Measuring the Impacts of Cooperative Participation on Vanilla Farmers in Madagascar

A Thesis Submitted by:
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Abstract

This paper examines the effects of cooperative participation, and the bundle of benefits the cooperative offers, on various household indicators for vanilla farmers in rural Madagascar. The primary benefits of the cooperative are access to zero interest seasonal credit, collective price bargaining, increased security from crop theft, environmental education, and a bonus payment made after the conclusion of the vanilla market. Using a difference in differences approach to compare vanilla farmers who chose to participate in the cooperative to vanilla farmers who chose not to participate, I find that take up of high interest informal loans is significantly reduced for cooperative participants. Similarly, I find that cooperative participants receive higher vanilla prices on average and see a significant reduction in price dispersion. Some of this price increase can be attributed to the fact that farmers no longer accept high interest informal seasonal loans but collective bargaining and transparent markets cannot be ruled out. Surprisingly however, I find a decrease in vanilla production, a decrease in total cash crop income, and a decrease in coffee production for farmers who enter the cooperative. Based on focus groups held during the data collection phase of this study, these decreases could be driven by cooperative members increased entrepreneurial investments in the non-agricultural sectors or side selling to buyers outside of the cooperative, but more research is required to confirm this hypothesis. Most interestingly however, I find differential treatment effects for women for almost all outcome variables with most negative results coming from male cooperative members. Similarly, differential effects were found for different age groups, and across different villages, which suggests cooperative programs could be modified to meet specific needs.

Acknowledgments

For Patsy and Phyllis Tata, for always giving me the confidence, love, and support

to take on any task….

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1. Introduction

With the relatively recent development of microcredit and microlending, access to credit for farmers in developing countries is becoming more and more popular. Taken together, microcredit organizations delivered credit to more than 150 million poor people at interest rates that are much lower than what they previously had access to (Karlan and Mordoch 2010). Rural farming villages were typically cut off from formal credit and savings institutions, either because they were looked at as risky investments or because of geographical restrictions (Diagne 2001). These same farmers usually had rich access to informal credit markets provided by family, friends, neighbors or local merchants. Depending on the source of lending, these informal lenders can charge very high interest rates which could have potentially severe impacts on various household characteristics (Banerjee and Duflo 2007).

Cooperatives in Madagascar are often a unique solution to this credit problem as they are commonly set up in the countryside specifically targeting agricultural workers, offer seasonal credit to their members, and come with a bundle of other benefits. This paper investigates the impacts of cooperative participation, and the bundle of benefits this participation includes, on vanilla farmers in rural Madagascar. Using difference in differences methodology, I find a positive treatment effect of cooperative participation on vanilla prices. I find a negative treatment effect of cooperative participation on the acceptance of high interest informal seasonal loans but also a negative effect on vanilla production,

coffee production, and total household income coming from cash crops, when compared to farmers who chose not to enter the cooperative.

The purpose of this thesis is to expand the literature on the impacts of cooperative participation, particularly in the context of cooperative lending, and to investigate the impact of cooperatives in a context where no formal institutions previously existed. I use qualitative and quantitative data collected through surveys and through focus groups, to understand the impacts of agricultural cooperatives. I will begin with a literature review to outline the work that has already been done in the field of cooperatives and microfinance, then I will lay out my research design, results, and the policy implications of this study.

2. Literature Review

In this section I review the relevant literature in order to shape my hypothesis and increase my knowledge in this field. According to data from the United Nations (UN 2016), 75% of Madagascar's total work force is in the agricultural sector. Ninety percent of the country's working population are classified as "working poor" and earn $3.10/day, and 77.8% of the country's total population is living below the income poverty line on less than $1.90/day (UN 2016).

A case study conducted by the International Association for Agricultural and Rural Credit (ICAR) found that formal lending and savings institutions are poorly developed in rural Madagascar and even when accessible the types of loans they offer are not suited for farmer's needs (Fraslin 2003). Similarly, they

found informal lenders dominated rural financial markets with neighboring farms, local merchants, traders and land owners offering informal cash or in-kind loans at annual rates of 120% - 400% a year, depending on the relationship between the two parties (Fraslin 2003). The research team examined farmers from the central highlands of Madagascar who organized rural agricultural lending groups and formed Savings and Agricultural Credit Cooperative Societies (CECAM). The CECAM groups made just fewer than 28,000 loans totaling over 6 million USD annually over the course of the study (2001-2002) and had a yearly repayment rate of over 95%. The authors attribute the success of these credit cooperatives to the fact that all the governing cooperative bodies are made up almost exclusively of farmers, information and resources are shared amongst cooperatives, credit is tailored to the specific needs of farmers, and there was no link between prior savings and the amount granted to potential borrowers (new borrowers did not need previous financial sector experience). While this is a specific example of successful microlending in Madagascar, I also investigate the more general trends found in the literature.

While still developing, the literature around the impacts of seasonal credit and microcredit in developing countries has had some conflicting results. Banerjee and Duflo (2010) are quick to point out the need and reliance of the rural poor on informal lenders which shows a desire from the rural poor for some type of access to credit. In a survey study of 13 developing countries, Banerjee and Duflo found that no more than 6 percent of the funds borrowed by

the poor in their survey sample came from a formal source (Banerjee and Duflo 2010). While they provide evidence for the demand for credit of the rural poor, the impacts of this credit is still unclear.

There is evidence, for example, that seasonal credit in Kenya enabled rural farmers to arbitrage prices over the lean season and had a positive overall effect on household income (Burke 2014). Similarly, an evaluation of seasonal food security programs in East Indonesia showed that in kind food loans helped recipients smooth their consumption over the year and treated households were more able to manage risk and exogenous shocks to consumption (Basu and Wong 2012). In Malawi, access to village savings and loans had a positive and significant effect on consumption, household expenditures and poverty indicators (Ksoll, 2016). Using a randomized control trial, Fink and Jack (2015) found that access to credit during the lean season increases harvest output and revenue by around 10% relative to their control group. Their results were driven by increased consumption, increased labor hirings, and a decrease in the frequency of selling labor to other farms. Pitt and Khandker (1998) found that microcredit increased household consumption expenditures, assets, labor supply and children's school attendance, especially when provided to women (Pitt and Khandker 1998). However, Pitt and Khandker's results have been questioned as there is doubt surrounding the random selection of the treatment group (Morduch 1998). While these studies find relatively positive impacts of

microlending and access to credit for the rural poor, not all the literature concurs.

Diagne and Zeller (2001) found that in Malawi, when several institutions offered credit to poor farmers who owned small parcels of land to buy fertilizer and seeds, the families that chose to participate ended up with less net crop income than those who did not participate. While the findings of Diagne and Zeller were negative for household income, the results were not statistically significant. The authors attribute this negative relationship to farming loans that were specifically targeted to borrowers who were willing to buy maize seeds and two consecutive seasons of low rainfall in areas where rural lending was high. This study further adds value to the Fraslin 2003 study which attributed the success of previous cooperative lending in Madagascar, at least partly, to lending practices tailored to rural farmers needs as opposed to lenders desires.

A randomized evaluation of the impacts of microcredit in Bosnia and Herzegovina (Augsburg et al. 2015) similarly found mixed results. The authors found evidence of higher self-employment for the study sample and a reduction in the incidence of wage work but found reductions in savings. Additionally, the authors found no evidence that the program increased overall household consumption. A randomized control trial in Ethiopia evaluating the impacts of microcredit on socioeconomic indicators found no clear evidence of widespread improvements in treated areas (Tarozzi et al. 2015). The authors did find evidence of increased economic activity in treated areas but found no reason to

believe the increased activity will lead to increases in the majority of their outcome variables. A randomized control trial in Mexico which examined over 16,000 households over 37 development outcomes of interest found no evidence of transformative impacts on any of their variables (Angelucci et al. 2015). A randomized control trial evaluating joint liability lending targeting women in Mongolia found a positive impact of access to group loans on female entrepreneurship and household food consumption, but not on total working hours or income in the household (Attanasio et al. 2015). Similarly, a randomized evaluation of microcredit in rural areas of Morocco found that access to credit lead to an increase in assets used for self-employment activities and an increase in profits, but was offset by decreases in income from casual labor (Crepon et al. 2015). The authors found no evidence of increases in consumption or overall household income. These above randomized evaluations were published together in a volume of the *American Economic Journal: Applied Economics* in 2015 and were summarized as finding "modestly positive, but not transformative, effects" of microcredit as a development tool (Banerjee et al. 2015b).

When I examine the literature on the impacts of cooperative participation alone without a microlending component, we find similarly mixed results. A study of cooperative coffee farmers in Ethiopia found that the probability of cooperative participation increased with age, education level and family size and was positively associated with household income and assets

(Mojo, Fischer and Degefa 2017). A similar study of cooperative membership on milk production and productivity in Addis Ababa also found positive impacts on milk production and productivity (Francesconi and Ruben 2012). Conversely, many less successful and negligible impacts of cooperative participation on farmers have been found. For example, another study conducted in Southern Ethiopia on cooperative coffee farmers found that cooperative members only sold a portion of their coffee to the cooperative because the cooperative did not pay cash on the spot during the coffee market and they did not offer credit to their members (Anteneh et al 2011). Instead cooperative farmers sold a portion of their coffee to private traders, informal traders, and other cooperatives that offered benefits their cooperative did not offer. Similarly, a study of small scale cooperative farmers in Malawi found negligible impacts of cooperative participation on farmers due to lack of managerial skills and resources of the cooperative directors (Nkhoma and Conforte 2011). While positive impacts of cooperatives can be realized for rural farmers, it seems many farmers face complex and multi layered problems.

The literature surrounding cooperatives, microcredit, and seasonal lending for the rural poor provides no clear consensus of the impacts these types of programs may have on the recipients. While there have been some positive examples in Madagascar and in similar rural settings, there is no guarantee that these results will hold true for this study.

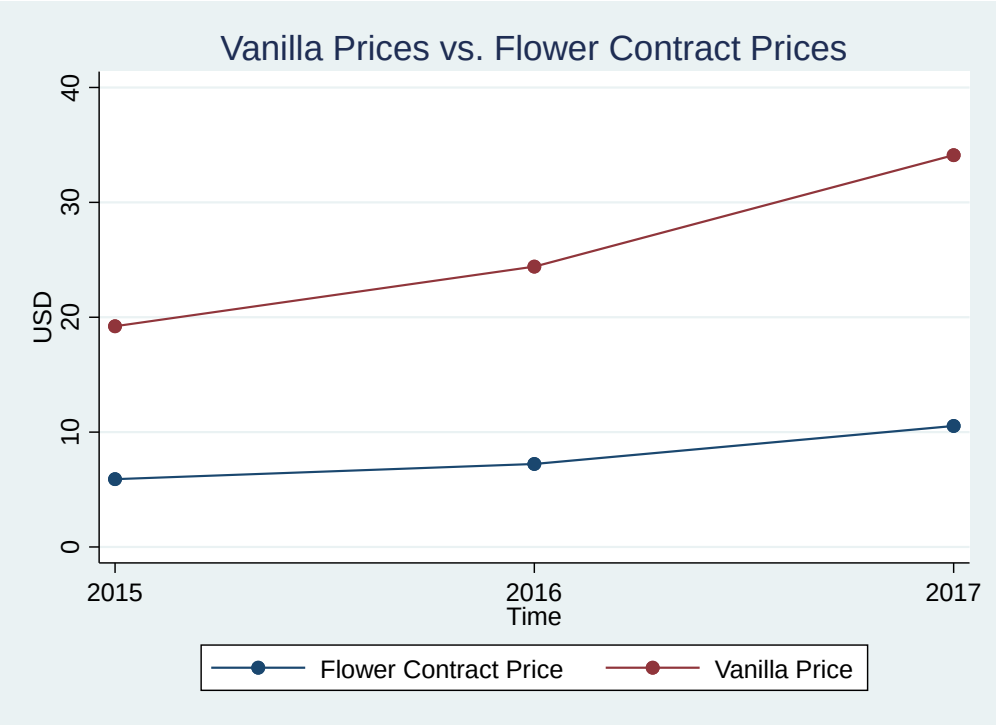
3. Background

The Malagasy vanilla market is interesting to investigate in the context of seasonal credit for two reasons: First, there is an observable market for informal seasonal loans, and second, new vanilla cooperatives are forming at an increasing rate as world vanilla prices rise and international investors show increased dedication to cooperative models. The observable market for seasonal loans can be witnessed in what Malagasy farmers call “flower contracts”. Flower contracts are a practice of vanilla farmers taking credit against their vanilla during the lean season. Farmers will typically sell their vanilla at a reduced price to a local merchant and are responsible to maintain, harvest, and deliver the already sold vanilla to the merchant around the time of the official vanilla market. As you can see in **Figure 1**, flower contract prices were significantly lower than the official market price during the years of this study (2015-2017). On average, the market vanilla price was 30% higher than the flower contract price (30.7% higher in 2015, 29.59% in 2016, and 30.87% in 2017). However, one can argue that if there is a price crash in vanilla between the time of the flower contract and the official vanilla market, vanilla farmers can be the beneficiary of these transactions.

As the world price of vanilla has increased, international partners have shown increased interest in pursuing cooperative business models to not only ensure their market share of vanilla but to increase welfare of farmers who produce this crop. The United States Agency for International Development

(USAID), Volunteers for Economic Growth and Alliance (VEGA) and the National Cooperative Business Association (NCBA) all have cooperative development projects in Madagascar along with many other private sector companies (Karg, 2017). Because of this observable need for credit during the lean season and the interest of international organizations to work with vanilla farmers, the framework for this study was developed.

