Impact Dynamics of Livestock Assets Transfers in Nicaragua: Evidence from a Randomized Controlled Trial

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Abstract

Using a randomized controlled trial, this paper explores the impact of a livestock assets transfer program on small-scale farmers in Nicaragua. The analysis uses a panel data for a sample of 1,098 farmers, representative of beneficiaries and control groups, to measure impacts on farmers' productivity, income, and food expenditures. In addition, program rollout was used to explore the effects of the treatment intensity overtime. The analysis shows that the project's intervention produced an initial negative shock in productivity that brought about changes in farmers' production behaviors in the early stage. However, in the medium run, income and production improved greatly generating an overall positive impact. These findings suggest that effects from asset transfer programs are gradual since farmers require time to adjust agricultural production practices and obtain positive gains.

Keywords: impact evaluation, duration effect, difference in difference, technical assistance, asset transfer.

I. Introduction

Recently various studies are discussing the importance of access to assets as a means to escape poverty . (Carter, and Barret, 2006, Barret and Swallow, 2006, Jalan & Ravalian, 2002). Transfer of assets such as land, machinery and livestock has been used as an instrument to improve livelihoods, and few studies have proved the effectiveness in achieving this goal (Johnson et al, 2016, Ahmed et al, 2009, Adato, Carter, and May, 2006, Keswell and Carter, 2014). In some asset transfer project evaluations, researchers suggest that the effect of the interventions are not instantaneous but gradual (Adato, Carter, and May, 2006, Keswell and Carter, 2014). In other words, the treatment effect is continuous, as it evolves overtime. . Also, it has been shown that some interventions might actually have a negative short term effect, which is referred as the Ashenfelter dip, followed by long term positive effects (Heckman, 1999). For this reason, it is fundamental to understand the nature of the interventions in order to account for timing and duration exposure when measuring project impacts (King and Behrman,2009; Woolcock,2009)) argue the importance of taking timing and duration of exposure to intervention into account when designing an impact evaluation.

This study aims to contribute to the empirical evidence on livestock transfer programs, by analyzing the project APAGRO, financed by the Inter-American Development Bank and implemented by the Ministry of Agriculture and Forestry (MAGFOR) in Nicaragua. .

This paper is structured as follows, Section 2 presents the background and describes the APAGRO program and Section 3 presents the identification strategy. Section 4 and 5 present the data and the econometric methodology respectively. Section 5 describes the results and Section 6 concludes. 4 presents the results of the analysis and the conclusions are discussed in Section 5.

2. APAGRO

The program APAGRO was designed to improve the limitations and the opportunities identified from the Zero Hunger program (Hambre Cero in Spanish) [1] aimed at improving the food security of small-scale farmer households in Nicaragua, particularly by targeting female producers. APAGRO was implemented in

[1] Based on lesson learned from initial period of Zero Hunger, the new features of APAGRO included: transparent beneficiary selection process, an external verification mechanism and social audit, systemized monitoring and evaluation system, and a decentralized asset transfer (Refer to Barret and Swallow) and technology transfer scheme.

2009 by the Ministerio Agropecuario y Forestal (MAGFOR) until the end of 2012, when the implementation unit was replaced by the Ministerio de Economía Familiar, Comunitaria, Cooperativa y Asociativa (MEFCCA), until 2014. The general goal of the program was to improve household income of low-income farmers in Nicaragua, by targeting women. The objectives of the program included: i) improving productivity of rural families; and ii) improving business management skills of beneficiary households.

The program financed productive asset transfers and technical assistance. Productive assets included livestock and forage as well as materials for corral construction. Beneficiaries could choose among three different livestock packages: i) one cow, one pig, and chickens; ii) one pig, goats andchickens; or iii) one cow, sheeps and chickens[2]. The technical assistance was provided by extension workers , who visited individual households and held group training sessions once a month for a 22-month period. The cost of the productive assets and technical assistance was about US$ 1,400.[3]

In total 21,548 families applied for the program and 11,543 families were accepted to the program. Those accepted were allocated into 223 groups comprised of 45 to 55 beneficiaries. Each group had a technician who held trainings on associativity and agricultural production.

Market-like features were integrated into the provision of program benefits in order to guarantee competition and reduce distortions. For instance, beneficiaries received vouchers to purchase the livestock assets and materials in the chosen markets. In the same manner, farmers had vouchers to pay the extension workers every month in exchange for technical assistance . The extension workers received their payment from the executing unit by submitting the vouchers received as payment by the farmers. In this way, the project ensured that beneficiaries received continuous, high-quality technical assistance.

The elibility criteria for program participation included the following aspects: (i) to have access to at least one manzana of land and maximum 10 manzanas of land (one manzana is equivalent to 0.7 hectares); (ii) not to have been benefited by the Zero Hunger program; and (iii) to be a female producer. Overall, the program

[2] The most demanded package of livestock assets was the cow, pig and chicken combination.

benefited of 11,543 farmers selected in two rounds. The first round of beneficiaries, also called *Conveniencia,* was composed of 4,275 farmers who were selected following the principle of logistical convenience in terms of geographical scope. In other words, these farmers were chosen as a pilot to test the operational arrangements by the executing unit. The second round of beneficiaries (r*andom group),* were randomly chosen to participate in APAGRO.

3. Counterfactual Identification

The most important problems to identify a counterfactual was caused by the selection process which followed a differential approach between two subgroups. As mentioned, the first subgroup was chosen based on the criteria of geographical convenience for logistical purposes while the second subgroup was chosen randomly. These two subgroups of beneficiaries might be systematically different and therefore, comparability might have been compromised. For this reason, the impact assessment is conducted by analyzing the subgroups together and separately.

Specifically, the control group was identified from the pool of applicants to the program which was composed of about 22,000 farmers who registered to participate. Registration lists and databases from the program executing unit MAGFOR were used to identify the control group, which was comprised of households that applied to participate in the program but were not accepted because they did not meet one of the criteria for eligibility. The fact that the control group was not eligible for program participation can be a cause of bias in the estimates of the effects if not controlled. For these reasons, we used a combination of propensity score matching and double differences in order to identify a comparable counterfactual and control for time-invariant unobservable characteristics.

Next we will analyze the comparability of the treated and the control groups, using the both subgroups of beneficiary households (pilot and randomized). Follow, by an analysis of comparability between both subgroups of beneficiary farmers pilot and randomized. It is worth mentioning that a panel data for a sample of 1098 farmers was collected. Specifically, the baseline data was collected in 2011 and the follow-up in 2014.

To solve the abovementioned issues, a combination of Propensity Score Matching and a Difference in Differences methodologies was applied. First, we applied the Propensity Score Matching method to identify those households that were most similar to the beneficiary households in terms of observable characteristics at the baseline Choosing the right covariates is very important in constructing a propensity score model. Caliendo and Kopeinig (2008) argue that the PSM model should include variables that influence simultaneously the program participation decision and the outcome variable, therefore economic theory as well as design and implementation of the project should be considered to structure the PSM model . Considering the selection process and the eligibility criteria as well as the program's objectives, the propensity score was constructed using a probit model and a set of variables that included area of land owned by households, head of household characteristics, distance to market, access to credit, participation in social activities, having access to technical assistance, food insecurity, access to assets such as television, motorbike and cellphones as well as participation in other government projects. The sample of analysis was composed by 1,098 observations out of which 1,070 are used in the analysis (18 observations were outliers and 10 observations were not part of the common support). The descriptive statistics presented in Table 1 confirm the comparability between the treated and the control group for the pooled sample, where the pilot and the randomized subgroups composed the beneficiary group. In fact, only two variables show statistical significant differences at the 5% level: running water in the house and owning a television.[4] The control group has a higher percentage of having running water in the house and a television by 12% and 9%, respectively.

