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Impact of Cooperative Membership on Members' Household Economies: The Case of Chiapas Coffee Farmers

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Abstract: Coffee producers typically sell raw coffee beans as the first step in a global value chain. Recently, groups of producers have formed coffee cooperatives that attempt to regain market power by integrating the other steps of the value chain. This study uses matching to estimate the effect of membership in one such cooperative on the household economy of indigenous coffee producers in the state of Chiapas, Mexico. It contributes to the literature by considering new determinants of participation and outcomes of interest. First, social capital at the individual and village level is correlated with cooperative membership more than other demographic factors. Second, cooperative members report an increase in the share of coffee sold and income from coffee sales but not in per-kilo price or total income. These two results reflect particular features of the Chiapas reality and the desires of the indigenous people the cooperative serves. Thus, they reiterate the importance for economic development projects to consider the context of their interventions.

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1. Introduction

Coffee is the second most traded commodity in the world after oil and illegal drugs. Because of the tropical climate in which the coffee bean grows best, smallholder coffee producers in the developing world grow most of the world's coffee, which is then processed and consumed in the developed world. Of the 25 million coffee farmer families in the world, 70% own less than 10 hectares than land. Since the breakdown of the International Coffee Agreement in 1989, these farmers have suffered adversely from the volatility of coffee prices. The price of green coffee beans has swung wildly from year to year, changing by as much as a factor of six (Fridell 2014). Figure 1 shows the world price per kilo of Arabica coffee in USD, before and after the collapse of the ICA. Figure 2 shows the steadily increasing volume of coffee exports.

In addition to the volatility of coffee prices, though the price and popularity of specialized coffee drinks has increased in recent years, coffee farmers' share of the overall revenue from finished products, whether roasted beans or lattes, continues to decrease. Recent literature calls this phenomenon "the coffee paradox." Not only do transnational coffee roasters and retailers manage to earn a profit in both boom and bust cycles, but they also capture over 80% of the rents associated with these finished products. In one extreme Ugandan case, coffee producers received 14 cents for a kilo of coffee that was later sold for $26.40 in supermarkets. In a more typical example, $2 worth of raw coffee beans sell for $15-$25 in a supermarket and can produce $70-$90 of specialized drinks.

In general, coffee consuming countries lie outside the tropical belt where most of the world's coffee is grown, so a separation already exists between coffee consumers and producers. The price premium of these drinks illustrates the importance of immaterial aspects of coffee production as well on top of roasting and branding, which recent literature terms "symbolic and in-person service quality attributes." The rising importance of these immaterial aspects of production has intensified the differentiation between the product that producers grow and the product that consumers purchase (Daviron and Ponte 2005).

The fair trade movement has emerged as one approach to helping coffee producers and other smallholder farmers. In fair trade, consumers voluntarily pay a price premium for products whose producers organize and meet stricter certification standards, which often include environmentally friendly production processes. Moreover, the price premium frequently funds social and educational programs that benefit the coffee producers' community. Proponents of fair trade thus claim that it restores market power to smallholder producers, grants them a higher, more stable income, and takes steps in

addressing the root causes of their poverty. Recent literature on fair trade, however, has suggested that the certification costs absorb the cost of the price premium and negate the economic benefit to the producer (de Janvry, McIntosh, and Sadoulet 2015).

This thesis evaluates a project that takes an alternate approach: vertical integration of the value chain from the producer side in the form of a coffee cooperative. As described above, the coffee value chain concentrates power in the hands of importing countries to the detriment of exporting countries (Fitter and Kaplinksy 2001). To address the effects of this imbalance in the value chain, interventions must address the structure at the value chain level. In one case, help from further up the supply chain stabilized a coffee producer in Nicaragua (Donovan et al. 2015). Another case study from Costa Rica, however, showed that informal relationships among coffee producers do not produce the same lasting effects as formally constructed value chains (Macchiavello and Miquel-Florensa 2017). Thus, this project formally constructs a value chain related to the producer cooperative that includes both a coffee roasting facility that sells directly to consumers and also coffee shops throughout Mexico.

Cooperatives fall under the general pattern of smallholder farmer organizations, which have been used in a variety of contexts in the developing world to improve production processes, access to inputs, and marketing for rural agricultural producers (Hellin, Lundy, and Meijer 2009). Because of the wide variety of cooperatives, approaches, crops, and contexts, the literature reflects their mixed results. In one success story from Costa Rica, a cooperative increased coffee farmer income by encouraging coffee farmers to grow a specialized coffee product (organic, shade-grown, or fair trade) and providing them with increased market access (Wollni and Zeller 2007). On the other hand, in a representative year (2004), Ethiopian cooperatives nationwide could only purchase 15% of members' coffee because of lack of credit (Kodama 2007). These ambiguous results show that to ensure their long-term success, coffee cooperatives need a multifaceted approach that not only provides a guaranteed market but also financial stability.

The approach of the program that this thesis evaluates combines access to inputs (improved coffee plants and agricultural training), a specialized product, an international network of coffee shops and customers, and integration of the entire value chain. It began in 1993, when a group of 30 smallholder coffee farmers established the Batsil Maya coffee cooperative, in Chiapas, Mexico. From the beginning, the cooperative not only has purchased green beans at a set price higher than local coffee buyers (*coyotes*) but also has included a coffee roasting plant with the capacity to produce and sell a finished product.

Moreover, in 2010, the coffee cooperative launched the first Capeltic coffee shop; with this step, the coffee cooperative controls the entire coffee value chain. At present the coffee roasting plant produces three metric tons of coffee per month, one of which is purchased by the five Capeltic coffee shops that the cooperative operates throughout Mexico. The value chain integration provides a guaranteed market that allows the cooperative to purchase all of the members' coffee every year. Membership is open to any Mexican citizen who agrees to sell only to the coffee cooperative and transition to organic farming practices within three years.

The state of Chiapas, Mexico, where the coffee cooperative is located, is a major worldwide center of coffee. In particular, Mexico ranks among the 10 countries with the most coffee production in the world and ranks first in the organic production of coffee. Among the coffee-producing states of Mexico, Chiapas is the main producer of organic, aromatic coffee. Despite the presence of this lucrative commodity, the domination of the value chain above is especially apparent here, for while 66% of coffee production is in the hands of indigenous communities, 75% of coffee exports are controlled by four multinationals. Moreover, 76% of coffee is exported as raw material, and only 1% of production is exported as roasted coffee. The price of the green beans is set by the commodity market in New York without any consideration of the indigenous families that produce it ("Carpeta Delegaciones Convención Internal Del Cafe" 2015; "Impactos Café" 2012). Thus the producers themselves do not share in the profit. In 2014, the Mexican government ranked Chiapas as the poorest state in the nation, with 76% of residents in a situation of poverty: 44% in moderate poverty and 32% in extreme poverty ("Medición de La Pobreza, Chiapas" 2014). After Oaxaca, it contains the second highest number of indigenous in the country: just over a million.

This section concludes with a brief outline of the thesis's method and main results. The coffee cooperative operates within a region of five *municipios* (an administrative division like a US county) in northeastern Chiapas as one of 28 programs of the Jesuit mission of Bachajón, which serves the indigenous Tseltal population. Its 250 member families come from the 6000 families who live in this region. Over nine months, a surveying team administered a rural household survey to both 192 of the cooperative member families and 434 non-member families: 302 who grow coffee and 132 that do not. The survey was based in large part on another major rural household survey executed in another part of Mexico, with an additional module on social capital ("ENHRUM" 2015).

Following previous studies, this thesis employs a two-stage analysis on the subsample of coffee growers as well as the entire sample (Mojo, Fischer, and Degefa 2017). The first stage examines determinants of cooperative membership. It groups potential covariates into three categories: household demographic characteristics, household social capital, and village-level social capital. In contrast to the literature, household demographic characteristics do not correlate significantly with the decision to join a cooperative. Social capital, stemming from geographic factors as well as the religious programs of the mission, correlates highly in both directions. The propensity to participate increases by 3% for each mission workshop (*curso*) completed, and participation by a household member in a popular movement is associated with 20% higher propensity to participate in the cooperative. On the other hand, participation by a household member in a political party is associated with a 20% lower propensity to participate in the cooperative. Moreover, village-level capital is also associated with propensity to participate. The presence of a Mexican government store in a village is associated with a 20% lower propensity to participate, while coffee-producing infrastructure like a manual coffee huller or an automatic coffee huller is associated with a 10% or 40% higher propensity to participate, respectively.

The second stage of the analysis uses matching methods to analyze the impact of cooperative membership on a variety of outcomes related to the household economy of the members. Using the first-stage results, it constructs a logistic model of propensity to participate and then use propensity score matching to examine the effect of propensity to participate on several possible outcomes. Cooperative members do not receive a higher price per-kilo than non-members. Thus, the coffee cooperative does not achieve its stated objective. Both the per-kilo price of coffee and the propensity to participate are strongly correlated with the walking distance from a major population center, however. Next, it examines the difference between cooperative members and non-members in terms of market access. It finds that cooperative members sell 15% more of their coffee harvest, consume 5% less, and share 1% less than non-members. Moreover, cooperative members harvest 30 kilos more coffee per hectare. Finally, it examines the difference between cooperative members and non-members in income: coffee sales, agricultural, non-agricultural, government, and total income. Cooperative members receive 160 pesos more per year from coffee sales. Cooperative members do not devote more land to coffee farming than non-members but they do sell more of what they produce. Overall, the rural coffee growers who tend to participate in the coffee cooperative live in mountainous regions with less hectares of land for coffee farming.

The results here demonstrate the importance of the consideration of the social context of economic development programs in selecting determinants of participation as well as outcomes of interest. Reflective of dominant trends in economics, the prevailing impact evaluation methodology tends toward relying on demographic characteristics as determinants of participation and measures of income at the individual or household level as outcomes of interest. Many parts of the developing world, however, do not share this same commitment to economic growth at the individual or the social level as the primary end of development. As a result of these differences in values, evaluations of development programs should utilize outcomes of interest that are valued by the participants in these programs, not their architects. Thus, this thesis contributes as well to the recent debate about the nature of economic growth and the ultimate end of development.

Following this introduction, Section 2 of this thesis presents additional literature on the fair trade coffee movement, social capital, the Chiapas context, and coffee cooperatives. Section 3 explains the empirical strategy and sampling plan. Section 4 presents the first-stage regression results on determinants of cooperative participation as well as the second-stage matching results on effect of participation on outcomes of interest. Section 5 summarizes and concludes.

2. Literature Review

2.1 Fair Trade

A recent article provides a critical overview of the fair trade movement (R. E. Dragusanu, Giovannucci, and Nunn 2014). The movement emerged in 1988, when a faith-based NGO from the Netherlands began an initiative to ensure that smallholder producers in developing countries received sufficient wages. Through its use of a specific fair trade label, the movement aims to provide a higher and more stable livelihood for producers. In addition, as side benefits, it also aims to provide greater access to credit, improved labor conditions, effective producer organizations, and environmentally friendly production processes. Fair trade works through a voluntary certification process. Third-party organizations like Fairtrade International certify producers as compliant with the fair trade movement. In turn, producers can market their products as fair trade to consumers and charge higher prices for them. The Batsil Maya coffee cooperative that this thesis examines does not follow the fair trade model, because it still deals with the purchase of raw coffee beans. Instead, the cooperative follows a value chain reform model, which allows the coffee cooperative to sell finished product coffee. Nevertheless, because the value chain reform

model shares certain similarities with the fair trade literature, this section reviews the fair trade literature in detail below.