Figure 1 – Green Vanilla Prices (Farm Gate Prices)



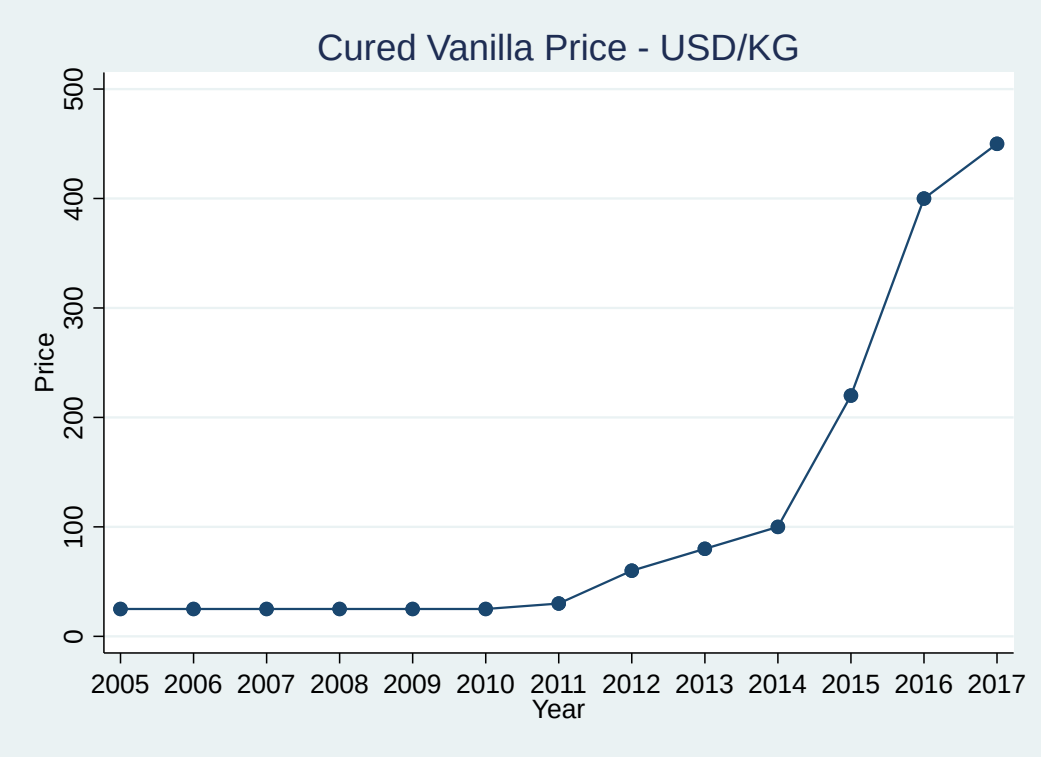
Note: The prices in the figure above are for green (uncured) vanilla, bought directly from farmers. All prices adjusted to 2015 levels. All prices come from survey data collected directly from farmers in this study.

3.1 Cooperative Development

Madagascar is consistently one of the world leaders in vanilla production and almost all of this vanilla production comes from the Sava and Analanjirofo regions located in the north eastern part of the country. According to the Food

and Agriculture Organization, Madagascar produces around 40% of the world supply of vanilla (FAO) and as seen in **Figure 2,** black vanilla prices have risen almost exponentially since 2011 (Cooks 2017). The international price for cured black vanilla has increased from 30 USD per KG in 2011 to 450 USD per KG in 2017. You can see when comparing **Figure 1 & Figure 2** that there is imperfect pass through from the black vanilla market to the green vanilla market. Retailers of black vanilla are seeing huge price increases while farmers are only seeing modest increases in farm gate prices, which further motivates the cooperative model.

Figure 2 – Retail Vanilla Prices



Note: Data from the "Cooks Vanilla Market Report" (2017), all prices listed are for black (cured) vanilla sold on the international market

The Aust & Hachmann 2017 Vanilla Market Report (2017) and the Quartz website (2017) attribute some of this rise in prices to cyclone Enawo that slammed the north eastern region of the country in early 2017. Additionally, The Cooks Vanilla Market Report (2017) attributes some of the rise in price to speculation from buyers in country and the belief that prices will continue to rise. The changing preferences of consumers in the United States and around the world for "natural" products has further added pressure on companies to use natural products and flavorings as opposed to artificial flavorings. Partly due to these changing preferences, I was sent to Madagascar as part of the "Farmer to Farmer" program funded through the United States Agency for International Development (USAID) to help organize vanilla farmers into cooperatives in both the SAVA and Analanjirofo regions.

USAID is working in partnership with McCormick Spice Company to train vanilla farmers in cooperative management practices and to establish a direct link with vanilla growers and suppliers in Madagascar. In January 2017, I was sent as a volunteer to do a feasibility study on the possibility of starting a cooperative in Madagascar and to gauge farmer's interest and concerns. During this time I held focus groups with farmers in the Sava and Analanjirofo regions who stated the main benefits they would like to gain from a vanilla cooperative would be access to credit during the lean season, increased vanilla prices at the official vanilla market, and increased security to protect their vanilla from theft. Shortly after these meetings the cooperative was formed and vanilla farmers

were offered entry. From these meetings a partnership was born and a bundle of benefits was offered to cooperative members.

3.2 Cooperative Benefits

McCormick Spice Company, in partnership with a large national Malagasy Exporter (Ramanandrabe Exporters), developed two vanilla cooperatives in early 2017. This study examines only one cooperative in the Sava region centered in the village of Doany (see **Figure 3** below) as a cyclone made the cooperative in Analanjirofo inaccessible during my last visit in January 2018. To arrive in Doany, one must take a four hour car ride from the regional capital of Sambava to arrive in the village of Andapa. From Andapa one must then walk for 6 hours along a very difficult road to arrive in Doany. Needless to say this area is very remote and we will assume that villages in this area centralized around Doany face similar market conditions and receive limited market information from outside of this area. Doany was specifically targeted because of this inaccessibility.

While farmers in this area produce a large amount of vanilla, there are no large exporters present, and the farmers have no access to formal lending or savings institutions. Vanilla farmers were offered entrance to the cooperative conditional on yearly trainings, ownership of vanilla producing plants, and the sale of their product to the cooperative. Farmers were free to sell their vanilla outside of the cooperative but would not have access to cooperative benefits in the following season if they did so. Farmers in each village were left to decide if they would enter the cooperative and were asked to elect two village

representatives to monitor cooperative activities and represent their village at cooperative meetings held in Doany. All members of the cooperative board of directors (President, Vice President, Secretary and Treasurer) are from Doany and the cooperative office is located in Doany.

Just fewer than 500 farmers joined the cooperative from over thirty villages around Doany. The farthest village was located 2hrs (by foot) from Doany but we will again assume similar market conditions between all villages. The cooperative offered a bundle of benefits to its members and because of design restrictions we will not be able to separate the different effects of each benefit offered. We will instead view treatment as enrollment into the cooperative and access to the multiple benefits this enrollment includes.

The cooperative offers mandatory environmental and health trainings, access to zero interest loans during the lean season, increased bargaining power on the day of the vanilla sale, a bonus paid to vanilla farmers three months after the vanilla market (1.51USD/KG), and funding for a local police force to monitor vanilla fields and reduce theft. The loans, increased prices, and increased security were specifically requested by farmers during focus groups prior to the establishment of the cooperative.

Figure 3 – SAVA Region and Doany

3.3 Research Question

The primary research question this study aims to address is "how does cooperative entrance impact vanilla prices and various household outcomes for member farmers." In order to understand and provide an answer to this question, it is important to first understand the vanilla market farmer's face and the flower contracts vanilla farmers could potentially take.

3.4 The Vanilla Market and Flower Contracts

Vanilla is a flowering orchid and flowers during the months of November and into December. The flower opens in the morning and is dead by night if not hand pollinated. Pollination of the vanilla flower is very labor and skill intensive and usually reserved for the oldest females in the home. The vanilla then matures on the vanilla vine for six months until it is ready to be harvested in June, July and August (see **Seasonal Chart** in **Appendix I**). The Minister of Agriculture, working with local elected officials, sets the official vanilla market calendar and determines when buyers may enter villages and purchase vanilla. The official market lasts two to three days per village and buyers and vanilla farmers meet face to face to discuss prices in a public setting. While this timeframe seems short, once vanilla prices are agreed upon, farmers and their families quickly harvest all ripe vanilla and bring it to the market for sale. This process usually takes around one full day to complete and often-times vanilla farmers have their vanilla already harvested and stored safely in their home in anticipation of the market.

Often however, no official market is held and buyers go door to door and bargain vanilla prices directly with individual farmers. Buyers have the advantage when no market is held as they hold almost all information about market prices and buying patterns outside of each given village. When no markets are held, farmers generally receive lower prices and variation from household to household in the same village can exist. According to the mayor of Doany, no official markets were held in or around Doany prior to the formation of the cooperative. After the formation of the cooperative, all member farmers should receive the same vanilla price per village but variation may still occur from village to village. Farmers in the cooperative should receive the same price per village because they will argue prices collectively and will sell their product at the same time to one buyer. Non-cooperative members could receive different prices as there are many potential buyers and prices outside of the cooperative are not always clear and transparent. Variation between villages can occur even for cooperative farmers because of transportation costs between villages. Although villages are often very close geographically, because of poor or non-existent road conditions, transportation costs are often different.

While vanilla is the most expensive cash crop in this area, farmers typically plant coffee to supplement their income and rice to meet their consumption needs. During the lean season, typically between February and May (see **Seasonal Chart** in **Appendix I**), farmers have no cash crop income to meet basic consumption needs and are in between rice harvests. In March and

April, many farmers plant a variety of rice that comes into harvest during the lean season but these harvests are usually labor intensive and rice is not immediately ready for consumption. Additionally, in March and April, vanilla farmers are typically tending to their vanilla fields in preparation for the harvest and sleep in the vanilla fields to protect their crops from thieves. Farmers are often faced with the choice of guarding their vanilla or harvesting their rice.

When food becomes too scarce, or other unforeseen shocks hit a household (like health emergencies), informal loans and flower contracts are a farmer's only choice. As discussed above, flower contracts are substantially less than the market price and pull down the average vanilla price, and total household income from cash crops, a family receives. Local merchants offer these flower contracts and usually have a lot of influence and power within the villages. The main goal of the zero interest cooperative loan, is to avoid flower contracts and help farmers smooth their consumption over the course of the year.

4. Hypothesis and Theory of Change

Based on the above literature review and my experiences in Madagascar with vanilla farmers, I expect cooperative participation to have positive household impacts on those farmers who choose to participate. I expect the reduction of flower contracts, increased vanilla prices, increased production of vanilla, and increased total household income from cash crops for cooperative members relative to non-cooperative members.

The theory of change I expect to see is farmers who chose to enter the cooperative will be those who suffer from the longest lean seasons and who most want to avoid flower contracts. This theory of change operates under the assumption that zero interest credit will allow vanilla farmers to smooth their consumption over the lean season, reduce flower contracts, and increase production. I predict that farmers who choose to enter the cooperative will be the ones who most want access to cooperative lending and want to eliminate flower contracts. I expect to see flower contract take up reduced to zero for cooperative members.

Similarly, because farmers will now own 100% of their vanilla (as opposed to a portion of it already being sold as a flower contract), I predict they will be more willing and able to protect their vanilla prior to harvest. In the year prior to the intervention (2016), farmers who accepted flower contracts were selling almost 25% of their total vanilla crop as flower contracts on average across both the treatment and control group. Cooperative members should see increased vanilla production as they should be able to spend more time and resources tending to their vanilla and have time to protect it from thieves. Therefore, farmers should see increased income coming from vanilla and increased total cash crop income.

I expect to see increases in the price cooperative members receive for two separate reasons. First, because of transparent and collective bargaining practices for cooperative members, vanilla prices should rise. Secondly, because

member farmers will avoid flower contracts which can significantly reduce the average vanilla price they receive. When I calculate the average price of vanilla, I calculate it based on how much vanilla is sold on the open market times the price, plus how much vanilla was sold as flower contracts times the price of the flower contracts, divided by the total amount of vanilla sold in both scenarios. Because the price of flower contracts is so low, it pulls this average price of vanilla down. As average vanilla price is weighted for how much vanilla is sold as a flower contract, the less vanilla sold in this way will have less of a negative impact on price. The elimination of flower contracts should have a significant positive effect on average vanilla prices. I will test these hypothesis using the methodology and data described below.

5. Methodology

In order to evaluate the impact of cooperative lending on member farmers, we chose both a qualitative and quantitative approach. In early 2017 the cooperative was formed and offered cooperative benefits to all member farmers who chose to enter. In January 2018, I returned to Madagascar and conducted household surveys and focus groups to collect data and information from both cooperative and non-cooperative members. Because of time constraints, I was only able to collect data from villages that were offered entrance into the cooperative. Therefore, the control group for this experiment will be those vanilla farmers who were offered treatment into the cooperative and declined. This introduces selection bias as those farmers who refuse

entrance are assumed to be very different from those farmers who enter the cooperative on unobservable characteristics and therefore would not be a valid counterfactual group. Using difference in differences techniques however, we can control for these individual unobservable characteristics as long as market conditions and other observable characteristics were similar for both groups prior to the intervention. We can check for these similarities through testing for parallel trends and showing evidence that observable characteristics were moving in similar trends prior to the cooperative intervention. All references moving forward to the control group will be to the farmers who were offered treatment but refused.