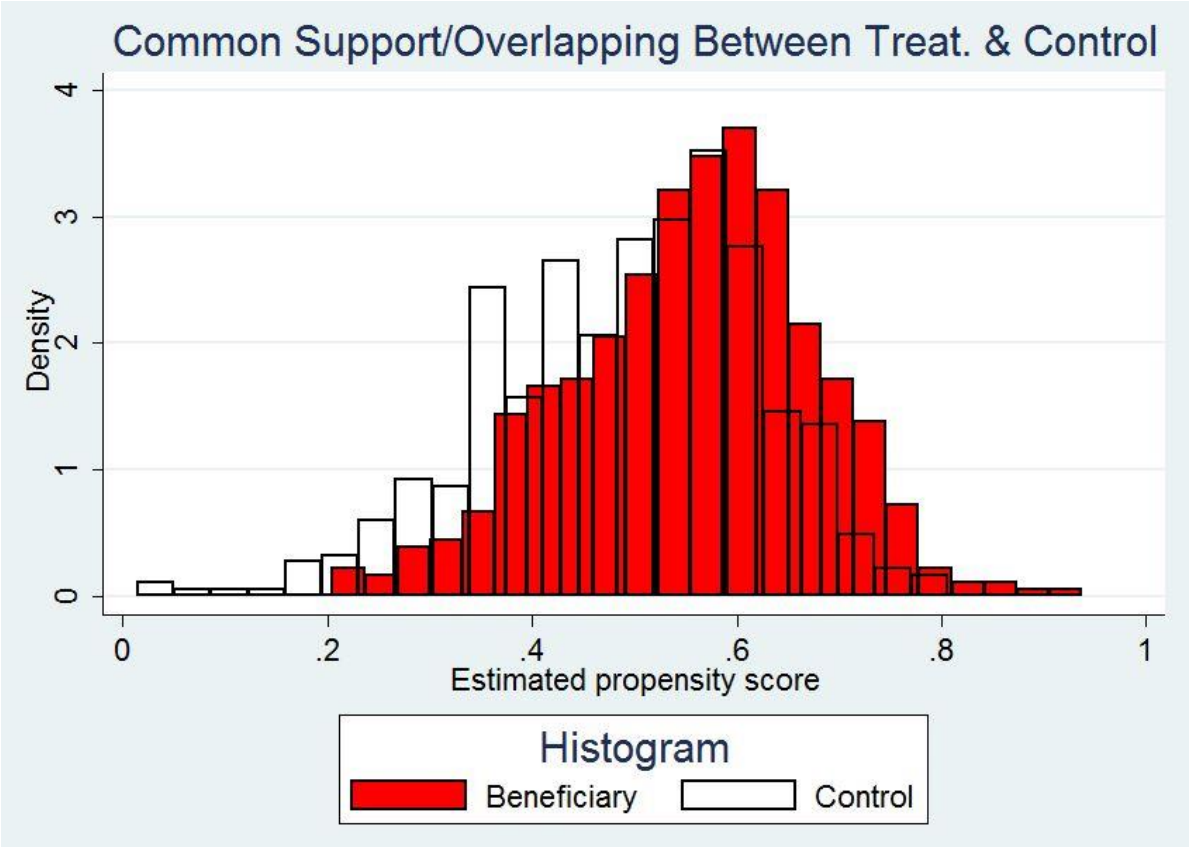


Figure 1. PSM common support between Treatment and Control Group

Next, we explore comparability between the beneficiary subgroups of *Pilot* and *Randomized*, at the baseline. Table 2, shows few significant differences between groups. First, in terms of house characteristics and household assets all variables are balanced except for owning a television. Also, compared to the randomized subgroup, 11% more of the head of households in the *pilot subgroup* are literate. Both groups have similar distance to infrastructure and social facilities with an exception of distance to market, where the pilot group is located 4 km further from markets than the random group. There is no difference in terms of associativity between two groups. Regarding agricultural practices, there are some differences between the two groups. Specifically, pilot group invested more in agricultural production inputs and hired labor than the randomized group (33% and 41%, respectively). Lastly, the ratio of households who faced a food shortage in the year prior to the survey was 12 %higher for the pilot group compared with the randomized group.

Table 1. Descriptive Statistics – Pooled sample

Pooled Sample (Beneficary vs Contol)		Variables(unit)	Total	Beneficiary	Control	Diff in Mean	T-statistics
Household	1	Household Size(# members)	5.31	5.41	5.21	0.20	1.45
House Characteristic, Assets	2	Water Pipe (0,1)	0.49	0.44	0.55	-0.117***	-3.85
	3	Dirt floor (0,1)	0.74	0.77	0.71	0.0635*	2.38
	4	Cell phone (0,1)	0.48	0.49	0.47	0.02	0.57
	5	Television (0,1)	0.45	0.41	0.50	-0.0915**	-3.01
	6	Refrigerator (0,1)	0.12	0.10	0.13	-0.03	-1.31
	7	Motocycle (0,1)	0.06	0.07	0.06	0.01	0.61
Head of Hosehold	8	Woman (0,1)	0.83	0.86	0.80	0.0564*	2.47
	9	Literacy (0,1)	0.64	0.64	0.64	-0.01	-0.20
	10	Education (years)	6.41	6.49	6.31	0.18	0.57
Distance to facilities	11	Distance to road (km)	1.72	1.96	1.46	0.491*	2.02
	12	Distance to market (km)	13.40	13.71	13.06	0.65	0.94
	13	Distance to head city (km)	17.88	17.89	17.87	0.02	0.02
	14	Distance to health center (km)	4.15	4.47	3.79	0.682*	2.37
	15	Distance to primary school (km)	1.21	1.31	1.09	0.22	0.99
Associativity	16	Participation in other project (0,1)	0.19	0.19	0.20	-0.01	-0.37
	17	Participation in local group (0,1)	0.28	0.28	0.27	0.01	0.46
	18	Technical assistance (0,1)	0.16	0.17	0.15	0.02	0.81
	19	Contract farming (1,0)	0.11	0.13	0.09	0.0424*	2.20
	20	Access to credit service (1,0)	0.25	0.27	0.24	0.04	1.35
Agricultural practice	21	Land owned by HH (manzana)	3.89	4.28	3.45	0.822*	2.09
	22	Cultivated land area (manzana)	4.45	4.67	4.21	0.46	1.57
	23	Agricultural input costs (colon/mz)	1913.11	1785.90	2057.06	-271.20	-1.12
	24	Cost for hired labor (colon/mz)	877.61	893.62	859.49	34.12	0.28
	25	Irrigation (1,0)	0.50	0.52	0.48	0.04	1.34
	26	Total Livestock Unit (between 0 and 1)	0.53	0.48	0.58	-0.10	-1.28
Ingresos	27	Income from sales of crop production (colon)	21407.66	25292.81	17011.72	8281.1*	2.05
	28	Value of livestock production (colon)	587.88	499.33	688.08	-188.7*	-2.02
	29	Value of agriculture and livestock production (colon)	30798.85	34107.24	27055.49	7051.8*	2.21
Others	30	Migration (0,1)	0.07	0.05	0.09	-0.0368*	-2.36
	31	Quantity of remittance (colon)	544.79	491.06	605.59	-114.50	-0.57
	32	Food shortage in past year (1,0)	0.60	0.57	0.63	-0.05	-1.78
Productivity	33	Value productivity (colon/mz)	7985.96	8064.77	7896.79	168.00	1.89
N			1070.00	502.00	568.00		
		Difference in means is significant at the *** 1%, ** 5%, * 10% level					