From the perspective of economic theory, fair trade works via two mechanisms: a price floor and a fair trade premium. The price floor is set by a relevant organization. In the case of coffee, it is the International Coffee Organization. The fair trade buyer agrees to pay this minimum price, even in cases when the world price is lower than the minimum price. Ideally, the presence of a minimum price reduces the risk that growers bear. Especially given the recent volatility in the international price of coffee, fair trade certification has provided risk protection to coffee producers through the late 1990s and the early 2000s. Fair trade certification does not guarantee that the producer can receive a higher price for all fair trade certified coffee, however. Frequently, this lack of market access prevents smallholder producers from gaining the full benefits of fair trade. The governing board of Batsil Maya annually sets a purchase price for members' beans based on the international price of coffee. Members are required to sell all of their coffee to the cooperative.

In addition to the higher sales price, fair trade producers also receive a price premium, typically 10 or 20 cents per pound. Through a democratic process, the fair trade producers together decide how to spend the price premium, typically on community development such as schools, health clinics, crop storage facilities, etc. As a result, their community ties are strengthened and their communities benefit. Five years ago, the governing board of Batsil Maya chose to invest the surplus profits from coffee sales into a community bank, which grants emergency loans for unexpected expenses in the following categories: education, food, health, and culture.

Certification is a key part of the fair trade process. By providing credible information to the consumer, it allows the fair trade organization to differentiate its product. This product differentiation allows the fair trade organization to move out of a perfectly competitive market for a commodity like green coffee beans into one where it can market its improved products to discerning consumers. Andrea Podhorsky has extended models of international trade to incorporate fair trade certification in two ways. First, by incorporating a fair trade certification program administered by a worldwide certification body, one of her models predicts an increase in bilateral trade between the two countries and consumer welfare for consumers in both countries (Podhorsky 2013). Second, even if the certification program is too small to affect worldwide commodity prices, another of her models predicts a reduction in the market power of intermediaries who purchase the raw materials; this redistribution of income increases the wage of not only participants but also

non-participants in the fair trade program and thus the welfare of the entire region (Podhorsky 2015). These predictions hold true empirically. Experiments with consumers in the United States have shown increased sales and willingness to pay higher prices for fair trade coffee (Hiscox, Broukhim, and Litwin 2011; Hertel, Scruggs, and Heidkamp 2009).

If certification leads to higher consumer demand and better sales prices, are these benefits passed along to the farmers themselves? The literature reveals that Fair Trade-certified producers receive higher prices for their products, but the extent to which the Fair Trade certification causes the higher prices remains unclear, as does the ability for the certification to deal with the structural issues responsible for the poverty of the coffee producers. For example, a review of 469 producers in 18 cooperatives in Central America and Mexico reveals that certified producers receive higher per-pound prices and overall coffee sale revenue, but these higher prices do not improve their livelihood in broader ways, such as by increasing educational attainment or reducing the incidence of migration (Méndez et al. 2010). In another case, a group of 228 producers in a Fair Trade cooperative in Nicaragua received higher prices for Fair Trade and Organic-certified coffee ($0.63 or $0.56 per pound respectively, in contrast to $0.40 per pound for non-certified coffee), but they were not able to always sell all of their coffee at the higher price. Nevertheless, all of the producers credited the cooperative with the higher prices, in contrast to a comparison group from a conventional cooperative in which only half of the members credited the cooperative with higher prices (C. Bacon 2005; C. M. Bacon et al. 2008). Moreover, a study of 1269 farmers from Nicaragua, Peru, and Guatemala revealed that in addition to higher prices, Fair Trade-certified producers received greater sales and higher incomes (Arnould, Plastina, and Ball 2009). Thus, this study will examine not only the per-pound price that coffee producers receive but also their market power, coffee sale income, and overall income.

As in any impact evaluation, evaluating the impact of Fair Trade cooperatives requires establishing causality. Quite possibly the same factors that influence selection into certification could also account for the positive effects of Fair Trade certification above. Thus, instead of simple comparison of means between treatment and control group, recent literature has employed matching methods on observable characteristics. Two examples of matching techniques reveal mixed results. One study that used matching techniques on 327 members of coffee cooperatives in Nicaragua found that Fair Trade-certified farmers obtained higher prices (Beuchelt and Zeller 2011). On the other hand, another study that used matching techniques on 360 coffee producers in Peru did not reveal a difference in price for Fair Trade-certified farmers (Ruben and Fort 2012).

Though Batsil Maya's integration of the value chain differs from Fair Trade certification, its approach shares many of the same characteristics. It addresses the low prices and price volatility of raw coffee beans by offering a specialized product with more demanding production requirements to consumers who are willing to pay a higher price. These increased profits are in turn passed along to the coffee producers. Thus, this thesis examines the effect of participation in Batsil Maya in the same way that the literature has examined the effect of participation in Fair Trade certification: using matching techniques on observable characteristics of coffee producers across a variety of outcomes of interest.

The literature still lacks consensus on which variables should be used for matching. Age of household head, size of family, and educational attainment are exogenous. In the Mexican context, since land cannot be bought or sold under the *ejido* system, this thesis also considers landholding as exogenous as well. Thus it uses six demographic variables: female-only household, age of household head, education level, number of males, number of children, and landholding. In addition, however, it considers other forms of social capital at the household and the village level that are particular to the Chiapas context. Thus this literature review turns next to social capital in general and social capital in Chiapas in particular before finally examining literature on cooperatives.

2.2 Social Capital

A recent literature review on social capital summarizes its basic premise: "relationships matter" (Coleman 2010). Through interpersonal interactions, people build up community; this experience of belonging that comes from feeling oneself as a part of a community touches a basic human need. Moreover, this social capital undergirds social norms and formal institutions, two subjects that have recently emerged as areas of ongoing research in economic development. An emerging literature has analyzed the effect of all three of these elements on economic growth. Four elements have emerged that explain the channels by which social capital helps economic growth: 1) it encourages cooperation; 2) it increases the efficiency of everyday business interactions; 3) it expands individuals' awareness of linkages and dependencies beyond the self; 4) it serves as a conduit for useful information (Putnam 2007).

This thesis proposes that the first and the fourth element of social capital play a particular role in coffee cooperatives. Through preexisting social capital, it argues individuals find out about the existence of the coffee cooperative in the first place. This view of the role of social capital as the source of information about new agricultural technology

aligns with other literature, such as the adoption of fertilizer by pineapple farmers in Ghana (Conley and Udry 2010). Moreover, in order for the coffee cooperation to function, its members must trust one another to engage in the collective action of processing and marketing the coffee together.

Initial empirical work on social capital established a relationship between cross-country economic growth and survey data about trust (Knack and Keefer 1997). Following sociological literature, this work proposed an increase in the associational life of a nation as a possible intervention to increase trust in countries that exhibited low levels of it. These associations include social welfare groups, unions, arts and cultural organizations, religious congregations, volunteer organizations, youth work, and community development groups. This thesis employs a different measure of social capital that will be discussed below: participation of households in mission workshops, political activism, and popular movements. In addition, it considers village-level proxies for social capital such as the presence of coffee hulling infrastructure provided by NGOs and government stores, meeting halls, and road improvements subsidized by the Mexican government.

2.3 Three Types of Social Capital in Chiapas

Based on the increasing recognition of the importance of social capital in economic development in general, this thesis will consider three important sources of social capital in the Chiapas context in particular: religious organizations, political organizations, and the Mexican government. Its results suggest that a household's preexisting alignment with one of these sources is reflected in its decision to participate in the coffee cooperative and the subsequent effect of this participation on its household economy.

Sociologists have studied the role of religion in creating social capital. Important factors include the size of the congregation, the sort of relationships (horizontal or vertical) that it creates, and the way that it manifests itself in terms of practical action in the surrounding community (Coleman 2003). In the context of this thesis, these factors would indicate a strong potential for the Jesuit mission. First, it spans 622 villages and five *municipios*. Second, it promotes horizontal relationships among the indigenous themselves. In response to the scarcity of priests, for the past forty years, it has trained local religious leaders, deacons and their wives, so that nearly every group or two or three villages. Moreover, a sophisticated system of local village jobs (*cargos*) that has evolved over the four centuries since the initial contact of the Tseltales and Catholicism at present includes 10% of the population of the mission and serves as a strong base of social capital (Maurer 1984).

In addition, developments in the Chiapas political reality since the middle of the 20th century have continued to strengthen social capital. This political social capital overlaps with religious social capital. Since the 1950s, all across Mexico, in response in part to external competition from Protestant missionaries and in part to the internal dynamic of the Second Vatican Council, the Catholic Church began to strongly supported movements for land redistribution and indigenous rights and work not only in city centers but in rural, indigenous villages (Trejo 2014). In the Chiapas context in particular, a combination of liberation theology and political activism by groups associated with the Catholic Church beginning in the 1970s laid the groundwork for the 1994 Zapatista uprising (Washbrook 2007). In the 1990s, the Zapatistas' use of the nascent Internet created a tipping point that allowed them construct an inclusive social movement and successfully wage a publicity war against the Mexican government. Eighteen months after the successful occupation of 250,000 hectares of land in 1994 that originally belonged to indigenous groups, the Mexican government agreed to purchase it and return it to them (Martinez-Torres 2001).

The natural social capital in Chiapas has taken a variety of forms. Some of the capital has emerged completely from below, like the Zapatista movement and its own coffee cooperatives. Other strands of social capital have emerged as a result of partnerships with religious organizations and other NGOS who have helped local people establish the coffee cooperatives. Interviews with Chiapas coffee producing families have shown that both of these types of social capital have worked with natural capital to contribute to the success of Chiapas coffee cooperatives (Martinez-Torres 2006). This difference is reflected in two of the measures of social capital that this thesis employs: participation in political activism and popular movements.

A third type of social capital also plays an important role. Since 1992, the Mexican government has offered a rural food store program, DICONSA, by which autonomous food councils in local villages open government-subsidized stores that sell staple goods. They represent a partnership that allows the Mexican government to utilize natural social capital, and their continued success has come on account of their local oversight. Most of the 22,000 stores are in rural places like Chiapas, and independent evaluations have confirmed that they offer a wide variety of goods at the same or lower prices than neighboring private stores (Fox 2007). Nevertheless, the presence of a DICONSA store in a village is associated with a lower probability that a resident of that village will participate in Batsil Maya. This result suggests that individuals choose to align themselves with either the Mexican government or the Jesuit mission.

2.4 Coffee Cooperatives

The cooperative movement emerged in Europe in the late 19th century in response to the expanding global market as a similar mechanism by which agricultural producers used collective action in reaction to an outside shock. By banding together, small and middle-sized farms gained increased access to inputs, improvement knowledge about new production technologies, and the ability to sell in new markets. In the case of Spain, for example, the management of collective resources and common lands allowed for a stock of natural social capital that contributed to the success of rural agricultural cooperatives (Tapia 2012). A century later, when the coffee crisis hit in 1989, smallholder coffee producers in the developing world as well tried to use coffee cooperatives to deal with the effect of globalization. As the introduction mentioned, the smallholder producers suffered from both price volatility in addition to a generally lower price for raw coffee since the collapse of the ICA. Figure 1 demonstrates this trend.