During my 2018 visit, I travelled to 20 villages in and around Doany and held small community meetings with all vanilla farmers available on that given day. All villages were villages that had previously been offered entrance into the cooperative and had already elected two village level cooperative representatives. The elected village representatives organized and informed the community prior to our arrival so we were not showing up unannounced. Each community meeting began with introductions and an explanation of the research team and of the cooperative. We then explained the benefits of the cooperative, previewed upcoming cooperative activities and held a short question and answer session with all participants. These meetings usually lasted half an hour and were generally well attended with a low of 6 participants and a high of 31 participants. On average we usually received more cooperative

members than non-cooperative members but both groups were represented at every meeting.

At the conclusion of the introductory meeting, we asked all cooperative members who were willing and able to participate in a quick survey to join us after the meeting in a set location. We similarly invited all non-cooperative farmers to take the same survey but in a separate and similar location. The survey lasted 30 minutes and no compensation was offered for the surveys. However, it gave the participants an opportunity to ask questions about the cooperative and to have some individual time with the research team.

Once the surveys were finished, all cooperative members from the original meeting (whether they participated in the surveys or not) were offered to participate in a 30 minute focus group to discuss perceptions of the vanilla industry, perceptions of the cooperative, and ask any general questions to the research team they might have. Below I will describe the data collected and provide summary statistics of our findings.

5.1 Data Description

In total, 198 vanilla farmers were surveyed and just over 200 participated in the focus groups. After inputting data and removing any incomplete or unusable surveys, I was left with 132 survey responses and countless notes and quotes from the focus groups. The 66 dropped surveys were farmers who had planted vanilla but had no vanilla producing vines, refused to give price information, or left the majority of the survey blank. As the survey asked many

questions about household income and savings, some participants chose not to fully participate and the surveys were unusable. Of the remaining survey responses, 67 were cooperative members and 65 were not. The majority of the respondents were from Doany (39 respondents), where the cooperative headquarters is located, and a neighboring village of Ambalihabe (50 respondents).

All the summary statistics listed in **Table 1** are from 2017 as this is the year in which the treatment was administered. 76% of survey respondents were male, 85% were married and they had an average age of 46 years old. The average household had 5 members, 3 kids, and 2 working adults. The average vanilla farmer had a primary school education, had a house with a tin roof, owned two hectares of farm land, .85 hectares of rice field, 2 cows and 10 chickens. Forty-four percent of the farmers surveyed reported that at least one person in their home needed in hospital medical care in 2017 at an average cost of 48 USD annually. Twenty-eight percent of respondents reported they had at least one formal savings account, and of these 30 respondents said they had an average savings of 1,405.89 USD. Enthusiastically, 83% of respondents stated that the female head of the household was at least the co-manager of household finances which is not unusual as Madagascar has a traditionally maternalistic society. It is also interesting to note that only 46% of respondents reported a lean season in 2017 but of this 46% they reported the lean season lasted almost 4 months.

Table 1 – Summary Statistics

2017	Summary Statistics		
Variable Name and Description	N	Mean	Standard Deviation
Married (1 if yes)	131	0.85	0.35
Age (in years)	131	46.38	10.99
Total Household (HH) Members	132	5.36	1.98
Sex (1 if Male)	132	0.76	0.41
Number of Kids in HH	132	2.75	1.64
Number of Students in HH	132	2.09	1.48
Number of Workers in HH	132	2.04	1.09
Finished Primary School	131	0.59	0.49
Finished Middle School	131	0.29	0.45
Owns a Telephone (1 if yes)	132	0.62	0.48
House has a Tin Roof (1 if yes)	132	0.95	0.20
Any family member required in hospital care (1 if yes)	132	0.44	0.49
Total Medical Expenses in USD	132	48.01	126.7
Land holdings in hectares (other than vanilla and rice fields)	130	2.04	3.02
Rice Fields in hectares	130	0.85	0.64
Lean Season (1 if yes)	130	0.46	0.50
Number of Months in lean season	60	3.68	3.17
Number of Cows	129	1.96	1.99
Number of Chickens	130	9.37	12.79
Female head of HH makes financial decisions (1 if yes)	129	0.83	0.37
Household owns a savings account	132	0.28	0.45
Total value of bank account in USD	30	1405.89	1967.42

Notes: All USD values are 2015 inflation adjusted values

In **Table 2** I examine the year just before the cooperative began (2016) to determine if treatment and control farmers were similar on observable characteristics prior to treatment. We find that while farmers who chose to enter the cooperative and those who chose not to enter the cooperative were similar along many observable characteristics, some differences did exist.

The treatment group was older on average by five years and had one additional household member and one additional worker. Therefore, treated households had one more worker on average when compared to the control group. This seems to coincide with the findings of Mojo, Fischer and Degefa (2017) that also found higher cooperative participation rates from older farmers with larger families. Other than these differences, the treatment and control groups were similar along many observable characteristics prior to treatment. The additional worker can be important however as an additional worker per household in a rural farming community can have potentially significant impacts on household outcomes and production of cash crops. Additionally, the extra worker could free up time for the head of the household to participate in cooperative activities and therefore could be correlated with cooperative enrollment and participation and other outcomes of interest such as vanilla production and total household income coming from cash crops.

Table 2 – Balance Table

2016	**Control Group**			**Treatment Group**			**Means Comparison Test**	
Variable Name	N	Mean	Standard Deviation	N	Mean	Standard Deviation	Difference in Means	P-Value
Married	64	0.82	0.38	67	0.88	0.33	-.052	0.390
Age	65	43.87	10.05	66	48.80	11.40	-4.97	0.009***
Total Household	65	4.96	1.76	67	5.75	2.13	-.777	0.020**
Sex	65	0.78	0.41	67	0.75	0.44	.035	0.600
Kids	65	2.78	1.55	67	2.73	1.74	.053	0.850
Students	51	1.96	1.18	65	2.21	1.65	-.254	0.360
Workers	51	2.03	0.79	65	2.76	1.27	-.73	0.000***

Finished Primary	64	0.65	0.47	67	.55	0.50	.1189	0.168
Land in Hectares	64	1.83	3.90	66	2.25	1.80	-.4147	0.436
Rice Fields HC	64	0.77	0.63	66	.934	0.66	.8542	0.155
Vines Pollinated	65	785.69	704.80	66	772.90	1186.67	12.78	0.971
Total Vanilla Sold	65	81.32	111.97	65	85.50	80.56	-4.19	0.800
Flower Contract	65	0.09	0.29	67	0.09	0.29	.0027	0.956
Flower Contract KG	6	25	12.64	5	15	4.47	10	0.186
Total Coffee Sold	43	135.79	132.43	45	153.88	125.62	-18.09	0.510
Vanilla Price USD	65	24.70	5.43	62	24.09	5.38	.61	0.520
Flower Contract Price USD	6	7.81	4.19	5	6.53	4.66	1.27	0.643
Avg. Vanilla Price USD	65	24.36	5.92	62	23.84	5.49	.52	0.600
Coffee Price USD	42	1.43	0.36	42	1.40	0.37	.020	0.798
Vanilla Income USD	65	1899.90	244.17	63	1961.50	1995.36	-61.62	0.876
Total Cash Crop Income USD	65	2156.70	2608	65	2173.30	2146.10	-16.57	0.968

Notes: ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level

It is also interesting to note that the average income coming from all cash crops of both the treatment and control group was above 2000 USD per year. This measurement includes only income from coffee and vanilla as these are the two main cash crops reported in this area. In Madagascar, the typical Malagasy farmer makes around 2 USD per day or 730 USD annually. Because of the relatively high yearly incomes of the farmers in this study, we should consider these farmers to be relatively high income earners (UNDP 2017). It is also significant to note that almost 1900 USD of both the treatment and controls total cash crop income came from vanilla. This is the overwhelming majority of

their cash crop income which again highlights the importance of the vanilla crop in this area.

We should also note that only about 9% of the total respondents reportedly accepted a flower contract in 2016. The average price of the flower contract for the treatment group was 6.53 USD and 7.81 USD for the control group. While the difference was 1.27 USD per kg, this difference was not statistically significantly at any conventional levels. Both groups pollinated around 780 vanilla vines and produced around 82 kg's of vanilla annually. This averages out to about 0.10 kg per vanilla vine. There was no statistically significant difference in the price the two groups received in 2016 as they both received an average price around 24 USD.

5.2 Estimation Techniques and Model

In each village, farmers were left to decide whether they would participate in the cooperative or not. Therefore, we must assume that those who chose to enter and those who chose not, are not comparable and are different on unobservable characteristics. Using difference in differences estimation techniques, we can control for fixed individual differences between the treatment and control groups. This will be a measurement of the treatment on the treated (TOT) as member farmers voluntarily enroll in the cooperative, and either sell to the cooperative on not. In our survey we can differentiate those who sold vanilla to the cooperative, and thus participated in the cooperative, and those who did not. The below model will be the primary model for this

experiment and my standard errors will be clustered at the household (or individual) level as I have household per year panel data.

$$Y_{it} = \beta_0 + \beta_1 T2016_t + \beta_2 T2017_t + \beta_3 Coop_i * T2016_t + \beta_4 Coop_i * T2017_t + \gamma_i + \varepsilon_{it}$$

In the above equation, Y_{it} is the outcome variable of interest. The primary indicator variable will be average vanilla prices over time but we can also look at a number of other socioeconomic indicators. For example, I will first regress "FlwContract" on my right hand side variables to see how cooperative participation affects the probability of accepting a flower contract for a given farmer who enters the cooperative. $T2016_t$ and $T2017_t$ are time dummies that represent the year of 2016 and 2017 respectively with 2015 as the left out year. These dummy variables will correct for any natural variation in the vanilla market that might occur from year to year. $Coop_i * T2016_t$ is the interaction of cooperative participation and time from 2015 to 2016. This coefficient should be statistically insignificant for all outcomes as the cooperative did not form and offer treatment until 2017. As I will later discuss the coefficients on β_3 will be important for my robustness checks and establishing parallel trends. $\beta_4 Coop_i * T2017_t$ is the coefficient of interest and represents the treatment effect of cooperative participation for individual i during year t who chose to enter the cooperative when compared to farmers who chose not to enter the cooperative. γ_i is a control for individual fixed effects and ε_{it} is the error term which will include any variation not controlled for in this model.

Per my hypothesis, I assume β_4 will be positive and statistically significant for all outcomes relative to the price of vanilla and total cash crop income. I expect estimates of β_4 to be negative for the acceptance of flower contracts by cooperative members.

6. Results: Graphical Analysis

6.1 Parallel Trends

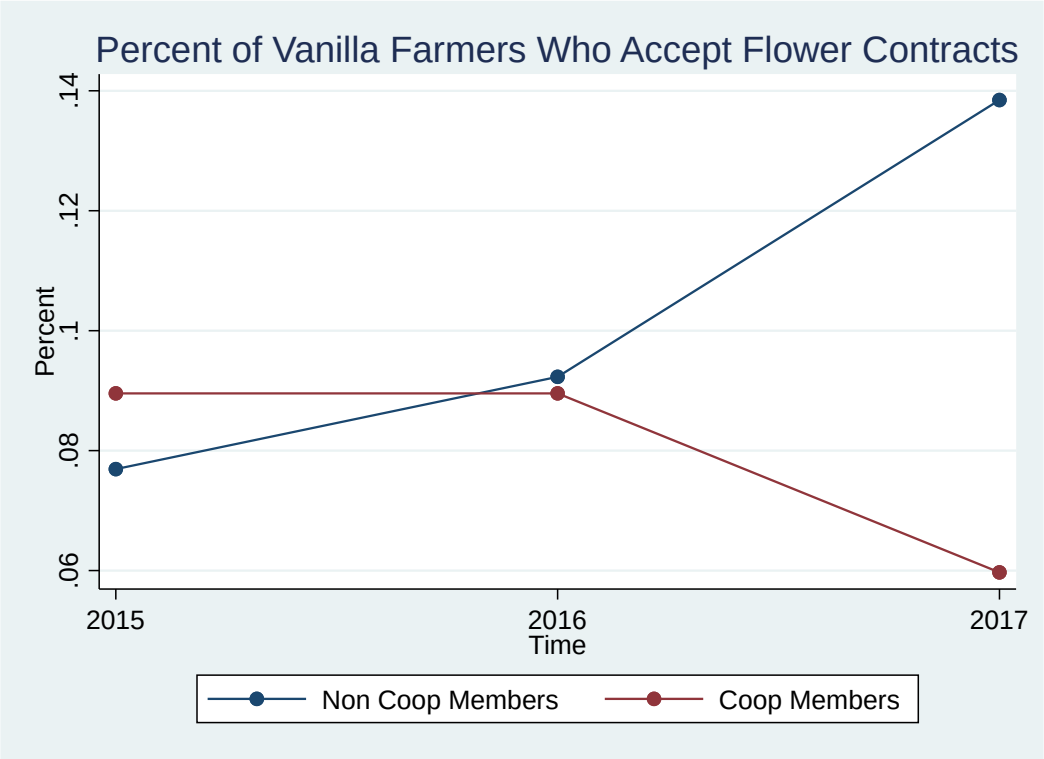
In order for the above DD model to be valid, we must first determine if the treatment and control groups were on different trajectories even before the treatment was introduced. We can check for this graphically by graphing mean yearly outcome data prior to treatment. This process is often called a "parallel trends" check. If the mean outcome variables are moving in similar trends over time prior to treatment, we can assume parallel trends hold for the given variable, and we can assume the treatment and control groups would have continued on similar paths in the absence of treatment.