Table 2. Comparative Statistics - Subgroups

Treatment (Conveniencia vs Al azar)		Variables(unit)	Total	Conveniencia	Al azar	Diff in Mean	T-statistics
Household	1	Household Size(# members)	5.41	5.41	5.41	0.00	0.01
House Characteristic, Assets	2	Water Pipe (0,1)	0.44	0.48	0.40	0.08	1.81
	3	Dirt floor (0,1)	0.77	0.75	0.79	-0.04	-1.19
	4	Cell phone (0,1)	0.49	0.50	0.48	0.02	0.40
	5	Television (0,1)	0.41	0.46	0.36	0.108**	2.63
	6	Refrigerator (0,1)	0.10	0.11	0.09	0.02	0.78
	7	Motocycle (0,1)	0.07	0.05	0.08	-0.03	-1.39
Head of Hosehold	8	Woman (0,1)	0.86	0.84	0.88	-0.04	1.41
	9	Literacy (0,1)	0.64	0.69	0.58	0.111**	2.76
	10	Education (years)	6.49	6.98	6.05	0.931*	2.18
Distance to facilities	11	Distance to road (km)	1.96	1.75	2.15	-0.40	-1.09
	12	Distance to market (km)	13.71	15.78	11.82	3.955***	4.13
	13	Distance to head city (km)	17.89	17.35	18.38	-1.02	-0.78
	14	Distance to health center (km)	4.47	4.34	4.59	-0.25	-0.59
	15	Distance to primary school (km)	1.31	1.47	1.17	0.31	0.97
Associativity	16	Participation in other project (0,1)	0.19	0.19	0.19	0.00	0.10
	17	Participation in local group (0,1)	0.28	0.27	0.30	-0.03	-0.90
	18	Technical assistance (0,1)	0.17	0.17	0.16	0.00	0.03
	19	Contract farming (1,0)	0.13	0.13	0.14	-0.01	-0.44
	20	Access to credit service (1,0)	0.27	0.28	0.27	0.01	0.29
Agricultural practice	21	Land owned by HH (manzana)	4.28	3.61	4.88	-1.267*	-2.23
	22	Cultivated land area (manzana)	4.67	4.57	4.76	-0.19	-0.50
	23	Agricultural input costs (colon/mz)	1785.90	2155.71	1448.45	707.3**	2.69
	24	Cost for hired labor (colon/mz)	893.62	1137.32	671.24	466.1**	3.06
	25	Irrigation (1,0)	0.52	0.49	0.55	-0.05	-1.21
	26	Total Livestock Unit (between 0 and 1)	0.48	0.43	0.53	-0.10	-1.18
Ingresos	27	Income from sales of crop production (colon)	25292.81	28236.02	22607.25	5628.80	0.81
	28	Value of livestock production (colon)	499.33	511.94	487.82	24.13	0.23
	29	Value of agriculture and livestock production (colon)	34107.24	33302.68	34841.38	-1538.70	-0.32
Others	30	Migration (0,1)	0.05	0.06	0.05	0.00	0.26
	31	Quantity of remittance (colon)	491.06	291.51	673.13	-381.60	-1.32
	32	Food shortage in past year (1,0)	0.57	0.63	0.52	0.120**	2.89
Productivity	33	Value productivity (colon/mz)	8064.77	8861.03	7338.22	1522.80	1.60
N			568.00	271.00	297.00		

In general, the differences between both groups is small in terms of magnitude which suggests that a priori the beneficiary subgroups are rather comparable. .

4. Econometric Methodology

In this section we explained the different models used to measure the program's impact. Overall, three different models were applied using a difference in differences estimation to control for time-invariant unobservable heterogeneity. Model I is the basic model for this study which considers the pooled sample of the pilot and randomized subgroups. The following equation represents the basic difference in difference method for the pooled sample analysis for continuous outcome variables.

(1) $Y_{it} = \alpha_i + \beta_0 t + \beta_1 D + \beta_2 t * D + \gamma X_{it}^{'} + \varepsilon_{it}$

Where, Y_{it} is the outcome of interest and i denotes household unit and t denotes time period. The α_i represents a household constant, β_0 captures the trend effect in the period between 2011 and 2014. X_{it}' represents the control variables. D represents the treatment dummy and the parameter β_2 captures the difference in difference estimator which is the treatment effect . For discrete outcome variables such as food shortage[5] a Probit model was estimated instead of an OLS model.

In much of the impact evaluation literature, timing and duration of the intervention have not been given enough consideration yet. Most of the literature considers treatment as a dichotomous variable; that is, either treated or not treated at the time of evaluation. However, there are various reasons that this assumption can generate biased treatment effects estimates. One of the reasons is that the effects can be varied among beneficiaries due to the duration, timing, or intensity of the intervention. Therefore, if variation in exposure to the program is not taken into account, the estimated effects can be biased downward since some of beneficiaries might have not reached their full potential of the treatment effect. Especially if program exposure is not random and is directly correlated to the traits of beneficiaries, the underestimation can be a serious issue (King and Behrman, 2008). In the case of APAGRO, the pilot group joined the project earlier than the randomized group. Hence, the randomized group has shorter exposure to treatment than the pilot group.. This fact can be a source of bias estimation; therefore, the variation in duration, timing, and intensity

[5] The values of this variable are either 1 if the household had had food shortage in the previous year of the survey or 0 if it had not had food shortage.

of intervention exposure should be taken into consideration. Model II and Model III are structured to examine the issues mentioned above.

In Model II we analyze the difference in the treatment effect between the two sub groups which is derived from the structure of program rollout as presented in equation 2. r This model includes an interaction term that captures the additional impact (positive or negative) obtained by the longer exposure to treatment faced by the pilot group.

β_1 is the estimator of the overall treatment effect while $\beta_1 + \beta_2$ represents the treatment effect for the pilot group. This will allow us to test whether being more exposed to treatment will have a different impact.

(2) $Y_{it} = \alpha_i + \beta_0 t + \beta_1 t * D + \beta_2 t * D * Pilot + \gamma X_{it}^{'} + \varepsilon_{it}$

In Model III, we incorporate the duration of project participation, which means the number of years since the beneficiary received the program. In fact, it is expected that beneficiaries had a learning period to learn how to utilize their assets in the more efficient manner. This model will allow us to measure whether having longer exposure to treatment has an actual impact. As mentioned, in order to test this hypothesis, we used the number of years that a farmer received technical assistance. Based on the surveys conducted for baseline and follow-up, we could retrieve information on the approximate time of exposure to treatment for each beneficiary. . The maximum amount of years of technical assistance varied from 0-5 years as presented in figure 2. . In fact, as expected, the pilot group received longer exposure to treatment compared to the randomized group. Specifically, the majority of the beneficiaries with more than 3 years of exposure correspond to the pilot group (74% and 68% respectively). The majority of the randomized group received less than 1 year or 2 years of treatment. Finally, for the first year of treatment, the composition was rather balanced between pilot and randomized groups (46% and 54% respectively).

