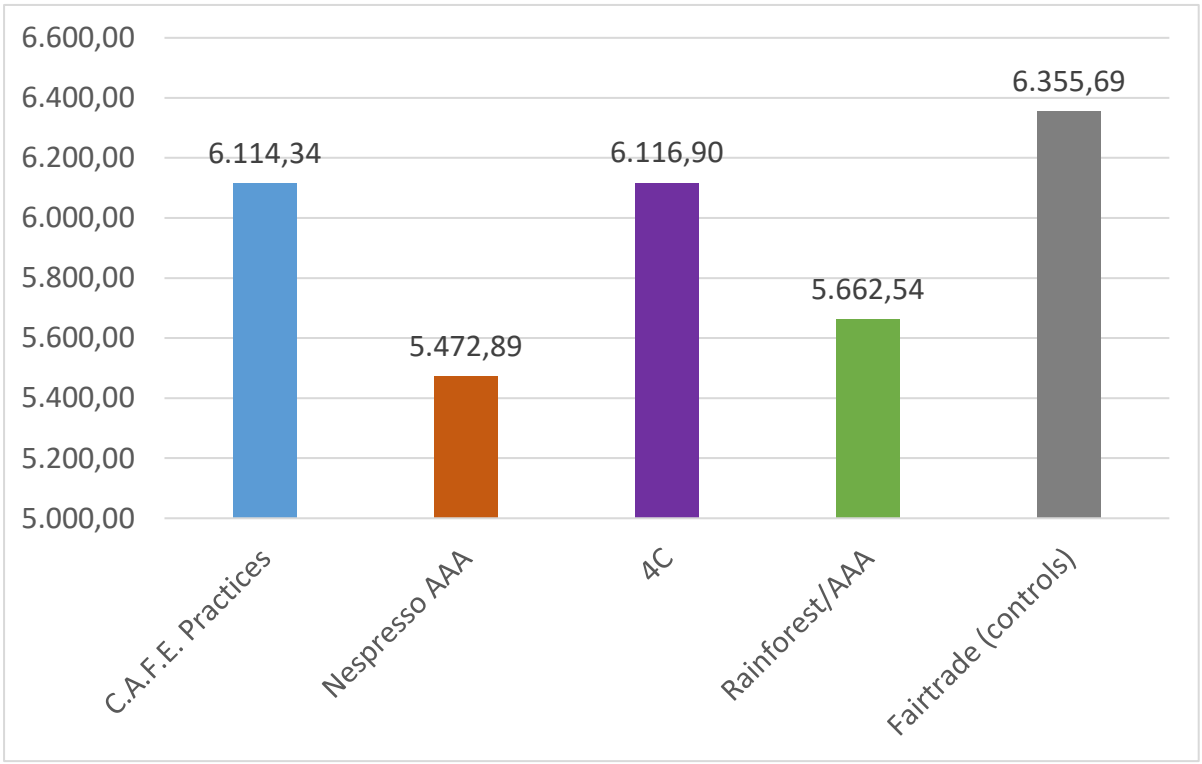


Figure 28. Production costs per hectare in Colombia, in 1,000s COP (2015)



In terms of the breakdown of costs, Nespresso AAA farmers display lower labor and input costs, and Rainforest Alliance/ Nespresso AAA farmers present fewer expenses in agricultural inputs than their controls. The underlying practices that could potentially be influencing these results are i) higher levels of record-keeping of Rainforest Alliance/ Nespresso AAA farmers; ii) increased access to soil analysis, which determines the optimal fertilizer application rate. On the other side of the spectrum, Starbucks C.A.F.E. Practices and 4C label do not present significant differences to their controls. For the case of C.A.F.E. Practices, their higher levels of record-keeping fail to translate into decreased costs of production.

8.3.2. Honduras

In the case of Honduras, the only analyzed certification that displays a significant impact is the Rainforest Alliance standard (see results in Table 20). These certification holders have higher production costs per farm and per hectare than their similar non-certified controls. The increase in production costs per hectare is 9,022 HNL, or the equivalent of US 401.7 dollars. In this case, the increased rates of record-keeping (28%) for these certification holders does not seem to have an effect in lowering their production costs. Moreover, these farmers have significantly higher access to soil analysis and they still apply fertilizer at much higher rates than their non-certified counterparts. As for the Fairtrade, UTZ and 4C standards, the effects on production costs are non-significant. Figures 29 and 30 depicts these effects per farm and per hectare.

Figure 29. Production costs per farm (HNL) 2015/16

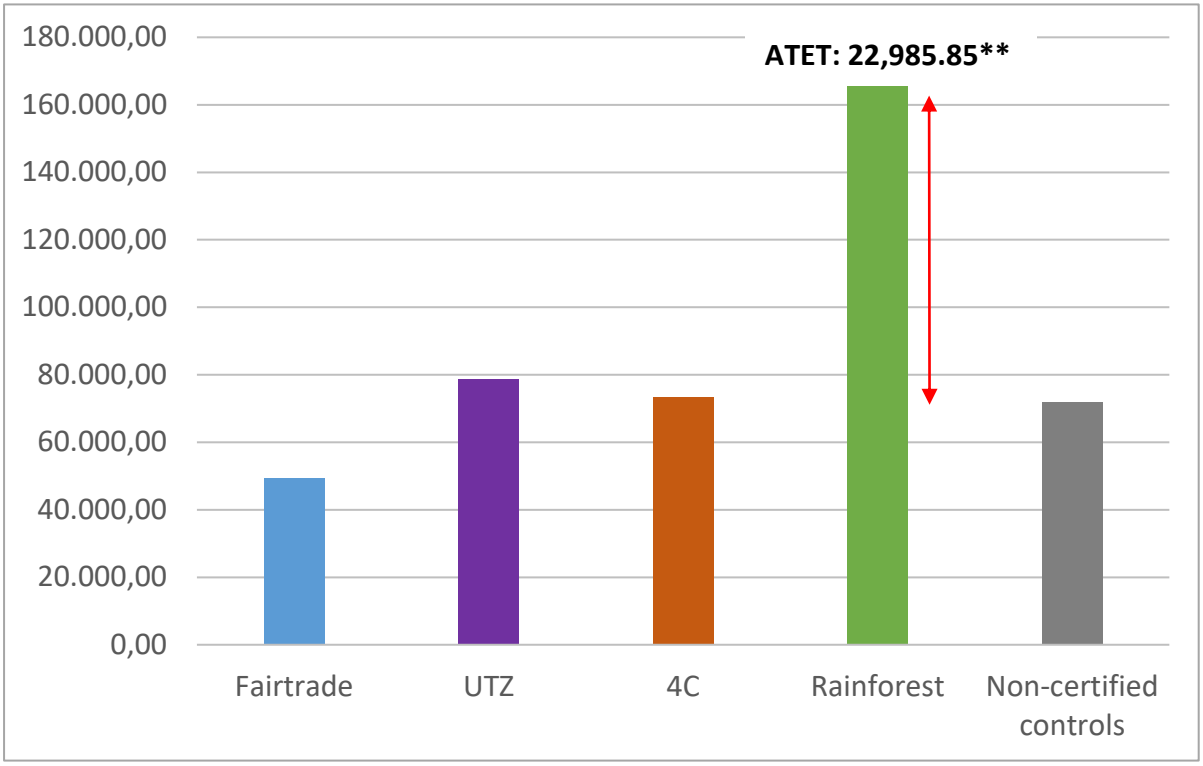
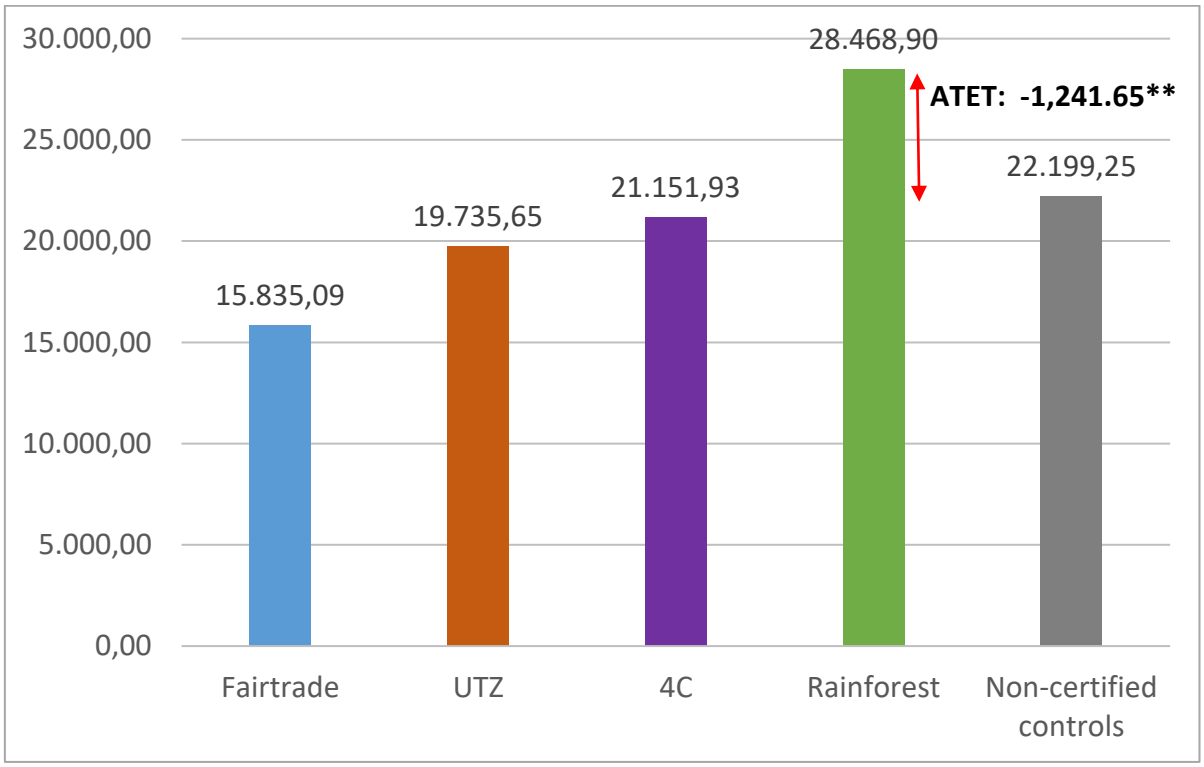


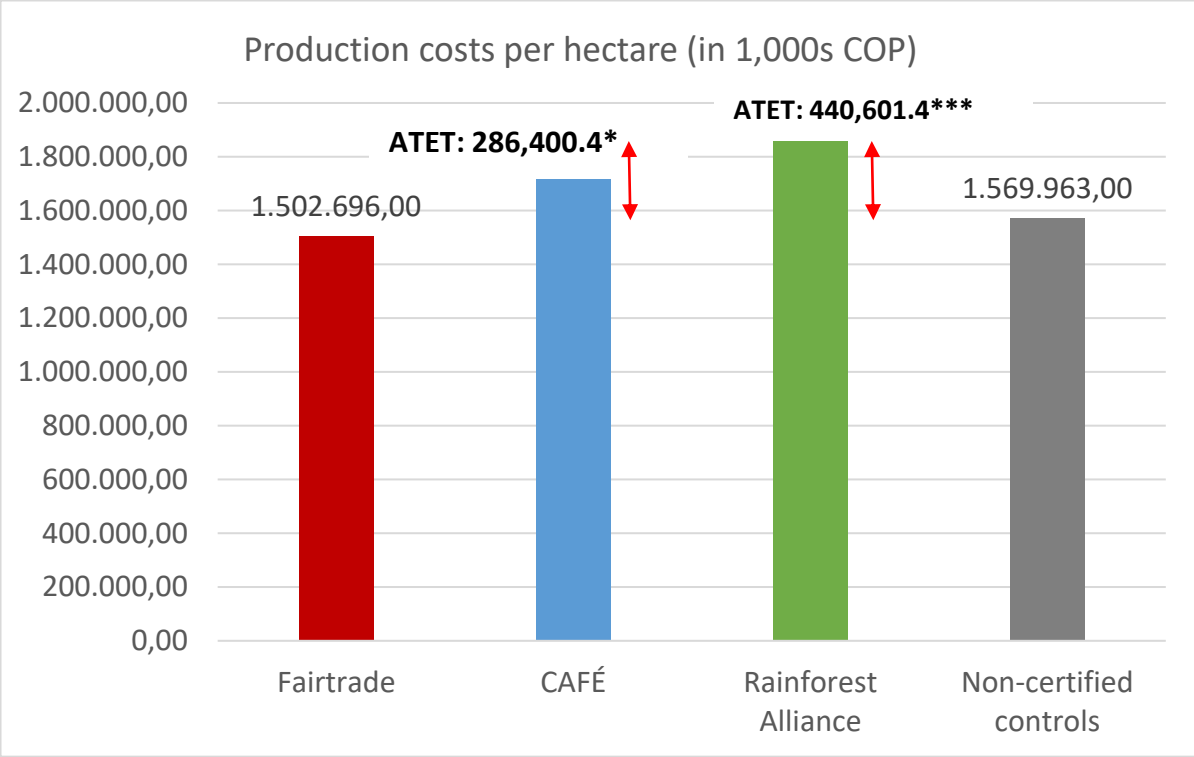
Figure 30. Production costs per hectare (HNL) 2015/16



8.3.3. Costa Rica

As for the case of Costa Rica, the analysis displayed in Table 21 shows that Starbucks C.A.F.E. Practices and Rainforest Alliance farmers have significantly higher costs of production per hectare. The amount, as depicted in Figure 31, is quite significant: holding the Rainforest Alliance certification is associated with an increase of 440,601 CRC in per hectare expenditures, or the equivalent of USD 825 dollars; and the effect of Starbucks C.A.F.E. Practices translates into USD 536 more in costs. Fairtrade certified farmers do not present significant differences to their controls. The underlying practices that could potentially be influencing these results are lower levels of record keeping, which is common to all three certification groups. In addition, this could be an indication that the implementation of practices required to comply with the more stringent certifications result in increased production costs (Potts et al., 2014). One potential source of higher expenses is the increased use of fertilizer inputs per hectare found in Starbucks C.A.F.E. Practices and Rainforest Alliance certified farmers.

Figure 31. Production costs per hectare in CRC (2015/16)



8.3.4. Major takeaways

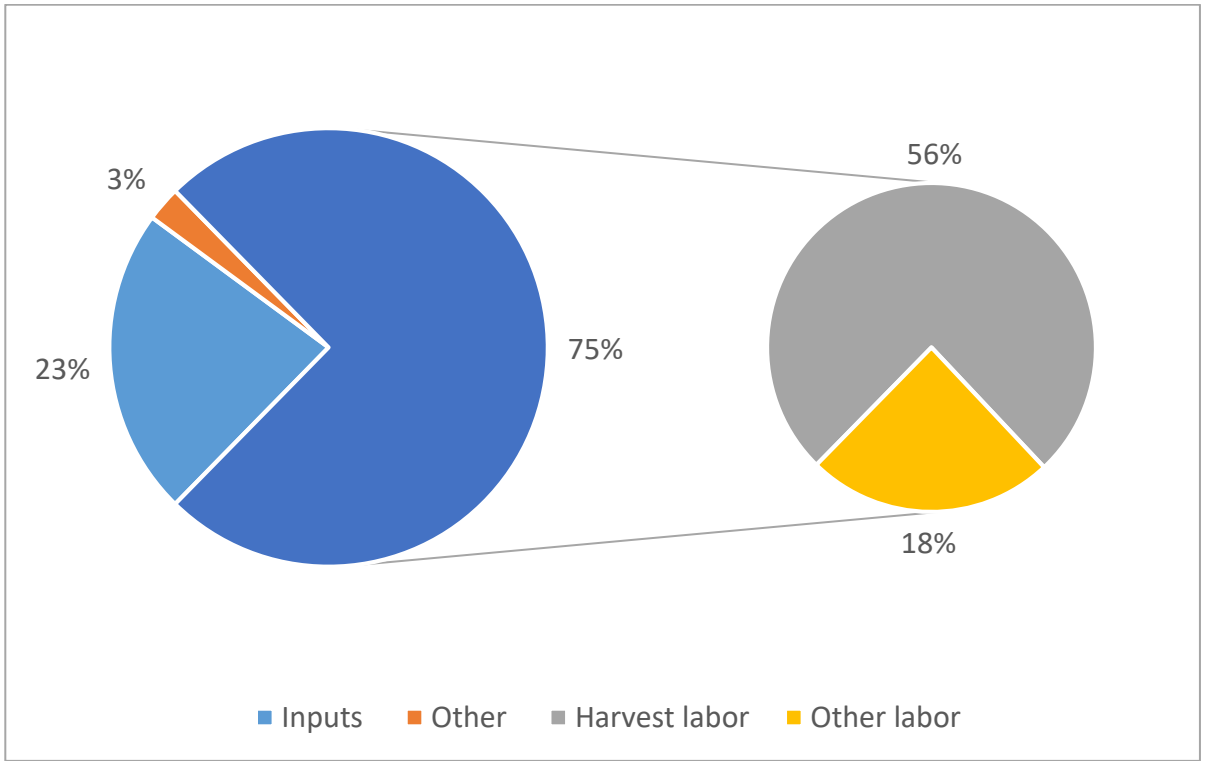
Summarizing the overall results per certification, Rainforest Alliance showed to be associated with decreased production costs in Colombia, while in Costa Rica and Honduras these certification holders displayed higher production costs. Fairtrade farmers in Colombia had significantly higher production costs than non-certified farmers; while in Costa Rica and Honduras the effects of this certification were non-significant for this indicator. UTZ and 4C standards also failed to show an effect in costs of production. Starbucks C.A.F.E. Practices displayed a negative effect in production costs in Costa Rica, and in Colombia the results for this certification were non-significant. Nespresso AAA certified producers, on the other hand, had lower production costs than their counterparts.

It is noteworthy that the certified farmers that had significantly higher yields also exhibited increased production costs. As has been mentioned in the yields pathway, these farmers adopt a high-input, high-volume approach, which entails more expenditure in inputs and labor (Specialty Coffee Association, 2017). While that strategy leads to higher revenues in every analyzed case, unless their output is very large or they manage to keep their costs at reasonable levels, this will not result in higher gross profits. For instance, Fairtrade certified farmers in Colombia, who display significantly higher yields than their counterparts, also present much higher labor and input costs per hectare, as well as other costs such as transportation, water and energy use and processing costs. This is similar for Rainforest Alliance producers in Costa Rica and Honduras. For Starbucks C.A.F.E. Practices in Costa Rica, the higher production costs are concentrated in input and other costs, rather than labor costs.

Calculating and comparing production costs for smallholder farmers is critical to determine their profitability. Indeed, one of the main determinants of competitiveness of individual origins in the world market is the cost of production at farm level (International Coffee Organization, 2019). Coffee production costs have been on the rise for several decades. More specifically, labor costs have been increasing due to the ageing agricultural population, with youth migrating towards urban areas and seeking new opportunities. As for the cost of fertilizers, its main components – nitrogen, potassium and phosphates – have experienced price changes, including a general increase of around 300% since year 2000 (International Coffee Organisation, 2014). In Colombia, the cost of production has increased 39% from 2002/2003 to 2012/2013; and in Costa Rica the increase was

almost 58% (International Coffee Organisation, 2014). Indeed, the empirical findings reflect high production costs for smallholders in the sampled producing regions, with the highest costs accrued by Colombia and followed by Costa Rica. As previous literature has found, higher costs of production per hectare are a function of increased labor costs (Kilian et al., 2004). In Colombia and Costa Rica, as depicted in figures 32 and 34, more than 70% of the explicit production costs are concentrated in labor expenditures (75% and 71%, respectively). Of this number, a staggering 56% of Colombian smallholders' average production costs is spent in hired labor for harvest season (76% of total labor costs), while in Costa Rica it is 45%. In Honduras, the cost of hired labor corresponds to a lower share of the total production costs per hectare (see Figure 33). There are two main reasons for this: i) the labor costs are lower in that country; and ii) a considerably higher burden of the work is carried by family and/or unpaid labor (including own labor). That is, unpaid labor accounts for 44% of the labor used for productive activities such as planting, fertilizing, spraying, shade management, among others. In Colombia, unpaid work represents 34% of the total workforce used for Coffee production in year 2015.

Figure 32. Distribution of production costs per ha for Colombian farmers (2015)



Agricultural inputs also represent a large share of production expenditures: more than 20% in Colombia and Costa Rica, and 35% in Honduras. Most of these expenditures go towards fertilizer, which in Colombia and Honduras add up to more than 90% of expenditures in agricultural inputs. In Costa Rica, fertilizer accounts for 77% of agricultural input costs per hectare.