As displayed in **Appendix II – Parallel trends**, parallel trends seem to hold for most variables between cooperative farmers and non-cooperative farmers in the year prior to treatment however, there are some violations that are not pictured below. Coffee production does not hold for parallel trends as the treatment group was declining in the years leading up to the cooperative intervention and the control group was increasing coffee production in the years leading up to the intervention. This could be evidence that some cooperative members knew that the cooperative would be forming and would be offering

benefits so they stopped harvesting their coffee and only focused on their vanilla crops.

Additionally, parallel trends are inconclusive for the percent of vanilla farmers who accepted flower contracts (pictured below in figure – **Figure3**) prior to the formation of the cooperative. As suspected, the percent of treatment farmers who accept flower contracts falls once the cooperative is formed. As you can see in the graph, cooperative members had a slightly negative trend in the acceptance of flower contracts prior to treatment while non cooperative members were steadily increasing their reliance on flower contracts over time. Again, this could mean that some cooperative members knew the cooperative would be starting soon and offering zero interest credit so they were less likely to accept flower contracts in the lead up of the cooperative. While this can't be directly investigated, this does introduce some concern that market conditions were not the same for the treatment and control groups leading into the formation of the cooperative.

Figure 4 – Flower Contracts



Note: Percent of Vanilla farmers who sold at least 1 KG of vanilla as a flower contract

While parallel trends are inconclusive in the above graph for the percent of famers who accept flower contracts, they do hold for the number of vanilla vines pollinated, the price of vanilla with and without flower contracts included, and the price of coffee. There seem to be positive treatment effects for cooperative members for vanilla price and average vanilla price as suspected, but surprisingly there seems to be a large negative treatment effect of cooperative enrollment on vanilla output. The complete list of parallel trends can be seen in **Appendix II – Parallel trends**. Because total vanilla output falls, there is also a negative treatment effect on total cash crop income and total vanilla income.

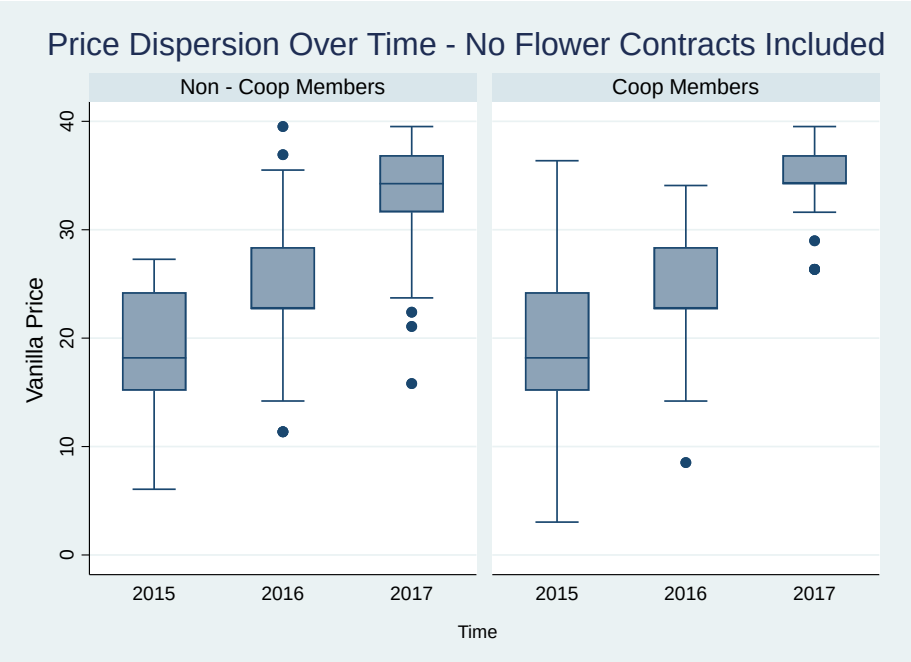
6.2 Price Dispersion

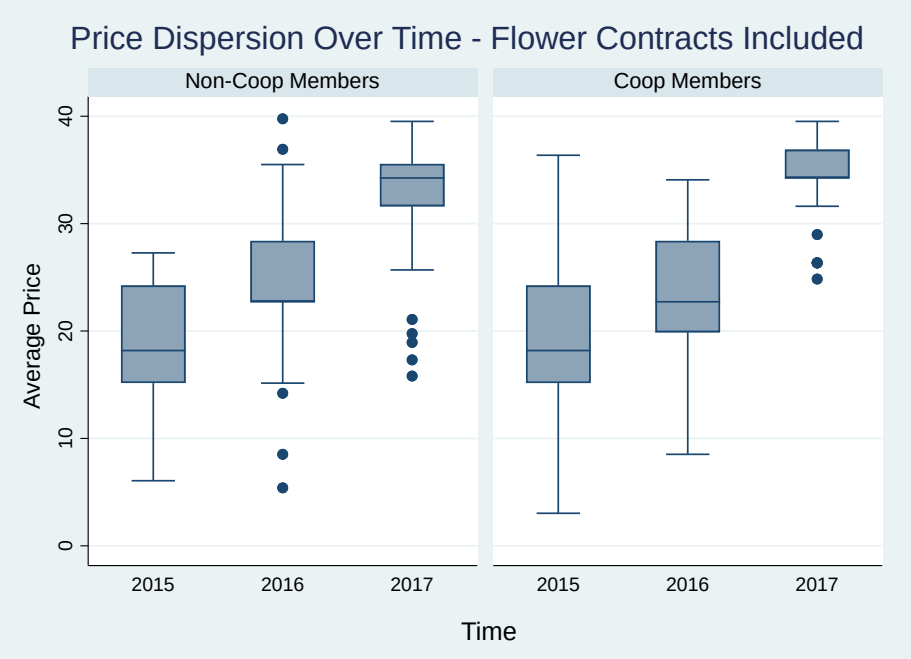
In **Figure 3** below we examine price dispersion for cooperative members and non-cooperative members over time. As discussed earlier, we would expect to see a decrease in price dispersion in treatment villages as cooperative members should receive the same price within a village. We would expect this decrease for two reasons. First, the open and transparent bargaining process between the cooperative and the buyers should guarantee an equal price for all cooperative members in a given village. Secondly, the elimination of flower contracts for cooperative members should reduce dispersion of the average vanilla price by eliminating the extremely low prices offered as flower contracts.

The two graphs in **Figure 3** below show price dispersion between treatment and control villages. The first graph shows price dispersion for the price of vanilla only (no flower contracts included) and the second graph shows price dispersion for the average vanilla price with flower contracts included. Price dispersion diminished over time from 2015-2017 on average between both groups and across both measures of price. Part of this reduction in price dispersion should be attributed to the fact that 2015 and 2016 prices were recalled from memory and there is recall error included. There is however, a noticeable reduction in price dispersion and in price outliers for cooperative members across both measures of price in 2017 once cooperative treatment was offered. This coincides with the researcher's theory of change and is evidence of the transparent bargaining practices of the cooperative. This elimination of price

risk is a benefit of the cooperative and can potentially help farmers with financial planning and savings/investment decisions into the future.

Figure 5 – Price Dispersion





Note: Prices are for green vanilla sold by farmers on the open vanilla market. All prices are adjusted for inflation to 2015 levels. Dots in the figures represent outliers or prices that fall outside of the adjacent values of the box plot

7. Results: Regression Analysis

7.1 Effect of Cooperative on Flower Contract Take Up

While the graphical analysis provides some interesting and insightful results, we now turn to regression analysis to add further support to our claims. When we use regression analysis to examine the impacts of cooperative participation on the acceptance rate of flower contracts, we arrive at similar results as found in the graphical analysis. In **Table 3*,*** we can see that flower contract take up fell by 9.1 percentage points for farmers who chose to enter the cooperative. This estimate is significant at the 10% level and effectively eliminates flower contracts for the treatment group as flower contract take up of the treatment group was 9% in the year prior to treatment (2016).

When we focus our analysis on Doany and Ambalihabe only, we can see that there is evidence of village specific effects in these two locations. We focus on Doany and Ambalihabe because we had the largest number of survey responses from these two villages, and Doany is where the cooperative headquarters is located. While the treatment effect in Doany is similar in sign and magnitude to the effect on the entire sample, it is no longer significant at any conventional levels. In 2017, 21% of the control group still accepts flower contracts in Doany which leads me to believe there is still a demand for credit coming from non-cooperative vanilla farmers. Ambalihabe on the other hand, had a 15 percentage point decrease in the take up of flower contracts for farmers enrolled in the cooperative and this was statistically significant at the

10% level. Flower contract take up in Ambalihabe for the treatment group was 0% in 2017 for the sample of farmers surveyed.

It is also important to point out that there were no statistically significant differences between the treatment and control groups in flower contract take up in the year prior to the intervention which adds support to our parallel trends assumption. As you can see from the interaction term of Coop and time 2016 (T2016) in **Table 3** we find no statistically significant results for the entire sample or in any sub samples prior to intervention in 2017.

Table 3 – Flower Contract Take Up

Dependent Variable: FlowerContract	(1) **Entire Sample**	(2) **Doany Only**	(3) **Ambalihabe Only**
Year 2016	0.015	-0.052	0.033
	(0. 0346)	(0.0931)	(0.033)
Year 2017	0.061	-2.50e-17	0.10*
	(0.0372)	(0.076)	(0.056)
Coop * Year 2016	-0.015	0.002	-0.033
	(0.0406)	(0.1058)	(0.033)
Coop * Year 2017	-0.091*	-0.10	-0.15**
	(0.0477)	(0.103)	(0.075)
Mean in Control	.10	.10	.06
Number of Observations	396	117	150
R squared	0.019	0.0359	0.0244

Notes: The dependent variable is the percent of farmers surveyed who accepted a flower contract. Standard errors presented in the parenthesis and clustered at the individual farmer level. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level

7.2 Effect of Cooperative on Prices

If we assume that the acceptance of flower contracts negatively effects average vanilla prices and vanilla prices in general, we would assume that the elimination of flower contracts for the treatment group should increase both of these measures of price. In 2017, the average vanilla price for both the treatment and control group was 33.69 USD (including flower contracts). The average vanilla price not including flower contracts for both groups was 34.10 USD. In **Table 4 – Columns 1 & 2** below, we can see the impact of the cooperative on both vanilla price and average vanilla price. Again, average vanilla price is a weighted average of prices received on the open market and the flower contract price, divided by the total amount of vanilla sold in each situation.

As expected, there are positive coefficients on vanilla price and average vanilla price for cooperative members when compared to non-cooperative members. Cooperative enrollment increased vanilla prices by 1.07 USD on average and average vanilla price by 1.41 USD on average. Neither of these results were statistically significant at any conventional levels but this treatment effect could be underestimated, especially average vanilla price, as it is likely only representing the price increase from the 9% of farmers who were previously taking flower contracts but no longer need them because of cooperative lending. Because only around 9% of farmers were initially accepting flower contracts, there might not be a large enough number of farmers substituting away from flower contracts to see a statistically significant increase in average vanilla prices.

These impacts could however, be large in magnitude for this select group of farmers.

7.3 Effect of Cooperative on Vanilla Production

While there is a correlation between higher prices and cooperative participation, we find a surprisingly negative relationship between the total amount of vanilla produced and cooperative participation. As seen in **Table 4 – Column 3**, those who enrolled in the cooperative produced and sold 26.4 kilograms of vanilla less than the control group on average. This finding is statistically significant at the 5% level and is large in magnitude as the average vanilla farmer in the control group sold 90 kilograms of vanilla. This result is unexpected as we would assume farmers who enroll in the cooperative would be more diligent in the maintenance and harvest of their vanilla as they expected higher prices and continued benefits of cooperative participation. This result is particularly surprising as the amount of vanilla vines pollinated between the treatment and control groups was not statistically significantly different. Vanilla farmers who enrolled in the cooperative had a lower yield than those who chose not to enroll.

It is important to note that these results could be driven by side selling of vanilla by cooperative members. It is possible that cooperative member farmers sold their vanilla to buyers other than the cooperative and did not want to report the side selling during the survey. As I did not know there was this reduction in vanilla production until that data analysis portion of this study, I was unable to

ask focus group participants about side selling. Additionally, this reduction in vanilla production could be caused by higher incidents of vanilla theft associated with cooperative participation or neglect of pollinated vanilla vines prior to harvest and this will be discussed in further detail below.