Equation (3) represents model III, it includes four interaction terms to capture different duration effects

(3) $Y_{it} = \alpha_0 + \beta_0 t + \beta_1 t * D * Duration_{1y} + \beta_2 t * D * Duration_{2y} + \beta_3 t * D * Duration_{3y} + \beta_4 t * D * Duration_{4y} + \gamma X_{it}^{'} + \varepsilon_{it}$

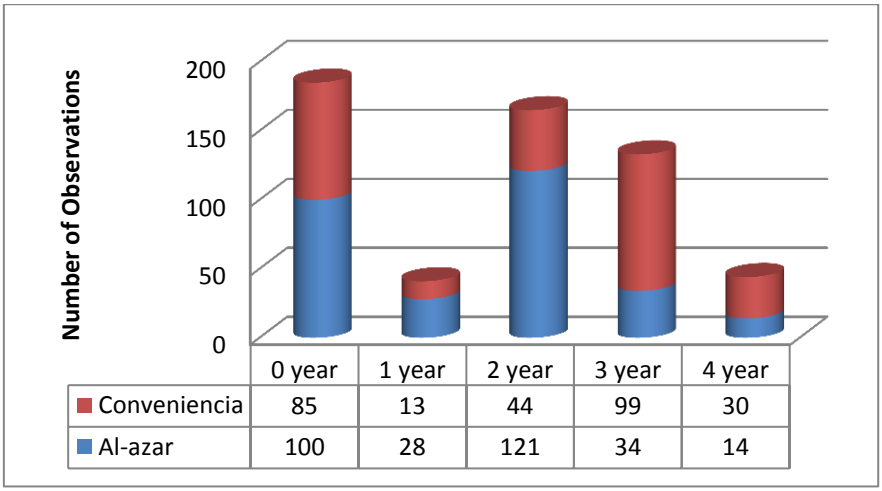


Figure 2. Composition of groups

5. Results

Model I. Pooled sample analysis

In the pooled sample analysis we could find few significant impacts of the project on beneficiary farmers, mostly related to livestock production. Table 2 shows average treatment effect on outcome variables with statistical significance. Appendix 3 shows the full result of Model I.

Table 2. Average treatment effect on treated

Technology Adoption -Livestock	Total Livestock Unit	Animal Product Sales Income	Livestock Investment	Ratio - Livestock production / Agriculture production
2.09***	1.25***	204***	1,505***	0.099***
(0.126)	(0.136)	(46.42)	(176.3)	(0.0161)

First, beneficiary group adopted 2.09 more livestock related technologies than control group which is expected. Also beneficiary group increased its total livestock[6] unit by 1.25compared to the control group. Aforementioned effects are self-explanatory in that the project directly provided the livestock and technical assistance in livestock production to the beneficiaries, therefore the results can be interpreted as a successful

[6] Total Livestock Unit (TLU) is an indicator quantifying various livestock resource into a uniform unit. Livestock Units are 'exchange ratio' among livestock species and obtained by converting the body weight into metabolic weight (Chilonda and Otte, 2006). For example, coefficient of a unit of cattle, sheep, goat, pig, and chicken are 0.7, 0.1, 01, 0.25 and 0.01 respectively.

delivery of project components. It is also intuitive that beneficiary farmers increased their investment in livestock production . However, there was no significant difference in value of livestock production between beneficiary and control groups(Appendix 3); however the estimated average effect on sales from animal products is significantly positive, 204 Córdobas.[7] The fact that beneficiary achieved better animal product sales despite no significant production volume increase compared to control group indicates that beneficiary farmers might have achieved improvement in marketing of animal products. Although neither significant nor great in magnitude, there is general tendency of negative effect in most of income variables including total income, net income, and crop sales income for the beneficiary group (Appendix 3). Nevertheless, this model does not consider the exposure to treatment or the difference between the pilot and the randomized groups.

Model II. Pilot vs. Randomized Groups ,

Model II exploits the fact that the pilot group has a longer exposure to treatment. . The results from model II show that, compared to the control group, beneficiary groups had larger animal product sales, increased their Total Livestock Units and the ratio of livestock production over agriculture. However, the pilot group presents better results compared to the randomized group. Specifically, compared to the randomized group, the pilot group increased their net income, obtained higher value of livestock and agricultural production (higher productivity), reduced food expenditures (probably due to home consumption from livestock and agricultural production) and increase their livestock production with respect to agricultural production. This might suggest that effects from project participation are initially negative but compensated with exposure to program overtime which might be due to experience and learning from doing effects. A possible hypothesis, however, is that there might have been systematic differences between pilot and randomized groups that caused better outcomes for the first group of farmers. On the other hand, the differential effects might have been caused by the different exposure to treatment. The following results will allow us to determine the cause of the impacts.

Model III. Exposure to treatment

[7] Animal product sales include sales of milk, cheese, meat and eggs.

In model III we test whether the effects of the intervention evolve along with the duration after treatment. However, to test this hypothesis it is crucial to examine potential differences between the different cohorts. Table 5 suggest that the differences among cohorts are very small or inexistent and therefore, any difference in impact among these groups might have been due to program exposure. As graphs 1 and 2 show total and net income have upward sloping trend along the duration with remarkable dip on year 2, followed by sharp recovery. This gradual income improvement over duration with a dipping in earlier stage is consistent with the argument that the impact of asset transfer and technical assistance program will be gradually in effect rather than instantaneous. (Keswell and Carter, 2014) There are number of literatures showing pre-project dipping effect and dynamic of project effect along the duration (Keswell 2014, Carter 2006, Adato 2006, Heckman 1999). Each intervention of the literatures is unique, and to our knowledge (to be confirmed more carefully) there has not been a literature on impact evaluation using duration as a main component of analysis on the asset transfer and technical assistance combined kind project. Interpretation of the dipping effect on the 2 year group is susceptible to be subjective, and should consider the nature of the project. We remind that the project aimed to benefit farmers who do not have large quantity of livestock unit, therefore the target beneficiaries were mostly crop producers rather than livestock producers. The intervention however was livestock production assets transfer and technical assistance for the livestock production. In a way, the intervention acted as a shock for the beneficiary which affected their production behaviors (function). The shock was prevalent on the 2 year group since they started to include livestock production in their production function and invest input into the livestock production more intensively compared to 1 year group; however their skills and experience was not mature enough to generate the optimal outcome yet as 3, 4 year group achieved later. In other words, they were off from the optimal efficiency in their agricultural production. After 2 years of participation in the project, however, they recover back to efficient production function; especially 4 year group becomes highly efficient in generating income. As an evidence, we see that the coefficient of livestock production input of 2 year group is significantly higher than average of 4 groups by 42 %.