Figure 33. Distribution of production costs per ha for Honduran farmers (2015/2016)

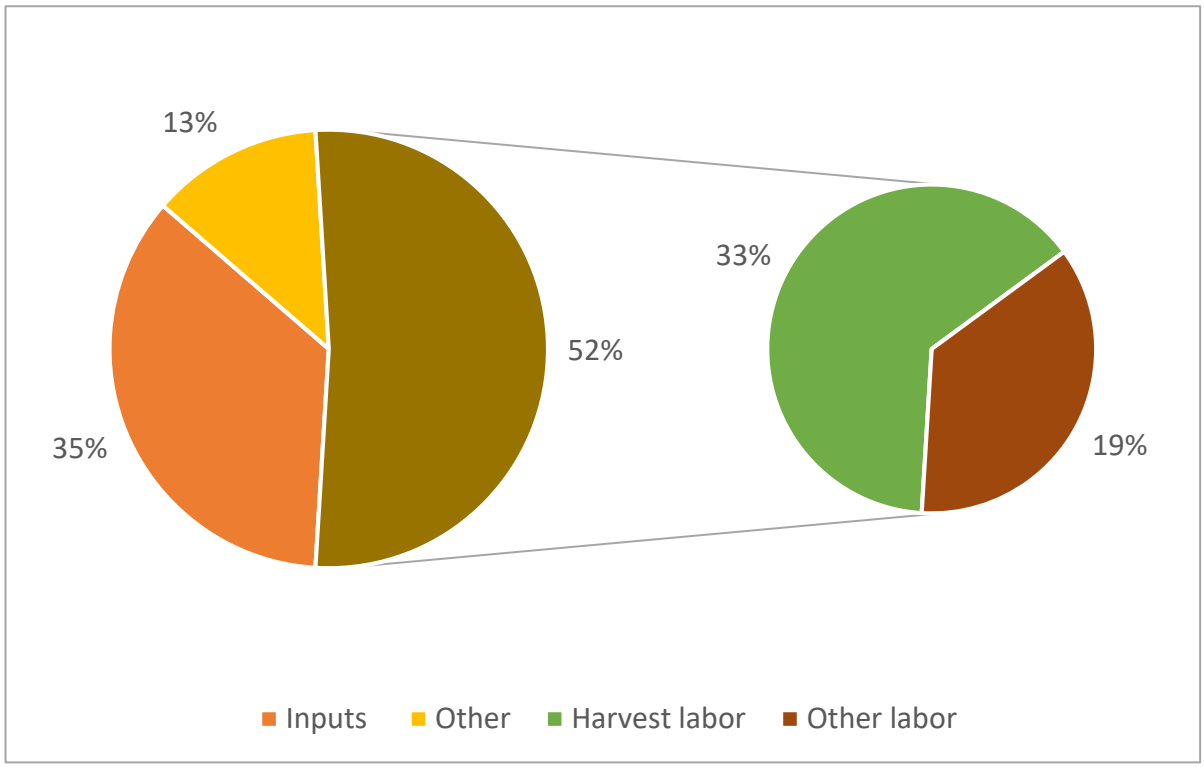
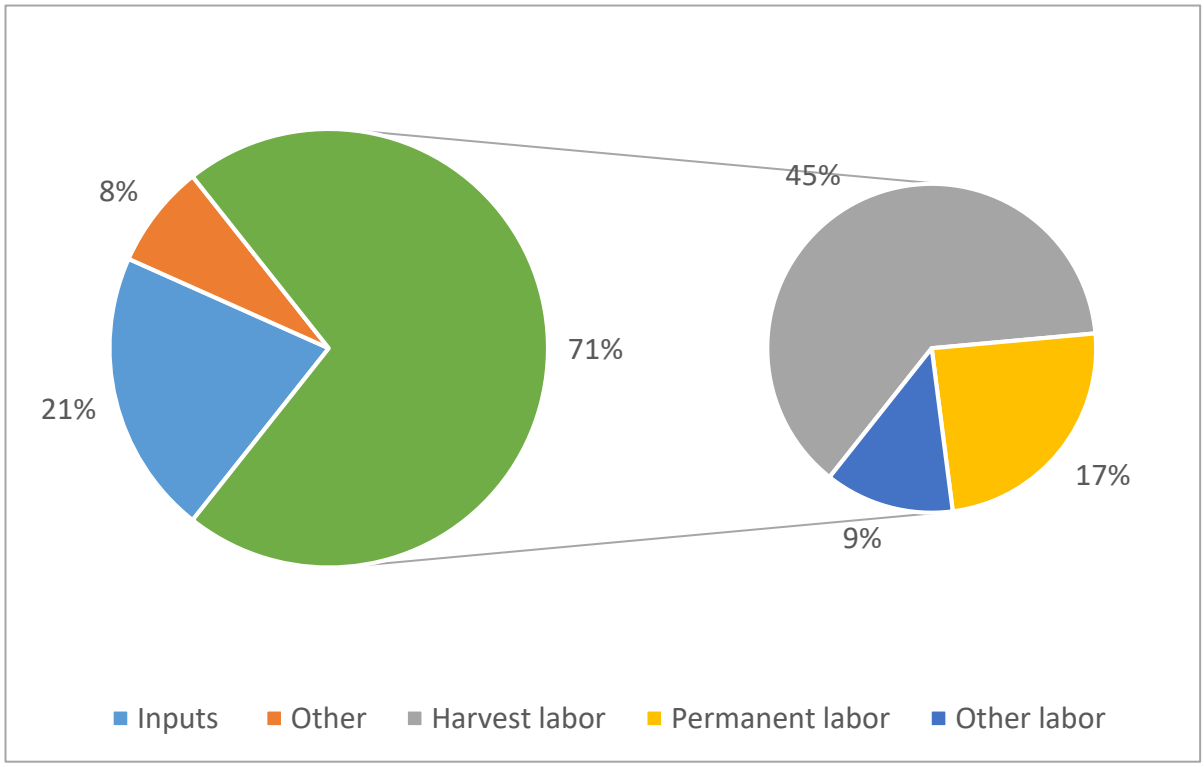


Figure 34. Distribution of production costs per ha for Costa Rican farmers (2015/2016)



Rainforest Alliance

According to the certifications' theories of change and codes of conduct, Rainforest Alliance is one of the standards that prioritizes reduced production costs and increased on-farm efficiency. Record-keeping is mentioned as a key underlying practice that informs producers' financial decisions. The results on the ground show that this pathway works as expected with Colombian Rainforest Alliance certified farmers: these producers report significantly higher levels of record-keeping than their controls and utilize less inputs per hectare than their controls, which ultimately leads to lower production costs per farm. In the other two countries, however, the mechanism for this certification failed to work as expected: in Costa Rica, these certified producers used record-keeping at lower rates than their counterparts and applied significantly higher amounts of fertileizer per hectare, resulting in higher production costs. In Honduras, even though Rainforest Alliance farmers reported higher levels of record-keeping than non-certified farmers, they also used a significantly higher amount of fertilizer per hectare, resulting in increased production costs per hectare and per farm. In all three cases, Rainforest Alliance farmers achieve increased revenue and gross profits and/or household income.

Fairtrade certification

The Fairtrade standard does not reference production costs or farm efficiency in their theory of change and Code of Conduct. The empirical results reflect this: Fairtrade producers in Colombia have significantly higher production costs than their counterparts; and these certified producers in Honduras spend significantly more in labor than non-certified farmers. These findings are in line with previous literature that reports higher input and labor costs for Fairtrade producers, as compared with their control groups (Ruben & Zuniga, 2011).

Industry-oriented standards: UTZ and 4C

UTZ, on the other hand, despite mandating record-keeping to achieve farm-efficiency for their certified farmers, fails to display a significant difference from comparable non-certified farmers in terms of production costs. There is also no significant difference between their levels of record-keeping and those of their controls (37% of UTZ certified farmers reported keeping records). These findings differ with previous studies conducted in Nicaragua and Colombia that report lower per unit costs for UTZ certified farmers (Garcia, 2014; Haggar et al., 2017).

4C verification also references record-keeping of the main Coffee costs and income, as well as their analysis as a way to inform decision-making, as relevant criteria to comply with their standard. Nonetheless, the results in the field for Colombia and Honduras do not show significant effects in record-keeping nor in farm efficiency or decreased production costs. The results from the field differ from previous insights from Kuit et al. (2016) who found positive changes in production costs per unit in Uganda.

Private standards: Nespresso AAA and Starbucks C.A.F.E. Practices

Starbucks C.A.F.E. Practices does not include decreasing production costs as part of their certification code. The results on the ground clearly depict this: in Colombia, these certified producers do not present significant differences to their controls, and in Costa Rica they display significantly higher production costs per hectare. Interestingly, in Colombia the higher levels of record-keeping of these certified producers fails to translate into decreased production costs. This result is line with previous studies conducted in Nicaragua, which find that costs of production for Starbucks C.A.F.E. Practices were 40% higher than those of non-certified farmers (Haggar et al., 2017).

The Nespresso AAA standard does emphasize decreased production costs as one of the main pathways to profitability. The empirical evidence, which reports a positive effect for this pathway, fails to show an association between record-keeping and decreased production costs: Nespresso AAA certified producers do not display significant differences in terms of record-keeping; however, they do have lower production costs per hectare. Given their significantly lower production and revenues as compared to their counterparts, it is inferred that, in this particular case, lower production costs reflect a lack of sufficient investment in Coffee farming (e.g. lower fertilizer input in Cooperative 1) rather than efficiency gains. Currently there is no available impact literature reporting decreased production costs for Nespresso AAA producers; the results focus on productivity and net income gains (CRECE, 2013b, 2013a).

In sum, the analysis of this pathway shows that certifications, for the most part, fail to decrease production costs and increase efficiency[9]. In fact, only the

[9] It is important to note that the costs included in this analysis comprise only cash outlays or variable operating costs, which is usually the reference point farmers use to determine their profitability. A number of other costs, such as unpaid labor; and fixed costs like installation costs, depreciation of equipment and machinery, the opportunity cost of land and finance

Rainforest Alliance and Nespresso AAA certifications displayed positive effects in Colombia. Otherwise, Coffee certifications were either associated with higher costs or the effect on this indicator was non-significant. This could be the result of the cost of implementing good agricultural practices and a higher investment in measures to increase productivity associated with several of the certification schemes. From the two cases where a positive effect in production costs per hectare was displayed, it only translated into increased profits for the Rainforest Alliance certification. For the case of Nespresso AAA, their low production costs reflected a low investment in Coffee production with consequently lower production and revenue. Therefore, a clear association between decreased production costs and profitability was found. In their review of costs and benefits of certifications, Kuit and Waarts (2014) found similar results: 40% of the studies assessed had higher production costs for certified Coffee.

8.4. Access to credit

For this study, two different types of access to finance were evaluated for the different certification holders: i) access to cash loans, either from banks, cooperative, traders, among other sources; and ii) agricultural credit, understood as having paid for agricultural inputs, such as fertilizer after harvest, as opposed to at the time of purchase (only for the case of Colombia). This credit was provided by the cooperatives.

8.4.1. Colombia

For the case of Colombia, all the certifications showed positive results either in access to loans or agricultural credit except for 4C, where this is unclear. Starbucks C.A.F.E. Practices producers show significantly higher levels of access to cash loans[10] than their counterfactual, with an increase of 15%. The Fairtrade certification had the most significant effect in terms of importance: holding this certification is associated with a rate increase of 30% in access to cash loans (see Table 17). In terms of agricultural credit, Rainforest Alliance/ Nespresso AAA farmers (in Cooperative 1) and Nespresso AAA producers (in Cooperative 2)

costs, are purposefully omitted from this analysis. That means that in this analysis, production costs are being underestimated.

[10] Of the total sample, 43.61% of the farmers had accessed formal credit in the year 2015. The sources of the credit were the banks (61.28%), cooperative (36.09%), merchants (1.5%), and other sources (1.13%).

reported having access to it at higher rates than control farmers (see Appendix D). The Fairtrade certification also shows positive results on the ground concerning higher access to agricultural credit (see Appendix F).

8.4.2. Honduras

In Honduras, the only certification that had a positive impact in access to loans was the Rainforest Alliance standard. For these certification holders, having the Rainforest Alliance standard led to an increase of 22% in access to loans rates. The results for UTZ, 4C and Fairtrade were non-significant, which indicates that these certifications do not have a clear impact in access to credit (see Table 20).

8.4.3. Costa Rica

In Costa Rica, all the certification groups showed non-significant results for this indicator. This points to the fact that Coffee certifications, either NGO-driven or industry-led; do not necessarily translate into higher access to credit (see Table 21). These findings support the results reported by COSA (2013), which also claim similar levels of access to credit for certified and non-certified farmers in Costa Rica. One potential explanation for this outcome is that cooperatives offer loans to their producer members equally, without differentiating between farmers who hold a certification and those who do not.

8.4.4. Major takeaways

Overall, the results on the ground show positive effects of the Fairtrade certification in Colombia, both in terms of higher access to cash loans and agricultural credit. Yet, these results are not replicated in Costa Rica or Honduras, where the impact on this pathway is non-significant. 4C verified producers display non-significant results for access to finance, a similar result to UTZ certification. Rainforest Alliance producers in Colombia reported higher rates of access to agricultural input credit, and in Honduras there is a positive effect in terms of access to cash loans. As for the industry-led certification Starbucks C.A.F.E. Practices, the data shows positive effects in accessing financial services in Colombia, while in Costa Rica no significant differences were found. Nespresso AAA producers reported higher use of informal credit only in one of the cooperatives, yet there were no effects in access to formal financial services.

The positive results for Rainforest Alliance certification could partly explain their higher profits: in Colombia, these farmers received agricultural input credit at higher rates than their controls, potentially allowing them to make more investments in Coffee farming without the financial constraints of a bank loan. In Honduras, the positive impact was found for formal financial services. For these certified farmers, the main sources of the credit were the traders (61%), followed by banks (29%) and other organizations (11%).

The positive effects found for the Fairtrade certification demonstrate that, in the case of Colombia, the implementation of this standard is leading to the expected results in terms of access to finance. These findings are in line with previous literature that reports positive effect of this standard in access to credit. Utting (2009), for instance, reported that a Fairtrade cooperative in Peru had allowed their certified producer members to access credit for the first time. Similarly, Ruben and Fort (2012) found that Fairtrade farmers in Peru had better access to credit than their counterfactual. Both studies conclude that farmers in older Fairtrade cooperatives were able to reap more benefits in terms of access to credit. Having access to finance potentially enabled these farmers to invest in fertilizer and other agricultural inputs needed to increase productivity – reflected in their higher yields as compared to non-certified farmers, and significantly higher revenues. Yet, Fairtrade farmers failed to achieve higher gross profits due to their high production costs.

As for the other standard that references access to credit in their Code of Conduct, 4C verification, the non-significant results mirror previous impact evaluations that show that while farmers expect access to finance as part of the benefits of being 4C verified, these expectations are not realized as they join this scheme (Kuit et al., 2016). UTZ, on the other hand, does not reference access to credit in their Code of Conduct, and the field results reflect this, with no significant impacts found. However, other impact evaluations in Kenya do report higher access to credit for UTZ certification holders (Kamau et al., 2010).

In sum, Fairtrade certification, Starbucks C.A.F.E. Practices and Rainforest Alliance display positive results in access to finance. Of these certifications, the only one that has a positive impact in their profitability indicators is Rainforest Alliance. Given these outcomes, it is not possible to conclude that the pathway of access to finance actually leads to higher profits, at least in these sample farmers.

However, one interesting avenue that is worth exploring is if the type of credit accessed makes a difference in the financial situation of the farmer. In the case

of Rainforest Alliance, for example, the producers displayed positive results in access to more informal forms of credit, such as agricultural inputs provided by the cooperative for the case of Colombia. In Honduras, most growers had borrowed from traders rather than from banks. This could be an indication that fewer formal forms of credit have the potential of improving economic outcomes, or at least provide easier access to inputs or cash, allowing producers to make the necessary investments in Coffee growing. A more detailed analysis of this topic would be needed to make such assertion though.

9. Excursus: Quality impact pathway (Costa Rica case study)

An important variable that is mentioned throughout the literature on Costa Rica is Coffee quality. This seems to be important in a country like this, which thoroughly controls the production process and has strict quality standards. A number of authors assert that certification premiums reward the quality of the Coffee rather than the sustainability practices used in its production (Ruben & Zuniga, 2011; Snider et al., 2017). The Coffee quality, then, is considered a precondition to receive price premiums (Kilian et al., 2004), which means farmers implement sustainability practices without a clear compensation (Giovannucci et al., 2008). Although this variable is not included in the econometric analysis given that it does not fit the concept of a "pathway" as defined for this study, this topic is explored through the use of descriptive statistics and a probit model that determines the likelihood of participating in a sustainability standard according to the quality of the Coffee produced. For this study, the following indicators are used as proxies for Coffee quality: i) altitude, as Coffee grown at higher elevations is generally considered to provide high quality and distinct characteristics (Snider et al., 2017; Wollni & Zeller, 2007); ii) share of farmers reporting price reduction due to sales of lower quality Coffee; iii) share of farmers that report knowing their cup quality; iv) share of non-rust resistant varieties planted, which are commonly considered to provide higher cup quality (ICAFE, n.d.-b).

As for the association between quality and increased revenue and profits in certified farmers, this is tested using descriptive statistics and qualitative analysis. The results displayed in Table 29 confirm the connection between higher quality Coffee and a better financial situation in certified smallholder farmers. The multi-certified farmers holding the Rainforest Alliance standard clearly perform better in the measured quality indicators than C.A.F.E. Practices and Fairtrade certification. Only 5% of their certified producers report having had a price cut due to lower quality, 40% reported knowing their cup quality, 73% of their Coffee plants were non-rust resistant varieties and their Coffee farms were located at an average elevation of 1,500m. Fairtrade only farmers, on the other hand, grew Coffee at lower altitudes (<1,000m), had a high rate of rejection and/or price cuts due to sales of lower quality Coffee, and only 12% of these certification holders reported knowing their cup quality. Therefore, from this analysis,

one conclusion that is drawn is that quality is a pre-condition to access the most stringent certifications, such as Rainforest Alliance. As a matter of fact, Starbucks C.A.F.E. Practices defines quality as a pre-condition to access this certification. This is supported by other studies conducted in Costa Rica stating that certifications such as Rainforest Alliance or Starbucks C.A.F.E. Practices "are effectively only available to the producers of high altitude Coffee as buyers are willing to pay a certification premium only for Coffee of high quality and the distinctive flavor profile associated with high elevation production" (Snider et al., 2017).

Table 29. Quality indicators per certification group

Quality indicators	Rainforest	CAFÉ	Fairtrade	Non-certified
Rejected quality	5%	35%	62%	1%
Cup quality	40%	25%	12%	19%
Share rust resistant	73%	67%	65%	90%
Average altitude	1,509.74	1,401.17	998.36	1,607.67
High altitude (<1,000)	87.22%	86%	38%	84.38%

Interestingly though, non-certified farmers perform even better than Rainforest Alliance producers in these indicators, except for the share of producers reporting to know their cup quality. This topic was explored further by adapting a probit model used by Wollni and Zeller (2007). This model measures the probability of participating in a sustainability certification based on indicators that proxy quality, such as the aforementioned ones. In addition, other indicators are included in the model, such as participation in microlot programs (high-quality Coffee with full traceability) and having received training in good agricultural practices, which should help farmers increase their Coffee quality (Wollni & Zeller, 2007). Moreover, other relevant variables such as sex, age, total area, tenure, household size, schooling, share of income from Coffee, are included. The results show that Coffee grown at higher elevations (>1,200m) is more likely to adopt certifications, which is in line with Wollni and Zeller (2007) findings in Costa Rica. However, in terms of the other indicators, there is a negative association between higher quality and probability of participation in sustainability standards. The higher quality Coffee grown by non-certified producers does translate into higher prices per "fanega" (258 kg of Coffee cherries), as shown in the pathway analysis (see Table 21). For ease of understanding, in Figure 23 the prices in USD per pound of Coffee are displayed.

These findings led to further exploration of this topic, in order to determine if "cooperative effects" explained Coffee quality. Indeed, cooperatives 4, 5 and 7 produce higher quality Coffee (see Table 30). Their emphasis in quality is confirmed by the existence of a micro lot program in these three cooperatives. And, in fact, these cooperatives are the ones able to negotiate a better value for their Coffee, therefore offering higher prices to their producer members. These cooperatives are also less dependent on certifications: cooperative 7 does not hold any certifications, while cooperative 5 has only certified 11% of their total producer members with individual certifications (Starbucks C.A.F.E. Practices and Rainforest Alliance). While they did hold the Fairtrade certification for two years, the sales through this certification channel were so insignificant that they decided it was not cost-effective to keep this standard. As for Cooperative 4, although they do hold the Fairtrade standard and Starbucks C.A.F.E. Practices as collective certifications, and 4% of their producer members are Rainforest Alliance certified, their general perception is that certifications are not worthwhile. In fact, one of their goals is to progressively phase out sustainability standards in favor of their own origin standard.