Table 4 – Cooperative Treatment Effects

Dependent Variable	(1) Vanilla Price USD	(2) Average Price USD	(3) Total Vanilla Sold	(4) Total Cash Crop Income USD	(5) Vanilla Income USD
Year 2016	5.997***	6.014***	23.793***	1081.602***	779.179***
	(0.8319)	(0.847)	(7.503)	(192.117)	(177.809)
Year 2017	14.609***	14.290***	51.624***	2874.718***	2224.235***
	(0.9431)	(0.9662)	(8.389)	(398.526)	(338.805)
Coop * Year 2016	-1.276	-1.383	-4.275	-291.476	-123.032
	(1.003)	(1.012)	(8.829)	(239.710)	(225.772)
Coop * Year 2017	1.074	1.410	-26.493**	-892.319*	-711.100*
	(1.246)	(1.265)	(11.25)	(484.401)	(419.938)
Mean in Control	26.33	25.85	89.14	2569.84	2265.11
Number of Observations	364	364	364	378	370
R squared	0.783	0.776	0.245	0.435	0.382

*Notes: The dependent variable is the percent of farmers surveyed who accepted a flower contract. Standard errors presented in the parenthesis and clustered at the individual farmer level. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level*

7.4 Effect of Cooperative on Income

As vanilla farmers who enrolled in the cooperative produced and sold less vanilla, it is unsurprising that total cash crop income and total vanilla income fell for these farmers as well. In **Table 4 – Columns 4 & 5** we can see that total cash crop income for farmers who enrolled in the cooperative fell by 892 USD on average compared to the control group. Similarly, vanilla income fell by 711 USD

on average and both results are statistically significant at the 10% level. This large drop in total cash crop income relative to vanilla income again highlights how large a portion of total cash crop income is made up from the sale of vanilla.

7.5 Effect of Cooperative on Theft and the Lean Season

While I do not have historical theft or lean season data, I did collect data for these outcomes in the treatment year of 2017. The results of running a simple regression of reported theft, the reported percentage of vanilla stolen, the existence of a lean season, and the total duration of the lean season, on cooperative participation is reported below in **Table 5.**

We can see that for cooperative members there was a negligible impact on the probability of a theft occurring but a reported 6.53 percentage point increase in the amount of reported vanilla stolen between the treatment and control groups. As the mean vanilla production for the treatment group in 2017 was about 90 kilograms, this increase in theft translates into roughly a 6 kilogram loss in vanilla production. While this increase in theft percentage helps explain some of the decrease in vanilla production from cooperative members, these results are not statistically significant at any conventional levels and theft percentages are often difficult to estimate.

The lean season, as defined in this region of Madagascar and for the purpose of my survey, are any periods of time where a family does not have enough rice or enough money to consume three full meals of rice per day. Cooperative members were 19 percentage points more likely to experience a lean season

after joining the cooperative on average, holding all other factors constant. These results were statistically significant at the 5% level and surprising at first glance. However, cooperative participation decreased the duration of the lean season by 2.3 months on average compared to the control group. This result was statistically significant at the 5% level. It seems that cooperative participation increased the extensive margin of experiencing a lean season but decreased the intensive margin for those who experienced them.

It is also important to note that I feel there is a certain level of the Hawthorne effect present in the reporting of a lean season. Cooperative farmers know that zero interest loans are given during the lean season and if they report that their lean season has been completely eliminated, they might be worried that the zero interest loans will not be offered the following year. This idea was later confirmed in the focus groups with respondents acknowledging that they reported a lean season because they did not want to lose access to loans and because they were accustomed to reporting a lean season when asked. Additionally, this could just be selection as we would assume those with a lean season are more likely to enter the cooperative and take the loan.

Table 5 – Theft and the Lean Season

	(1)	(2)	(3)	(3)
Dependent Variable:	**Theft (1 if yes)**	**Theft Percent**	**Lean Season (1 if yes)**	**Lean Months**
Coop	-.019	6.53	.19**	-2.321**
	(.0866)	(5.74)	(.0935)	(.900)
Age	.0069	.065	-.0011	-.0744**
	(.0041)	(.267)	(0.0042)	(.034)
Workers	.0155	-2.32	.013	.2935
	(.040)	(2.56)	(0.0412)	(.212)
Mean in Control	.307	33.75	.375	5.17
Number of Observations	131	42	129	60
R squared	.0292	.0415	.039	.1944

*Notes: See the list of variables for a full explanation of the Dependent Variable. Robust Standard errors presented in the parenthesis. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level*

8. Robustness Checks and Heterogeneous Effects

In the previous sections I found a negative treatment effect of cooperative participation on the acceptance of flower contracts to the extent that cooperative participation practically eliminated flower contracts for those farmers who chose to enter the cooperative. We also found a positive correlation between cooperative participation and average vanilla prices. However, we found a negative treatment effect of cooperative participation on the total amount of vanilla produced and sold, and total cash crop income. In this section we investigate what confounding factors could be influencing our results. We then look at specific demographic groups in an attempt to identify which groups were most (or least) affected by the cooperative treatment.

There is graphical evidence found in **Appendix II – Parallel Trends** that observable characteristics were changing at similar rates between the treatment and intervention groups prior to the development of the cooperative. I use regression analysis to add evidence to this claim that parallel trends hold between the treatment and control groups. In **Table 4** I report regression results for the impact of cooperative participation for farmers who chose to enroll in the cooperative on various outcomes. As the cooperative did not begin until 2017, all observed treatment effects should be negligible in magnitude and insignificant in 2016 prior to intervention. As we can see in **Table 4** looking specifically at the interaction between treatment (Coop) and 2016 (T2016), there are no statistically significant differences between our treatment and control groups for the reported variables. This adds support to our claim that market conditions were similar for the treatment and control groups prior to the intervention. These results also suggest that cooperative members did not change their behavior in anticipation of cooperative formation.

In a similar robustness check, we can replace our outcome variable with an outcome that should not be effected by cooperative enrollment and measure the impacts. As more than two thirds of the vanilla farmers in this study were also coffee farmers, and the cooperative was not involved in any coffee market activities, the price of coffee is an excellent candidate for an alternative outcome robustness check. As we can see in **Table 5 Column 1** there was no significant effect of cooperative enrollment on the price of coffee at any conventional

levels. Similarly, when we examine the impact of cooperative enrollment on vanilla vines pollinated, there are no statistically significant impacts at any conventional levels. Some may argue that 43 less vines pollinated on average by the treatment group is large in magnitude, but given the average yield of an individual vanilla vine in this study was 0.10 kilograms, this only equates to 4.3 kilograms less of vanilla on average.

The most surprising result found in this section is the effect of cooperative enrollment on coffee production. Similar to vanilla production we can see in **Column 3** that coffee production falls by 47.75 kilograms on average for farmers who enroll in the cooperative compared to those who do not enroll. This finding is statistically significant at the 5% level and accounts for roughly a 75 USD drop in total cash crop income for farmers who enrolled in the cooperative (using an average price of 1.5 USD / kilogram of coffee). These findings are particularly interesting because it seems cooperative members switched away from agricultural activities in general after enrolling in the cooperative and were spending more time on off farm activities.

Table 6 – Robustness Checks

	(1)	(2)	(3)
Dependent Variable	**Coffee Price USD**	**Vines Pollinated**	**Coffee Sold at Market**
Year 2016	0.388***	194.304***	19.852*
	(0.039)	(39.966)	(11.091)
Year 2017	0.924***	300.611***	31.177**
	(0.062)	(47.849)	(14.942)

Coop * Year 2016	-0.128 (0.062)	-50.202 (69.614)	-19.342 (12.874)
Coop * Year 2017	0.040 (0.111)	-43.328 (100.364)	-47.757** (19.449)
Mean in Control	1.52	771.56	136.12
Number of Observations	247	387	259
R squared	0.724	0.179	0.055

*Notes: See the list of variables for a full explanation of the Dependent Variable. Standard errors presented in the parenthesis and clustered at the individual farmer level. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level*

8.1 Gender Effects

Using triple differencing techniques I examine the effect of both cooperative enrollment and gender (in this case being a male) for the treatment group. In **Table 7** (Sex * Year 2017), we can see that women who enrolled in the cooperative fared far better than their male counterparts. Females had positive coefficients on vanilla prices, total vanilla harvested and sold, and total cash crop income and had a negative coefficient for flower contract take up. Vanilla price was 3.71 USD higher and average vanilla price was 4.62 USD higher on average per kilogram for women who entered the cooperative compared to farmers who chose not to. Both of these results were statistically significant at the 10% level.

Men had negligible impacts of cooperative enrollment on flower contract take up, and they had negative and statistically significant coefficients on total vanilla produced and sold, total cash crop income, and vanilla income. Men who enrolled in the cooperative produced and sold 36.39 less kilograms of vanilla on average (statistically significant at the 5% level), and received 1346 USD less total cash crop income on average (statistically significant at the 1% level) when

compared to farmers who chose not to enter the cooperative. These results are interesting because over 80% of households reported females had at least equal say in financial decisions.

These differential results could be driven by the fact that women tend to have less off-farm opportunities than men. Even though women in Madagascar typically have household financial management responsibilities and are often involved in general decision making, household responsibilities and child rearing often falls disproportionately on females and limits their ability to work and invest in off farm activities. However, additional research and qualitative analysis would be required to confirm these thoughts.

Table 7 – Differential Gender Effects

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	**Flower Contract**	**Vanilla Price USD**	**Average Price USD**	**Total Vanilla Sold KG**	**Total Cash Crop Income USD**	**Vanilla Income USD**
Year 2016	0.071	4.140***	3.546**	6.091	585.175**	497.927**
	(0.070)	(1.217)	(1.543)	(9.440)	(236.479)	(208.515)
Year 2017	0.071	11.375***	10.461***	20.020***	1268.991***	1012.885***
	(0.070)	(1.596)	(2.232)	(7.385)	(216.917)	(221.977)
Sex * Year 2016	-0.071	2.256	3.008	21.483	613.051*	353.819
	(0.080)	(1.564)	(1.823)	(12.982)	(330.195)	(300.765)
Sex * Year 2017	-0.013	4.010**	4.743*	39.201***	2026.864***	1539.237***
	(0.082)	(1.922)	(2.454)	(12.343)	(528.453)	(470.598)
Coop * Year 2016	-0.071	0.698	1.292	13.172	285.768	202.561
	(0.070)	(1.634)	(1.889)	(14.236)	(427.672)	(392.850)
Coop * Year 2017	-0.071	3.710*	4.625*	11.931	825.271	596.753
	(0.070)	(2.178)	(2.679)	(15.278)	(565.752)	(508.556)
Sex*Coop*2016	0.071	-2.419	-3.291	-21.066	-716.898	-411.688
	(0.085)	(2.017)	(2.221)	(17.570)	(510.026)	(473.525)

Sex*Coop*2017	-0.027	-3.210	-3.919	-48.320**	-2171.895***	-1667.026**
	(0.092)	(2.615)	(3.029)	(20.312)	(811.324)	(720.033)
Mean in Control	0.10	26.33	25.85	89.14	2569.84	2265.11
Number of Observations	396	364	364	364	378	370
R squared	0.023	0.787	0.782	0.264	0.459	0.405

*Notes: Standard deviations presented in the parenthesis. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level. All prices adjusted to 2015 levels*

8.2 Age Effects

As age was statistically significantly different between the treatment and control groups, I investigate if cooperative enrollment had differential effects between age groups. Because both the median and mean age of the farmers in this study is 45, I chose this age as the cutoff for my analysis. As seen in **Table 8.1 & 8.2**, farmers under 45 were 11.1 percentage points less likely to accept a flower contract on average when compared to farmers under 45 who chose not to enter the cooperative. This finding is statistically significant at the 10% level. The coefficients for vanilla price and average vanilla price are both positive but not statistically significant at any conventional levels. While the coefficients for total vanilla produced and total cash crop income are insignificant, they are less negative then the results we find for our full sample.

Farmers over 45 who chose to enter the cooperative produced and sold 46 less kilograms of vanilla, and had a decrease of 1724 USD total cash crop income on average compared to farmers of the same age who chose not to enter the cooperative. Additionally, the coefficients for average vanilla price and vanilla price were both negative and large in magnitude. However, none of these results were statistically significant at any conventional levels, so it seems there

is evidence for general negative effects of being older on our outcomes of interest.

Table 8.1 – Differential Age Effects (Under 45)

Dependent Variable: Under 45 Years of Age	(1) Flower Contract	(2) Vanilla Price USD	(3) Average Price USD	(4) Total Vanilla Sold KG	(5) Total Cash Crop Income USD	(6) Vanilla Income USD
Year 2016	-0.000	5.924***	6.011***	15.285***	874.424***	624.126***
	(0.050)	(1.114)	(1.143)	(5.246)	(137.138)	(135.970)
Year 2017	0.111*	14.305***	13.631***	48.592***	2670.094***	2051.675***
	(0.065)	(1.270)	(1.313)	(7.019)	(291.432)	(263.516)
Coop * Year2016	0.000	-0.657	-0.845	-3.991	-299.903	-196.333
	(0.050)	(1.510)	(1.528)	(8.935)	(243.664)	(243.063)
Coop * Year2017	-0.111*	0.612	1.234	-11.212	-523.061	-424.804
	(0.065)	(2.062)	(2.088)	(13.336)	(489.309)	(445.431)
Mean in Control	0.16	26.44	25.68	75.97	2248.98	1947.57
Number of Observations	192	179	179	179	183	181
R squared	0.056	0.735	0.716	0.412	0.629	0.549

Table 8.2 – Differential Age Effects (Over 45)

Dependent Variable: Over 45 Years of Age	(1) Flower Contract	(2) Vanilla Price USD	(3) Average Price USD	(4) Total Vanilla Sold KG	(5) Total Cash Crop Income USD	(6) Vanilla Income USD
Year 2016	0.047	7.832***	7.723***	43.264*	1746.341***	1339.615**
	(0.047)	(1.313)	(1.314)	(23.492)	(613.241)	(573.830)
Year 2017	0.005	17.301***	17.430***	60.889**	3529.777***	2812.817***
	(0.006)	(1.525)	(1.521)	(25.640)	(1128.518)	(976.811)
Coop * Year2016	-0.062	-3.266**	-3.248**	-16.824	-757.726	-464.154
	(0.062)	(1.455)	(1.450)	(24.393)	(649.276)	(609.176)
Coop * Year2017	-0.072	-2.168	-2.289	-46.596	-1724.845	-1455.227
	(0.047)	(1.797)	(1.791)	(27.979)	(1202.673)	(1046.306)
Mean in Control	0.01	26.26	26.17	111.49	3083.82	2781.91
Number of Observations	184	166	166	166	176	170
R squared	0.032	0.826	0.829	0.188	0.335	0.299

*Notes: See the list of variables for a full explanation of the Dependent Variable. Standard errors presented in the parenthesis and clustered at the individual farmer level. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level*

8.3 Location Effects

As discussed in **Table 3**, the flower contract acceptance rate for cooperative members was statistically significantly different between Doany and Ambalihabe. These two villages are important in the context of this experiment because Doany is where the cooperative headquarters is located and Ambalihabe is important because we received the most survey responses from that village.