In response to the coffee crisis, smallholder coffee farmers across the coffee-producing countries have organized into coffee cooperatives. Two results from the microeconomic theory of the firm provide potential theoretical underpinning for the success of these cooperatives. First, product differentiation allows producers to move from a perfectly competitive market to one of monopolistic competition. This differentiation often takes the form of the adoption of organic, shade-grown, fair trade, or similar certification schemes. Moreover, it allows consumers in coffee consuming countries to express their preference for this certified coffee. Thus in this new market, coffee producers can retain some of the rents and increase their producer surplus. (Barham and Weber 2012). Second, in many coffee markets, the buyers function as a cartel to set higher prices; thus, when smallholder farmers, through collective action, sell their coffee together, they once again regain price maker power and increases their producer welfare (Milford 2004). In addition to these two insights, collective action and institutional support is thought to help smallholder agricultural producers share knowledge and reduce transaction costs in order to more effectively sell their products in international markets (Narrod et al. 2009).

Despite the theoretical promise, the mixed success of coffee cooperatives in practice in improving smallholder farmers' participation in the market motivates this thesis. A study of coffee farmers in Costa Rica indicates that participating in specialty market channels and cooperatives increases the price that farmers receive. Access to reliable price information about the national and world price of coffee in particular enhances the improved price (Wollni and Zeller 2007). Nevertheless, as the introduction discussed, in many cases the

additional costs of certification for the specialized coffee absorb all of the rents that the producers gain, leaving the net impact on producer welfare as zero.

Three pieces of recent literature have revealed the complexity of this story by examining the heterogeneous benefits of cooperative membership. A study of coffee farmers in Ethiopia found increased income and assets for cooperative members, but substantially higher benefits for non-members (ATU) than for members (ATT), suggesting evidence of negative selection. A study of agricultural cooperative members in Rwanda found similar results: the income effect of cooperative membership was higher the lower the propensity to participate in the cooperative (Verhofstadt and Maertens 2015). Finally, a study of coffee cooperative members in Costa Rica found increases in income as a result of participation in Fair Trade certification predominantly for skilled coffee producers at times when the global coffee prices are lowest (R. Dragusanu and Nunn 2018). In the latter case, the fair trade organization redistributed income to the skilled coffee producers from the intermediary coffee buyers, who were members of the same community, resulting in a net social welfare effect of zero for the region served by the fair trade organization as a whole.

Finally, recent literature has empirically examined the effect of social capital on cooperative membership. One study of four coffee cooperatives in Ethiopia found a positive effect of bonding (within group) social capital but a negative effect of bridging (between group) social capital on income. Rural coffee farmers with less opportunities for outside work and less influence from Western individualism tend to exhibit higher social capital in general and greater participation in cooperative activities (Ruben, Ruerd and Heras, Jorge 2012). Another study of 147 Chinese agricultural cooperatives finds a positive relationship between three dimensions of social capital—external networks outside the cooperative, internal relationships among cooperative members, and cognitive alignment with the cooperative mission—on both participation in meetings and training sessions as well as the economic performance of the cooperative.

The present thesis contributes to the literature on cooperatives and social capital by employing a broader definition of social capital than individual-level surveys about trust, participation in religious and political programs, and by examining the relationship between these indicators of social capital and cooperative membership. In this way, it examines the effect of the broader context on a household's selection into a particular development program. After all, development programs do not function in a vacuum, and organizations that promote them are always located somewhere in the existing social network of a region.

3. Methods

3.1 Sampling and Data Collection

A household survey was conducted in the mission of Bachajón, Chiapas, Mexico between August 2017 and April 2018. A full list of the indigenous villages (*comunidades*) does not exist, and at least half of them do not appear on the localities list of the Mexican government census (INEGI). Thus, instead of the list of villages, the sampling plan is based on the list of 622 village chapels (*ermitas*). In most cases, each chapel corresponds to exactly one village. In a few cases, a large village may have two chapels or two neighboring villages may share the same chapel. For all of those surveyed, the surveyors asked both for chapel and village, and as part of the data cleaning process, mission staff reviewed both lists to verify consistency.

The mission is divided into 23 interzones and 60 zones in five adjacent municipalities: Bachajón, Chilon, Ocosingo, Sitalá, and Pantelho. The 250 members of the coffee cooperative are in 50 of the 622 village chapels, which fall under 20 of the 60 zones. Figure 3 shows the area of the mission and Figure 4 shows the sampling area. 192 of them were surveyed. In addition, a control group of both coffee growers and non-coffee growers was randomly selected using stratified random sampling: non-members of the cooperative who live in the same chapel, non-members of the cooperative who live in the same zone as cooperative members but a different chapel, and non-members of the cooperative who live in a zone that does not have cooperative members. This two-level approach was chosen to account for spillover effects (Abate, Francesconi, and Getnet 2014). On the one hand, the presence of cooperative members in the same zone might affect the entire market for the zone; the local coffee buyer would have to match the cooperative's price even when purchasing the coffee of non-cooperative members. On the other hand, comparing cooperative members from a different zone would increase the likelihood of selection bias based on differences among zones. Incorporating both types of respondents in the control group accounts for these two concerns.

For the second and third stage, one third of the possible units (zones and villages) were selected using Excel random numbers. Surveyors were instructed to survey one half of the households of each village that was selected. A few small zones that did not contain at least 10 villages were excluded. In addition, logistical difficulties prevented surveyors from visiting five zones: two that contained cooperative members and three that did not. Thus, 58 members of the coffee cooperative and 100 potential members of the control group were not surveyed.

The survey contains seven modules: village characteristics, household characteristics, social capital, household economy, labor income, non-labor income, and debt level. The household economy module included questions about livestock, land, and crops, with detailed questions about the three principal crops: coffee, corn, and beans. The social capital and debt level modules were constructed with input of cooperative staff, and the other modules were adapted from another rural Mexican household survey ("ENHRUM" 2015). Mission staff assisted in the translation of the survey from Spanish to Tseltal, and tablets were programmed with a bilingual version of the survey, to ensure that respondents understood the technical terms, which sometimes appeared in Tseltal using Spanish words. Younger respondents tended to understand the Spanish terms, while older respondents the Tseltal terms. Thus the survey provided both sets of terms.

The survey team consisted of 12 bilingual Tseltal men and women. It included members of the mission radio station and other mission programs who were familiar with the villages in the sampling area and had previous experience administering surveys. In addition, in some cases, members of the coffee cooperative staff surveyed coffee cooperative members. In the month of July, the surveyors received a day-long training workshop. Subsequently, the survey was piloted and revised with their input, and from August 2017 to April 2018, 626 households were surveyed, of which 494 respondent households were coffee growers and 192 respondent households were cooperative members.

3.2 Analytical Frameworks and Estimation Strategies

Retrospective program evaluations can present difficulties in terms of an identification strategy because of concerns about endogenity: program participation may be influenced by the same outcome whose treatment effects the evaluation is trying to measure. Even more, unobservable differences between participants and non-participants may bias results. As a result, researchers match units of the participant and non-participant group based on observable factors, all of which they consider exogenous to program participation. The number of observable factors, however, can result in the "curse of dimensionality," which can make it difficult to find exact matches between units in the treatment and control groups. Propensity score matching addresses this concern by computing an instrumental variable of a unit's "propensity to participate" and matching based on this variable alone (Rosenbaum and Rubin 1985).

Propensity score matching depends on three important assumptions (Heinrich, Maffioli, and Vázquez 2010). First, through the *conditional independence assumption*, after

controlling for the set of covariates *X*, the potential outcomes are independent of the treatment status. In this way, PSM can provide an unbiased estimate like the random assignment in a randomized control trial. Second, through the *common support assumption*, for each set of covariates *X*, there is a positive probability of both being treated and untreated. This assumption is also known the *overlap condition*, because it allows PSM to find comparable units within the treatment and control group for every value of the propensity score. Third, the *balancing property* requires that the covariate means be the same after balancing to verify that PSM has successfully addressed the problem of selection on unobservables and that the difference in outcomes can be attributed only to participation in the program.

This thesis will employ PSM in three variations: 5 nearest neighbor matching, radius matching, and kernel matching. These three variation provide a robustness check. The household survey includes a number of observable factors that are expected to influence a household's propensity to participate but are not expected to influence any of the outcomes of interest. As section 2 indicated, these factors are classified into three groups: demographic characteristics, household-level indicators of social capital, and village-level indicators of social capital.

3.3 Determinants of Cooperative Participation

Table 1 contains descriptive statistics of demographic characteristics as well as mean differences between treatment and control groups. The first group of demographic characteristics include demographic characteristics that have been employed by other literature on cooperative membership (Mojo, Fischer, and Degefa 2017; Elder, Zerriffi, and Le Billon 2012): female-only head of household; age, marital status, and education level of head of household; number of children and men; and total land area. In the context of the Mexican *ejido* system, land cannot be bought or sold, merely inherited, so cooperative membership could not influence land area. The treatment and control groups do differ on age, the presence of men, and marital status. These differences would imply that households consisting of younger, unmarried women do not participate in the coffee cooperative, probably owing to the labor-intensive nature of the coffee production process. Nevertheless, Table 3 shows that after matching the treatment and control groups are balanced.

Table 2 contains a breakdown of the physical capital indicators at the village level and the social capital indicators at the individual level. The village-level physical capital indicators come from the community characteristics module of ENHRUM, which contains

27 measures of village-level physical capital. This model includes five that are hypothesized to potentially affect market access (the presence of dirt or paved roads), coffee production (the presence of a manual or automatic coffee huller), and social capital (the presence of a DICONSA government store or Ejido Meeting Hall). In the context of the various types of social capital that the previous section presented, road maintenance, the government store, and the meeting hall would be provided by the Mexican government, while the coffee production infrastructure would be provided by an NGO.

The social capital indicators come from two sources. First, participation in political activism or a popular movement is asked at the individual level by the household member characteristics module, also from ENHRUM. The first-stage model uses a dummy variable: a household is considered politically active if any member reports political activism, and likewise for a popular movement. Second, walking distance in hours to a population center also comes from ENHRUM at the household level. Figure 5 presents the distribution across coffee growers (top) and the total sample (bottom).

Finally, the social capital module of the survey measures both the total number of workshops (*cursos*) of the mission that household members reports participating in and the total number of community jobs (*cargos*) of household members. The two measures highly correlate, so the number of courses is used, because it has more variation, and reflects not only social capital within the village but also across the mission, since courses take place at the mission center (*colegio*) in Bachajón. The distribution of the course count suggests diminishing returns for additional courses, so the logged value of the variable is employed. Figure 6 shows the distribution, across the full sample and the subsample of coffee growers. As the previous section indicated, these measures serve as proxies for the natural social capital present in the Tseltal community. In addition, mission workshops provide opportunities for the information exchange that could result in a household's decision to join the coffee cooperative.

3.4 Outcome Variables of Interest

Table 5 gives descriptive statistics on outcome variables of interest. The literature suggests that per-kilo price of coffee and total income should be considered. The stated aims of the cooperative as well as the value chain literature that section 2 surveyed both place a considerable amount of weight on the per-kilo price of coffee. As section 4 will reveal, however, participation in the cooperative does not affect the per-kilo price of coffee. In contrast, distance to the population center as well as unobservable effects at the village-

level both correlate significantly with it. These results corroborate with the hypothesis of cooperative staff members that local coffee buyers (*coyotes*) set different prices farther away and at different times during the harvest season depending on the surrounding market access, creating "micromarkets" for the coffee. In contrast, the coffee cooperative pays the same price year round for any member in the geographical region of the mission.