Table 30. Quality indicators per cooperative in Costa Rica (2015/2016)

Quality indicators	Cooperative 7	Cooperative 4	Cooperative 5	Cooperative 6	Cooperative 8
Rejected quality	2%	2%	0%	17%	99%
Cup quality	13%	19%	29%	28%	33%
Share rust resistant	19%	28%	4%	42%	25%
Average altitude	1,178.17	1,621.89	1,713.80	1,263.09	1,020.04
High altitude >1,000	65.52%	100%	100%	61.59%	57.33%
Microlot program	Yes	Yes	Yes	No	No

On the other hand, cooperatives that perform lower in the quality indicators use sustainability certifications to differentiate their Coffee. Cooperatives 6 and 8, for instance, mention that certifications have been one of the pillars that allow for better market access and prices for their Coffee. These two cooperatives hold the Fairtrade certification and individually certify some of their farmers with C.AF.E. Practices certification. Cooperative 6 additionally holds the Rainforest Alliance and Nespresso AAA sustainability standards. These two cooperatives offer the lowest prices as compared to the other three cooperatives. The price of conventional Coffee in Cooperative 6 was significantly lower than the price offered by the other cooperatives, and within our sample, 20% of total production

in this cooperative was sold as conventional Coffee. This indicates that the burden placed by certifications in terms of trainings, extension services, audits, compliance with requirements, among others, is not compensated by the price incentives offered by certifications.

This leads to two important conclusions. First, the micro institutional conditions in the Coffee value chain – in this case the cooperatives – make a difference in the price setting mechanism. Though, the underlying predicting variable for Coffee prices seems to be quality. Second, cooperatives producing higher quality Coffee generally do not have the need to differentiate their Coffee through certifications. Instead, they rely on quality and the distinctive characteristics of their Coffee to market their product, with high levels of success reflected in the high demand for their Coffee (Snider et al., 2017).

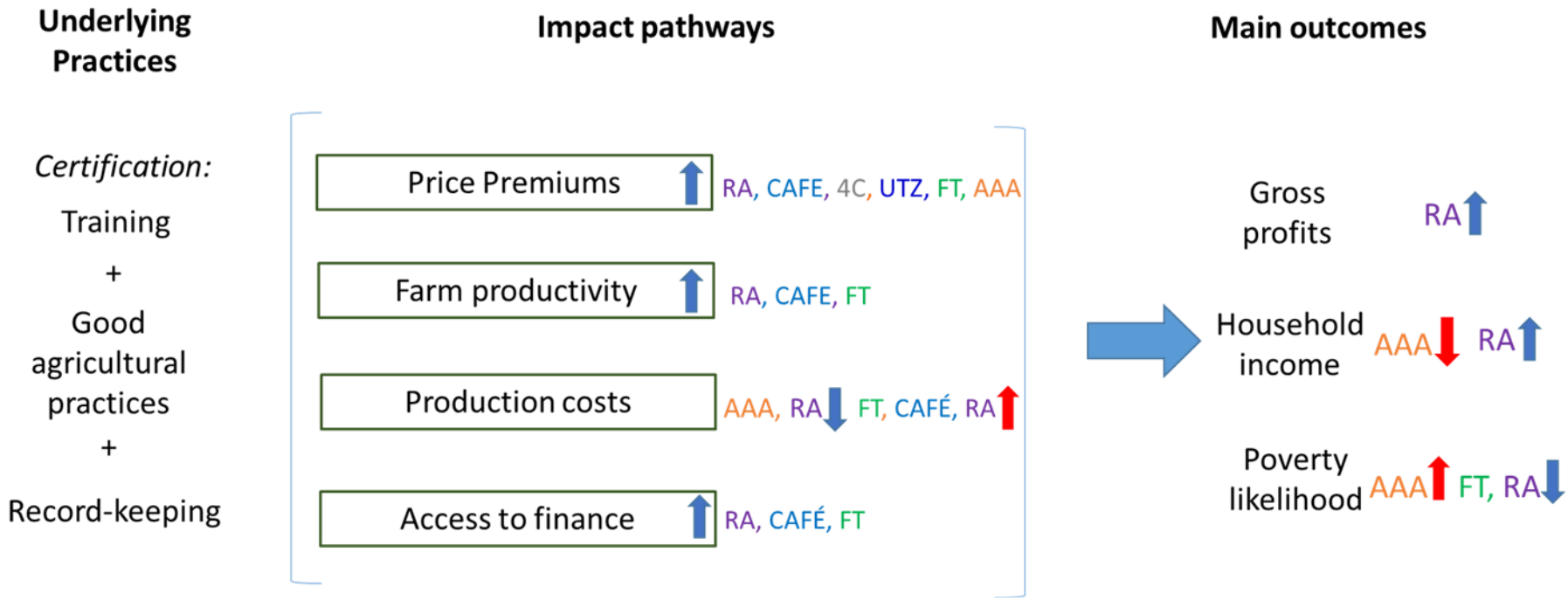
To recapitulate, higher productivity appears to be the most important pathway leading to higher profits for certified farmers, which is shown in the case of multi-certified farmers holding the Rainforest certification. Quality appears to be a precondition to access the more stringent certifications, which is shown by the higher quality performance in Rainforest Alliance farmers. But non-certified farmers perform even better in terms of quality than certified farmers. This indeed translates into better prices per fanega than the certified groups, which speaks to the higher demand for their Coffee. Thus, my analysis confirms that there is a strong link between quality and price. These two variables are in part explained by "cooperative effects", although it is difficult to attribute quality enhancements to the cooperative trainings/extension services/programs, since several of these characteristics are a given, such as altitude. Price setting depends on the cooperative and its bargaining power, but the underlying variable that determines it is quality.

Part IV: Theoretical Insights

10. Causal relations between pathways and economic impact

Now, I go back to the initial theoretical model of this research and analyze if and how these identified pathways lead to farm profitability. Figure 35 depicts the initial theoretical model and includes how certifications performed in each of the four specified pathways and ultimately, in the main economic outcomes analyzed. The blue arrow signifies a positive and significant effect, and the red arrow indicate a negative and significant effect. The direction of the arrow (upwards or downwards) signals an increase or decrease in the analyzed variable, respectively. The acronym of the certification shows that a significant effect was found either for the pathways or the main outcomes, in at least one of the three countries analyzed. For example, for the outcome of poverty likelihood, Nespresso AAA farmers exhibited a higher probability of living under the poverty line than their counterparts (negative effect). On the other hand, Fairtrade only and Rainforest Alliance certified producers had a lower probability of living under the poverty line than their paired matches (positive effect). In some cases, one certification can have opposing effects in different countries. For instance, for the pathway of production costs, Rainforest Alliance displayed lower production costs in Colombia, while in Costa Rica and Honduras this certification was associated with higher costs of production. In these cases, the acronym of the certification is included next to the blue and red arrow.

Figure 35. Impact pathway results depicted on the initial theoretical model



As shown, all the certifications studied perform positively in at least one of the pathways. In the price premiums pathway, every certification seems to provide additionality as reflected in higher prices per unit than their counterparts. Albeit, for the results of Rainforest Alliance and Nespresso AAA in Colombia, these positive findings were only present in one of the cooperatives analyzed (see Appendix D for Cooperative-specific results). In terms of farm productivity, Rainforest Alliance, Starbucks C.A.F.E. Practices and Fairtrade have positive and significant outcomes in at least one of the three countries studied. Concerning production costs, Nespresso AAA and Rainforest Alliance certified farmers presented lower expenditures in Colombia, while Fairtrade and Starbucks C.A.F.E. Practices had significantly higher costs than their counterparts. As for access to finance, Rainforest Alliance, Starbucks C.A.F.E. Practices and Fairtrade certified farmers reported higher rates of access to and utilization of financial services.
However, as has been previously discussed, these pathways only translate into positive outcomes in the cases of the Rainforest Alliance and Fairtrade certification, with the latter having attained social goals rather than higher economic returns. The question is, then: Why do the other certifications perform positively in some pathways, but ultimately fail to lead to improvement in the smallholders' economic conditions?

11. Trade-offs of adopting Voluntary Sustainability Standards

My analysis points to different trade-offs and drawbacks associated with the adoption of sustainability standards. In the following, I show how these trade-offs and drawbacks affect the overall performance of VSS for each of the analyzed certifications.

Nespresso AAA farmers perform positively in terms of price premiums, market uptake and costs of production. Yet, I also find that they implement the content learned in trainings at lower rates than their counterparts. What is more, lower production costs, reflect a lack of sufficient investment in Coffee farming (e.g. lower fertilizer input in Cooperative 1) rather than efficiency gain, as their production in 2015 was significantly lower compared to the counterfactual[11]. I hypothesize that given the strong emphasis of this certification on quality, producers invest more time and effort in quality control, therefore making it difficult to produce higher volumes[12]. In addition to finding a negative impact on these farmers' Coffee income, my research also proved that they do not show substantial gains from other on-farm or off-farm activities, and consequently have significantly lower household income. This ultimately increases their probability of living under the poverty line, which is above average for the sample.

A similar case is observed for the other company-led standard, Starbucks C.A.F.E. Practices. Their non-significant results in gross profit and household income despite receiving a higher price for their Coffee in Colombia and having significantly higher yields in Costa Rica have two different potential explanations: i) in Colombia, this certification has a low market uptake; ii) In Costa Rica, the higher yields were also associated with higher production costs, therefore offsetting the positive effects of this pathway. As previously mentioned, these farmers adopt a high-input, high-volume approach, which in principle affords them higher revenues, but ultimately it decreases the farm's profitability due to

[11] These producers also showed significantly lower yields than their controls in the t-test (See Table 8).

[12] Quality control practices include picking only ripe coffee cherries, controlling the floaters, in addition to processing practices such as fermenting and drying the coffee appropriately. While these practices do not result in higher labor costs, I argue that given that these producers are the poorest of our sample, it is more likely that they utilize unpaid family labor at higher rates (I are not considering unpaid labor for the analysis of costs of production).

the increased input costs (Specialty Coffee Association, 2017). Likewise, these producer's higher access to credit in Colombia does not result in a clear positive impact on their economic situation. Moreover, the fact that they require credit possibly indicates that they are financially constrained. These results differ with the previous findings reporting higher net revenues for Starbucks C.A.F.E. Practices certified farmers (Haggar et al., 2017), as well as with the literature that reports positive effects on productivity and increased diversification of their production portfolio (Ruben & Zuniga, 2011).

Like C.A.F.E. Practices, 4C verified farmers also displayed non-significant results in their economic indicators. This, even though in both of the countries where this certification is present (Colombia and Honduras), holding this standard is associated with receiving higher prices. However, further exploration of this impact pathway shows that this entry-level standard has a very low market uptake in Colombia. In Honduras, there is indication that this certification is associated with higher production costs, although these results were not statistically significant (see means in Table 20). In addition, while these farmers in Colombia implement some GAP at higher levels than their counterparts, these positive practices fail to translate into significant positive effects on yields or income.[13] These results align with the findings of Kuit et al. (2016) in Uganda and Vietnam, showing that this entry-level standard has very limited effectiveness in improving farmers' livelihoods.

In the case of UTZ in Honduras, price premiums also fail to translate into positive economic outcomes at the household level. Similar to 4C verification, based on averages for the certified and control sample, there is indication that these farmers incur in higher costs than their non-certified counterparts.

The Fairtrade certification performs positively in the price premiums, farm productivity and access to finance pathways, in Colombia. However, the trade-off is that these farmers also exhibit higher production costs than non-certified farmers. This could explain why their good performance in the mentioned pathways does not translate into increased profits or household income. Nevertheless, Fairtrade certified farmers have a lower probability of living under the poverty line than their counterparts in Colombia, and they also displayed positive results in the social indicators, such as lower rates of food shortage reported during the

[13] Some potential explanations, as previously mentioned, would be that yield levels in Colombia were already high at a pre-certification level, or that GAP such as pruning would only show effects past the period of this study.

year and a higher share of producers having savings. This is an indication that Fairtrade is delivering on its social goals, though not directly reflected in all the economic outcomes.

The case of Rainforest Alliance is very particular given that two different strategies are adopted in the countries, and both result in higher profitability. In the case of Colombia, higher profits are explained by significant price premiums associated with this certification and, perhaps more importantly, lower production costs due to a more efficient use of agricultural inputs. Therefore, in this case, certified growers are adopting a lower-cost strategy while maintaining their yields at similar levels as their controls (this could be a signal of agricultural intensification). In Honduras and Costa Rica, these certified producers adopt a high-input, high-volume strategy, reflected in an increase in yields, as well as higher cash outlays. In these specific cases, the returns gained in productivity are more than enough to offset the higher production costs. In Honduras, productivity gains combined with income from other sources result in increased household income and a lower probability of living under the poverty line than their controls.

In addition, these farmers also performed positively in the access to finance pathway. In Colombia, Rainforest Alliance certified farmers received agricultural input credit at higher rates than their controls, potentially allowing them to make more investments in Coffee farming without the financial constraints of a bank loan. In Honduras and Costa Rica, mostly informal lenders such as traders provided the loans.

The positive economic results for this certification are in line with previous studies that find significantly higher income for Rainforest Alliance farmers (Ruben & Zuniga, 2011; Rueda & Lambin, 2013a). These effects are either explained by increased yields (Hughell and Newsom, 2013; Whelan and Newsom, 2014), or higher farm-gate prices (Mitiku et al., 2017). In this study, I find both explanations of positive economic outcomes to be true. For the case of Colombia, price premiums explain the higher profits, and in Costa Rica and Honduras, higher yields explain the higher returns to Coffee farming. Furthermore, this research contributes to the literature by adding another explanation to the benefits associated with the Rainforest Alliance certification, for the Colombian case. That is, reduced production costs and increased on-farm efficiency, which is in line with this certification's code of conduct. These positive results also point to the effectiveness of double-certification (van Rijsbergen et al., 2016), and specifically of

NGO-led standards, as this is the only certification group that displays positive economic outcomes.

Another potential trade-off associated with the adoption of Voluntary Sustainability Standards is the potential specialization in Coffee production. Diversification beyond Coffee farming, either other on-farm or off-farm activities/income sources, is a key strategy for increasing income and greater economic resilience (Godoy & Bennett, 1988). This is of paramount importance considering the price volatility of the Coffee sector, pests and diseases such as the Coffee leaf rust (Coffeelands, 2013) and climate change threats (Haggar & Schepp, 2012). For this study, diversification was measured using income from other sources additional to Coffee as a proxy (see variable additional income in Tables 12, 15 and 16), and share of income from Coffee (see Tables 8-10).

As remarked by the impact evaluation literature of Coffee certifications, there is a growing body of evidence that shows that Coffee certifications encourage further specialization in the Coffee sector – either intensification or area expansion – potentially leading to substitution effects in terms of foregone economic opportunities and income (Barham & Weber, 2012a; Ruben & Fort, 2012; van Rijsbergen et al., 2016). Conversely, a diversified production portfolio can lead to both higher household income as well as increased resilience to economic and environmental shocks. The latter livelihood strategy gains importance in the context of climate change, the uncertainty of Coffee prices and overcertification issues that lead to lower market uptake of certifications as a share of total certified production.

In the Colombia case, a result common to all the studied certification schemes, except for the Rainforest Alliance/ Nespresso AAA double certification, where results are ambiguous, is a less diversified activity pattern than their controls. These findings suggest that, in this region, production of certified Coffee could be associated with the re-allocation of resources from other economic activities, while non-certified farmers are able to maintain a more diversified activity pattern, which ultimately results in higher household income (Vellema et al., 2015). This could be explained by two factors: i) the strong push for the adoption of certifications by the FNC, which considers them as a key pillar of their specialty Coffee strategy; and ii) the guarantee of purchase of Coffee, also by FNC, which might provide a sense of "safety" when producing this cash crop.

In Honduras and Costa Rica, the results differ from the findings in Colombia. In both of these countries, the NGO-led standards of Fairtrade and Rainforest Alli-

ance are associated with a more diversified production portfolio than non-certified farmers. These two certifications display higher additional income than the controls, as well as a lower dependency on Coffee production for their overall income (see descriptive statistics in Tables 8-10). Still, both certification groups are highly dependent on Coffee for their livelihoods. For Fairtrade producers, Coffee production accounts for 85% and 74% of their cash income in Honduras and Costa Rica, respectively. For Rainforest Alliance certified growers in Honduras, 88% of their household income comes from Coffee, and in Costa Rica Coffee production accounts for 82% of their annual revenue. For non-certified farmers, Coffee income represents 91% (in Honduras) and 87% (in Costa Rica) of their household income. What is more, in Costa Rica around 50% of certified farmers relied solely on Coffee for their income.

With the evidence displayed, it might seem unclear or even unreasonable why farmers choose to specialize in Coffee, given the low market uptake in Colombia and the ambivalent effect on their economic outcomes in the other two countries – especially of industry-led standards. But, the decision to become certified often does not depend directly on the producer. For example, with Nespresso AAA and Starbucks C.A.F.E. Practices, the roasters themselves select specific areas for VSS roll-out/adoption, based on farm location and quality requirements. They typically commission technicians to support farmers in achieving their quality standards and bear most of the certification costs. Furthermore, in Colombia, it is part of FNC's strategy to push for VSS adoption in the Coffee sector, so they provide capacity building, extension services and, in some cases, they hold the certificate for groups of farmers (Grabs et al., 2016).

This is linked to the issue of who gets access to certifications and therefore the potential benefits that come with it. Several authors assert that while, in theory, certifications are made available for all farmers, given the high transaction costs of certifications, cooperatives are more inclined to certify larger farms and in general more progressive farmers (Snider et al., 2017; Bitzer et al., 2008; Kirumba and Pinard, 2010). Moreover, some cooperatives certify only a small number of farmers to fulfill the demand of a buyer who requests the Coffee to hold a specific sustainability standard. For the specific case of Rainforest Alliance, for instance, which offers the highest economic benefits in this study, cooperatives/agronomists choose which members to certify, which generally are the producers that already comply with most of the requirements (extensionist, July, 2016). For these farmers, the costs of adoption are marginal, reducing trans-

action costs significantly. This practice has two consequences: i) the economic benefits of the more stringent certifications are not spread equally between the more advanced and the weaker farmers (which are typically the poorer ones); and ii) the additionality of certifications in terms of sustainable practices would be very low, considering that producers who get certified already comply with the requirements.

Furthermore, the analysis of sustainability standards adoption suggests that different certifications act as stepping-stones for the more advanced and stringent ones. For instance, Fairtrade seems to act as a first step for farmers to organize collectively and implement improved management practices; Starbucks C.A.F.E. Practices provides incentives for the production of high quality Coffee and promote practices that increase farm productivity; Rainforest Alliance promotes environmental conservation practices along with improved working conditions for farm workers; and Nespresso AAA pushes for further quality control and requires working with International exporters (see depiction in Figure 36). This multi-step approach of Coffee certifications was also found in cooperatives in Central Kenya (van Rijsbergen et al., 2016). In Costa Rica, as previously mentioned, usually the "next step" certification was adopted in addition to the previous one. Hence, all Rainforest Alliance farmers were also Starbucks C.A.F.E. Practices certified, and all Nespresso AAA producers held also the Rainforest Alliance certification. This also points to the positive effects of multi-certification, which, in line with previous research by van Rijsbergen et al. (2016), was found to lead to improved yields, higher income from Coffee production and both better and more market outlets.

Figure 36. Depiction of stepping-stones of certifications

In terms of the mechanisms or pathways leading to higher economic returns in certified smallholder farmers, the empirical results point to the fact that none of the pathways on their own guarantee higher profits or household income. It is a combination of the pathways – for example, price premiums in addition to access to finance – which more effectively leads to a better economic situation for smallholder farmers. Following, I unpack this statement and discuss it in light of the literature review. It is noteworthy to mention that the literature on impact pathways was rather scarce – especially the academic literature – thus I also reference grey literature.

First, the price premiums pathway does not appear to be a very strong mechanism leading to farm profitability and better economic conditions for smallholder farmers. The certifications that performed positively in this pathway – 4C Association, Starbucks C.A.F.E. Practices, UTZ and Fairtrade in the case of Honduras – did not show an improvement in the overall economic situation of their respective certification holders. In these cases, the price premiums offered by the certifications were not enough to compensate for the changes in practices. Considering that in order to comply with certification requirements farmers need to investment in machinery, equipment, changes in practices and technology, it is hard to imagine that such low premiums can compensate for these costs. This is in line with previous impact literature that found that price premiums for certified Coffee amounted for only a small percent over the base value – between two and five percent over conventional Coffee prices (Rueda & Lambin, 2013b, 2013a), and it represented a relatively low share of the household income (Barham & Weber, 2012b).