Table 3. Treatment effect estimates of Model II - subgroup analysis

VARIABLES	Animal Product Sales Income	Net Income	Hired Labor Input	Livestock Inputs	Value of Livestock Production	Net Value Productivity - Crop	Food Expenditure per Capita	Food Expenditure per HH	Total Livestock Unit	Technology Adoption -Livestock	Ratio Livestock / Agriculture
D*t	212.8***	-10,240**	282.0*	2,071***	-608.2***	-900.7	11.79**	63.40***	1.472***	2.318***	0.0898***
	(55.44)	(4,814)	(156.8)	(208.0)	(226.0)	(974.5)	(5.127)	(23.54)	(0.162)	(0.149)	(0.0192)
D*t*Pilot	-18.19	11,897**	-461.2**	-1,198***	1,180***	1,969*	-12.63**	-72.08***	-0.466**	-0.482***	0.0195
	(64.03)	(5,560)	(181.1)	(240.3)	(261.1)	(1,126)	(5.922)	(27.19)	(0.187)	(0.172)	(0.0222)
D*t + D*t*Pilot	194.61	1657	-179.2	873	571.8	1068.3	-0.84	-8.68	1.006	1.836	0.1093

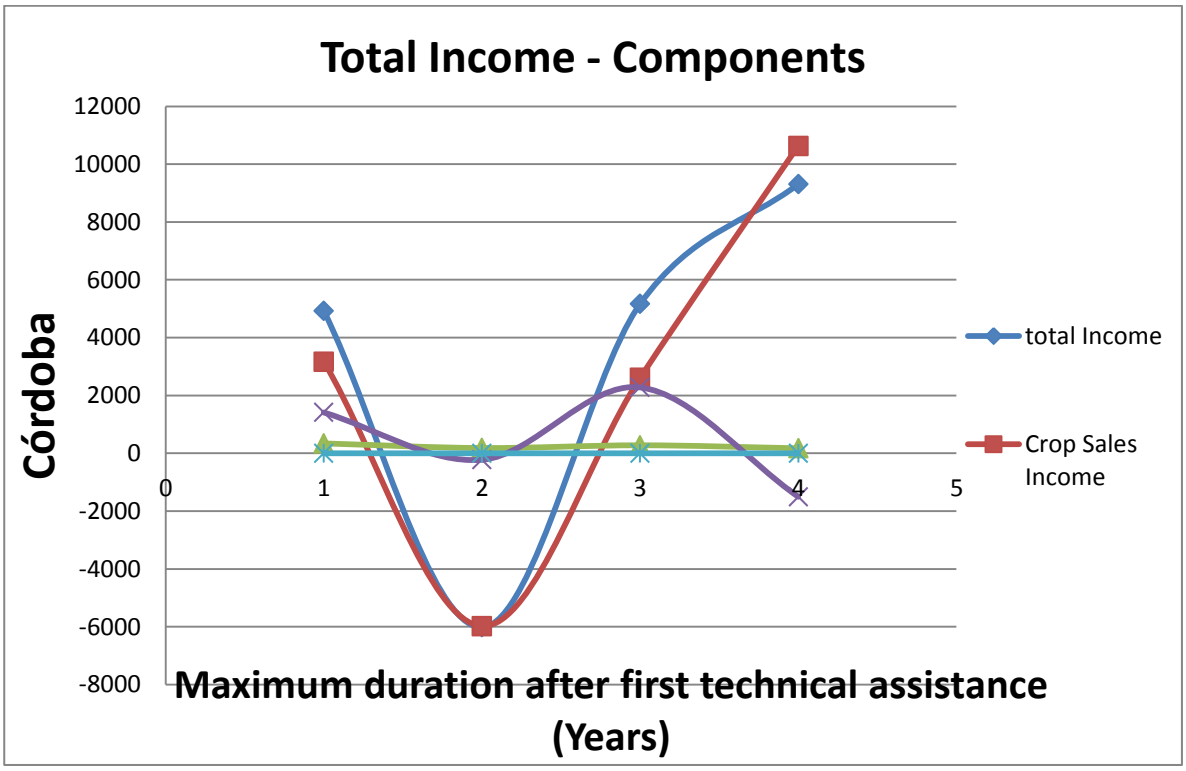
Notes:

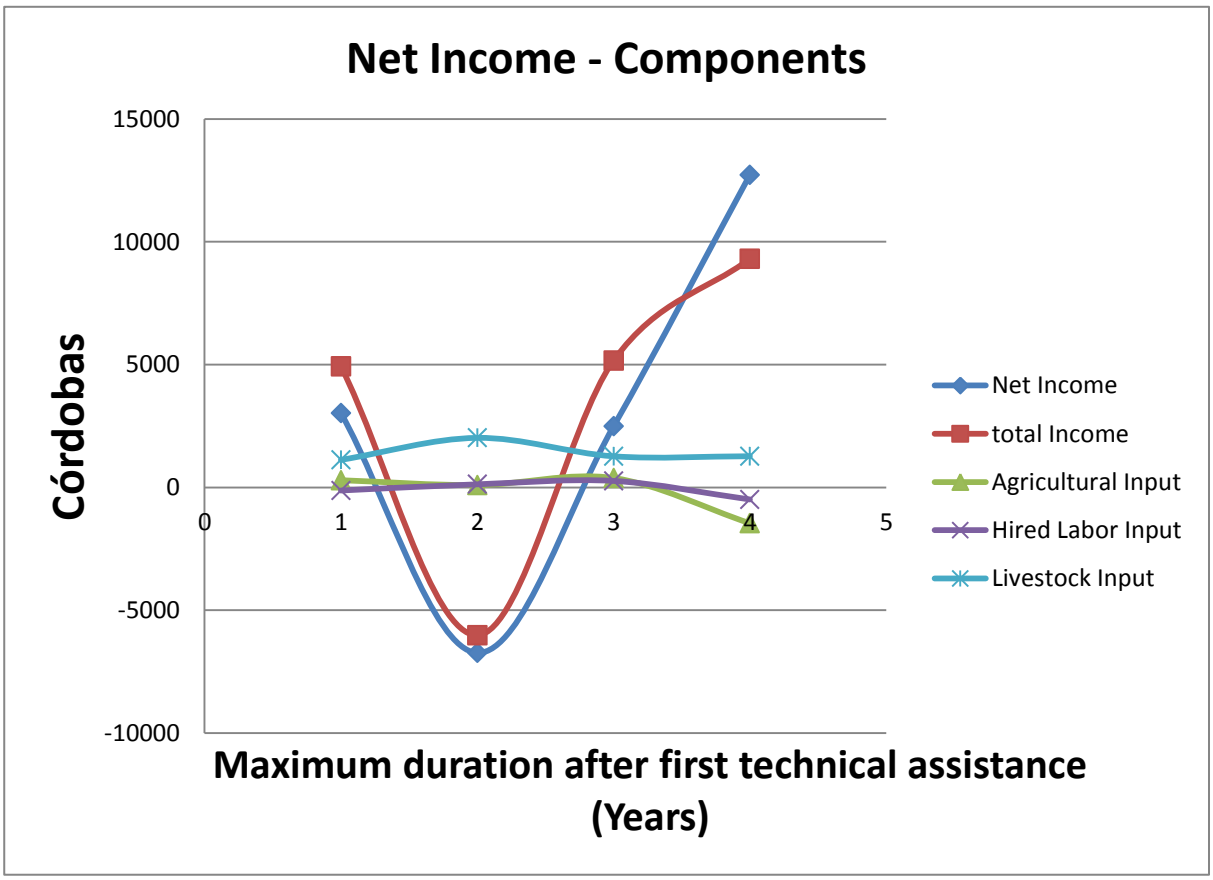
The stars mean statistical significance level: *** = significant at 1% level; ** significant at 5% level; * significant at 10% level

The coefficients for D*t variable can be interpreted as the overall effect , and D*t*Pilot is additional effect for Pilot group. Therefore, the fourth row sum of the coeffients of D*t and D*t*Conveniencia _dummy are treatment effect estimates of Conveniencia group.