Following the literature, the outcomes of interest break down income into total agricultural income (which includes sales of corn and beans as well), non-agricultural income (day labor, migrant labor, and support from government programs), and government income (participation in one of seven Mexican government social programs). Non-agricultural income includes both local and non-local sources of income. Seasonal migration is common in this part of Mexico, and survey questions about internal and international migration reveal the presence of migration both to the state capital (Tuxtla Gutierrez), the Yucatan tourist region, and northern Mexico (Sonora), which has a different growing season. Only one household reported migrating to the United States.

Government programs include the Progresa/Oportunidades program that section 2 mentioned, as well as other assistance programs for households, unemployed, rural workers (PROCAMPO), the elderly, nutrition, and education. Respondents only reported receiving income from the first four of these categories, and this thesis aggregates their response into a single outcome variable of government income. In addition, it aggregates all of these sources of income into a single outcome variable of total income.

In addition, this thesis also measures market access as an outcome of interest. For the three principal crops (corn, beans, and coffee), the survey asks for the amount harvested, the amount sold, the amount shared (outside the cash economy), and the amount consumed in the household. For the coffee data, the fraction of coffee sold, consumed, and shared is computed. The model here assumes that in order to maximize their income from coffee sales, households will sell as much of their coffee harvest as they can. The inability to sell some of it would indicate a market failure. Thus, these fractions (shares) are used as a measure of market access. In addition, standardized measures of sale and yield by hectare are computed in order to account for possible negative selection. Cooperative membership cannot change a household's possibly sub-par landholdings but it could help it cultivate them better.

4. Results

Once the balance of the sample has been verified, PSM proceeds in two stages. First, it uses a logit model to compute the propensity score. Section 4.1 discusses these results, which relate to determinants of participation in the cooperative. Next, it computes the ATT (Average Treatment on the Treated) on the outcome variables of interest. Section 4.2 discusses these results, which relate to impact of cooperative participation on the household economy.

4.1 Determinants of Participation in Cooperatives

Table 4 shows six models of a propensity to participate function: three apiece on the full sample and the subsample of coffee growers. Model (1) includes only demographic characteristics, Model (2) incorporates household measures of social capital, and Model (3) incorporates village-level measures of physical and social capital. Models (4), (5), and (6) proceed in the same way over the subsample of coffee growers.

4.1.1 Demographic Characteristics

Many demographic characteristics have correlated with cooperative participation elsewhere do not exhibit correlations here. As a point of comparison for the magnitude and significance level of these characteristics, this section compares the Chiapas results to a strand of recent literature on propensity to participate in various forms of cooperatives: coffee cooperatives in Ethiopia (Abate, Francesconi, and Getnet 2014; Mojo, Fischer, and Degefa 2017; Abebaw and Haile 2013), a banana cooperative in Kenya (Fischer and Qaim 2012), and specialized coffee marketing channels in Costa Rica (Wollni and Zeller 2007).

In models 1/4 here, the presence of a female head of household is associated with a 15% less likelihood of not participating in the cooperative (14% for coffee growers). In Ethiopia with coffee, the presence of a female accounted for 25% less. In Kenya with bananas, it was not significant; the authors report that bananas have traditionally been a women's crop in Kenya. I attribute the increased association here to the nature of coffee production; though it is not a male crop *per se* since an entire family tends a coffee field, various steps of coffee cultivation and processing require physical effort.

In Chiapas, each additional male in the household is associated with an increase in the likelihood of participating in the cooperative by 6% (5% for coffee growers). The correlation with the presence of additional men decreases in models 2/5 and 3/6, which consider explicitly possible activities by which these men would learn about the cooperative.

In addition, the correlation with a female-household decreases and loses its significance as well. As the subsequent section will discuss, these models consider explicitly channels by which men (and not women) would learn about the cooperative. Though from a young age, children help tend the coffee fields in Chiapas, the number of children is not correlated with the propensity to participate. The literature from Ethiopia did break down family members by age or sex: there each additional family member was associated with an increased propensity to participate of 6%. In Costa Rica, each additional male decreased propensity to participate in a specialized coffee-marketing channel by 7%. The authors above attributed this result to a preference among working-age men in a household for more-profitable off-farm work nearby instead of coffee production. In the surveyed region of Chiapas, in contrast, non-agricultural work is not available nearby and would require internal migration.

Another difference between the Chiapas cooperative and the other cooperatives is the relationship between education and the propensity to participate. In Ethiopia, each additional year of schooling of the household head is associated with an increased propensity to participate of 8%; in Costa Rica, the increase is 9%. The authors of these studies attribute their results to the fact that more experienced or more educated coffee producers were more likely to understand the advantages of the cooperative model and adopt it. On the other hand, in Chiapas, education level of the head of household does not correlate with cooperative participation. As an alternative, I tried a model that used a measure of informal education—literacy in Spanish and Tseltal and oral fluency in Spanish—instead of years of formal education; these covariates as well were not associated significantly with the propensity to participate.

The Ethiopia literature finds a strong association between age of household head and participation in the cooperative (2% higher probability for each year). The authors attribute this association to the increased experience of older farmers, which helps them appreciate the benefit of a cooperative. In Costa Rica, each additional year of experience with coffee cultivation is associated with a 1% increase. In Kenya, each additional year of age is associated with a 3% higher probability of participation. In contrast, none of the models here find an association between age and participation, despite the initial mean difference of 6 years between the group of cooperative members and the group of non-members.

In addition, in Ethiopia, each additional hectare of land is associated with a 32% higher probability of joining the cooperative. In Kenya and Costa Rica, the increase is more

modest, at 4%. Here landholdings do not appear to be associated with the probability of joining the cooperative. I propose that the differences in the Mexican land regime and those elsewhere could account for this difference. As a previous section mentioned, within the *ejido*, individuals cannot buy or sell land. Overall, demographic characteristics exhibit a far weaker association with cooperative membership in the Chiapas case, especially in models 2/5 and 3/6. In the latter model, in contrast with all of the literature I reviewed, no demographic characteristic shows a significant association with cooperative membership.

4.1.2 Individual Social Capital

Models 2/5 add the four measures of social capital that the previous section mentioned: the presence of a household member who participates in a popular movement, the presence of one who participates in political activism, the number of mission courses that the household has participated in the past year, and the household's distance from the population center. These measures differ from additional measures that were used in Ethiopia: the number of coffee customers, the number of agricultural experts, and whether the respondent knew the current prices of coffee at the central auction. In Kenya, possession of a cell phone was used as a proxy for social capital and is associated with a 17% higher rate of participation; the survey region of Chiapas does not have cell phone service beyond the population center, so I chose not to use cell service. On the other hand, in Kenya, a household's participation in other social groups was not significantly associated in the banana cooperativeaba, whereas the results below indicate a different result in Chiapas.

First, in models 2/5, the presence of a household member who participates in a popular movement is associated with a 27% higher propensity to participate in the cooperative (30% for coffee growers). This effect remains high (21% for the sample and 24$ for coffee growers) in models 3/6. These quantitative results support the qualitative results that the natural social capital present in Chiapas has contributed to the success of coffee cooperatives there (Martinez-Torres 2006). In contrast, the presence of a household member who participates in political activism is associated with a 13% lower propensity to participate in the cooperative (18% for coffee growers). The latter result increases with the incorporation of village-level factors in models 3/6. The high magnitude, strong significance level, and opposite directions of these two results support this thesis' hypothesis about mutually exclusive forms of social capital: popular movements that align with the Jesuit mission and NGOs in general and the hermetically sealed world of political

activism, like the Zapatista movement or the Mexican government, that does not admit other loyalties.

In addition, walking distance to a population center significantly correlates with propensity to participate. Each additional hour increases the probability by 15%, and this result retains the same magnitude and significance in both models 2/5 and 3/6. The lack of market access for coffee growers in more rural areas could explain this relationship, for the coffee cooperative would offer a greater benefit to rural farmers. The most similar variable that other authors have used to walking distance was distance in km to the nearest road in Kenya; there too, more rural households participated at a higher rate: 15% for each km. As Table 1 indicates, cooperative members live half an hour farther away from a population center (1.5 hours versus 1 hour). Figure 8, which the subsequent section will review in more detail, also shows the skewed distribution of members and non-members in terms of walking distance to a population center. A majority of members live more than 1 hour away from the population center, while a majority of members live within 1 hour or less from the population center.

4.1.3 Village Social Capital

Model 3/6 adds village-level measures of physical and social capital. Adjusting for these factors, the number of courses impacts propensity to participate, conditional on the prior alignment of the village. Each additional course increases the propensity by 3% for the full sample and the coffee growers. The courses take place at the mission training center (*colegio*) in Bachajón. On the other hand, a village *ejido* meeting hall, which I hypothesized would serve as a source of information exchange, does not impact participation. Perhaps the presence of the mission chapel already serves this purpose.

Of the village-level indicators, the presence of a dirt road does not significantly impact participation but a paved road increases it by 15% for the full sample. This result fits with my expectations because the coffee cooperative uses trucks to visit coffee growers during the growing season and to help them transport their coffee to the market at harvest time. The presence of a government store negatively impacts participation by 15% (18% for coffee growers). This strong relationship corroborates my hypothesis of multiple sources of social capital above. The presence of coffee-producing infrastructure also is associated with participation: a manual huller by 9% and an automatic huller by 41% (38% for coffee growers). This result calls for more investigation about the source of these hullers. In general, these results suggest that the coffee cooperative enhances certain types of village-

level infrastructure, conditional on the village's alignment toward the mission and away from the government.

Overall, the first-stage results differ from existing literature on determinants of cooperative membership in two important ways. First, household demographic characteristics play a much smaller role than in the literature I have surveyed. Second, measures of household-level social capital and village-level physical capital, which previous literature has not studied, play an important role as determinants. Previous studies that have employed PSM to perform impact evaluation on cooperative membership indicate a pseudo-R^2 of 0.2 to 0.4 as having a good fit on a logistic propensity score function, equivalent to 0.7 to 0.9 on a linear probability model (Elder, Zerriffi, and Le Billon 2012). Models 2/5 and 3/6 fit this criterion. Model 3/6 is my preferred specification.

4.2 Cooperative Impact Evaluation Results

The second stage of the analysis uses model (3), which employs all three sets of covariates: household demographic factors, household social capital measures, and village-level physical capital measures. Figure 7 shows the common support region and Table 3 shows the matching quality test. Both indicate that the three conditions for PSM that the previous section described have been met. These results reveal no effect on the per kilo price of coffee or income from coffee sales. As a robustness check, this stage employs three variations of propensity-score matching: five nearest-neighbor matching, kernel matching, and radius matching. Table 6 shows the results for these three variations on the ATT of the outcomes of interest for both the full sample and the subsample of coffee growers. The literature has analyzed the effect of cooperative membership on several different outcomes--price per kilo, market access (fraction sold), yield, and income—so this thesis looks at the effect of cooperative membership on each of these outcomes in turn.

4.2.1 Price Per Kilo

I do not find a significant difference in the price that cooperative members and non-members receive for their coffee. Depending on the method and the sample, the ATT estimates range from 0.22 to 0.62 pesos/kilo ($0.02 to $0.06/lb) but all lack significance. As a point of comparison, in Costa Rica, participants received $0.05/lb more by marketing their coffee through cooperatives and $0.09/lb more by marketing it through specialty channels; merely knowing the world market price increased the price they received by $0.03 (Wollni and Zeller 2007).