As you can see in **Table 9.1 & 9.2, Column's 2 & 3**, there are differential effects of cooperative enrollment between Doany and Ambalihabe. In Doany, farmers who enrolled in the cooperative had an average increase of 3.84 USD in average vanilla price compared to the control group. This finding was statistically significant at the 1% level. However, there was a decrease in Doany of 41.34 kilograms of vanilla produced on average by cooperative members and this was statistically significant at the 5% level. In Ambalihabe the coefficient on average vanilla price was small in magnitude and not statistically significant at any conventional levels. There was no statistically significant decrease in total vanilla produced compared to the control group in Ambalihabe. I believe that the higher price in Doany could reflect the transportation cost from Ambalihabe to Doany. As previously discussed the roads are very rough in this area and this price differential might reflect the cost the buyers accrue from traveling to Ambalihabe to purchase the vanilla. Additionally, because all cooperative

executive officers are located in Doany, there could be some political reasons that Doany cooperative members receive higher prices on average.

Table 9.1 – Differential Location Effects (Doany Only)

Dependent Variable: For Doany only	(1) Flower Contract	(2) Vanilla Price USD	(3) Average Price USD	(4) Total Vanilla Sold KG	(5) Total Cash Crop Income USD	(6) Vanilla Income USD
Year 2016	-0.053	5.620***	6.000***	16.370*	1005.378***	676.979**
	(0.093)	(0.981)	(1.033)	(8.826)	(302.219)	(299.538)
Year 2017	-0.000	11.854***	12.057***	46.896***	2529.323***	1766.939***
	(0.077)	(0.795)	(0.766)	(12.293)	(498.457)	(427.779)
Coop * Year2016	0.003	-1.892	-2.249	-7.370	-495.607	-276.461
	(0.106)	(1.377)	(1.413)	(11.510)	(381.490)	(368.935)
Coop * Year2017	-0.100	4.022***	3.843***	-41.341**	-1005.763	-688.626
	(0.103)	(1.349)	(1.339)	(17.690)	(611.517)	(535.539)
Mean in Control	0.19	27.81	27.06	69.02	2280.19	1887.22
Number of Observations	117	109	109	109	115	112
R squared	0.029	0.857	0.857	0.192	0.466	0.364

Table 9.2 – Differential Location Effects (Ambalihabe Only)

Dependent Variable	(1) Flower Contract	(2) Vanilla Price USD	(3) Average Price USD	(4) Total Vanilla Sold KG	(5) Total Cash Crop Income USD	(6) Vanilla Income USD
Year 2016	0.033	8.535***	8.426***	23.017**	1151.605***	849.103***
	(0.034)	(1.639)	(1.629)	(9.133)	(340.733)	(284.302)
Year 2017	0.100*	17.791***	17.293***	47.983***	2763.485***	2275.719***
	(0.056)	(1.846)	(1.781)	(11.023)	(682.716)	(576.498)
Coop * Year2016	-0.033	-1.495	-1.272	7.575	-49.162	208.021
	(0.034)	(1.827)	(1.795)	(13.506)	(454.141)	(421.956)
Coop * Year2017	-0.150*	0.202	0.998	-14.503	-644.296	-481.743
	(0.075)	(2.383)	(2.287)	(17.463)	(837.337)	(735.084)
Mean in Control	0.04	25.40	25.21	80.51	2170.95	1961.45
Number of Observations	150	131	131	131	136	134
R squared	0.071	0.776	0.778	0.348	0.431	0.404

*Notes: See the list of variables for a full explanation of the Dependent Variable. Standard errors presented in the parenthesis and clustered at the individual farmer level. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level*

In **Column 1** we see that the acceptance rate of flower contracts in Ambalihabe fell by 15% on average compared to the control group and this finding was significant at the 10% level. The reduction of flower contracts in Doany was similar in magnitude at 10%, but was not statistically significant at any conventional levels, however this effect does not seem to be different between the two villages. It is interesting however in comparison to the control group in Doany who were still accepting flower contracts at a rate of 20% on average. This indicates that there is still a market for informal credit in Doany and that there are still farmers in Doany who could benefit from the zero interest loans of the cooperative.

It seems that the majority of price increases and the majority of output decreases were coming from Doany. As Doany was the center of the cooperative, there could be additional cooperative work or responsibilities that led to farmers in the central city from spending less time on vanilla producing activities. Additionally, maybe their political or managerial influences over the cooperative helped to increase the price of vanilla in Doany compared to Ambalihabe. Similarly, the average flower contract price in Doany was 8.56 USD while it was 9.65 USD in Ambalihabe which leads me to believe the avoidance of flower contracts was not the main driving factor in this increase of average prices. Further investigation would be required to determine what factors lead to higher prices and a larger drop in vanilla produced in Doany relative to Ambalihabe.

While the graphical and regression analysis of the surveys collected in the Doany area provide some insight and evidence to the impact of cooperative enrollment for farmers in this study, there are still many questions that exist. It seems that while farmers who entered the cooperative took less flower contracts and had higher vanilla prices on average, they reduced their vanilla production. Similarly, they reduced their coffee production and seemed to shift away from agricultural production in general. This raises the question of – what were these farmers who enrolled in the cooperative doing instead of maintaining and harvesting their vanilla and coffee? I now turn to the analysis of the focus groups to hopefully answer this question.

9. Focus Groups

Given the surprising results of the graphical and regression analysis, it is helpful to now turn to the focus group discussions to possibly provide some insight into what might been the driving force behind them. The focus groups were held right after the surveys and were held in an open forum style. I introduced myself to the groups and asked some basic questions to ignite conversation. I kept detailed notes in both English and the native Malagasy language and tried to structure the focus groups first around the lean season loans, then security concerns and finally a general discussion of the cooperative and the vanilla market as a whole.

During the preliminary focus groups held in January 2017, the overwhelming majority of vanilla farmers stated they wanted to join a

cooperative because they wanted increased vanilla prices. Cooperative membership in their opinion would allow for “collective bargaining” and “increasing prices every year.” Often farmers would complain about the low price of flower contracts and door to door commissioners who would “cheat” them and “eat their vanilla profits.” I often got the sense that these concerns were coming from a loud minority during the focus groups but they were reoccurring themes with cause for legitimate concern.

9.1 Loans

During the follow up focus groups held in 2018 I first asked questions about loans during the lean season. When I asked what participants spent their loans on the majority stated it was for consumption. “Rice,” “Rice during the lean season,” general food supplies and “food for side dishes,” were the main responses. Many farmers also stated that they shared their rice with family and community members.

The second most common theme for consumption of the loans was for medical emergencies and to pay for funerals. These expenses were the single largest expenses focus group members addressed. Funerals in Madagascar can be very expensive and usually require high upfront costs that are repaid by family and friends on the day of the event. Traditionally, the family of a deceased person slaughters a cow and feeds the village and as people visit and eat they pay a small amount of money to the family as a condolence. Costly medical expenses included malaria, births, exhaustion, and stomach issues (especially for

children). In some cases, farmers reported they spent their loans on vaccinations for their animals, particularly cows and chickens.

Additionally, some participants stated that they bought “clothes,” “cell phone credit,” farming supplies like “seeds and fertilizer” and some stated that they hired workers to help in their rice fields or to “sleep in the vanilla fields.” Many respondents also stated they used the loans to improve their households and bought basic house supplies. The majority of improvement purchases included new tin for roofing, cement, new wood, paint, mattresses, solar panels, and some respondents mentioned gas powered motors. Observationally, I noted that more women stated they spent their loans in the lean season on their children as compared to men.

9.2 Security

As many focus group members were concerned with security issues in 2016, I asked questions about security to see how, if at all, the cooperative addressed these concerns. In general, focus group participants were still very worried about thieves stealing their vanilla and stated this was still a primary concern. According to the surveys, 28% of all respondents reported a vanilla theft in 2016 and 31.8% reported a theft in 2017. Some respondents reported thefts as high as 100% of their total vanilla production and often blamed members of their own village as the culprits.

Some focus group participants asked if the cooperative could provide guns or “security cameras” that could monitor their vanilla fields but these

requests can often not be met. In general the cooperative members were not completely satisfied with the work of the security force provided by the cooperative because they stated the security force only “walked around the vanilla fields but did not enter them or sleep in them.” These security concerns could help explain some of the decrease in vanilla output from cooperative members. If the cooperative security force was not actually effective in protecting cooperative members vanilla fields, and cooperative members were less diligent in their own personal protection practices because of the perceived better security provided by the cooperative, then there could have been more theft of cooperative member vanilla compared to non-cooperative members. While I have no concreate evidence that this scenario is true, it could be further investigated in a follow up survey or focus group.

9.3 The Vanilla Market and General Concerns

The majority of cooperative members had the idea that vanilla prices would “continue to rise” as the cooperative got stronger. Interestingly, almost all participants of all focus groups requested that the cooperative expand and purchase coffee as well as vanilla. This is interesting in hindsight as coffee production fell for farmers enrolled in the cooperative relative to the control group. Some cooperative members showed interest in selling ground nuts to the cooperative but coffee was definitely a common theme throughout all focus groups.

In just under half of the focus groups, some cooperative members mentioned entrepreneurial uses of their cash loans. Entrepreneurial uses included, buying “a machine to crush rice”, starting a “boutique business” next to their home, and many respondents stated they opened small restaurants and snack stands. Similarly, there was a minority in every focus group that stated they used the zero interest loans to buy vanilla and sell it to other buys in order to make a profit. While these activities are detrimental to the cooperative practices we are trying to promote, they are understandable given some of the financial difficulties some farmers face.

10. Threats to Validity

As this area was specifically targeted for inclusion in this program, and vanilla farmers were given the choice of participation or not, the external validity of this experiment is limited. These findings could be much different if we had selected a different area for treatment where farmers are not as reliant on vanilla as their main source of income or an area that is more familiar with microcredit or cooperative activities. Additionally, this study relies heavily on reported financial and vanilla market data recalled from memory. While I assume recall error should be consistent between the treatment and control groups, it is necessary to acknowledge these limitations.

Additionally, the increases in average vanilla price is largely driven by the avoidance of flower contracts by the treatment group. As only about 9% of the

total survey sample was taking flower contracts prior to the intervention, I might not have sufficient power to yield statistically significant results.

Spillover effects are also a concern with this study as we have treatment and control households living in the same villages. During focus groups, farmers were very open about the fact that they shared their cooperative advances (both cash and food) with family members and it is not unreasonable to assume that control farmers received other benefits from the existence of the cooperative in their village. This could underestimate the treatment effect of the cooperative as the consumption smoothing benefits of the cooperative lending, might have been shared with non-cooperative vanilla farmers. Similarly, the existence of the cooperative in a village might raise prices for the village as a whole and again underestimate the impacts of the cooperative on price outcomes.

11. Discussion and Policy Recommendations

Based on the results of the above data analysis and focus group discussions, I think it is important to look at the vanilla cooperative in the larger context of the international vanilla market. As international prices rise, cooperative farmers are showing increased confidence in the high and increasing prices they are experiencing year to year. Because of this relatively high market and increases in household income, it could be influencing farmers to make risky investments or pursue nonagricultural endeavors. While I can make no comment on the feasibility of the investments farmers may make, I am concerned that if vanilla prices fall, many vanilla farmers will be left in a dangerous financial

situation. Particularly concerning is the decreasing vanilla and coffee output displayed by those farmers who entered the cooperative.

In an effort to encourage crop diversification, and from suggestions from this experiment, the cooperative recently decided to buy coffee from their member farmers in addition to vanilla. I think this is a good policy moving forward for two reasons. First, as I previously stated, it gives vanilla farmers a second source of income and should in theory, help increase the price of coffee relative to other products. Secondly, coffee and vanilla are often planted on the same plot of land as vanilla is a climbing orchid and requires a host tree. By increasing the potential value of coffee, cooperative members are further encouraged to visit and maintain their farm lands which contain both coffee and vanilla. This could potentially increase production and quality of both goods.