Table 5. Descriptive Statistics – Model III.

		Descriptive Statistics - Comparison between subgroups.									
	Variables(unit)	**1 year vs 0 year**	**2 year vs 0 year**	**3 year vs 0 year**	**4 year vs 0 year**	**1 year vs 2 year**	**1 year vs 3 year**	**1 year vs 4 year**	**2 year vs 3 year**	**2 year vs 4 year**	**3 year vs 4 year**
1	Household Size(# members)	-0.663	0.163	-0.0262	0.287	0.826*	0.637	0.950*	-0.189	0.124	0.313
2	Water Pipe (0,1)	-0.0936	-0.0231	-0.0309	-0.0276	0.0705	0.0627	0.066	-0.00779	-0.00455	0.00325
3	Dirt floor (0,1)	-0.0033	0.0526	-0.107*	0.0117	0.0559	-0.104	0.015	-0.160**	-0.0409	0.119
4	Cell phone (0,1)	0.0691	-0.0192	0.0419	-0.151	-0.0882	-0.0271	-0.220*	0.0611	-0.132	-0.193*
5	Television (0,1)	0.0228	-0.0526	0.0274	-0.00713	-0.0754	0.00458	-0.0299	0.08	0.0455	-0.0345
6	Refrigerator (0,1)	0.0247	-0.0124	0.0531	-0.0518	-0.0371	0.0284	-0.0765	0.0655	-0.0394	-0.105
7	Motocycle (0,1)	-0.0729	-0.0306	-0.0597*	-0.0291	0.0423	0.0132	0.0438	-0.0291	0.00152	0.0306
8	Woman (0,1)	-0.0464	0.00311	-0.0336	-0.0802	0.0495	0.0128	-0.0338	-0.0367	-0.0833	-0.0467
9	Literacy (0,1)	0.0127	0.131*	-0.00862	0.057	-0.144	-0.0213	0.0443	0.122*	0.188*	0.0656
10	Education (years)	-0.735	1.457**	0.0928	0.207	-0.722	0.827	0.941	1.550*	1.664	0.114
11	Distance to road (km)	-0.371	-0.0443	0.104	-0.0646	0.327	0.475	0.306	0.149	-0.0204	-0.169
12	Distance to market (km)	-2.86	0.0423	2.931*	0.651	2.903	5.791*	3.511	2.888*	0.609	-2.279
13	Distance to head city (km)	-5.242*	2.568	2.052	0.208	7.810**	7.295**	5.45	-0.516	-2.36	-1.844
14	Distance to health center (km)	-0.16	-0.191	-0.682	-0.537	-0.031	-0.522	-0.376	-0.491	-0.345	0.145
15	Distance to primary school (km)	1.880**	0.197	0.409	-0.182	-1.683	-1.471	-2.062	0.212	-0.379	-0.591
16	Participation in other project (0,1)	0.0844	0.0406	0.136**	0.0694	-0.0438	0.0512	-0.015	0.0949*	0.0288	-0.0661
17	Participation in local group (0,1)	0.131	0.0375	0.0037	0.036	-0.0933	-0.127	-0.0948	-0.0338	-0.00152	0.0323
18	Technical assistance (0,1)	0.0736	0.0116	0.042	0.0131	-0.0619	-0.0315	-0.0604	0.0304	0.00152	-0.0289
19	Contract farming (1,0)	-0.0104	-0.0416	-0.0365	-0.0431	-0.0312	-0.026	-0.0327	0.00515	-0.00152	-0.00666
20	Access to credit service (1,0)	-0.0264	0.00246	0.0154	-0.0203	0.0288	0.0418	0.0061	0.013	-0.0227	-0.0357
21	Land owned by HH (manzana)	-1.33	-0.175	-0.666	-1.365	1.156	0.665	-0.0346	-0.491	-1.19	-0.699
22	Cultivated land area (manzana)	-0.666	0.155	0.482	-0.479	0.822	1.148	0.187	0.327	-0.635	-0.961
23	Agricultural input costs (colon/mz)	-180.6	183.1	-177.7	1423.8*	363.7	2.87	1604.4	-360.8	1240.7	1601.5*
24	Cost for hired labor (colon/mz)	7.114	-114	-219.8	234.2	-121.2	-226.9	227.1	-105.8	348.2	454
25	Irrigation (1,0)	-0.142	0.108*	-0.162**	-0.06	0.0336	-0.0198	0.082	-0.0534	0.0485	0.102
26	Total Livestock Unit (between 0 and 1)	0.212	-0.210*	0.228*	0.318	-0.00213	0.0155	0.106	0.0177	0.108	0.0907
27	Income from sales of crop production (colon)	-25996.3	-15286.4	-19311.4	-21320.6	10709.9	6684.9	4675.7	-4025	-6034.2	-2009.2
28	Value of livestock production (colon)	29.81	195.6	194.2	250.8	165.8	164.4	221	-1.473	55.12	56.6
29	Value of agriculture and livestock production (colon)	-21749.8*	-9979.5	-15785.7*	-15218.8	11770.3	5964.2	6531	-5806.1	-5239.3	566.8
30	Migration (0,1)	0.0705*	0.0396	0.0331	0.0184	-0.0309	-0.0374	-0.0521	-0.00652	-0.0212	-0.0147
31	Quantity of remittance (colon)	1088.3	209.3	379	182	-879	-709.4	-906.3	169.7	-27.25	-196.9
32	Food shortage in past year (1,0)	0.118	0.102	0.11	0.213*	-0.0158	-0.00825	0.0948	0.00756	0.111	0.103
33	Value productivity (colon/mz)	-3026.60	-1073.90	-2295.7*	1320.90	1952.70	730.90	4347.50	-1221.80	2394.80	3616.60
	N	226	350	318	229	206	174	85	298	209	177


Total Income - Components
12000
10000
8000
6000
4000
2000
0
-2000
-4000
-6000
-8000
0
1
2
3
4
5
Córdoba
total Income
Crop Sales Income
Maximum duration after first technical assistance (Years)


Net Income - Components
15000
10000
5000
0
-5000
-10000
0
1
2
3
4
5
Córdobas
Net Income
total Income
Agricultural Input
Hired Labor Input
Livestock Input
Maximum duration after first technical assistance (Years)

Total Income

First, we present the estimated effects of intervention on total income variable[8]. We can obtain treatment effect coefficients for the exposure to treatment by adding interaction terms to the base effect coefficient (D*t). Table 4 presents the coefficients for the variables of interest; crop sales income, animal product sales income, other income and food consumption from own production. The coefficients for year 1 to year 4 are calculated as the sum of the base coefficient plus the previous years. Hence, the triple difference represents the additional impact for each year of exposure to treatment.