As for the productivity pathway, the results in the field are more promising: in the case of the Rainforest Alliance certification, the increased yields resulting

from the adoption of this standard do lead to higher profits for these smallholder farmers. This supports the academic literature that attributes positive economic outcomes in economic welfare to improvements in farm productivity rather than farm-gate prices (Barham & Weber, 2012b; Ruben & Zuniga, 2011), as well as the gray literature (Hughell & Newsom, 2013; Milder & Newsom, 2015; Newsom & Milder, 2018). For instance, studies in Mexico identified that yield differences in the south of the country accounted for two-thirds of the net revenue per hectare gap that FT/organic growers make above conventional growers (Barham & Weber, 2012). These results mirror the ones in Colombia, where it was found that the Rainforest Alliance standard was associated with a two-fold increase in productivity of certified farmers, leading to a revenue almost 2.5 times higher (Hughell & Newsom, 2013). However, in some instances, investing in increasing yields leads to significantly higher production costs – such as the case of the Starbucks C.A.F.E. Practices certification – thus offsetting the positive economic effects. For this reason, it is important to work simultaneously in the implementation of practices that increase yields, and also strategies that improve efficiency on the farm, keeping costs at reasonable levels.

Concerning the third pathway, production costs, the results did not show a clear association between decreased production costs and profitability. That is, from the two cases where a positive effect in production costs per hectare was displayed, only in the case of the Rainforest Alliance standard did it translate into increased profits. For this specific certification, a positive effect in price premiums was found too, which supports the previous point that it is a combination of the pathways which leads to increased profitability, as opposed to one pathway on its own. For the case of Nespresso AAA, as has been mentioned, their low production costs reflected a low investment in Coffee production with consequently lower production and revenue. In addition, the results demonstrate that certifications, for the most part, fail to decrease production costs and increase on-farm efficiency. In most cases, sustainability standards showed either higher costs or non-significant results on the ground. The evidence on the effects of certifications on production costs is mixed and comes mostly from the gray literature. For example, in their review of costs and benefits of certifications, Kuit and Waarts (2014) found similar results: 40% of the studies assessed had higher production costs for certified Coffee. On the other hand, studies conducted by the Committee on Sustainability Assessment have found an overall reduction of production costs for certified farms (COSA, 2013; Giovannucci et al., 2008).

Older academic literature found that when accounting for the implementation costs borne by the farmer to become certified, production costs either remained the same or rose (Weber, 2011; Bolwig et al., 2007).

As for access to credit, given the outcomes, it is not possible to conclude that this pathway actually leads to higher profits. Of the analyzed VSS, three displayed positive results in access to finance: the Fairtrade certification, Starbucks C.A.F.E. Practices and Rainforest Alliance Of these certifications, the only one that has a positive impact in their profitability indicators is Rainforest Alliance. Again, the relation between VSS and access to credit has been understudied; with only one academic paper addressing this issue, which reported evidence that a Fairtrade cooperative had facilitated access to credit for its producer members (see Utting, 2009; Bray & Neilson, 2017).

Finally, I have explored the economic impact of certifications in countries with different frameworks of governance and institutions, including support provided to the Coffee sector. A preliminary finding is that in settings with weaker institutions, there is more potential for improvement from Voluntary Sustainability Standards. This is the case of Honduras, a country with low institutional development, where also the effects of the Rainforest Alliance certification were more prominent. Growers holding this certification, on average, doubled the gross margins per hectare of non-certified farmers, more than tripled their household income and reduced their probability of living under the poverty line by 19 percentage points.

The impacts found in Colombia and Costa Rica are not as striking. In Colombia, a country with better governance, more effective institutions, and significant support to the Coffee sector, positive economic impacts of certifications were only found in one of the cooperatives, which happened to be the "weaker" cooperative. Also, I did not find a significant impact on yields for any of the analyzed certifications, and, on average, non-certified farmers had higher household incomes. In Costa Rica, the country with the highest institutionality of the three countries (as depicted in the World Bank's World Governance Index) and the more developed Coffee sector, the effects of the Rainforest Alliance certification were also positive, but not as impressive as for Honduras. The improvements amounted to an increase of 40% in gross margins per hectare, and 27% in household income, compared to non-certified controls. On the other hand, non-certified farmers were receiving higher prices per unit of Coffee produced, given the higher quality of their Coffee.

12. VSS in the global Coffee market: sustainable livelihoods and rural development

The empirical results displayed occur in a rural landscape in the Global South, where the changes experienced in developing economies transformed traditional productive activities, giving rise to new livelihood strategies for agriculture-dependent populations. The empirical results presented, then, can be contextualized and broadly analyzed using the Sustainable Livelihoods and new rurality framework, described in Section 4. The Coffee smallholders in the three Latin American countries analyzed have different livelihood assets – human, natural, financial, physical and social capital –, which are influenced by policies, institutions and processes in their specific contexts. For instance, Colombia has a decentralized government structure that strongly supports the Coffee sector, with institutional presence reaching producers in regions all around the country, and policies aimed at improving Coffee production and protecting farmer's income. Honduras, on the other hand, has a less developed Coffee sector, which depends mostly on private actors rather than on government promotion and support. This is reflected in the Coffee infrastructure around the country, and the struggles to attain Coffee quality comparable to other mild Arabica washed producing countries. Costa Rica has the most stable economy of the three countries, but the once predominant Coffee sector has lost importance to the service and high-tech manufacturing industry. Costa Rica still benefits from their reputation as high Coffee quality producers though, hence can access differentiated markets and trade at significantly higher prices.

These macro conditions and institutional contexts affect the livelihood strategies adopted by rural Coffee farmers. In a way, participating in a certification scheme represents a choice of livelihood strategy, in which producers choose to implement a collection of practices to attain improved livelihood outcomes such as higher income, increased well-being, reduced vulnerability, food security, more sustainable use of resources, empowerment and social inclusion. Farmers holding different VSS also adopted certain livelihood strategies, such as agricultural intensification in the case of Rainforest Alliance certified farmers in Colombia, and an increased productivity strategy (high-input, high-volume) in these certified producers in Honduras and Costa Rica. Other strategies implemented by

farmers holding NGO-led certifications in Honduras and Costa Rica are income diversification and the adoption of off-farm income earning strategies.

Voluntary sustainability standards, as depicted in their theories of change, aim at improving the mentioned livelihood outcomes. However, as the results have shown, only in the case of the NGO-led standards Rainforest Alliance and Fairtrade they translate into higher income, increased well-being – measured using the Poverty Probability and Wealth Index –, and improved food security. These positive livelihood outcomes, however, at least in the case of Rainforest Alliance, are restricted to the higher performing farmers given the way these farmers are selected to join this certification scheme, thus reducing the overall impact of the certification in farmers' livelihoods.

Further, as I mentioned earlier, VSS fail to protect farmers against shocks typical from commodity markets, such as price volatility, weather and climate-related events, outbreaks of pests and diseases and rising input prices. For these reasons, I conclude that VSS are not effective in ensuring sustainable livelihoods in Coffee farmers in rural areas of the analyzed Latin American countries.

13. The study in context: Robustness checks and limitations

The quality of the matching was assessed in two different ways: i) by comparing the minima and maxima of the estimated propensity scores across the treatment and comparison groups, ii) by comparing the overlap in the p-scores of the treatment and control before and after the propensity score matching. In Appendix G, I present graphically the distribution of propensity scores of the treatment and comparison groups for all three countries.

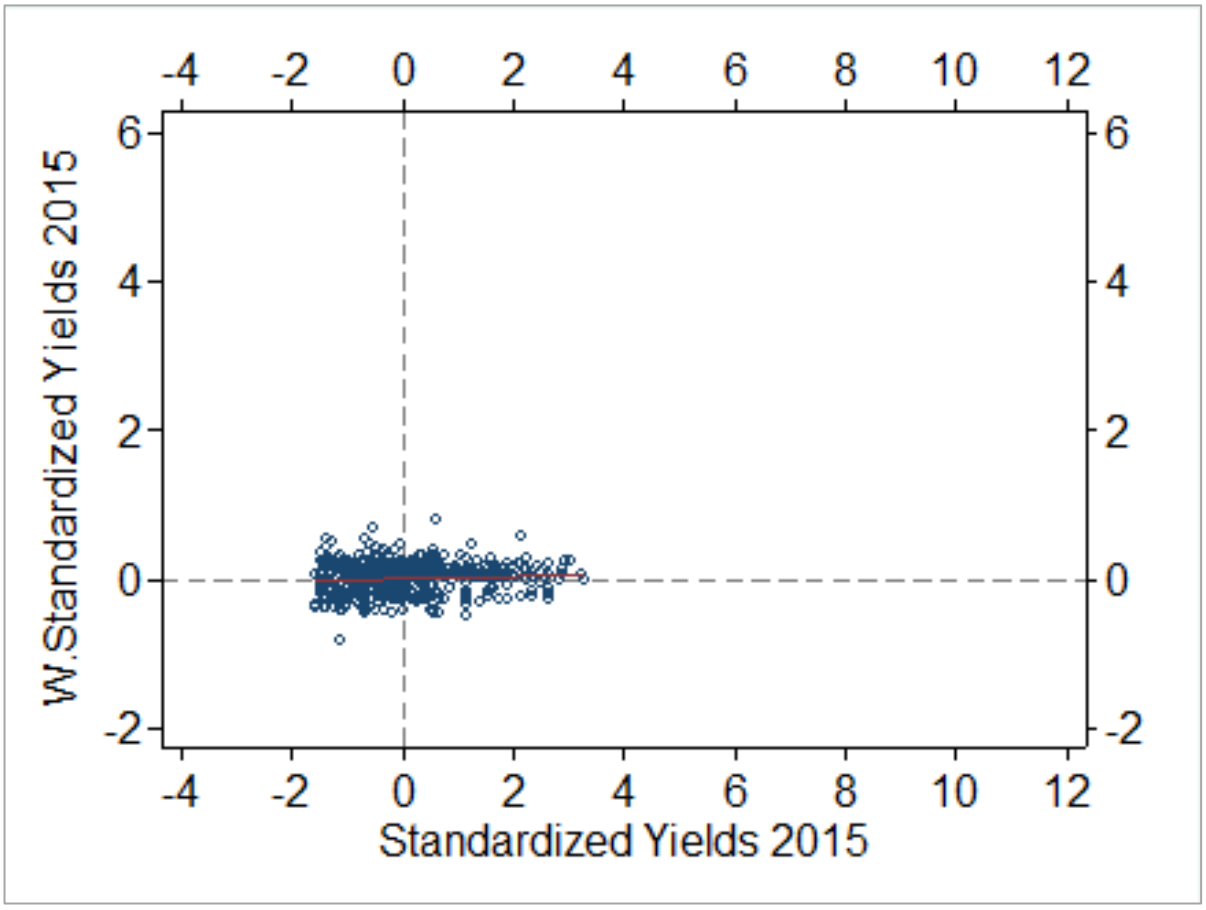
In order to control for selection bias in our analysis, I compared the attributes of certified farmers and their controls using t-tests, and where possible, added the variables displaying significant differences as covariates in the PSM and controls in the OLS regression. The coefficients vary slightly, but overall the results support the initial analysis. The only significant difference was found for Nespresso AAA, which for the model with additional controls displayed significantly higher average prices for the full sample. However, this failed to translate into higher revenue or gross profit.

However, it still remains possible that there are unobserved variables which affect both assignment in the treatment groups and the outcome variables, causing hidden bias to arise (Becker & Caliendo, 2007). In order to test for this, I calculated Rosenbaum bounds for the case of Colombia to assess how sensitive our results were to the presence of unobservables. The Wilcoxon sign-rank tests for the ATET gave us different levels of Γ that evaluate the strength that unmeasured variables would need to have to make our conclusions questionable (DiPrete & Gangl, 2004). For the significant ATET of the economic impact variables, the values of Γ ranged from 1.20 to 3.00 at a 10 per cent significance level. The PPI for Nespresso AAA farmers had a lower bound of 1.20, while the negative effect on household income for this certification had a critical value of $\Gamma = 1.55$. These results imply that our analysis is insensitive to bias that would increase the odds of treatment by 20 per cent and 55 per cent, respectively. The significant result of higher rates of reported food shortage for 4C farmers was insensitive to bias that would triple the odds of treatment, while the positive result of Rainforest Alliance/ Nespresso AAA in gross profit per hectare had a critical value of $\Gamma = 1.35$. While the outcome of this sensitivity indicates some uncertainty in the matching estimators, Rosenbaum bounds are a "worst-case" scenario (DiPrete &

Gangl, 2004). Therefore, although some level of caution is advised when interpreting our results, the conclusions I have arrived at remain valid.

A shortcoming of our study is that I only rely on cross-sectional data for the analysis. A difference-in-difference estimation (using panel data) or a randomized control trial could better address issues of endogeneity and self-selection bias. Furthermore, there could have been a weather shock that affected a specific group of producers located in a particular geographic region. A weather shock could translate into decreased yields, for instance. In order to test for this, I calculated Moran's Index using georeferenced data to find out if there was any spatial autocorrelation between geographic location and yields. The results show a positive coefficient, but it is very close to zero, which I interpret as there being low spatial autocorrelation (see Figure 31).

Figure 37. Results of Moran's Index for spatial autocorrelation



However, as an area of future research, a more comprehensive spatial analysis of each certification is recommended to check whether differences between certified farmers and controls are explained spatially.

14. Conclusions

Voluntary sustainability standards in the Coffee sector have become increasingly popular as a tool to ensure transparency and traceability for consumers and to contribute to the economic sustainability of smallholder Coffee farmers. Nonetheless, rigorous evidence on the economic impact of Coffee certifications is still relatively scarce (Chiputwa et al., 2015), and the literature on impact pathways is even more limited. This research sheds light on the economic impacts of NGO-led, industry and company-led standards in smallholder Coffee farmers from three important Arabica producing countries in Latin America: Colombia, Honduras and Costa Rica. In addition, I identified and assessed different impact pathways through which these standards can potentially improve the economic situation of smallholder Coffee producers.

Overall, the empirical evidence shows that while some impact pathways and their underlying practices are present, for the most part, they fail to translate into higher gross profit and household income, and they also prove ineffective in reducing poverty. Furthermore, my analysis of impact pathways and underlying practices suggests that Coffee certifications do not necessarily lead to the foreseen changes on the ground, with certified farmers sometimes underperforming their controls in expected sustainability practices. In addition, although some certification holders perform positively in certain pathways, this does not necessarily translate into an improved economic situation.

The economic impact analysis showed low additionality of Coffee certifications on the economic condition of smallholders. The disaggregated analysis of certifications showed better results for NGO-led certifications, especially for the Rainforest Alliance. This certification is associated with higher profits in Colombia and Costa Rica, and increased household income and lower poverty likelihood in Honduras. However, this certification is also one with more stringent requirements, thereby limiting its foothold amongst more risk averse farmers and the poorer farmers who lack the capital for the needed investments to conform to the standards. As such, the presence of the Rainforest Alliance certification skews toward more advanced or progressive farmers. The Fairtrade certification had a positive impact in social indicators such as lower rates of food shortage and a lower probability of living under the poverty line. This is an indication that Fairtrade is delivering on its social goals, but this is not reflected in higher eco-

nomic returns. The more industry-oriented certifications of UTZ and 4C fail to provide any significant changes to the economic standing of smallholder farmers in the analyzed countries, nor in the select social indicators. As for the industry-led standards of Starbucks C.A.F.E. Practices and Nespresso AAA, the results fall far from what is expected based on their sustainability claims. Starbucks C.A.F.E. Practices and Nespresso AAA displayed non-significant and negative economic impacts, respectively, and Nespresso AAA farmers had a higher probability of living under the national poverty line in Colombia.

These results are especially of concern given the proliferation of industry and company-led standards, which currently account for the largest share of certified Coffee in the market (Dietz et al., 2018). The ambiguous to undesirable effects of these industry-led standards, therefore, put into question the sustainability claims of the roasters and organizations leading these efforts. It becomes apparent that this shift to buyer-driven sustainability governance that emerged partially as a result of dissatisfaction with NGO-led standards has yet to prove its impacts on the ground (Grabs, 2017). These results are supported by The Voluntary Coffee Standard Index (VOCSI), which suggests that industry-led standards such as Nespresso AAA, C.A.F.E. Practices, and 4C perform significantly lower in the economic realm than standards developed by multi-stakeholder processes (Dietz et al., 2018).

The impact pathway analysis illuminates two important issues. First, several of the certifications analyzed are not resulting in the foreseen changes on the ground in terms of underlying practices and impact pathways. This is more prominent for the industry-led and private labels. Some notable examples are the UTZ certification, whose theory of change is based on increasing productivity to attain higher profits, but their certification-holders fail to show an improvement in yields or in the implementation of Good Agricultural Practices. Another case is the 4C Association, which, despite the emphasis in their Code of Conduct actions to decrease production costs, farmers with this certification had on average higher costs than their control farmers.

Second, even though all the certifications studied perform positively in at least one of the pathways (in at least one of the countries studied), this does not necessarily translate into farm profitability. For instance, in the price premiums pathway, every certification provides additionality, as reflected in higher prices per unit than their counterparts. As for farm productivity, Rainforest Alliance, Starbucks C.A.F.E. Practices and Fairtrade display positive and significant out-

comes. Concerning production costs, Nespresso AAA and Rainforest Alliance certified farmers presented lower expenditures in Colombia. In terms of access to finance, Rainforest Alliance, Starbucks C.A.F.E. Practices and Fairtrade certified farmers reported higher rates of access to and utilization of financial services. However, these pathways only translate into positive outcomes in the cases of the Rainforest Alliance and Fairtrade certification. I conclude, then, that none of the pathways on their own guarantee higher profits or household income. It is rather a combination of the pathways – for example, price premiums in addition to lower production costs – which more effectively leads to an improved economic standing for smallholder farmers.

Another key takeaway from our research is that smallholder Coffee farmers in these Latin American countries are struggling to make a living, especially in Colombia and Honduras, where smallholder farmers presented a higher probability of living under the poverty line. The challenging conditions of Coffee production are not expected to fade away, as price volatility, rising costs of production, low market uptake of certified Coffee, the negative impacts of climate change, pests and diseases are increasingly common for the Coffee sector. In this context, Voluntary Sustainability Standards are not a panacea: they provide little-added value and can lead to specialization. Conversely, a diversified production portfolio results in higher household income and increased resilience to shocks (Ambrosio-Albalá & Bastiaensen, 2010; Kay, 2008; Scoones, 1998).

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16. Appendixes

Appendix A

	Rainforest Alliance	UTZ	Fairtrade International	4C Association	Nespresso AAA	C.A.F.E. Practices
Who	The founder was Daniel Katz (US citizen), along with a group of volunteers that convened a major conference to address the deforestation and species extinction crisis. From this event, the Rainforest Alliance was born.	The founder was Nick Bocklandt, a Belgian-Guatemalan Coffee grower, and co-founder was Ward de Groote, a Dutch Coffee roaster.	Franz Van der Hoff, a Dutch priest working with a Mexican indigenous Coffee cooperative, and Nico Roozen, a leader of the Dutch NGO Solidaridad.	The German Coffee Association (DKV) and the German development cooperation (GIZ) initiated the process, and it was established with 37 founding members.	Nestlé Nespresso company, part of the Nestlé Group, in collaboration with the Rainforest Alliance	The standard was developed by Conservation International and Starbucks Coffee Company.
When	It was founded in 1987. Rainforest Alliance certified its first Coffee farm in 1995. Updated standard: 2017.	It begun in 1997 as an initiative from the industry and producers in Guatemala. UTZ Kapeh first certified farms in 2001. Last update: 2014.	In 1988 the first Fairtrade label was launched: Max Havelaar. In 1997, an "umbrella organization" that grouped national Fairtrade labelling organizations was established: Fairtrade Labelling Organizations International (FLO). Last update: 2011.	The creation process started in 2003 and it was officially founded on 1st December 2006. Last update: 2015.	Launched in 2003. Las update: 2013.	The standards were rolled out in 2001. Last update: 2015-2016.

	Rainforest Alliance	UTZ	Fairtrade International	4C Association	Nespresso AAA	C.A.F.E. Practices
Where	United States	The Netherlands	Germany	Germany	Switzerland	United States
Main Goals	Conserve biodiversity and ensure sustainable livelihoods by transforming land-use practices, business practices and consumer behavior. Environmental sustainability: protection and restoration of natural ecosystems (both aquatic and terrestrial); wildlife protection; water conservation and prevention from contamination; safe and fair working conditions for all workers; contribute to local economic development; reduction of pest infestation; prevent and control soil erosion and improve soil fertility; waste management.	Achieve sustainable supply chains through the implementation of good agricultural practices and farming management – leading to increased productivity; professionalism of the farm; protection of the environment, preserving flora, fauna, shade, buffer zones; respect and protection of fundamental human rights: safe and healthy working conditions, abolition of child labor.	Economic empowerment to impoverished and marginalized producers around the globe, aiming to lift them out of poverty, while encouraging environmental stewardship. Fairtrade aims to achieve this through a price floor for producers, to cover the costs of sustainable production, and the premium, which are additional funds above the selling price to be invested in community development projects. This model empowers smallholder farmers organized into democratically-run cooperatives, enabling them to be competitive in the global market.	Baseline standard that acts as a "stepping stone" for other standards. Through a continuous improvement process, it aims to exclude worst practices in the Coffee industry and unite relevant Coffee stakeholders to work towards the three pillars of sustainability – environmental, social and economic. The 4C Code of Conduct has an emphasis on social issues.	Nespresso's AAA Sustainable Quality Program has a strong emphasis on quality requirements. Once these are met, the social and environmental criteria are evaluated. The AAA program's three "A's" are Quality, Productivity, and Sustainability.	The standard has four main goals: i) High quality standards; ii) Economic Accountability and Transparency: Evidence of payments throughout the supply chain must be made available by suppliers; iii) Social Responsibility: protect the rights of workers and ensure fair, safe and humane working and living conditions; iv) Environmental Leadership: preservation of biodiversity, conservation of water and energy, protection of water quality, waste management and reduction of agrochemical use. Moreover, tracking climate change impacts and developing adaptation plans is encouraged.