Additionally, I suggest the increased participation of women in the cooperative as there is evidence that they had better overall effects of cooperative enrollment when compared to men. We currently have a requirement that 50% of all elected positions in the cooperative must be held by female members. I would also like to see two trainings held for all subjects of environmental education and health so both heads of the household have the opportunity to attend. Similarly, I suggest further investigating the differential effects of age and location. We are currently working on developing a youth cooperative council to encourage the participation of young farmers in the

cooperative and to promote the transfer of knowledge from older generations to the next generation of farmers.

12. Conclusions

In this paper I present the results of a quasi-experimental design that measures the impact of cooperative enrollment for vanilla farmers in a rural area of Madagascar. This research is particularly interesting because it is measuring the impact of cooperative enrollment, and the bundle of treatments the cooperative offers, on a population that previously had no access or exposure to this kind of intervention.

I find statistically significant reductions in the take up of high interest informal loans for those farmers who chose to enter the cooperative. Take up of high interest informal loans is almost completely eliminated for the treatment group relative to the control group. I also find a correlation between cooperative participation and increased vanilla prices, but reductions in total vanilla output, total coffee output, and total cash crop income resulting from cooperative participation. These results show sensitivity to specific groups as women seem to have been overall better off as a result of cooperative enrollment compared to men. Increases in vanilla price, cash crop income, and vanilla sold, were correlated with cooperative enrollment for women but were negatively correlated with cooperative enrollment for men.

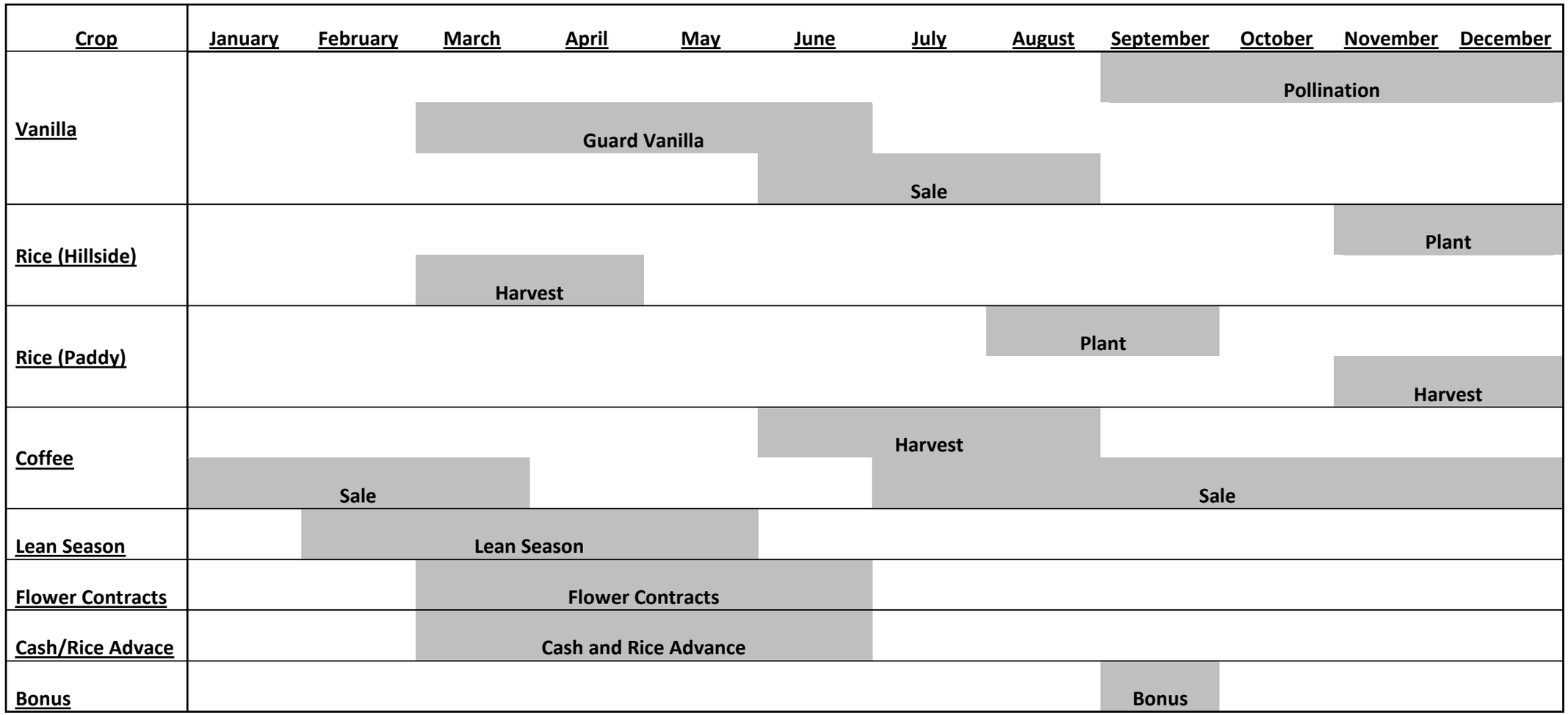
Additionally, farmers over the age of 45 who enrolled in the cooperative showed decreases in average vanilla price, total vanilla production and total cash

crop income when compared to farmers of the same age group who chose not to enroll in the cooperative. These results were not statistically significant but were much larger in magnitude than the negative results found for farmers under the age of 45. This could be an indication that older farmers are less willing to engage in on farm production activities and look at the cooperative as a type of social security or insurance mechanism.

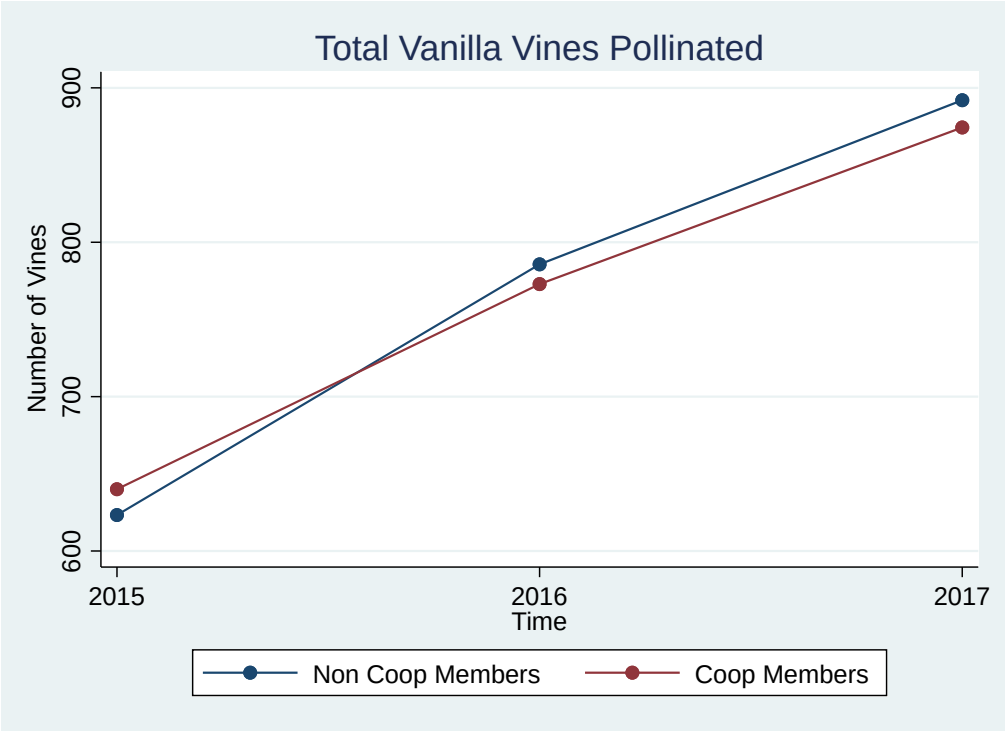
In summary, there is evidence that cooperative enrollment was effective in eliminating flower contracts and increasing vanilla prices for its member farmers but lead to a reduction of vanilla output, coffee output and overall cash crop income. These negative results were mostly driven by males over the age of 45 and women generally experienced positive treatment effects from cooperative enrollment compared to men. Further data collection concerning what farmers were spending their cooperative loans on would help to add evidence to my hypothesis that these loans are leading to more non-agricultural investments or long term investments that are not immediately increasing agricultural output. Additionally, it would be beneficial to collect data from farmers in villages where the cooperative has not yet been offered to have a true control group and to eliminate potential spillover effects.