Table 4. Treatment effect estimates – Total Income and its component variables

Group	total Income*	Crop Sales Income*	Animal Product Sales Income**	Other Income*	Consumption of own Production
(D*T)	-11,714*	-9,994*	147.9**	-1,868*	0.344
1 year	4928	3171	342.3	1413	0.896
2 year	-6016	-5976	183.39	-223	-0.161
3 year	5165**	2608	277.9	2279***	0.526
4 year	9306*	10633*	174.27	-1501.6	-0.127

Notice that cohorts in years 1, 3 and 4 have positive coefficients of total income and crop sales whereas 0 year and 2 year group have negative estimates. Especially 3 year and 4 year cohorts obtained significantly higher total income than the control group by 5,165 and 9,306 Cordobas respectively. All groups showed positive animal product sales income. Year 3 cohort has significant income from other activities than agriculture by 2,279 Cordobas. Consumption of own production does not have any significant nor noticeable coefficients. These results support the hypothesis that longer exposure to treatment generate income gains after an initial drop. .

Table 5. Treatment effect estimates – Net Income and its component variables

Group	Net Income**	total Income*	Agricultural Input	Hired Labor Input	Livestock Input***
(D*T)	-13,485**	-11,714*	599.0	30.53	1,351***
1 year	3025	4928	295.2	-124.37	1123.5***
2 year	-6732	-6016	96.4	127.7	2018.6**

[8] Total income = Crop Sales Income + Animal Product Sales income + Other Income + Consumption of own product

3 year	2490**	5165**	383.4	265.53	1267.48
4 year	12723**	9306*	-1459***	-489.17	1271.02

Net Income

Net income[9] shows efficiency of household in generating income; therefore by comparing the groups we can observe the evolvement of efficiency of households' production as they have longer exposure. .

Table 5 shows the estimated effect on net income and its component variables. Group 1 year, 3 year and 4 year gained 3,025 Córdobas, 2,490 Córdobas and 12,723 Córdobas more than the control group respectively. On the contrary, group 0 year and 2 year gained 13,485 Córdobas and 6,742 Córdobas less than the control group. Looking at the input sides, we can see that all group increased their input expenditure on livestock production. Especially, 2 year group has increased its input investment almost twice as other groups. The performance in production and sales of 2 year group however, it is not better than other group in terms of livestock production and animal sales income (table 4). Moreover, they generated less crop sales income than other groups. It indicates that 2 year group had changed its production function, however the change had not reached high efficiency, at least at the time of the survey. The other outstanding value is drastic reduction of agricultural input of 4 year group. Despite the reduction in input cost, the beneficiaries of group improved their crop sales income notably. As a result, 4 year group enjoyed much higher net income than any other group.

Food expenditure and food shortage.

One of the main goals of the project was improving farmer's nutrition through production of animal product. Table 6 shows the treatment effect on food expenditure and the incidence of food shortage. Although food expenditure shows no significant effect when we analyze it by duration, the coefficients are positive which means that all groups had increased their food expenditure compared to control group. In the figure 3, we observe that it showed U shape trend.

Looking at food shortage[10], we see mixed signs of coefficient. Group 0 year, 1 year, and 2 year have positive coefficient which mean they had increased rate of food shortage incidence than control group.

[9] Net Income = Total Income – Crop Production Input – Hired Labor Input – Livestock Production Input

[10] Surveyed households were asked if there had been food shortage at any point of the previous year with binary answers (If yes 1, no 0)

Group 4 year showed significantly negative coefficient meaning that the group has reduced the rate of food shortage incidence. Figure 3 shows decreasing trend of food shortage incidence over duration.

Table 6. Treatment effect estimates – Food Expenditure and Food Shortage

	Food Expenditure	Food Shortage
0 year	13.49	0.138
1 year	67.97	0.274
2 year	36.3	0.031
3 year	24.25	-0.005
4 year	51.07	-0.482***

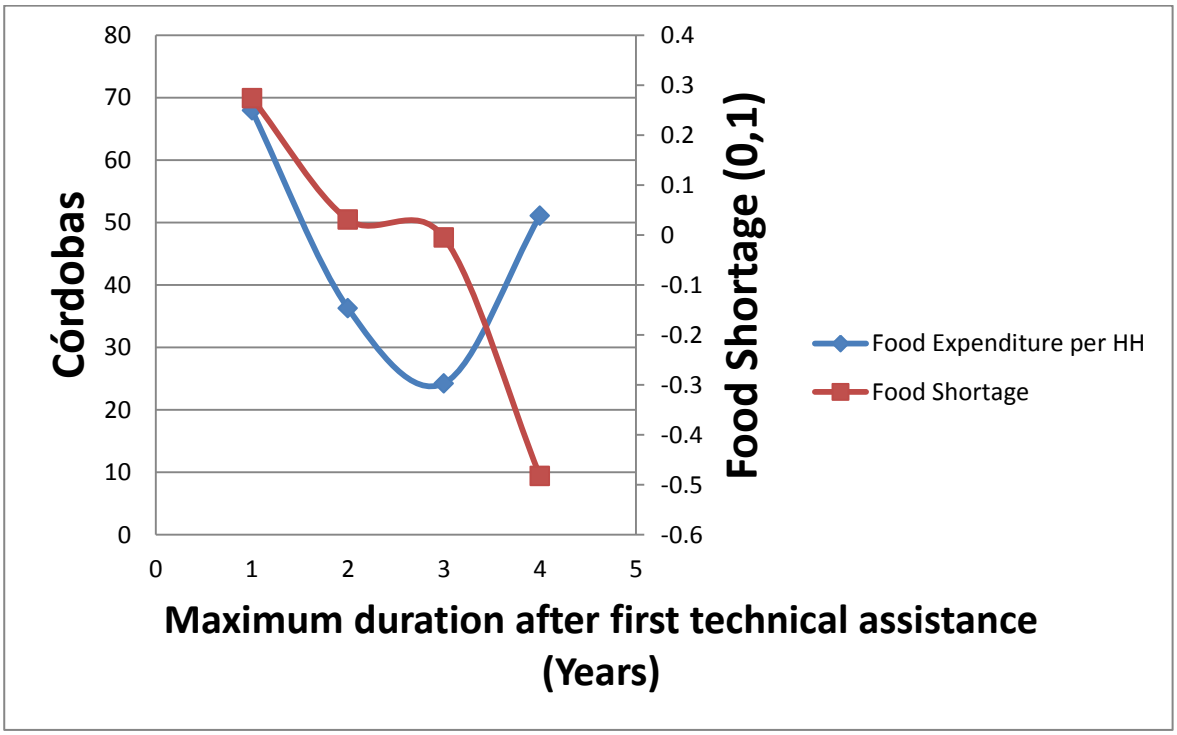


Figure 3. Food Expenditure and food shortage

Internal spillover effect

As shown in the graph x, we can see that the total income has moved along with the crop sales. Animal sales income is meager in terms of the magnitude and does not contribute greatly to the total income. Therefore,

we can conclude that crop sales were the main factors which drive the total income of the households. The project targeted farmers who were not participating livestock production, so most of the farmers did not have significant number of livestock.(Households with certain number of livestock were not eligible for the project. For example, if a farmer had a cow he would have not been eligible for the project.). However the results mentioned above indicate that farmers benefited in their crop production greatly. We suspect that there has been internal spillover effect between two production systems; crop and livestock production. The explanation for the spillover effect is the complementary nature of crop production and livestock production.. Animals, especially bovines can provide traction power improving work efficiency and dungs of cows and chicken can be used as a fertilizer. In addition, gains from livestock sales might have been used for inputs in agricultural production. In addition, it is also possible that socialization activities through technical assistance might have improved associativity and marketing of agricultural products.