In Costa Rica, the authors above found regional variation in the prices within the sample region. I hypothesize that the heterogeneous nature of village or zone-level coffee markets within the mission area from which the coffee cooperative draws its membership account for the lack of significance here. Local coffee buyers serve as the main competition for the coffee cooperative, and throughout the growing season, they adjust their prices based on both the international price of coffee and local factors throughout the growing season. On the other hand, the Batsil Maya cooperative board sets a price once a year for the entire region that it serves. Figure 8 supports this hypothesis of "micromarkets" within the survey region; the correlation between Per-Kilo price and walking distance to a population center shows that coffee producers in more rural villages receive a lower per kilo. Local buyers might possibly be offering them a lower price as a result of the "captive market." Apart from the significance level, the fair trade literature review in section 2 showed an impact on per-lb price that is an order of magnitude higher than these results: $0.20 to $0.60, depending on the study This impact is not reflected here.

4.2.2 Market Access

As the literature review indicated, fair trade producers suffer from lack of market access, and here Batsil Maya cooperative members fares better than fair trade producers, who often cannot sell their entire harvest for the fair trade price. I measure market access in terms of the percentage of the coffee harvest that is sold on the cash market, shared within the community, and consumed within the household. The PSM results show a difference from 12 to 15% in share of coffee crop sold. Under slightly different measures, cooperative members sell 25 kilos more per hectare of coffee planted and receive 160 pesos more per hectare. With varying levels of significance, the PSM results show that cooperative members share 0.5% less of their coffee and consume 5% less in their household. This difference does not account for the entire 15% that producers sell. Nevertheless, these results suggest that, though cooperative members do not receive a higher per-kilo price for their coffee, they do experience greater market access. This fact stands out especially since members tend to live in more rural areas.

Little literature about cooperatives considers the effect of membership on share of crop sold. As one exception, Kenyan banana farmers who participated in a collective marketing campaign experienced a 7% increase in the share of bananas sold (Fischer and Qaim 2012). Nevertheless, this lacunae in the literature suggests that further research is needed that considers crop share sold as a possible outcome of interest.

4.2.3. Income

Along with price per-kilo, the literature also frequently examines differences between cooperative members and non-members in both total income and income from coffee sales. Examining total income allows for the possibility of substituting coffee for other more profitable crops and non-agricultural work for agricultural work, depending on local markets and individual preferences. In Ethiopia, coffee cooperative members reported 10% higher overall income (Mojo, Fischer, and Degefa 2017). In Kenya, banana cooperative members reported double their income from banana sales and 25% higher overall income (Fischer and Qaim 2012). In Rwanda, coffee cooperative members reported a 40% higher overall income (Verhofstadt and Maertens 2015).

The PSM results for the coffee sale income received by Batsil Maya cooperative members show an increase relative to the mean differences. Cooperative members receive 200 pesos more per year in the full sample or 150 pesos more per year in the coffee grower subsample. This difference is approximately a 20% increase in income, and is consistent with the previous literature above.

On the other hand, cooperative members do not report significantly different incomes from non-members in other categories: agricultural income, government subsidies, non-agricultural income, or total income. I attribute this lack of a difference to substitution within types of income. For example, in the full sample, cooperative members receive less subsidies from the Mexican government (primarily, the Oportunidades program); on the other hand, since they are less likely to be female-only households and have more adult men, they may qualify for less subsidies. This increased household labor supply could account for the larger overall agricultural income reported by cooperative members, which encompasses sales of corn and beans as well as coffee. Nevertheless, further research is needed to understand the exact nature of the substitution that is taking place, especially in light of the significant portion of Tseltal life that does not take place on the cash economy.

Overall, my main PSM results are that cooperative members experience increased market access by selling 15% more of their coffee harvest and receiving 20% more income from coffee sales. These results differ from other literature that has only examined the effect of cooperative membership on price per-kilo and overall income. In this way, they reveal the necessity of considering an expanded set of outcomes of interest when evaluating fair trade and related projects that target smallholder agricultural producers of coffee and other crops.

5. Conclusion and Policy Recommendations

This thesis examined differences between members and non-members in a coffee cooperative in rural Chiapas, Mexico that employs value chain integration as an alternative approach to fair trade certification to address the effect of price volatility of green coffee beans on producers' household economies. It used propensity score matching techniques to examine both 1) determinants of participation in the coffee cooperative and 2) the impact of participation on members' household economics.

First, in examining the determinants of cooperative membership, it found that individual measures of social capital and village-level measures of capital correlate more highly with cooperative membership than individual-level demographic factors like age, landholding, education, and household size. The Chiapas context contains several sources of social capital: the Jesuit mission, a religious organization and NGO; the Zapatista political movement; and the Mexican government. The first-stage model incorporated these local factors. Households that participated in a popular movement were 21% more likely to participate in the cooperative; politically active households were 22% less likely to participate. Participation in each additional workshop at the Jesuit mission increased the probability of participation in the coffee cooperative by 3%.

Moreover, village-level capital also impacted cooperative membership. Each additional hour away from the population center increased probability of participation by 15%. The presence of a paved road, a manual coffee huller, or an automatic coffee huller increased the probability by 15%, 10%, and 38% respectively. Moreover, the presence of a DICONSA government store sponsored by the Mexican government decreased by 18% the probability of participation. This, the cooperative serves rural coffee producers who live in villages that already have the infrastructure to support coffee production and who are not served by the Mexican government. Overall, in contrast to previous literature on determinants of participation in coffee cooperatives, individual and village social capital impacted cooperative membership more than other demographic factors.

Second, the PSM results indicated that cooperative members sell 15% more coffee, harvest 30 more kilos/hectare, and receive 200 pesos (20% more) annual income from coffee sales than non-members. These results stand out in light of two other outcomes of interest in which the PSM results do not find a difference between members and non-members. First, cooperative members do not receive a higher price per kilo for their coffee. I hypothesize that a combination of negative selection on the part of coffee cooperative members and heterogeneity within the coffee market of the sampling area contributes to

this lack of difference. Cooperative membership correlates with increased distance from a population center, where local coffee buyers offer a lower price than closer to the population center, where the cooperative may not offer a better price than other places to sell one's crop. Second, cooperative members do not report increased overall income. I hypothesize that this lack of an increase comes from substitution within sources of income and unobservable heterogeneities among cooperative members and non-members. Nevertheless, the lack of difference in these two outcomes of interest does not imply a lack of effect of the coffee cooperative on the household economies of its members. Rather, they motivate the use of additional measures of market access to give a more fine-grained look at producers' household economies.

In general, the first-stage and second-stage results indicate the importance of considering local factors when implementing development programs in a given region. No program operates in isolation, and no entity, whether a government organization or an NGO, operates outside of an existing social fabric. Any uptake of a program or successful effect either is helped or hindered by its context, and so contextual factors merit more consideration that they frequently receive in the literature. Thus future literature on coffee cooperatives or other programs should consider the place in the social network of both the organization sponsoring the cooperative and the potential beneficiaries.

It should also consider the desires of the population that the project aims to serve. In the case of this cooperative, a significant part of the economic life of the indigenous Tseltal people operates outside of the cash economy, so increase in total income might not be the outcome that they desire. The history of Batsil Maya shows that when given the opportunity, the Tseltales do want to sell more of their coffee crop, and by measuring market access in terms of share of coffee sold as well as income per hectare, this thesis reveals the increase in market access that the cooperative offers. Moreover, given the possibility of negative selection into cooperative membership, this increase in market access, combined with a more stable price of coffee, could count as a more important outcome for the population that the coffee cooperative serves. At the fifteen-year anniversary of this coffee cooperative, given the continued volatility of the coffee market, these lessons seem as relevant now as ever.

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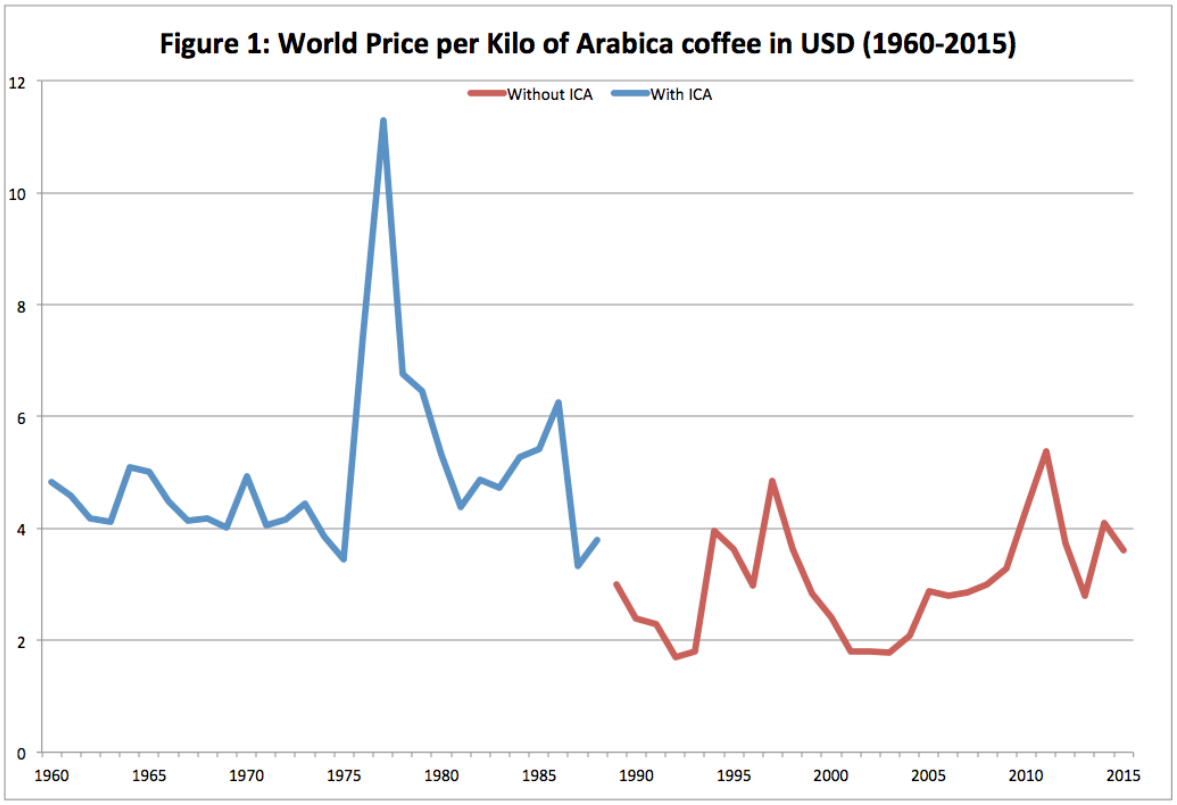


Figure 1: World Price per Kilo of Arabica coffee in USD (1960-2015)
Without ICA
With ICA
12
10
8
6
4
2
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