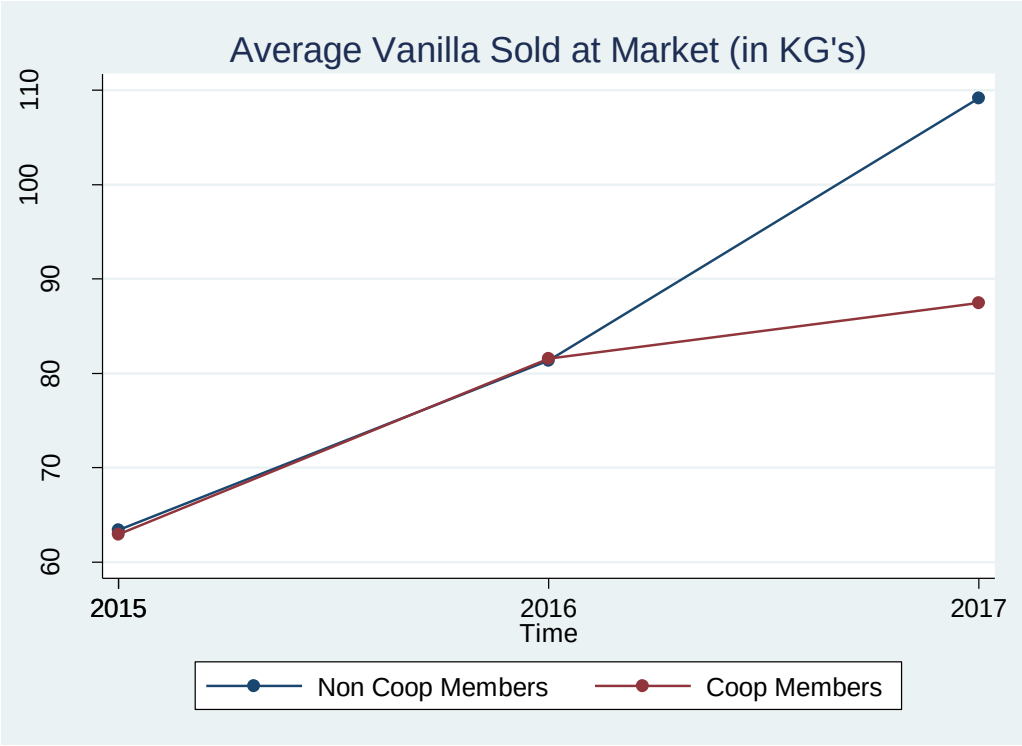
13. Appendix

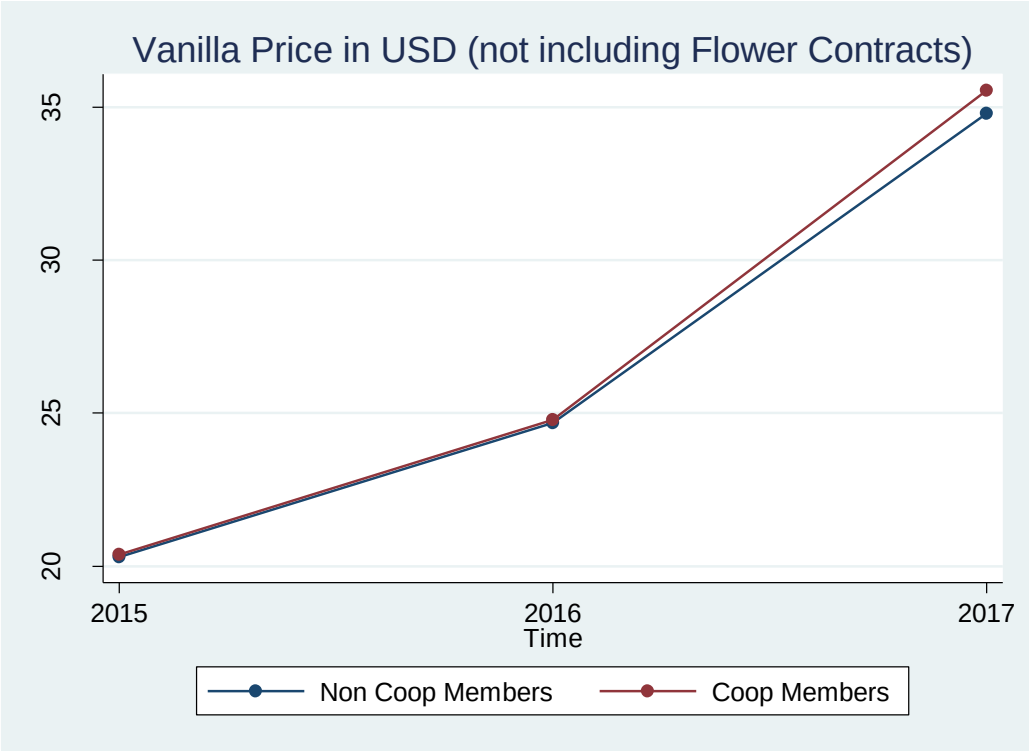
13.1 - Seasonal Chart

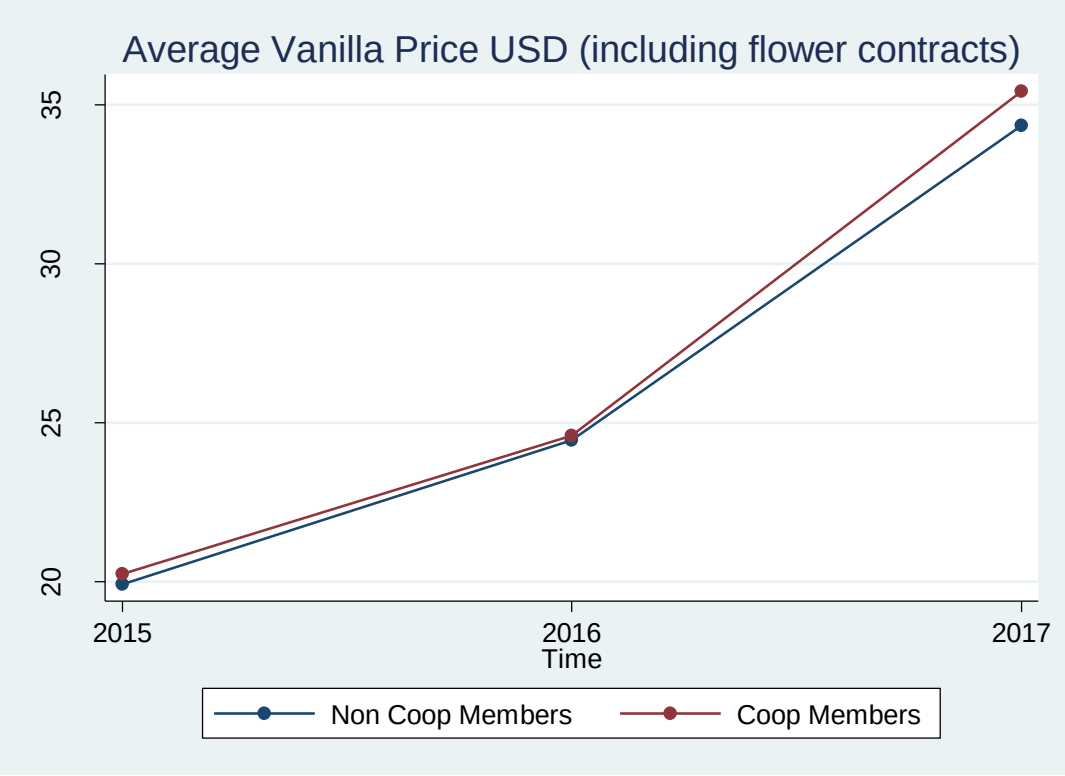


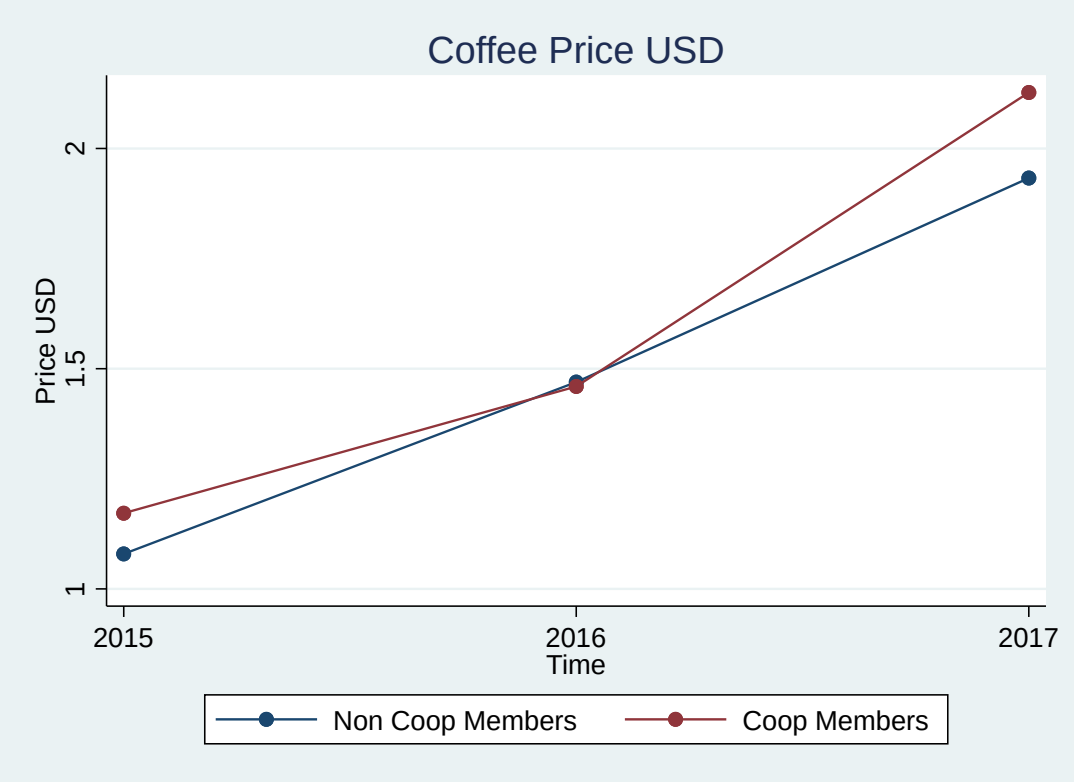
13.2 – Parallel Trends






Vanilla Price in USD (not including Flower Contracts)
35
30
25
20
2015
2016
2017
Time
Non Coop Members
Coop Members


Average Vanilla Price USD (including flower contracts)
35
30
25
20
2015
2016
2017
Time
Non Coop Members
Coop Members


Coffee Price USD
Price USD
1
1.5
2
2015
2016
2017
Time
Non Coop Members
Coop Members

13.3 – Household Survey

Household Survey

Village:	Age:
Profession:	Total Number of People living in your home:
Are you married (or do you live with your partner)?: ☐Yes ☐No	☐Male ☐Female

Of the people living in your home:

How many children: _____

How many children are still in school: _____

How many adults: _____

How many adults still work: _____

Who pollinates your vanilla flowers? _____

What is the highest level of education you completed? _____

Do you own a telephone? ☐Yes ☐No

What is your roof made of? ☐Tin/Metal ☐Organic Matter

Do you own your house or rent? ☐Rent ☐Own

If you rent how much do you pay? _____ AR/month

Did any member of your household need in hospital care this year? ☐Yes ☐No

If yes, why?: _____

What was the total cost for medical care? _____

How did you pay for the medical care? _____

Are you in a vanilla cooperative? ☐Yes ☐No

If yes, what is the name of the cooperative? _____

*** (If members are not in the cooperative) If you were offered entry into a vanilla cooperative would you enter? ☐Yes ☐No

Do you own land? ☐Yes ☐No If yes, how many hectares? _____

Do you plant rice? ☐Yes ☐No If yes, how many hectares? _____

Do you have enough rice for the full year? ☐Yes ☐No

If no, how many months is it not enough (how many months must you buy rice)? _____

During this time, what do you do for rice?

☐Borrow Money ☐Take a flower contract ☐Search for day labor

☐Other_____

Do you own cows? ☐Yes ☐No If yes, how many? _____

Do you own pigs? ☐Yes ☐No If yes, how many? _____

Do you own chickens? ☐Yes ☐No If yes, how many? _____

Who manages the money in your home?

☐Me ☐My husband/wife

☐Other _____

Do you save with an OTIV (village savings and loan association)? ☐Yes ☐No

Do you save with a bank? ☐Yes ☐No

Do you have an active mobile money account? ☐Yes ☐No

If yes, how many years have you used your account? _____

How much money do you have saved in all your accounts combined? _____AR

How much money did you have in your account at this time last year? _____AR

Vanilla Market	**2017**	**2016 (taona lasa)**	**2015 (dimbin'ny lasa)**
Total KG's of Vanilla produced and harvested			
Total number of vanilla producing vines			
Where did you sell your vanilla?	☐ From my home ☐ At the official market	☐ From my home ☐ At the official market	☐ From my home ☐ At the official market
How many total KG's of Vanilla did you sell?			
What was the price per KG you received for your vanilla?			
Did you accept any flower contracts?	☐No ☐Yes, I accepted a flower contract How many KG's _____?	☐No ☐Yes, I accepted a flower contract How many KG's _____?	☐No ☐Yes, I accepted a flower contract How many KG's _____?

	At what Price _____AR	At what Price _____AR	At what Price _____AR
Did you take a rice advance or cash advance? (other than a flower contract)	☐No ☐Yes, rice advance How many sacks of rice? _____ ☐Yes, cash advance How much money?_____	☐No ☐Yes, rice advance How many sacks of rice? _____ ☐Yes, cash advance How much money?_____	☐No ☐Yes, rice advance How many sacks of rice? _____ ☐Yes, cash advance How much money?_____
Whyy did you take the advance?	☐Health emergency ☐To buy food ☐School Fees ☐Other _____ _____	☐Health emergency ☐To buy food ☐School Fees ☐Other _____ _____	☐Health emergency ☐To buy food ☐School Fees ☐Other _____ _____
Did you fully repay your advance?	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Other Types of Cash Crops

Crops	**Cloves**	**Coffee**	**Other: _____**	**Other: _____**	**Other: _____**
2017 Season	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____
2016 Season	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____
2015 Season	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____	KG's _____ Price _____

Additional Work	**Job Description**	**Pay/Income**
2017		☐Every Year ☐ Every Month ☐ Every Day _____AR
2016		☐Every Year ☐ Every Month ☐ Every Day _____AR
2015		☐Every Year ☐ Every Month ☐ Every Day _____AR

What additional cash crops would you like to sell to the cooperative? _____

What percentage of your vanilla was lost/stolen this year (2017)?

☐0% ☐25% ☐ 50% ☐ 75% ☐100%

What percentage of your vanilla was lost/stolen last year (2016)?

☐0% ☐25% ☐ 50% ☐ 75% ☐100%

How do you protect your vanilla?

☐ Sleep in the vanilla fields ☐ Hire guards

☐ Other_____

For how many months do you protect your vanilla? _____

Focus Group Discussion

1. What were the main reasons you entered the cooperative?

2. What did you buy (or what are you planning on buying) with your vanilla money this year? (Including your advance, what did you do with the money?)

3. What changes or development goals would you like to see from your work with the cooperative? (General changes or specific changes in this village)

4. How do you see the cooperative in general? (Likes/Dislikes/Effectiveness)

5. How is live in this village since the cooperative entered? (Farming? Theft? Concerns? Future Actions?)

6. How do you view the vanilla market and future vanilla prices?

Variable Names and Definitions

Variable Name	Definition
VillageCode	20 Total Villages with unique id's for each village
FarmerCode	Unique farmer identifier 1-132
Married	1 if married, 0 if not married
Age	Numeric age in years
TotalHH	Total number of individuals living in the survey respondents home
Sex	1 if male, 0 if female
Kids	Total number of kids living in the survey respondents home
Students	Total number of students living in the survey respondents home
Workers	Total number of workers living in the survey respondents home
Primary	1 if the respondent left school during primary school, 0 if the respondent never attended primary school
Middle	1 if the respondent left school during middle school, 0 if the respondent never attended middle school
Highschool	1 if the respondent left school during high school, 0 if the respondent never attended high school
TifRoof	1 if the respondent has a tin roof, 0 otherwise
cows	Total number of cows owned by the respondents household
chickens	Total number of chickens owned by the respondents household
RiceFieldsHC	Total amount of rice fields in production by the household in a given season in hectares
LandHC	Total amount of land owned by the household in a given season in hectares (other than rice land or vanilla fields)
FemaleMoneyMgr	1 if the female head of household was involved with managing the money activities of the household, 0 otherwise
Theft	1 if the respondent reported any theft of their vanilla crop, 0 if there was no theft
Save	1 if the respondent reported any type of savings, 0 if otherwise
BankUSD	Inflation adjusted bank account value
HospitalCare	1 if any family member needed a hospital visit, 0 otherwise
FamilyMedExp	Total amount of family medical expenses per year
LeanSeason	1 if the household experienced any months were they faced food scarcity or shortage in the given year, 0 otherwise
VinesPollinated	Total amount of pollinated vanilla vines per household in a given season (in KG's)
TotalVanillaSold	Total amount of vanilla sold at the open market in a given season (in KG's)
FlwContract	1 if the household accepted a flower contract in the given year, 0 otherwise
FlwContractKG	Amount of vanilla the household sold as flower contracts (in KG's)

CafeKG	Total amount of coffee in KG's the household sold in a given season
CafePriceUSD	Total price of coffee per kilogram adjusted for inflation to 2015 levels
VanillaPriceUSD	Price of vanilla per KG the household received for their vanilla on the open market
FlwContractPriceUSD	Inflation adjusted price of flower contracts accepted by farmers (adjusted to 2015 levels)
AvgVanillaPriceUSD	(KG's of vanilla sold at market * market vanilla price) + (KG's of vanilla sold as flower contracts * flower contract price) (weighted for the portion sold at the market and the portion sold as flower contracts)
TotalCashCropIncUSD	Total inflation adjusted income coming from the sale of all cash crops (vanilla + coffee + flower contracts)
VanillaIncUSD	(Total KG of vanilla sold * price of vanilla in USD) + (Total number of vanilla KG's sold as flower contracts * Flower contract price)

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