	Rainforest Alliance	UTZ	Fairtrade International	4C Association	Nespresso AAA	C.A.F.E. Practices
Sub-standards	Chain of Custody Certification for Agricultural Products.	Two sets of guidelines: Code of Conduct (different for individual and group and multi-certification), and the Chain of Custody (covers Coffee from farm gate until retailer).	For Coffee: the standard for Small Producer Organizations and the Trader Standard.	No	No	No

	Rainforest Alliance	UTZ	Fairtrade International	4C Association	Nespresso AAA	C.A.F.E. Practices
Standard-setting procedure	Established as civil society movement aiming to exert pressure on the private sector. The standards are revised every 5 years, when the Sustainable Agriculture Network (SAN) conducts a public consultation process according to the ISEAL Alliance Code of Good Practice for Setting Social and Environmental Standards. It includes workshops and online interviews in selected countries and with identified technical and civil society stakeholders. The public consultation process report is published online and includes the participating stakeholders as well as the comments provided.	The Code of Conduct is developed, updated and revised in line with the standards of ISEAL Alliance. A public consultation process is conducted, which includes workshops in origin as well as online information gathering. The consultation includes industry, agricultural experts, NGO's, academia, governments and farmers. Following the public consultation process, the Code undergoes a period of pilot testing in the field (one year), in which feedback is also collected and incorporated. *Specific reference to participation of farmers.	Fairtrade was fostered by a group of committed people who believed that access to markets had the potential to change the lives of impoverished populations. The Fairtrade standards are developed in a collaborative manner, with the participation and involvement of members, farmers, industry, scientists and advisors from the public and private sector. The standards are set in accordance with the ISEAL Code of Good Practice on Standard Setting, which includes a consultation process.	DKC and the German Cooperation, along with more than 70 representatives of the Coffee industry (producers, trade unions, NGOs, certification organizations and International institutions) from 20 countries developed a code of conduct inspired by the UN Millennium Development Goals. Before its official establishment in 2006, this group finalised a code of conduct directly inspired by the UN Millennium Goals.	Nespresso's AAA Sustainable Quality Program was a company-driven process developed with the NGO Rainforest Alliance. For many years, the criteria or guidelines were not available to the public.	The standard-setting process was company-driven, in collaboration with Conservation International (CI) and an independent third-party company, SCS Global Services (SCS).

	Rainforest Alliance	UTZ	Fairtrade International	4C Association	Nespresso AAA	C.A.F.E. Practices
Proliferation	Cultivated area of Coffee: 364,785 hectares Production volume: 456,719 MT Number of producers: 388,712 Geographical distribution (10 major supplying countries): Brazil - 158,073 MT; Colombia - 53,813 MT; Vietnam - 39,234 MT; Peru - 24,486 MT; Honduras - 23,724 MT; Guatemala - 22,154 MT; Costa Rica - 20,168 MT; India - 16,965 MT; Indonesia - 15,913 MT; Nicaragua - 12,000	Area of harvested Coffee: 475,578 hectares Share of total Coffee area: 4.7% Production volume: 729,918 MT Number of producers: 162,515 Geographical distribution (10 major supplying countries): Brazil - 244,896 MT; Vietnam - 191,284 MT; Honduras - 69,253 MT; Colombia - 69,198 MT; India - 34,688 MT; Peru - 32,230 MT; Uganda - 20,443 MT; Nicaragua - 14,250 MT; Indonesia - 12,997 MT; Guatemala - 8,841 MT	Area of Coffee: 1,012,023 hectares Share of total Coffee area: 10.0% Production volume: 473,604 MT Number of producers (organizations): 439 Geographical distribution (10 major supplying countries): Colombia - 109,470 MT produced; Brazil - 83,739 MT; Peru - 80,679 MT; Indonesia - 32,332 MT; Costa Rica - 27,925 MT; Nicaragua - 23,752 MT; Honduras - 22,871 MT; Tanzania - 15,182 MT; Ethiopia - 11,547 MT; Kenya - 10,910 MT	Area of Coffee: 1,464,724 hectares Share of total Coffee area: 14.4% Production volume: 2,359,868 MT Number of producers: 721,284 Geographical distribution (10 major supplying countries): Brazil - 1,070,690 MT produced; Vietnam - 548,746 MT; Colombia - 365,857 MT; Peru - 104,092 MT; Honduras - 90,592 MT; Mexico - 41,201 MT; Indonesia - 40,715 MT; China - 26,369 MT; Thailand - 22,841; India - 15,349 MT	Area of Coffee: 290,000 hectares Number of producers: Over 70,000 farmers Number of clusters: 29 Geographical distribution: South Sudan, Peru, Kenya, Indonesia, Brazil, Colombia, Costa Rica, Guatemala, India, Mexico, Nicaragua and Ethiopia	Area of Coffee: 265,634 productive hectares Number of farms: 70,000 farms (2012 data)

Source: own elaboration.[14]

[14] Using data from: https://www.scaa.org/PDF/SustainableCoffeeCertificationsComparisonMatrix.pdf, http://search.standardsmap.org/assets/media/FairtradeInternational/English/AtAGlance_EN.pdf, https://www.nestle-nespresso.com/asset-library/documents/nespresso%20-%20history%20factsheet.pdf, Potts et al. (2014).

Appendix B

Source: The World Bank Group, 2019

Appendix C

Summary statistics (means)	Coop 1 (n=319)	Coop 2 (n=293)
Household characteristics		
Female household head (dummy)	0.32	0.17
Age of household head (years)	51	56
Years of schooling of household head	4.80	4.70
Household size (number of people)	3.10	3.30
Full tenure (dummy)	0.92	0.96
Distance to output market (minutes)	51.88	36.43
Farm characteristics		
Total farm area (hectares)	5.20	3.70
Coffee area (hectares)	2.70	2.60
Farm altitude (m)	1,713.41	1,714.33
Coffee production 2015 in # of cargas per farm (a)	31.10	36.90
Productivity 2015 (yields per hectare, kg)	1,440.30	1,686.40
Share of low quality Coffee	0.43	0.13
Share of income from Coffee	0.92	0.89
Household income and poverty		
Coffee gross margins per farm	1,728.74	3,657.97
Coffee gross margins per hectare	615.45	1,177.84
Revenue all sources per farm	7,960.92	10,174.35
Progress out of Poverty Index (PPI)	44.11	46.00
PPI probability of living under the national poverty line	30%	18%

Notes. (a) 1 carga = 125 kg. Exchange rate used from Colombian pesos to US dollars: 2,734 (average exchange rate for year 2015).

Appendix D

Impact pathways Cooperatives 1 & 2 certified farmers vs. controls in USD (2015)

Impact pathway variables	C.A.F.E. Practices		Nespresso AAA		Rainforest/ AAA	4C
	Coop A (n=46)	Coop B (n=35)	Coop A (n=100)	Coop B (n=41)	Coop A (n=79)	Coop B (n=74)
Price premiums						
Coffee sales revenue per carga (a)	18.50*** (6.28) *236.78*	0.74 *254.36*	8.77 *232.51*	10.41** (4.31) *274.2*	13.27** (5.85) *239.25*	0.49 *261.37*
Productivity						
Yields per hectare (in kg)	7.61 *1,549.18*	213.09 *1,748.87*	-174.73 *1,330.96*	-208.78 *1,699.14*	144.46 *1,451.90*	11.66 *1,668.49*
Costs of production						
Cost of agricultural inputs per farm	-318.82 *1,752.75*	147.37 *1,040*	-569.02** (229.97) *768.77*	33.35 *1,211.993*	-793.11 *971.20*	167.24 *1,160.22*
Labor costs per farm	-328.65 *5,687.4*	4.67 *4,148.23*	-1,053.10** (485.21) *2,771.94*	-699.96 *3,386.92*	-565.02 *4,231.34*	-594.48 *3,901.77*
Other costs per farm (b)	153.13 *249*	53.08 *160.34*	-36.41 *63.27*	30.37 *181.89*	55.48 *159.14*	36.63 *168.10*
Production costs per farm	-492.55 *7,701.48*	271.99 *5,438.45*	-1,653.22** (687.45) *3,615.08*	-948.79 *4,908.49*	-1,291.66 *5,381.1*	-324.03 *5,323.91*
Production costs per hectare	74.77 *2,193.77*	-175.18 *2,292.45*	-173.99 *1,971.73*	34.05 *2,075.10*	-96.39 *2,071.16*	-96.38 *2,279.51*

Impact pathway variables	C.A.F.E. Practices		Nespresso AAA		Rainforest/ AAA	4C
	Coop A (n=46)	Coop B (n=35)	Coop A (n=100)	Coop B (n=41)	Coop A (n=79)	Coop A (n=46)
Access to credit						
Received formal credit (dummy)	0.12 *0.54*	0.20* (0.11) *0.54*	-0.01 *0.37*	-0.19* (0.1) *0.54*	0.02 *0.36*	-0.11 *0.45*
Received informal credit (dummy)	-0.03 *0.04*	0.14 *0.34*	0.03 *0.05*	0.29*** (0.07) *0.37*	0.08** (0.04) *0.13*	0.03 *0.26*

Underlying practices Cooperatives 1 & 2 certified farmers vs. controls in USD (2015)

Underlying practices variables	C.A.F.E. Practices		Nespresso AAA		Rainforest/ AAA	4C
	Coop A (n=46)	Coop B (n=35)	Coop A (n=100)	Coop B (n=41)	Coop A (n=79)	Coop B (n=74)
Training						
Always attends trainings (dummy)	0.07 *0.98*	-0.06 *0.69*	-0.05* (0.03) *0.94*	-0.09 *0.76*	-0.04* (0.02) *0.95*	0.04 *0.82*
Always implements learned in trainings (dummy)	0.05 *0.95*	-0.19 *0.71*	-0.06* (0.03) *0.90*	-0.06 *0.9*	-0.03 *0.94*	0 *0.93*
Agricultural practices						
Prunes Coffee plants (dummy)	0.23** (0.10) *0.72*	-0.07 *0.06*	0.05 *0.51*	0.25*** (0.06) *0.27*	-0.04 *0.53*	0.20*** (0.07) *0.33*
Practices removing the stems (dummy)	0.12 *0.76*	-0.2** (0.09) *0.71*	0.02 *0.7*	-0.14 *0.59*	0.03 *0.71*	-0.17 *0.64*

Underlying practices variables	C.A.F.E. Practices		Nespresso AAA		Rainforest/ AAA	4C
	Coop A (n=46)	Coop B (n=35)	Coop A (n=100)	Coop B (n=41)	Coop A (n=79)	Coop A (n=46)
Implements insect control (dummy)	0.04 *1*	0.04 *0.69*	0.01 *0.99*	0.03 *0.65*	-0.03 *0.97*	0.01 *0.78*
Utilizes disease control (dummy)	-0.03 *0.07*	0.03 *0.17*	-0.02 *0.03*	-0.14 *0.56*	-0.02 *0.01*	0.15** (0.06) *0.57*
Access to soil analysis (dummy)	0.07 *0.20*	-0.13** (0.06) *0.03*	-0.07 *0.11*	0.38** (0.18) *0.54*	0.19*** (0.06) *0.30*	0.09 *0.27*
Input fertilizers per hectare	-61.45 *537.56*	-73.3 *372.54*	-113.59** (54.30) *430.10*	134.16 *501.79*	-125.94** (52.96) *367.11*	115.57* (66.38) *532.33*
Record keeping & knowledge						
Record keeping (dummy)	-0.05 *0.48*	0.3*** (0.08) *0.37*	-0.04 *0.42*	0.1 *0.49*	-0.025 *0.48*	0.01 *0.35*
Spend 5+ hours in record keeping (dummy)	-0.02 *0.07*	0.03 *0.03*	-0.06* (0.33) *0.02*	-0.01 *0.05*	-0.04 *0.05*	-0.03 *0*

***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. For C.A.F.E. Practices, PSM was conducted using calipers of width equal to 0.4 of the SD of the probit of the propensity score. (a) 1 carga = 125 kg.

Appendix E

Table 1. Covariates used in PSM analysis

Covariates used in PSM analysis	C.A.F.E. Practices	Nespresso AAA	Rainforest/Nespresso	4C
Gender	x	x	x	
Age	x	x	x	x
Years of schooling	x	x	x	x
Household size	x	x		x
Number of children			x	
Land tenure	x	x	x	x
Time to school	x			
Time to health center			x	
Time to market		x		x
Time to Coffee plot			x	
Total area	x	x	x	x
FNC membership	x	x	x	
Participates in cooperative programs				x

Note: The exclusion of certain covariates was most often due to collinearity, or because that specific variable predicted failure perfectly (e.g. gender for 4C), or the insignificance of these variables in the initial probit analysis of the treatment outcome. When these issues occurred, Iselected the variable that better predicted certification outcome for the particular treatment group. It is important to note that I could not control for Coffee area, since I used this variable to construct the yields variable. I did include total area in all of the analyses.

Table 2. Covariates used in PSM analysis with additional controls

Covariates used in PSM analysis	C.A.F.E. Practices	Nespresso AAA	Rainforest/Nespresso	4C
Gender	x	x	x	
Age	x	x	x	x
Years of schooling	x	x	x	x
Household size	x	x		x
Number of children			x	
Land tenure	x	x	x	x
Time to school	x			
Time to health center			x	
Time to market		x		x
Time to Coffee plot			x	
Total area	x	x	x	x
FNC membership	x	x	x	
Participates in cooperative programs				x
Altitude	x	x	x	x
Pruning	x	x	x	x
Use of organic fertilizer		x		
Shade cover		x	x	x
Tree age	x		x	
Region dummy	x	x		

Appendix F

Table 31. Economic impact Fairtrade vs. non-certified farmers (2015)

Economic indicators	Fairtrade (n=237)		NC (n=90)
	Mean	ATET	Mean
Income indicators			
Coffee sales revenue per farm	9,632.99	4,741.55*** (1,514.81)	8,576.30
Coffee sales revenue per hectare	3,127.17	916.30** (405.67)	2,052.92
Coffee gross profit per farm	2,873.53	143.56	2,318.66
Coffee gross profit per hectare	802.48	-243.12	619.52
Coffee gross profit per carga (a)	1.73	-98.34*** (27.65)	35.36
Other income per farm	785.19	-17,713.14	2,354.96
Household income	10,418.18	-12,971.58	10,931.26
Social outcomes			
Reported savings (dummy)	0.15	0.15*** (0.02)	0.00
Reported food shortage during the year (dummy)	0.00	-0.04** (0.2)	0.13
Progress out of Poverty Index (PPI)	45.52	12.22*** (3.60)	46.80

***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 carga = 125 kg.

Table 32. Impact pathways Fairtrade vs. non-certified farmers

Impact pathways	Fairtrade (n=237)		NC (n=90)
	Mean	ATET	Mean
Price premiums			
Coffee sales revenue per carga (a)	241.42	21.63	255.39
Productivity			
Yields per hectare (in kg)	1,604.12	329.00** (129.07)	1,010.66
Costs of production			
Cost of agricultural inputs per farm	1,434.72	1,086.19*** (135.92)	1,243.50
Labor costs per farm	5,150.94	3,530.35*** (555.90)	4,887.36
Others costs per farm (a)	136.92	50.20	109.32
Production costs per farm	6,759.46	4,597*** (696.48)	6,257.64
Production costs per hectare	2,324.69	1,159.41*** (81.73)	1,433.40
Access to credit			
Received formal credit (dummy)	0.43	0.30*** (0.04)	0.34
Received informal credit (dummy)	0.16	0.16*** (0.02)	0.01

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. (a) 1 carga = 125 kg.

Table 33. Underlying practices Fairtrade vs. non-certified farmers

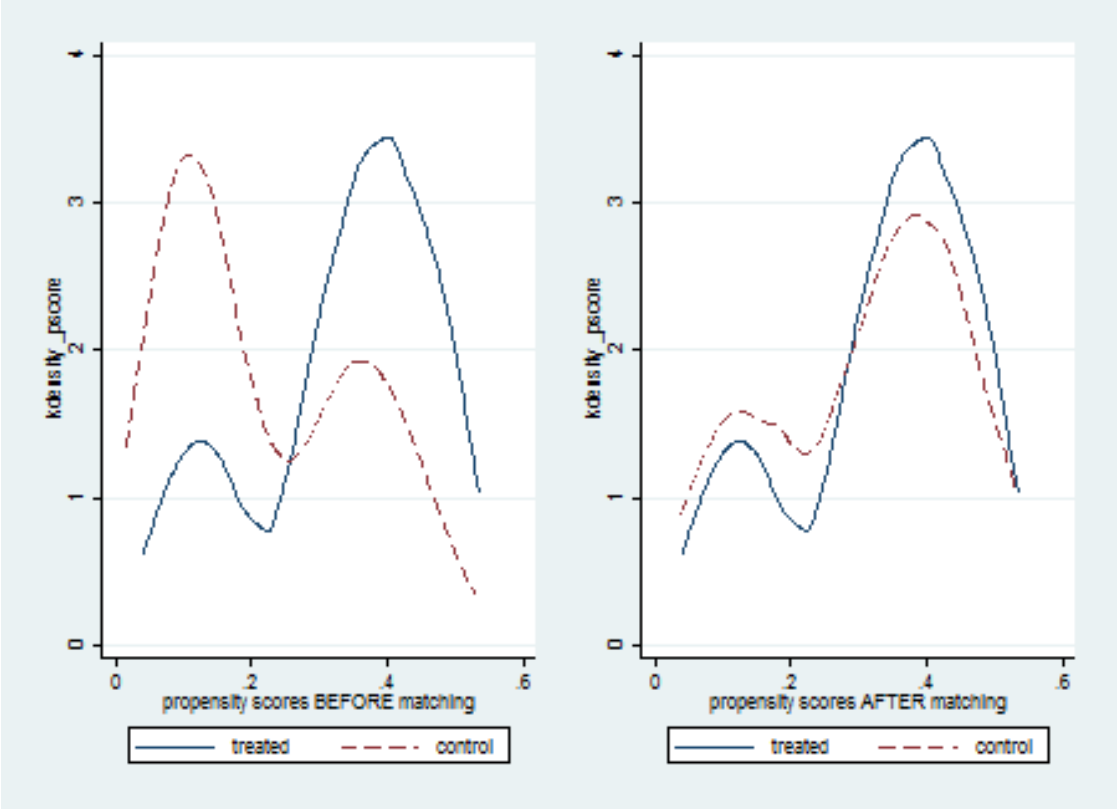
Underlying practices	**Fairtrade (n=237)**		**NC (n=90)**
	Mean	ATET	Mean
Training			
Always attends trainings	0.82	0.27	0.79
Always implements learned in trainings	0.87	0.29	0.85
Agricultural practices			
Prunes Coffee plants	0.22	-0.20	0.17
Practices removing the stems	0.71	0.18	0.86
Implements insect control	0.85	0.41	0.24
Utilizes disease control	0.18	0.175*** (0.02)	0.03
Access to soil analysis	0.14	-0.37	0.36
Input fertilizers per hectare	479.59	265.624*** (75.63)	354.77
Record keeping & knowledge			
Record keeping	0.29	-0.15	0.21
Spend 5+ hours in record keeping	0.04	0.04*** (0.01)	0.02

Notes. ***p < 0.01; **p < 0.05; *p < 0.1. Robust standard errors displayed in parenthesis for significant coefficients. All variables are dummies, except for input fertilizers per hectare.