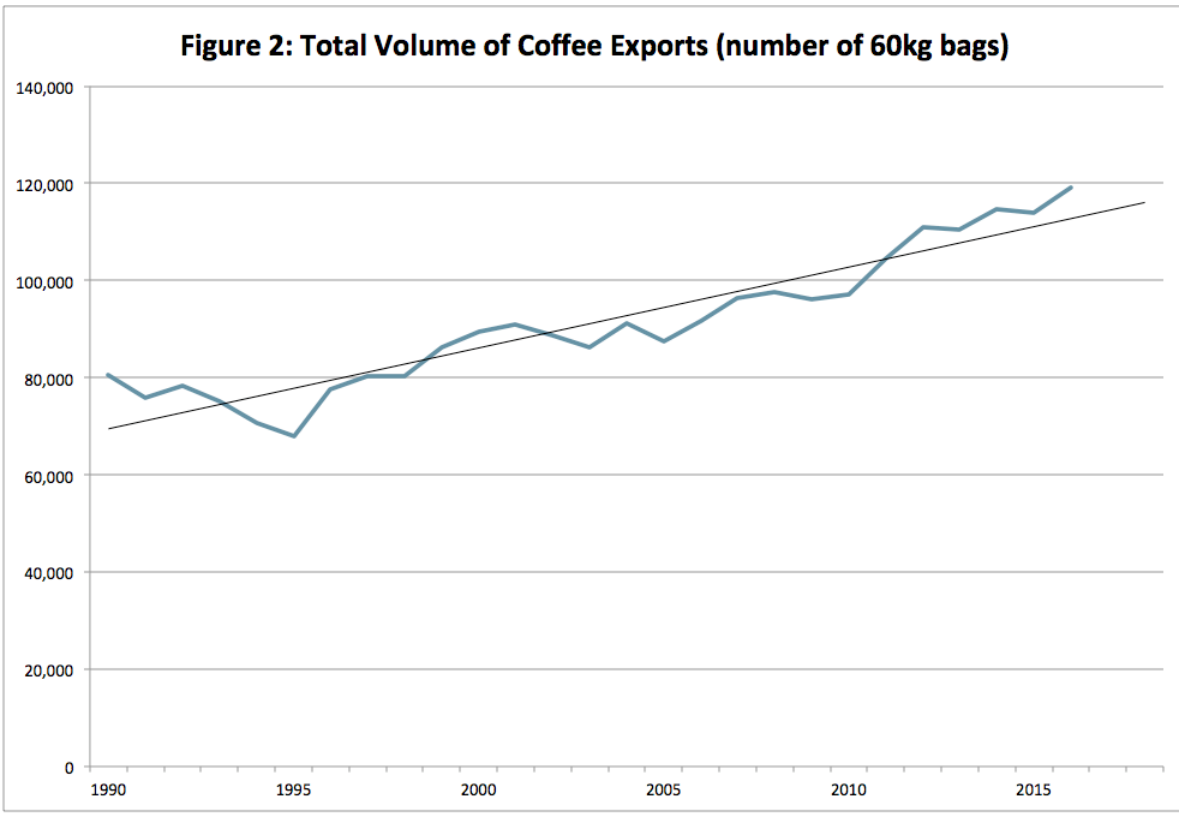


Figure 2: Total Volume of Coffee Exports (number of 60kg bags)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1990
1995
2000
2005
2010
2015

Figure 3: Sampling Area of the Jesuit Mission of Bachajón (60 zones with 622 chapels)

Figure 4: Zones Surveyed in the Sampling Area (22 zones and 59 chapels)

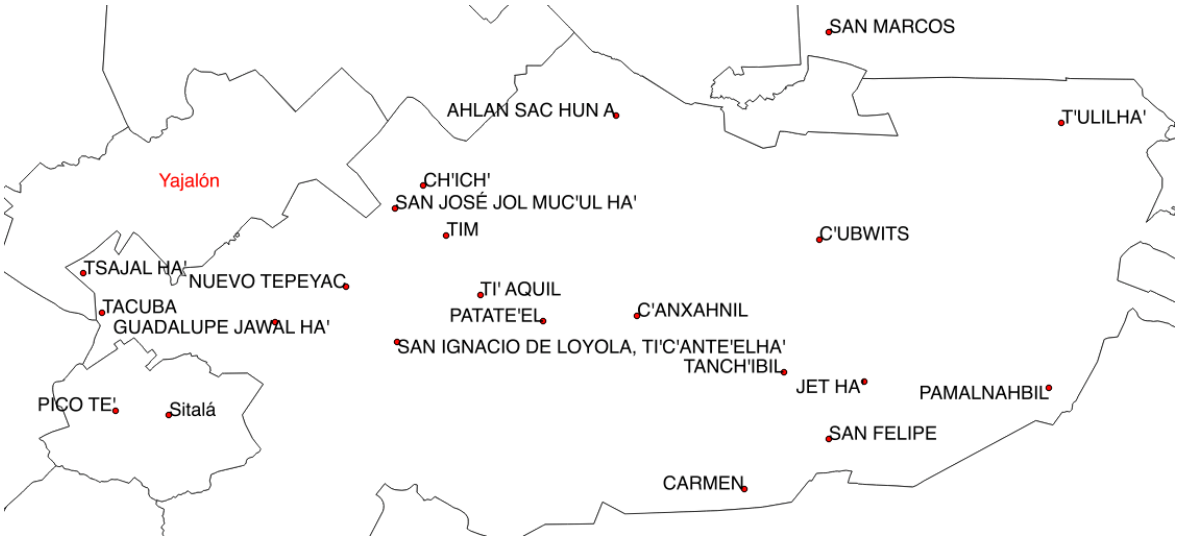
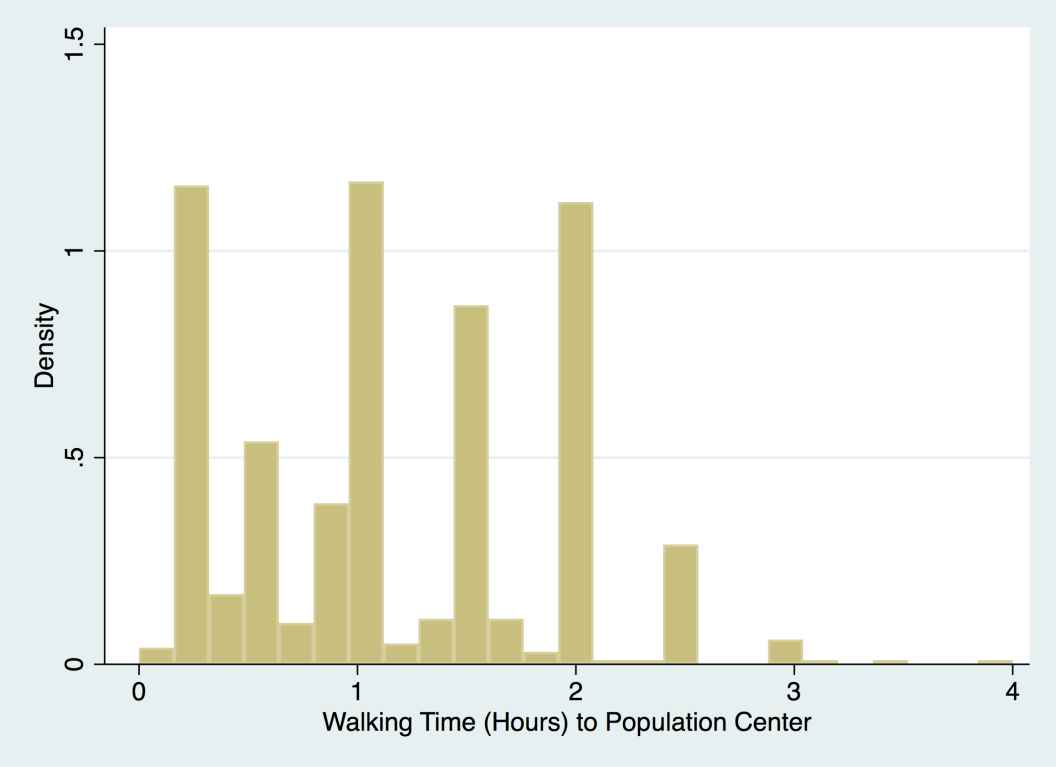


Figure 5: Time to Population Center
(Top - Full Sample; Bottom – Coffee Growers)



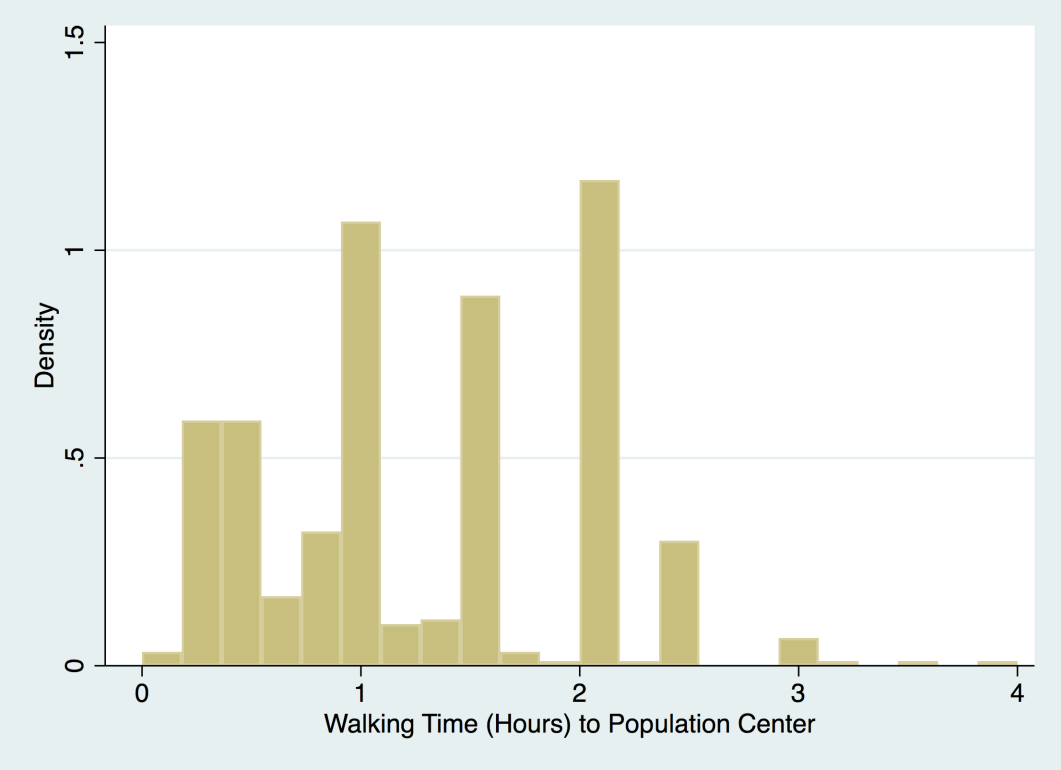
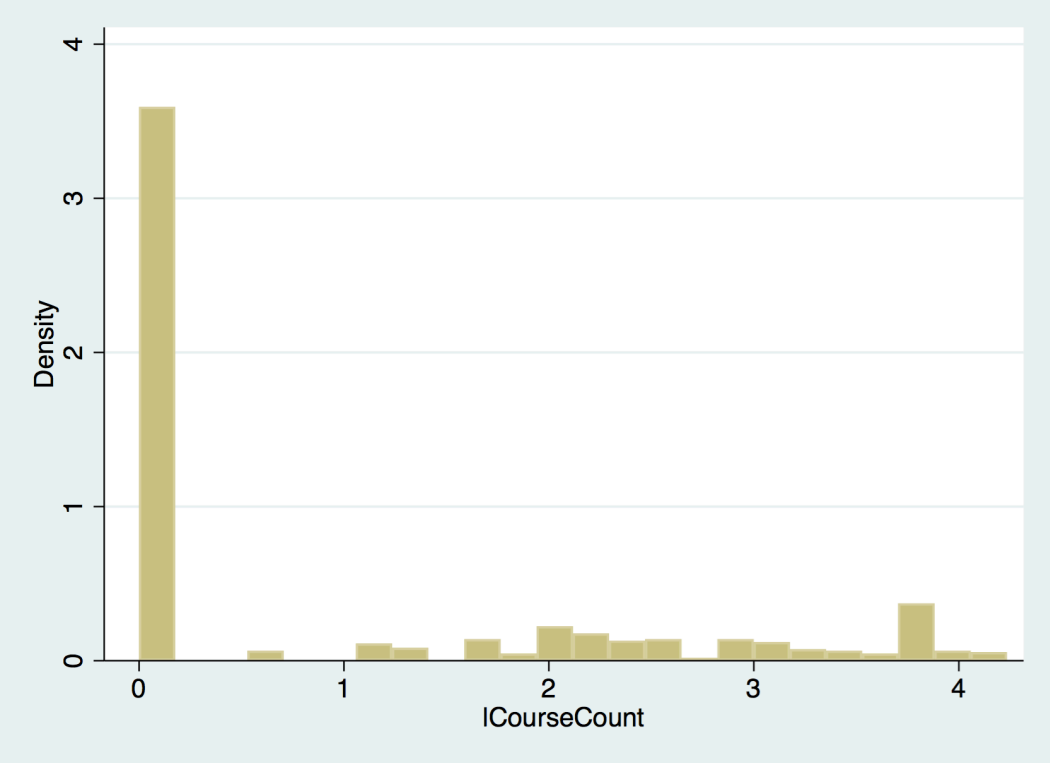