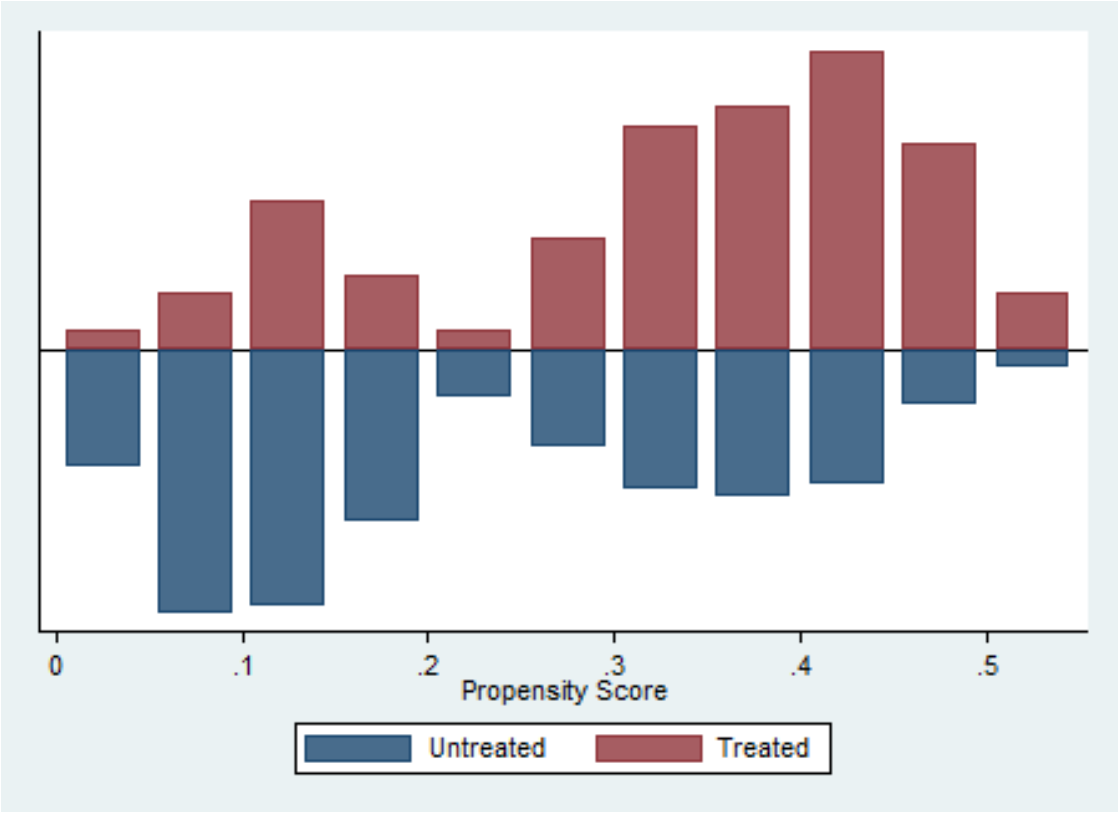
Appendix G

Colombia

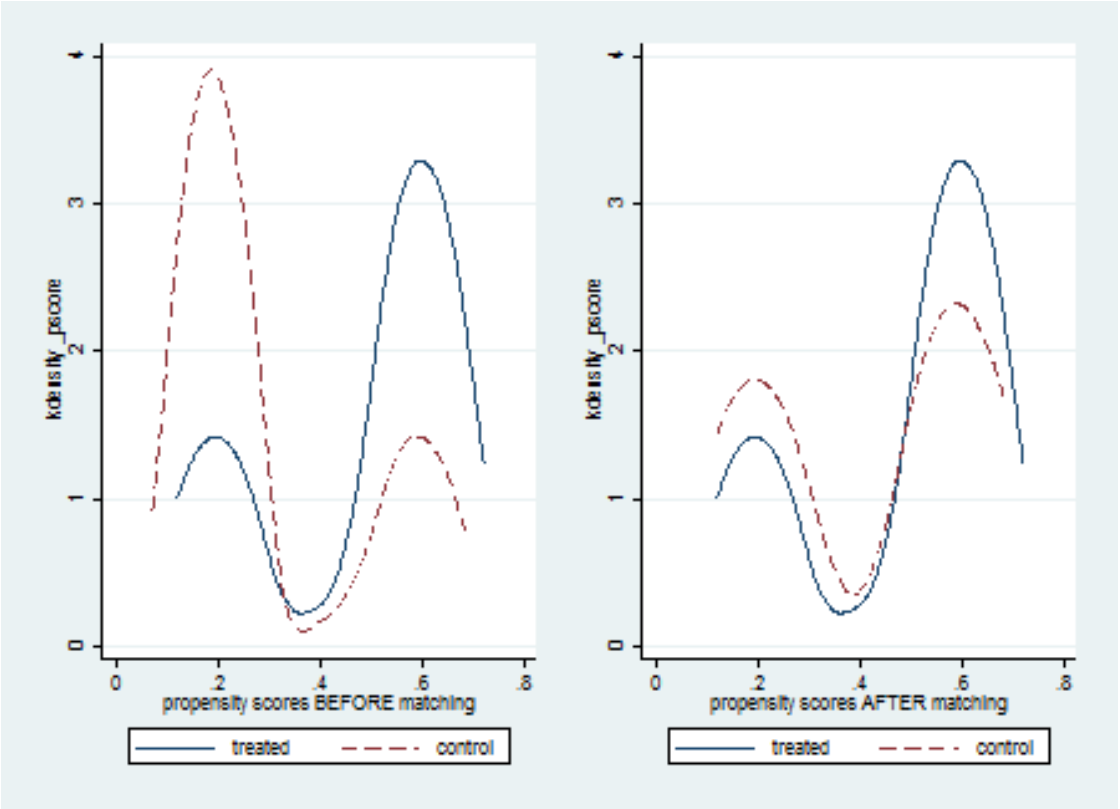
Rainforest/AAA: Propensity scores before and after matching



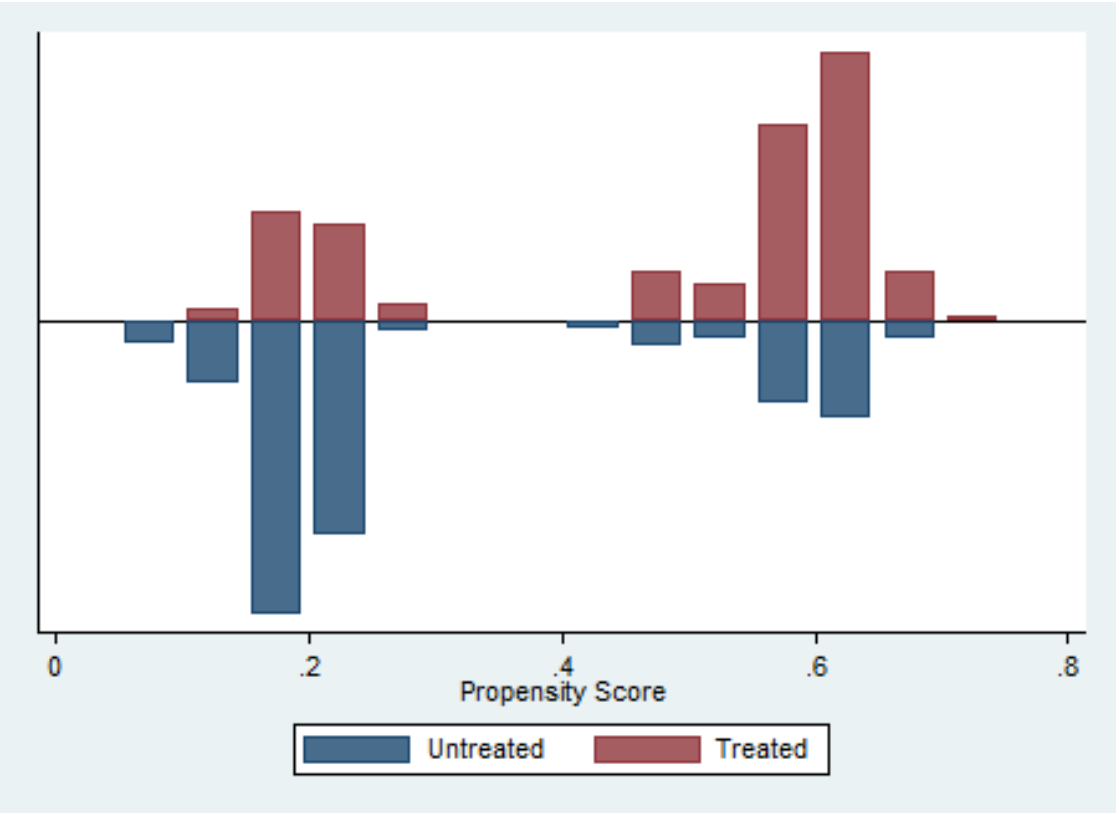
Rainforest/AAA: Minima and maxima of estimated Propensity scores



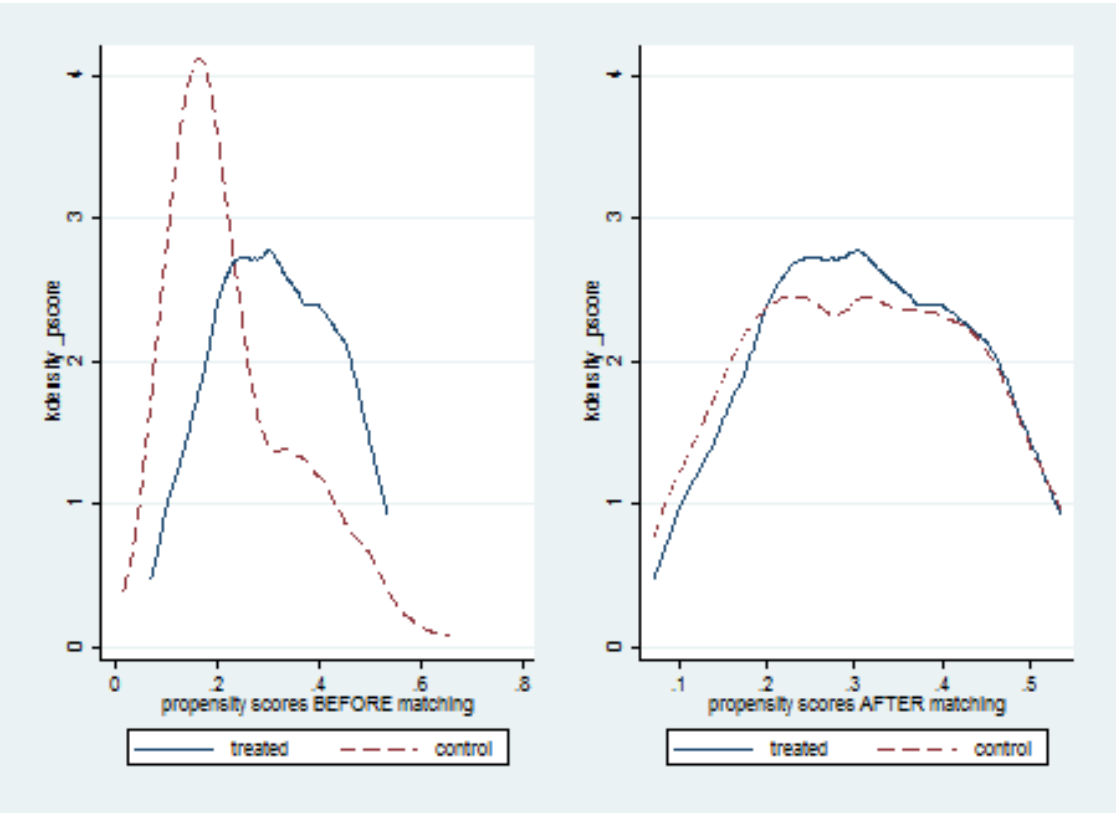
Nespresso AAA: Propensity scores before and after matching



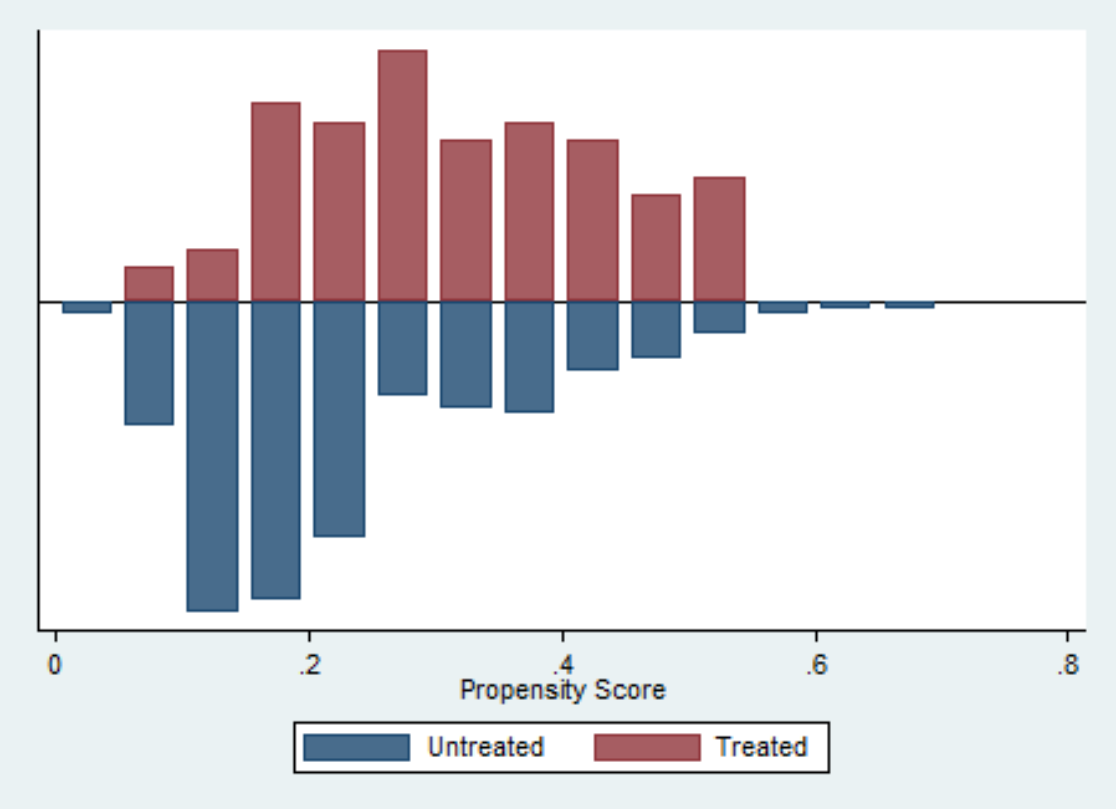
Nespresso AAA: Minima and maxima of estimated Propensity scores



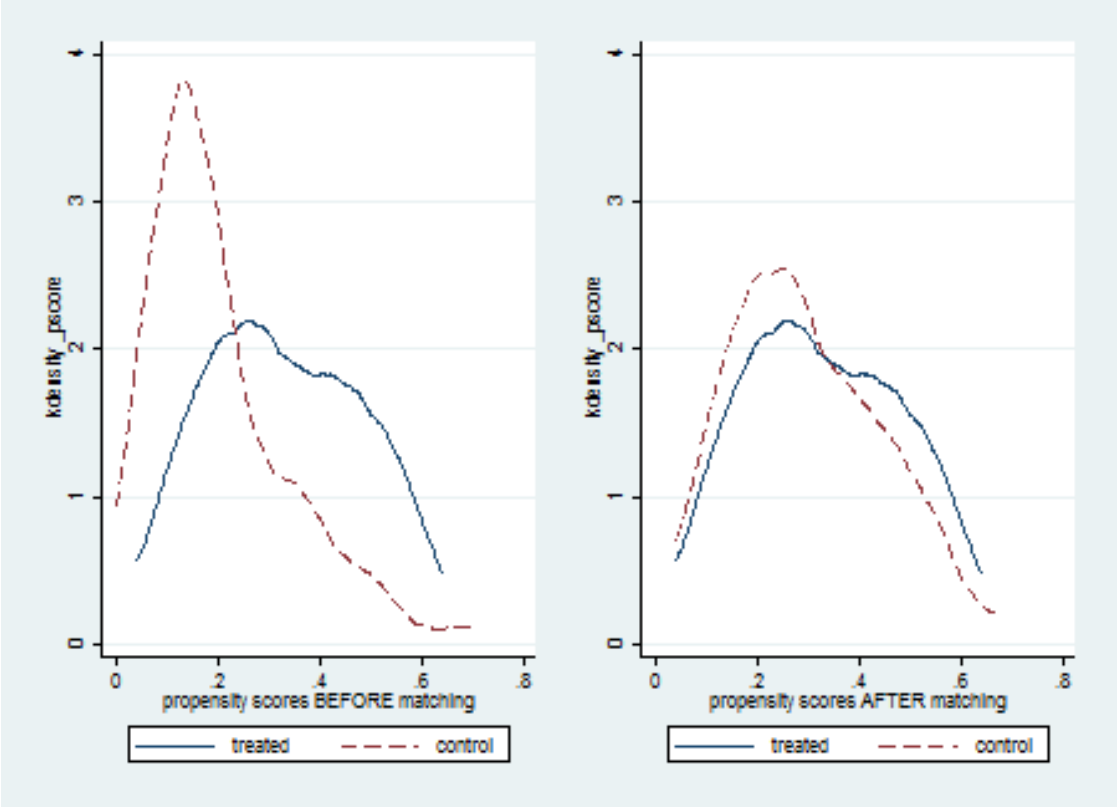
Starbucks C.A.F.E. Practices: Propensity scores before and after matching



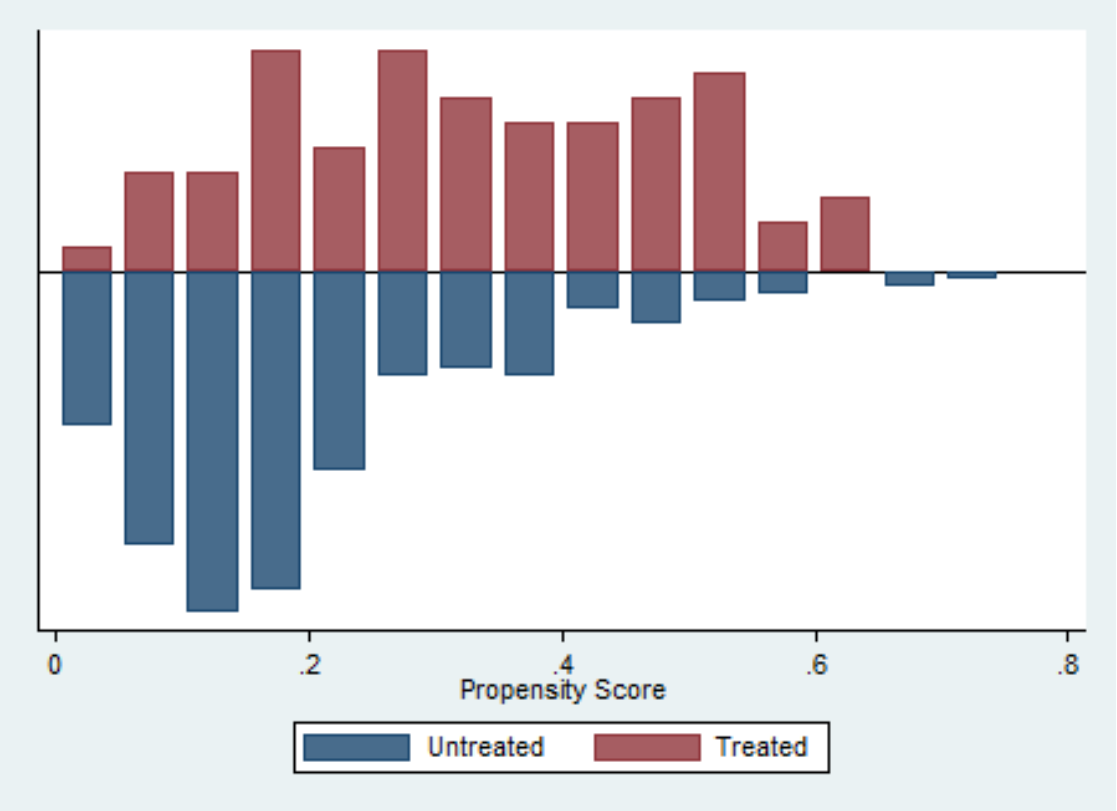
Starbucks C.A.F.E. Practices: Minima and maxima of estimated Propensity scores