Figure 6: Log of Course Count
(Top - Full Sample; Bottom – Coffee Growers)



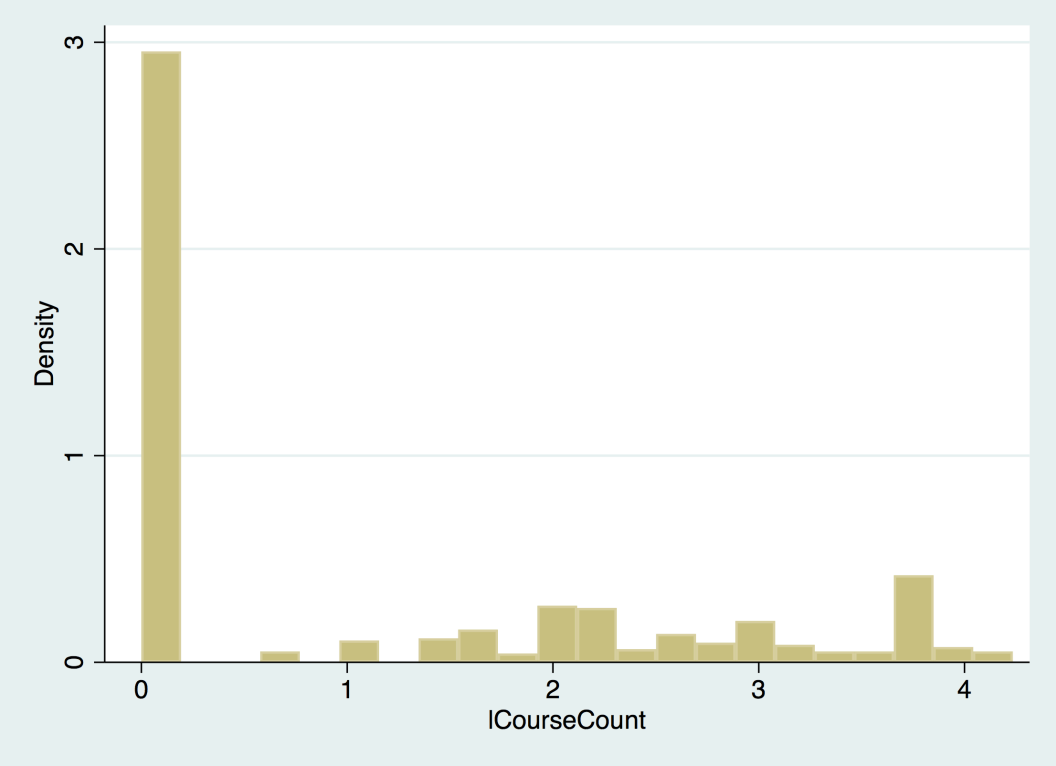
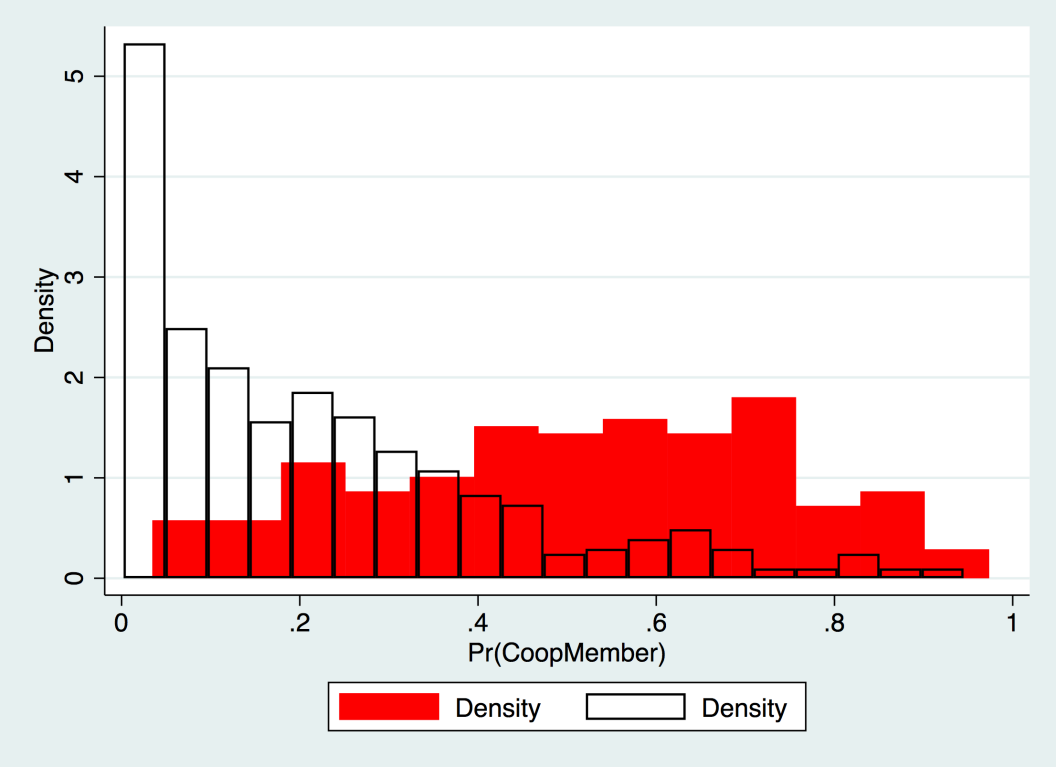


Figure 7: Common Support (Top – Full Sample; Bottom – Coffee Growers)

Red indicates the treatment group and black indicates the control group.



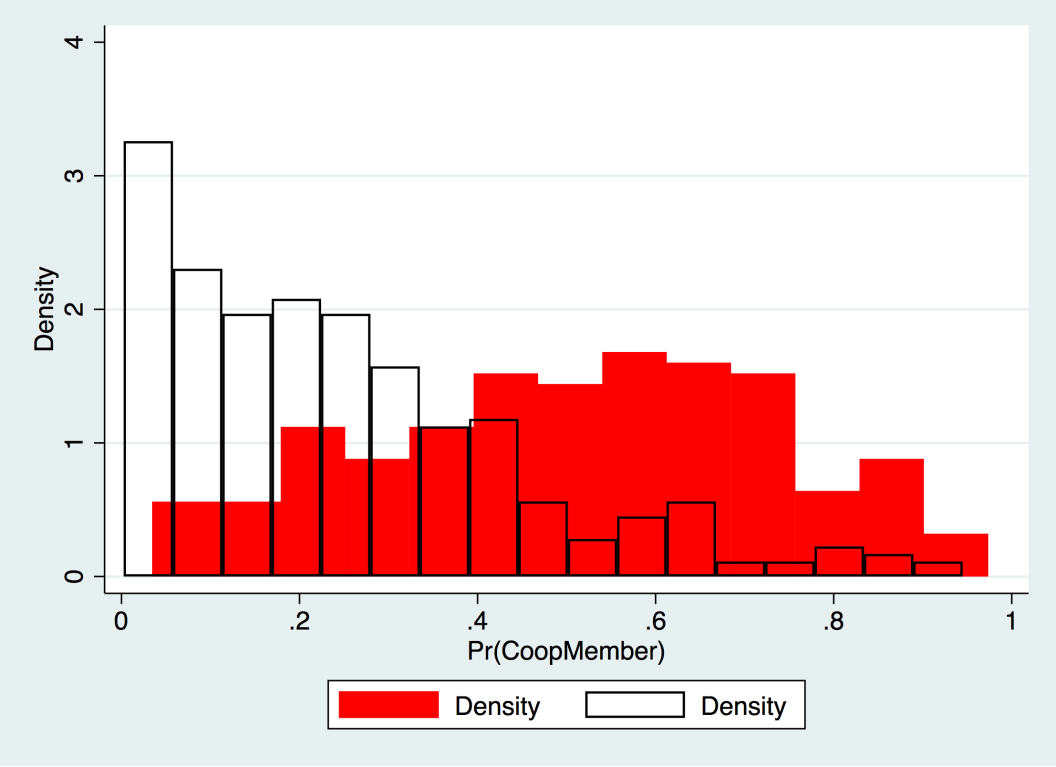


Figure 8: Walking Distance to Town Center and Price Per Kilo

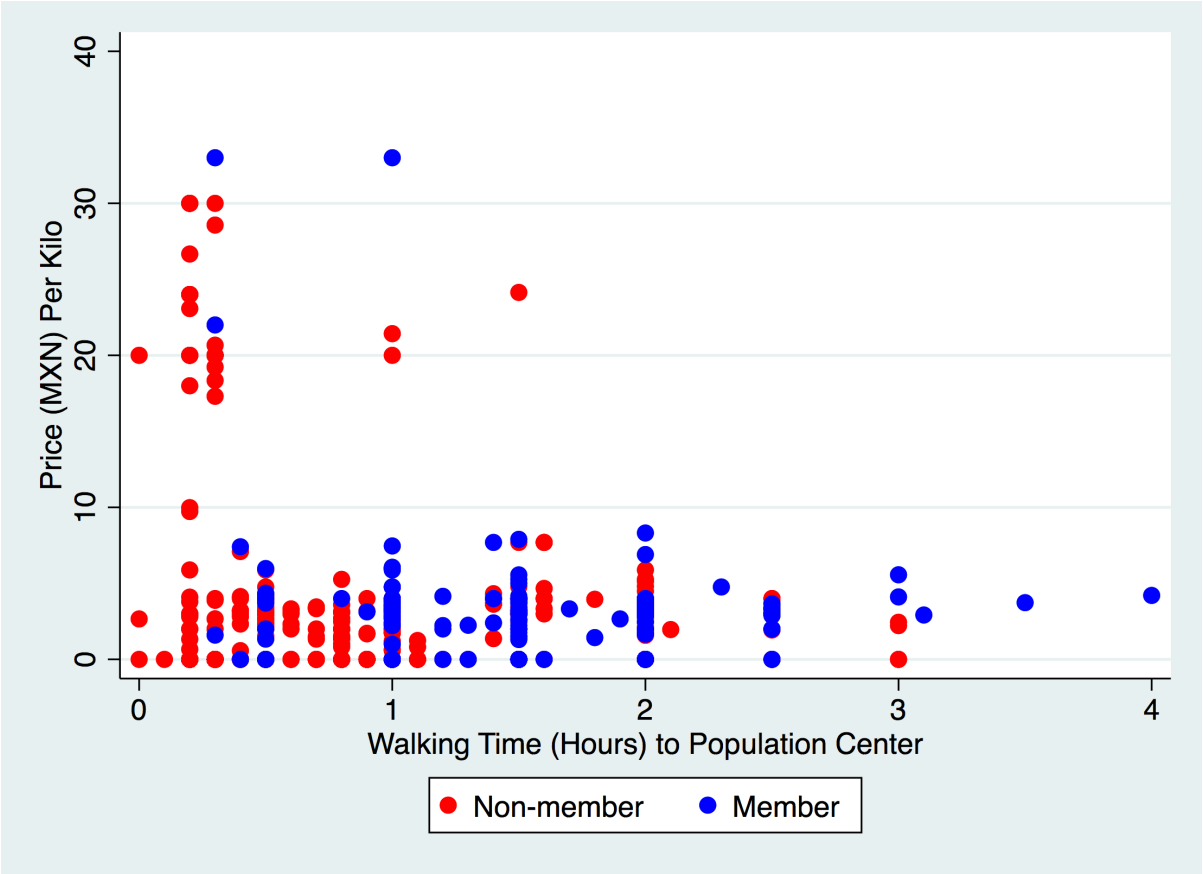


Table 1: Descriptive statistics of independent variables of sample households by cooperative membership status

Variables	Description	Members (N=192)		Non-members (N=434)		
Demographic		Mean	Std. dev.	Mean	Std. dev.	Mean differences
CoffeeGrower	Coffee producer (1 = yes; 0 = no)					
CoopMember	Membership status in cooperative (1 = yes; 0 = no)					
FemaleOnly	Female-only household (1 = yes; 0 = no)	0.016	0.124	0.217	0.412	0.201***
HHAge	Age of household head (years)	45.391	14.577	39.627	14.309	-5.764***
HHMarried	Marital status of household head (1 = yes; 0 = no)	0.615	0.488	0.357	0.480	-0.257***
HHEdLevel	Education level of household head	1.068	0.927	0.919	1.001	-0.148
	(0 = None, 1 = Primary, 2 = Secondary, 3 = Prep, 4 = University)					
MaleCount	Number of adult males (15 years or older)	2.099	1.356	1.286	1.088	-0.813***
Children	Number of children (less than 15 years old)	1.786	2.352	1.892	2.366	0.105
LandArea	Total household landholding (hectares)	7.016	12.736	7.018	9.156	0.003
Social						
dPopMovement	Household participates in Popular Movement (1 = yes; 0 = no)	0.323	0.469	0.088	0.283	-0.235***
dPolitical	Household participates in Political Party (1 = yes; 0 = no)	0.026	0.160	0.067	0.250	0.041*
lCourseCount	Number of mission courses the household has participated in past year (log)	1.399	1.453	0.756	1.277	-0.643***
tPopCenter	Walking distance to population center (hours)	1.533	0.638	0.993	0.698	-0.539***
Village						
DirtRoad	Presence of dirt road to village (1 = yes; 0 = no)	0.313	0.465	0.207	0.406	-0.105**
PavedRoad	Presence of paved road to village (1 = yes; 0 = no)	0.047	0.212	0.092	0.290	0.045
GovStore	Presence of Tienda Diconsa in village (1 = yes; 0 = no)	0.109	0.313	0.350	0.478	0.241***
MeetingHall	Presence of Salon Ejidal in village (1 = yes; 0 = no)	0.104	0.306	0.113	0.317	0.009
ManualHuller	Presence of manual coffee huller in village (1 = yes; 0 = no)	0.828	0.378	0.627	0.484	-0.201***
AutoHuller	Presence of automatic coffee huller in village (1 = yes; 0 = no)	0.052	0.223	0.007	0.083	-0.045***

Note: ***, **, * denote 99%, 95%, and 90% confidence levels, respectively

Table 2: Measures of social and village capital by cooperative membership status

Variable	Full Sample N = 626		Coffee Growers N = 494	
	Absent	Present	Absent	Present
Social				
dPopMovement	526	100	414	80
dPolitical	592	34	468	26
Village				
DirtRoad	476	150	374	120
PavedRoad	577	49	474	20
GovStore	453	173	375	119
MeetingHall	557	69	440	54
ManualHuller	195	431	133	361
AutoHuller	613	13	482	12

Note: See Table 1 for variable descriptions.

Table 3: Matching quality test: balancing property

Test for	Full sample (N = 626)				Coffee grower subsample (N = 494)			
	Before matching	After matching (algorithms)			Before matching	After matching (algorithms)		
		Five-nearest	Kernel	Radius		Five-nearest	Kernel	Radius
Pseudo R^2	0.263	0.024	0.070	0.018	0.224	0.024	0.012	0.013
LR x^2	203.060	12.870	9.310	9.560	143.490	11.420	5.750	6.200
p value	0.000	0.745	0.930	0.921	0.000	0.834	0.995	0.992
Mean standardized bias	37.100	6.600	5.700	5.800	29.900	6.900	5.000	5.200
Median bias	39.900	5.500	3.900	5.900	27.300	7.000	4.800	4.600

Table 4: LPM model results of factors affecting cooperative membership

	Full Sample (N = 626)			Coffee Grower Subsample (N = 494)		
	(1)	(2)	(3)	(4)	(5)	(6)
FemaleOnly	-0.154**	-0.053	0.005	-0.137*	-0.046	0.014
	(-3.21)	(-0.82)	(0.08)	(-2.43)	(-0.69)	(0.16)
HHAge	0.004	0.003	0.002	0.003	0.003	0.002
	(1.75)	(1.66)	(1.51)	(1.13)	(1.27)	(1.00)
HHMarried	0.054	-0.018	-0.016	0.068	-0.012	-0.004
	(0.83)	(-0.28)	(-0.35)	(0.98)	(-0.18)	(-0.09)
HHEdLevel	0.038	0.022	0.021	0.048	0.030	0.030
	(1.54)	(1.04)	(1.07)	(1.77)	(1.36)	(1.27)
MaleCount	0.062**	0.041	0.038*	0.053*	0.033	0.029
	(2.71)	(1.84)	(2.06)	(2.38)	(1.48)	(1.40)
Children	-0.006	-0.004	-0.003	-0.008	-0.006	-0.005
	(-0.76)	(-0.57)	(-0.48)	(-0.83)	(-0.68)	(-0.61)
LandArea	0.002	0.002	0.002	0.001	0.001	0.002
	(0.63)	(0.70)	(1.26)	(0.42)	(0.52)	(0.80)
dPopMovement		0.267**	0.207***		0.299**	0.236***
		(2.84)	(4.18)		(3.29)	(4.04)
dPolitical		-0.125	-0.175*		-0.183*	-0.218*
		(-1.17)	(-2.34)		(-2.14)	(-2.39)
lCourseCount		0.024	0.034*		0.022	0.032*
		(1.49)	(2.55)		(1.36)	(2.17)
tPopCenter		0.148**	0.145***		0.157**	0.156***
		(2.79)	(5.31)		(2.87)	(5.08)
DirtRoad			0.081			0.096
			(1.87)			(1.90)
PavedRoad			0.140*			0.152
			(2.09)			(1.45)
GovStore			-0.146***			-0.182***
			(-3.63)			(-3.79)
MeetingHall			0.018			0.048
			(0.31)			(0.73)
ManualHuller			0.094*			0.095*
			(2.38)			(1.98)
AutoHuller			0.405***			0.380**
			(3.46)			(2.94)
_cons	0.009	-0.135	-0.152	0.071	-0.111	-0.130
	(0.10)	(-1.32)	(-1.85)	(0.67)	(-0.98)	(-1.31)
R2	0.125	0.226	0.272	0.078	0.197	0.250

Standard errors in parentheses. *, **, and *** refer to p-values at the 10%, 5%, and 1% level respectively.

Table 5: Descriptive statistics of dependent variables of sample households by cooperative membership status

Variables	Description	Members N = 192		Non-members N = 434		Mean differences
		Mean	Std. dev.	Mean	Std. dev.	
Coffee Harvest						
PerKilo	Price Per Kilo from Coffee Sale (in MXN)	2.785	3.954	3.157	6.688	0.372
CoffeeSoldFraction	Fraction of Coffee Harvest Sold	73.950	41.800	52.405	47.400	-21.54***
CoffeeSharedFraction	Fraction of Coffee Harvest Shared	0.645	1.896	1.974	8.676	1.329*
CoffeeConsumeFraction	Fraction of Coffee Harvest Consumed	8.770	23.135	8.486	22.255	-0.284
YieldByHA	Coffee Yield (Kilos) Per Hectare	108.886	136.126	80.066	147.312	-28.82*
SaleByHA	Coffee Sale (MXN) Per Hectare	343.031	526.946	200.478	330.325	-142.6***
Income						
AgIncome	Total Agricultural Income (MXN)	2751.563	7999.620	1851.382	8115.890	-900.2
CoffeeSaleIncome	Income from Coffee Sales (MXN)	590.104	799.317	445.853	771.336	-144.3*
GovIncome	Income from Government Programs (MXN)	2634.896	4483.032	2962.903	4417.902	328.0
ExtraIncome	Total Non-Agricultural Income (MXN)	506.771	2087.687	468.433	1664.490	-38.34
Income	Total Income (Sum of Four Variables)	5893.229	9153.634	5282.719	9695.908	-610.5

Table 6: Propensity score matching results

	Full sample (N = 626)			Coffee grower subsample (N = 494)		
Outcomes	Five-nearest	Radius	Kernel	Five-nearest	Radius	Kernel
Coffee Harvest						
PerKilo (pesos / kilo)	0.615	0.469	0.464	0.453	0.307	0.220
CoffeeSoldFraction (% of harvest)	15.286***	14.134***	14.145***	12.503**	13.094**	12.428***
CoffeeSharedFraction (% of harvest)	-0.694	-0.942***	-0.915**	-0.567	-0.783	-0.810*
CoffeeConsumeFraction (% of harvest)	-5.189	-5.217*	-5.371*	-3.402	-4.104	-4.426
YieldByHA (kilos / hectare)	30.865**	29.043**	28.426**	20.036	23.304**	24.069
SaleByHA (pesos / hectare)	166.513***	165.046***	163.189***	155.26***	160.669***	162.077***
Income						
AgIncome (pesos per year)	1173.125	773.383	813.722	718.497	484.851	516.341
CoffeeSaleIncome (pesos per year)	207.500**	196.493**	191.33**	149.711**	180.841**	180.053*
GovIncome (pesos per year)	-291.458	-137.991	-128.923	101.272	65.738	39.637
ExtraIncome (pesos per year)	82.500	105.370	101.067	102.196	75.293	70.146
Income (pesos per year)	964.167	740.762	785.866	921.965	625.882	626.125

Note: ATT estimates of five-nearest neighbors, kernel (bandwidth = 0.06), and radius (caliper = 0.05) are estimated using the "psmatch2" command in Stata. The standard errors are estimated using bootstrap with 100 replications.