4C Association: Propensity scores before and after matching

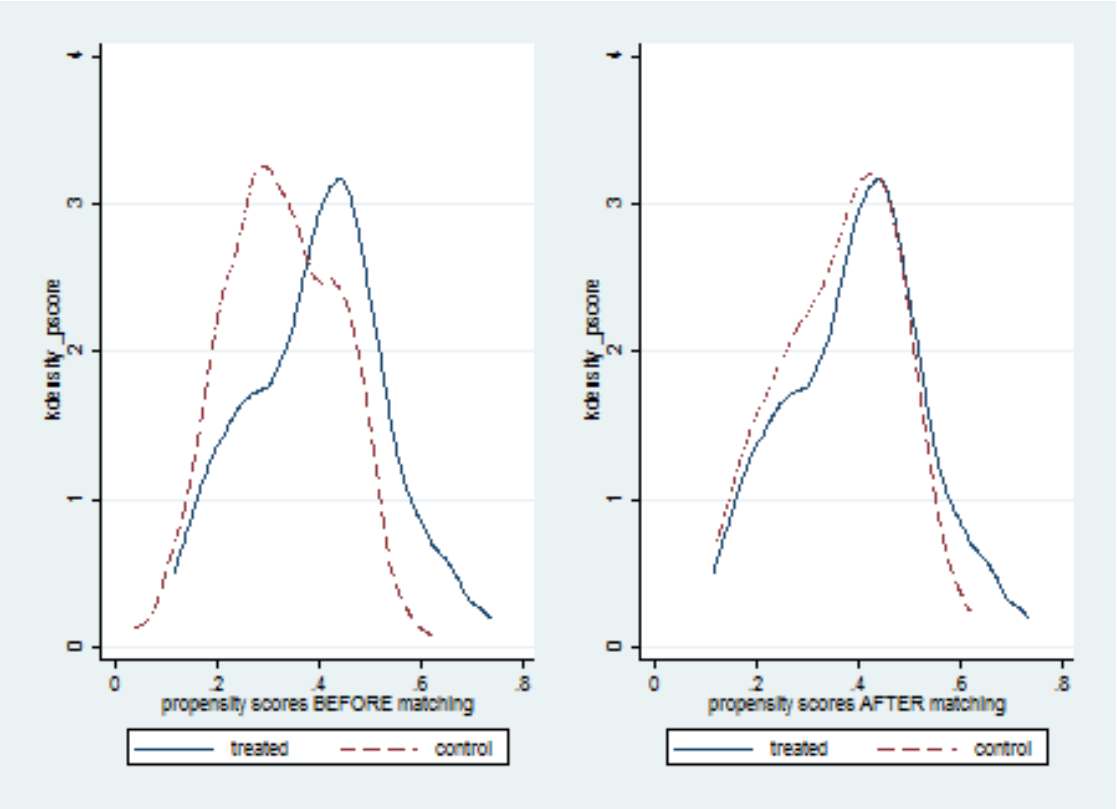


4C Association: Minima and maxima of estimated Propensity scores

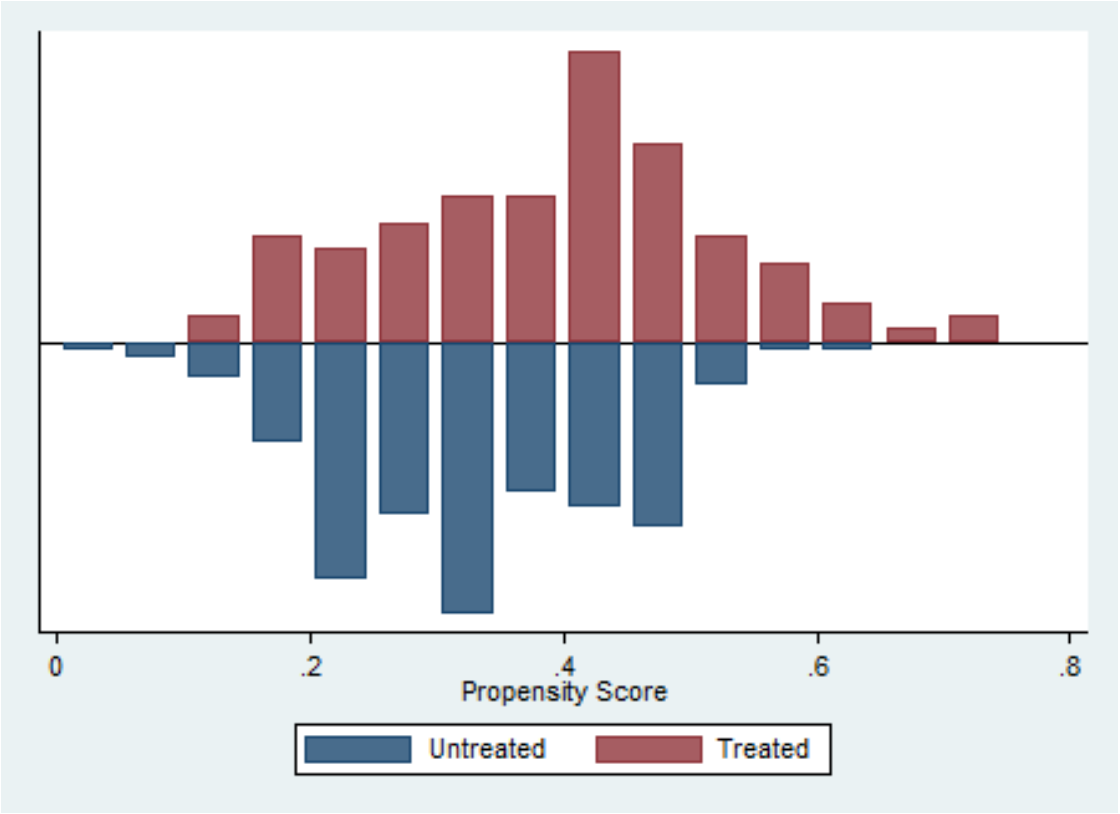


Honduras

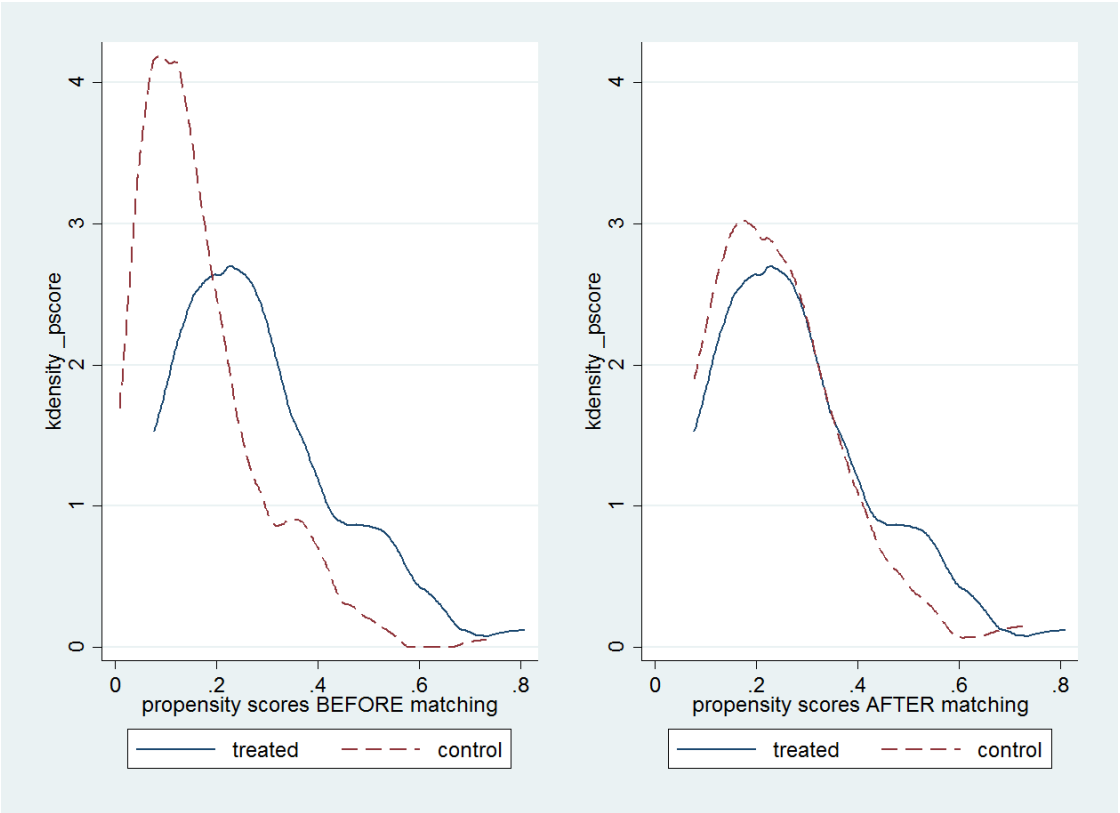
4C Association: Propensity scores before and after matching



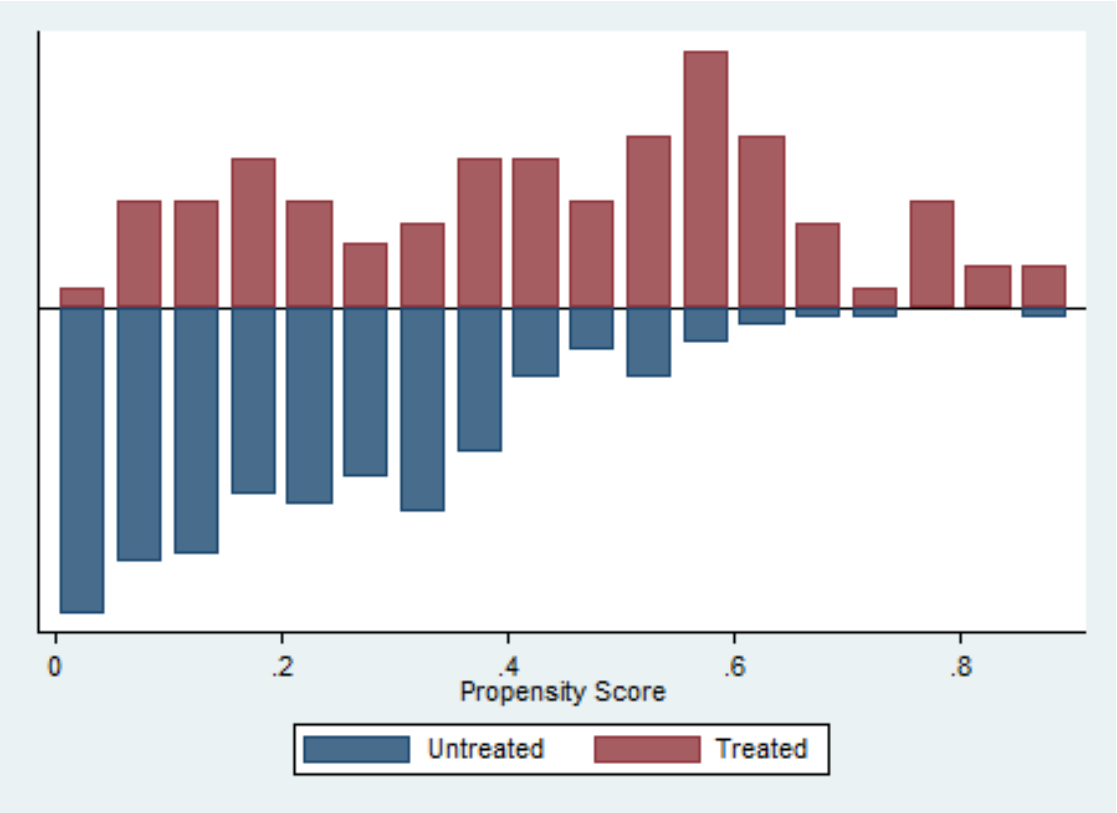
4C Association: Minima and maxima of estimated Propensity scores



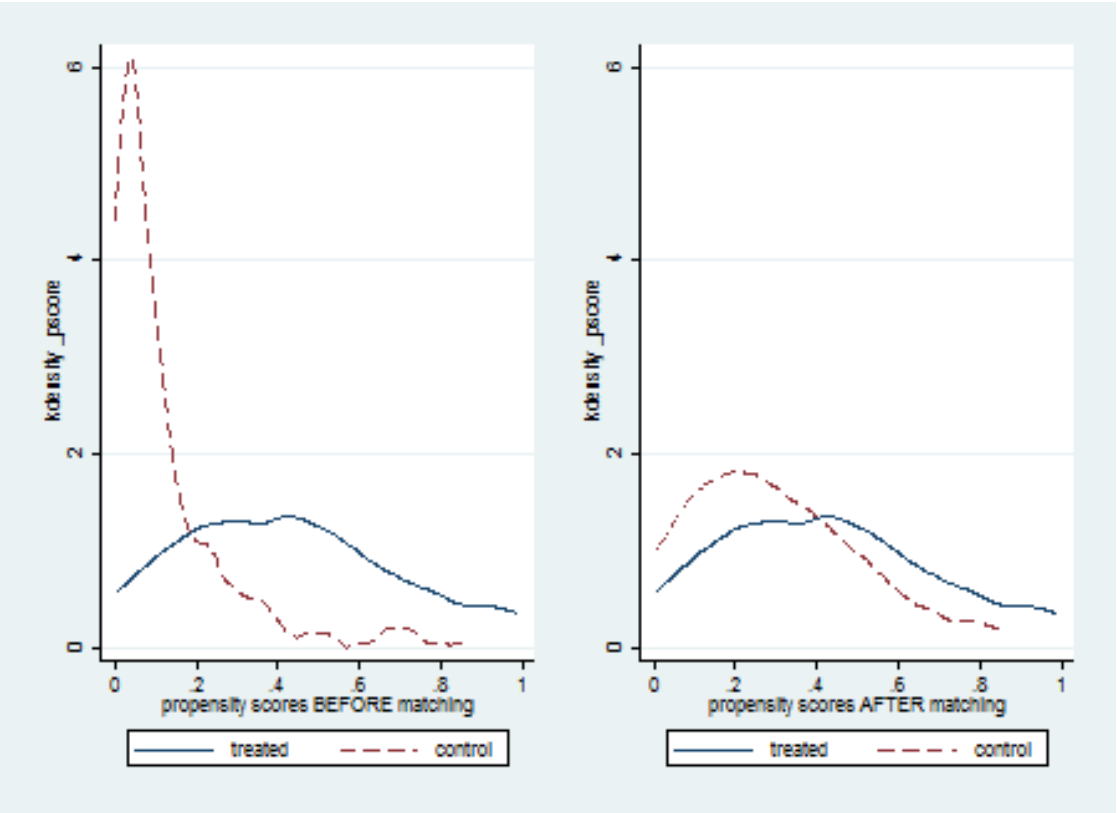
UTZ: Propensity scores before and after matching



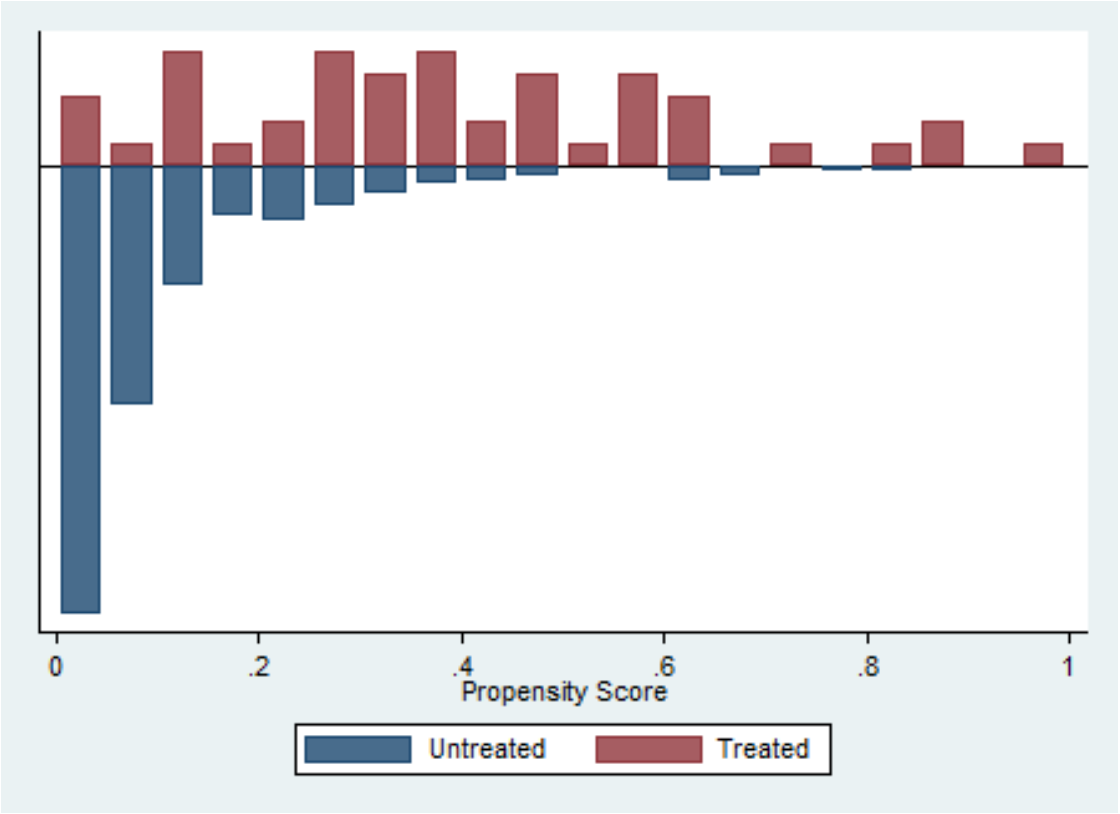
UTZ: Minima and maxima of estimated Propensity scores



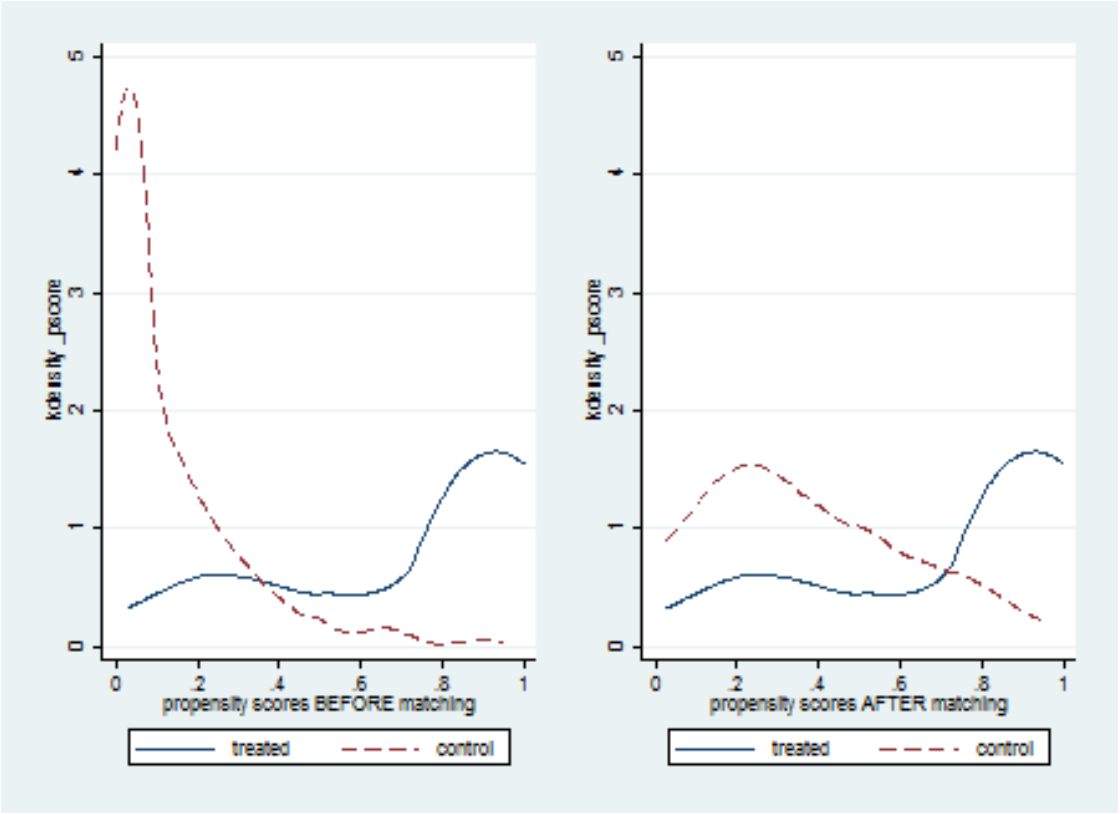
Rainforest/AAA: Propensity scores before and after matching



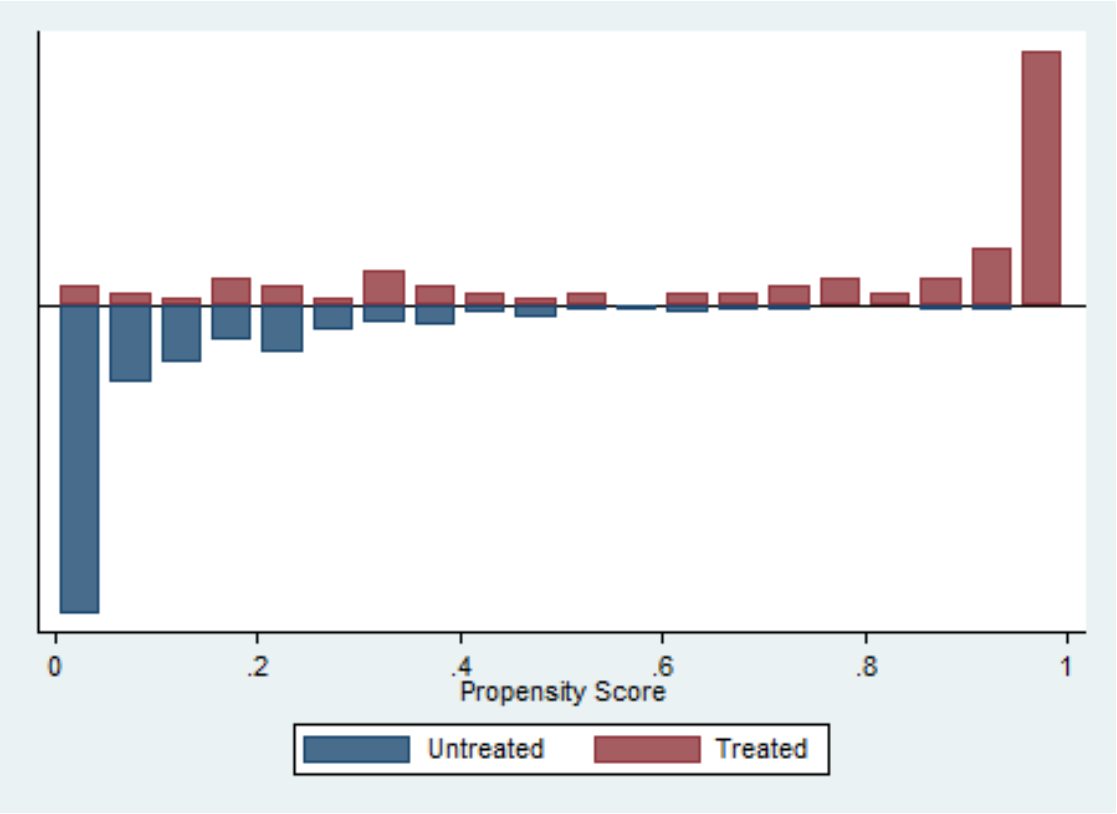
Rainforest/AAA: Minima and maxima of estimated Propensity scores



Fairtrade: Propensity scores before and after matching

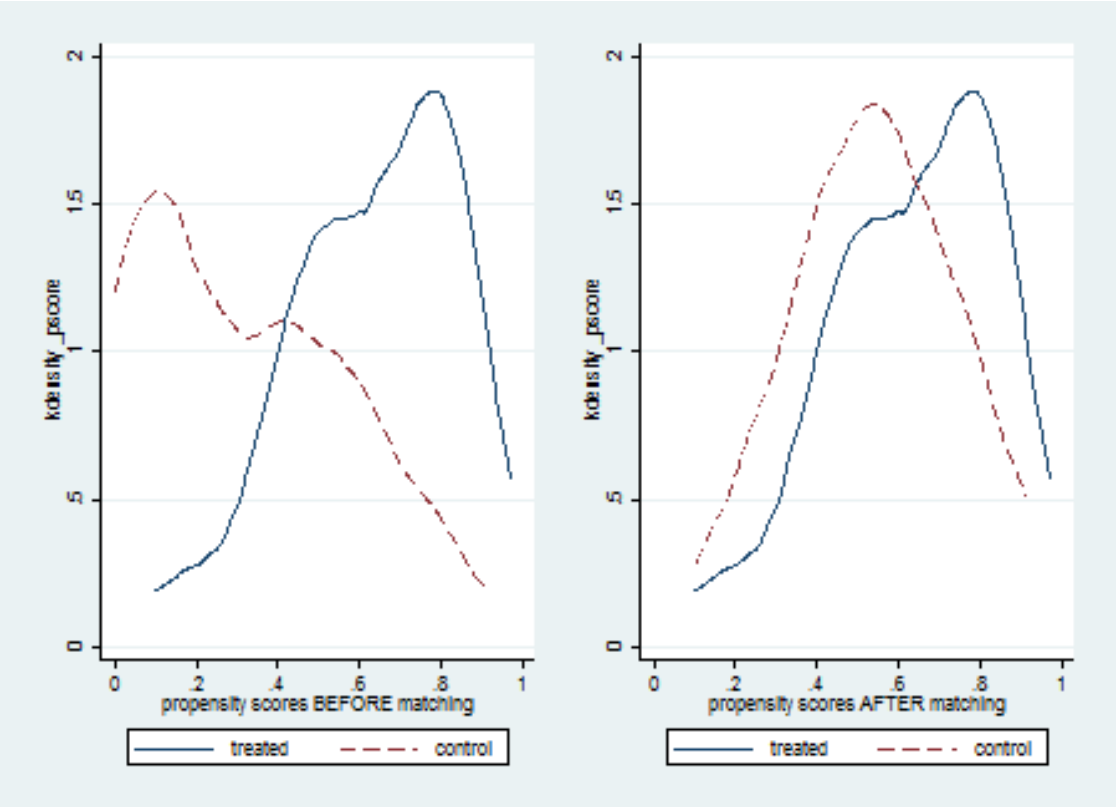


Fairtrade: Minima and maxima of estimated Propensity scores

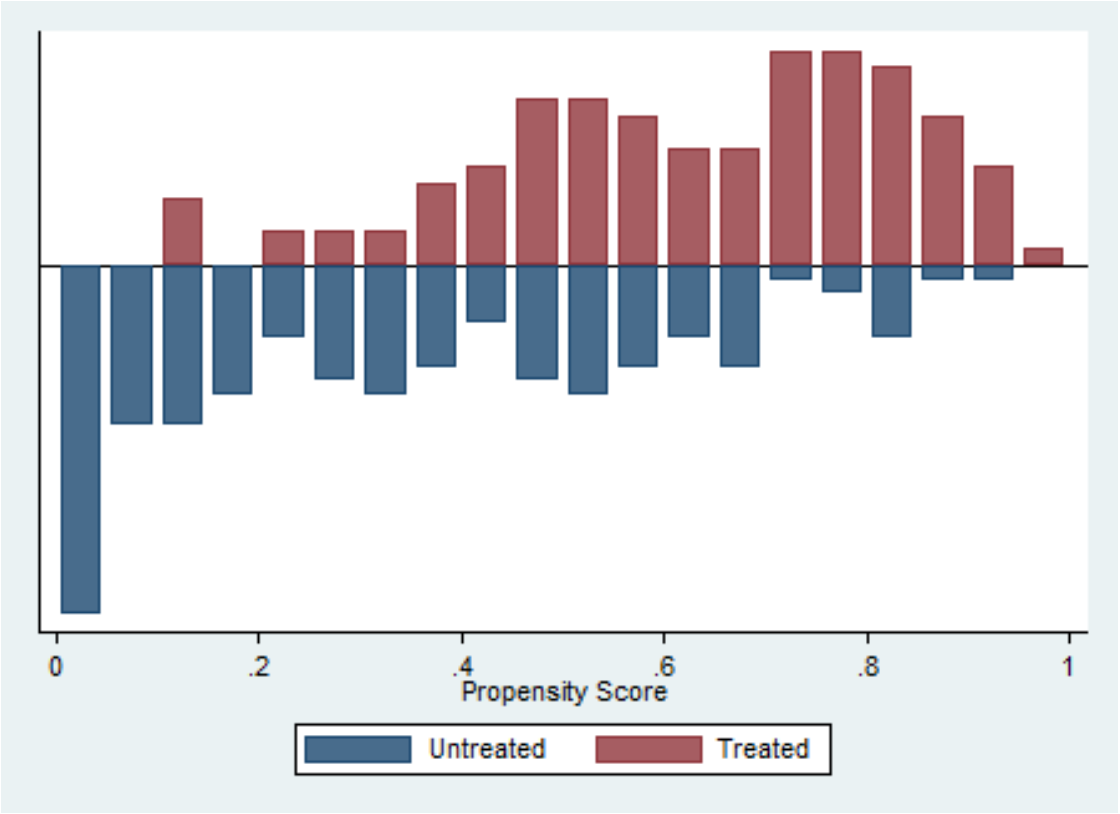


Costa Rica

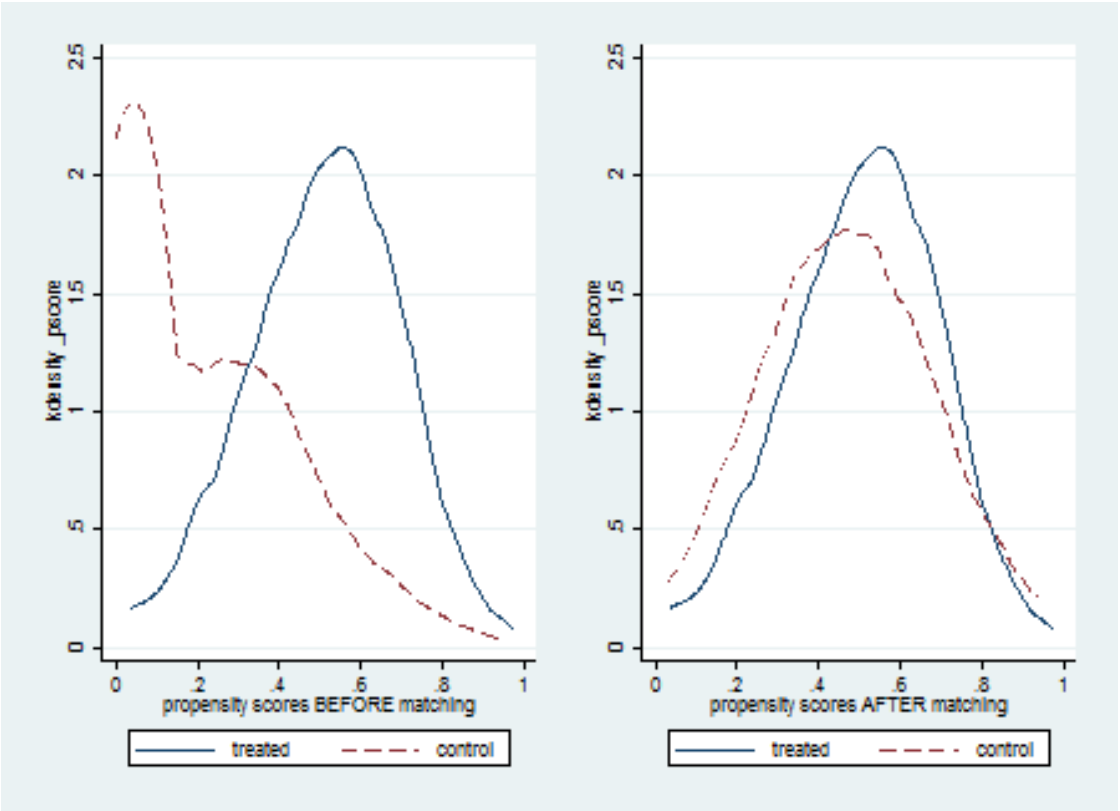
Starbucks C.A.F.E. Practices: Propensity scores before and after matching



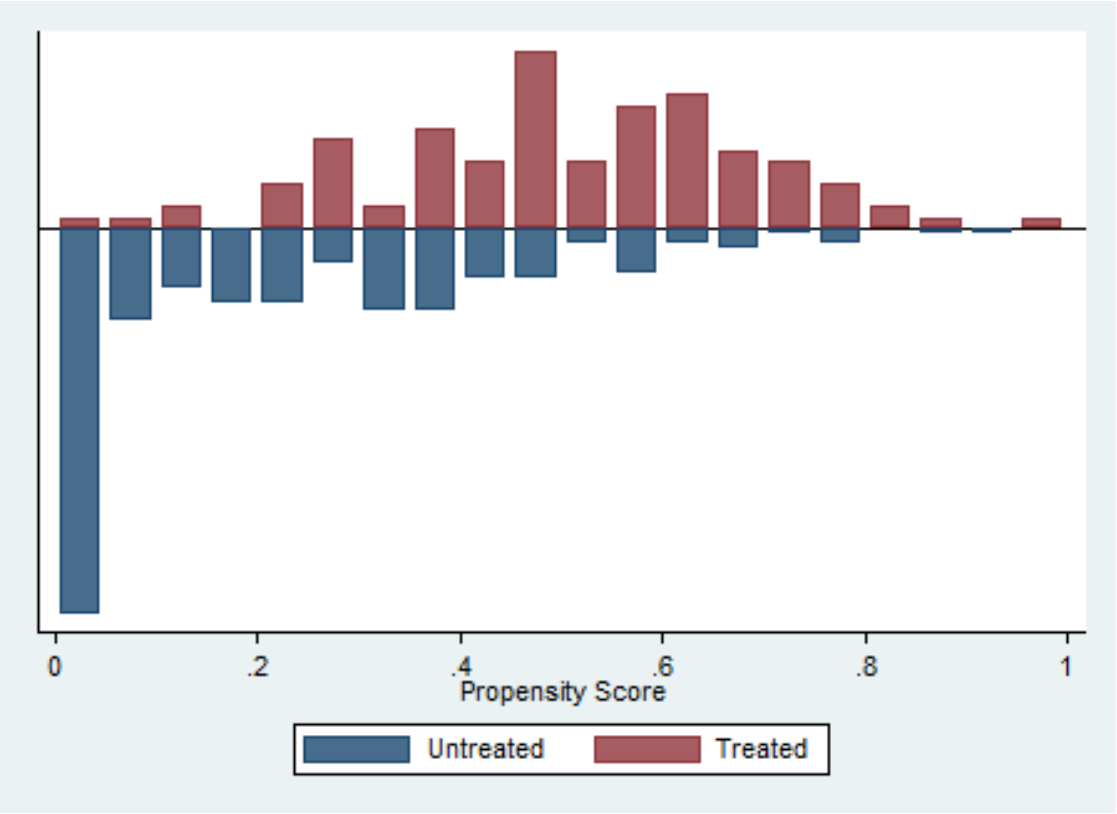
Starbucks C.A.F.E. Practices: Minima and maxima of estimated Propensity scores



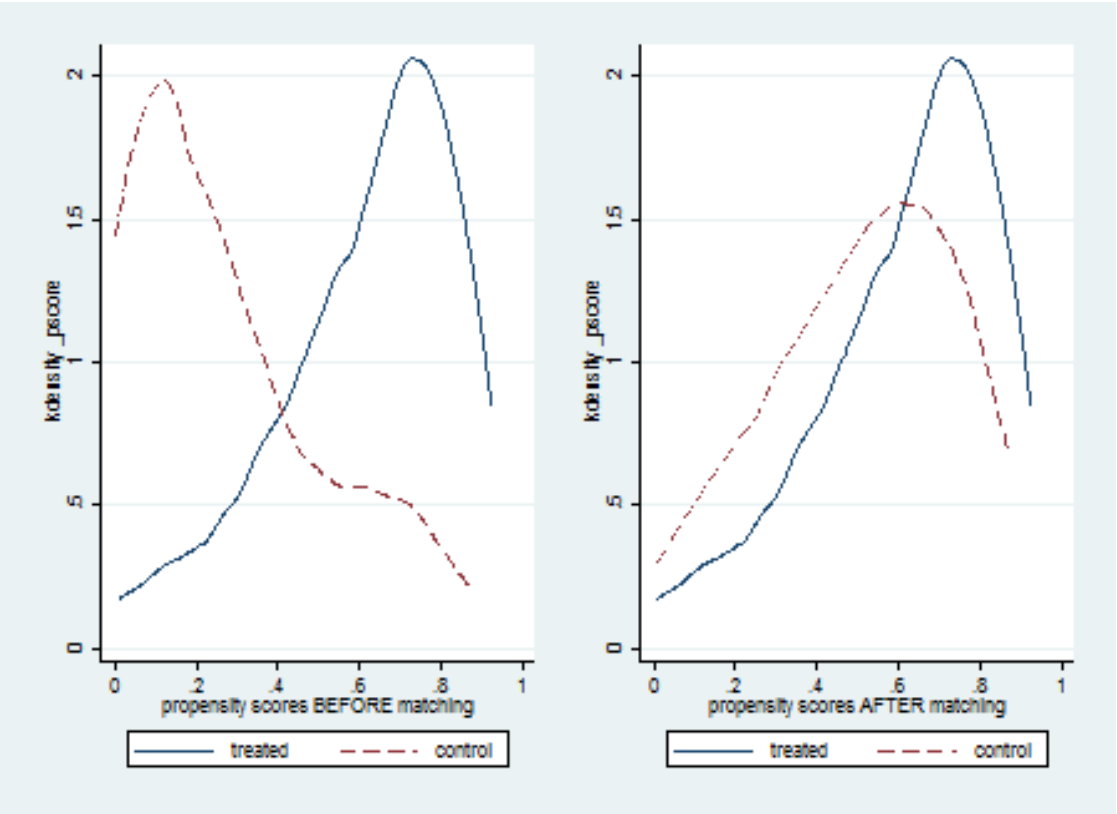
Rainforest Alliance: Propensity scores before and after matching



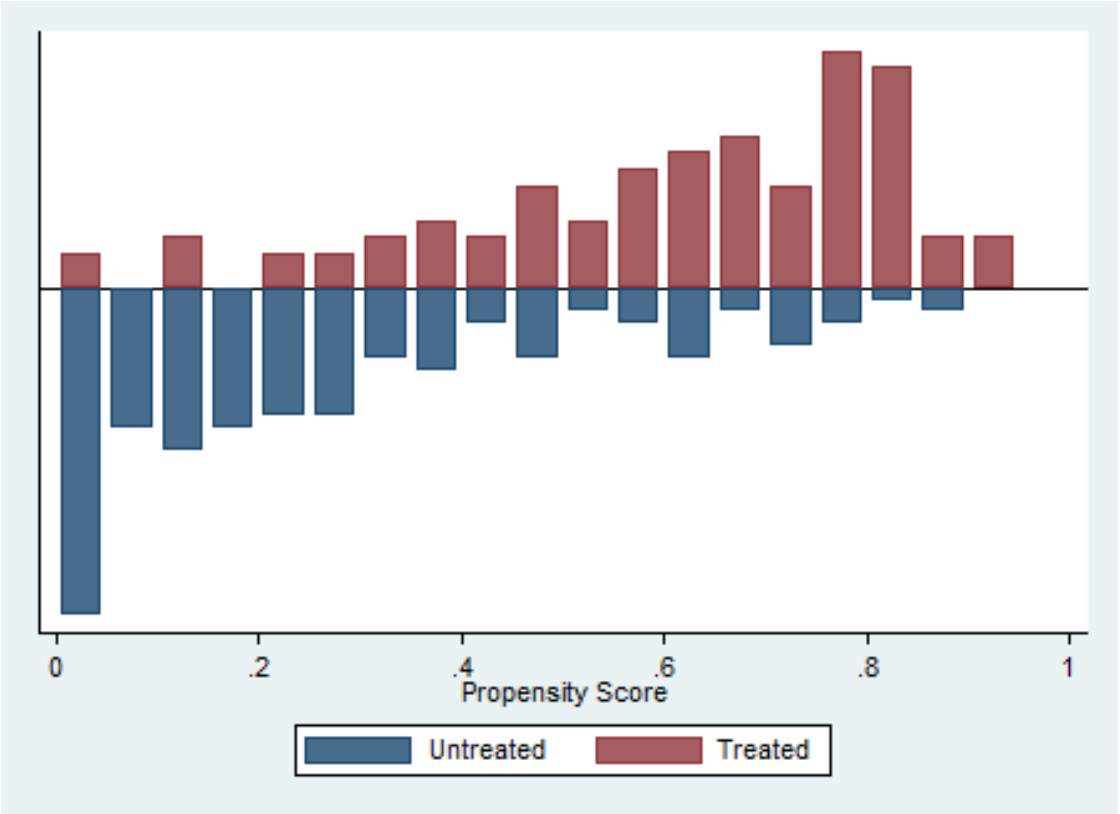
Rainforest Alliance: Minima and maxima of estimated Propensity scores



Fairtrade: Propensity scores before and after matching



3Fairtrade: Minima and maxima of estimated Propensity scores



The effects of Voluntary Sustainability Standards in the economy of smallholder farmers in Latin America

Andrea Estrella

This dissertation attempts to answer the following questions:

(1) What is the economic impact of different certifications in smallholder coffee farmers; (2) What are the “mechanisms” or “pathways” leading to higher economic returns in certified smallholder coffee farmers; and (3) How are the analyzed certifications performing in these impact pathways?

I develop a theoretical model based on impact pathways to determine whether voluntary sustainability standards lead to economic development for small coffee farmers in Latin America. The dataset used for this analysis comprises of cross-sectional data from three countries Colombia, Costa Rica and Honduras. I employ Propensity Score Matching and regression analysis, combined with sensitivity analyses such as Rosenbaum bounds. Each certification is assessed separately against a pool of controls to arrive at the disaggregated effects of each standard. The results suggest that certifications have very limited effects on farmer profitability.

23,50 €
ISBN 978-3-8405-0234-7