6. Conclusion

This paper presents the results from a rigorous impact evaluation of the APAGRO program, implemented in Nicaragua. The APAGRO program targeted small female farmers with high food insecurity and low livestock holdings. The results from a difference in difference estimation show that exposure to program was the key to generate program's impacts. In fact, simple analysis did not show the full picture of the treatment effect of program. The reason is that fraction of the beneficiaries have not reached the full potential of the treatment effect . Two sub group analyses confirm the importance of exposure to program. In fact, .beneficiaries' income increased overtime with a dipping phenomenon between a year 1 and year 2. This dipping effect indicates that there had been shift in the farmers' production decision and negative shock in production efficiency. Following steady and sharp increase in income after year 2 tells us that farmers achieved higher production efficiency in the long run.

Agricultural production technology transfer through extension service appeared to be a crucial component of the program. There had been significant and big difference in income gain between beneficiaries who received both livestock asset and technical assistance and beneficiaries who received only the asset but not the technical assistance. It indicates that agricultural extension service is an effective instrument to improve farmers' productivity and income. Additionally, market-featured extension service scheme was effective in

assuring continuous and high quality of the technical assistance. The fact that the intervention not only increased animal product sales but also crop sales indicate there has been internal spill-over effect between two production systems. In addition, it is worth mentioning that human capital and gender perspectives are important features to be considered when analyzing the impact of APAGRO. . The program not only empowered beneficiaries, most of whom were women, , but also strengthened the capacity of the extension service workers strengthening extension services and institutional capacity in the country.

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Viquez (2011)

NITLAPAN

Magfor (2013)

FAO

Appendix 1. PSM variables and rational

	PSM variables	comments
1	sexo	Gender was one of eligibility criterias
2	Celular	It may affect the possibility of hearing about the project. Also Celular can be correlated to outcome variable such as income
3	Televisor	It may affect the possibility of hearing about the project. Also Celular can be correlated to outcome variable such as income
4	Moto	Moto can provide better mobility to HH, thus it might increase possiblity of participation to projects. Also can be correlated with outcome variables.
5	Literacy	Literate people can have higher chance of participation. Same for incomes and other outcome variables.
6	educacion	Education can increase possiblity of particpation to project. Also it is correlated to outcome variables.
7	Dist_Ct_Sld_km	Project registration was occurred in health center, schools, etc. Therefore the distance could have affected on participation. Also these variables could affect outcome variables.
8	Dist_Escl_Prm_km	Project registration was occurred in health center, schools, etc. Therefore the distance could have affected on participation. Also these variables could affect outcome variables.
9	Particip_otro_Pryt	One of criterias of elegibility was previous participation in other PPA. Also it could affect outcome variables.
10	Particip_Comite_Lcl	Participation in local comite can increase the chance of participation in the project. Also can affect outcome variables.
11	Asstc_Tcnc	Having been assited by extension service could increase the chance of participation in the project. Also can affect outcome variables.
12	Area_tierra_propia	area of land is one of the criterias. Also correlated to outcome variables.
13	area_cltvd_P_29	cultivated area is correlated to area of land, which is one of the criterias. Also correlated to outcome variables.
14	escasez_alimento	Since the project is targeting small farmers, it is possible that beneficiaries tend to be food insecure. It is also correlated to outcome variables.
15	Venta_por_Contrato	It means they have better information and connection to market which can increase the possibility of participation. Also correlated to outcome variables.
16	Acceso_Credito	It cam mean they are relatively better off and well connected. Also correlated to outcome variables.
17	Total_Livestock_Unit	It is one of criterias. Also correlated to outcome variables
18	conveniencia_dummy	The conveniencia beneficiario group was chosen for its convenience in administration. It might have correlation with outcome variables
19	esteli	Although it is not very clear it is possible that departments had affected the participation decision. Regions are usually related to outcome variables.
20	Jinotega	Although it is not very clear it is possible that departments had affected the participation decision. Regions are usually related to outcome variables.
21	Matagalpa	Although it is not very clear it is possible that departments had affected the participation decision. Regions are usually related to outcome variables.
22	Value of Agricultural Production	
23	Value Productivity per Manzana	

Explain that we used values of those variables at the baseline.

Appendix 3 – Model I Regression Result

VARIABLES	total Income	Crop Sales Income	Animal Product Sales Income	Other Income	Consumption of own Production	Net Income	Agricultural Input	Hired Labor Input	Ag Input+Labor Input	Livestock Input	Value of Agricultural Production	Value of Livestock Production	Net Value Productivity-Crop	Food Expenditure per Capita	Food Expenditure per HH	Food Shortage	Ratio Livestock / Agriculture	Total Livestock Unit	Days of Farm Working	Technology Adoption - Livestock	Reproduction Skills
int_dXperiod	-3,327	-3,374	204.2***	-157.5	0.241	-4,615	223.2	63.92	287.2	1,505***	12.99	-49.96	30.47	5.821	29.32	0.0622	0.0990***	1.251***	-3.677	2.090***	-0.337
	(4,365)	(4,281)	(46.42)	(798.3)	(0.603)	(4,040)	(266.1)	(131.7)	(331.6)	(176.3)	(3,741)	(191.1)	(817.2)	(4.303)	(19.78)	(0.0387)	(0.0161)	(0.136)	(7.045)	(0.126)	(0.723)
period	-253.7	-1,082	-35.14	863.3	0.216	4,079	-464.9**	-433.2***	-898.1***	-64.24	-4,385	-58.81	-331.3	-30.27***	-158.5***	-0.188***	-0.0427***	0.0750	40.01***	-0.393***	-2.431***
	(3,324)	(3,260)	(35.35)	(607.8)	(0.459)	(3,076)	(202.6)	(100.3)	(252.5)	(134.2)	(2,849)	(145.5)	(622.2)	(3.276)	(15.06)	(0.0295)	(0.0122)	(0.104)	(5.364)	(0.0956)	(0.550)
Piso_tierra	9,923*	10,836**	55.00	-968.0	0.0906	8,654*	217.1	-70.45	146.7	22.73	3,658	-144.7	208.7	4.874	5.438	-0.0255	-7.91e-05	-0.166	-1.119	-0.132	-0.281
	(5,570)	(5,463)	(59.23)	(1,019)	(0.769)	(5,154)	(339.5)	(168.0)	(423.1)	(224.9)	(4,773)	(243.8)	(1,043)	(5.490)	(25.24)	(0.0494)	(0.0205)	(0.174)	(8.988)	(0.160)	(0.922)
Celular	2,394	2,501	94.09**	-201.1	0.230	682.4	38.92	16.79	55.71	313.6**	-315.5	-86.29	-345.4	7.766**	66.39***	0.00249	0.0105	0.109	3.993	0.151	-1.422**
	(3,701)	(3,630)	(39.36)	(676.9)	(0.511)	(3,425)	(225.6)	(111.7)	(281.2)	(149.4)	(3,172)	(162.0)	(692.9)	(3.648)	(16.77)	(0.0328)	(0.0136)	(0.116)	(5.973)	(0.106)	(0.613)
Radio	4,492	3,191	13.08	1,288*	-0.0664	4,082	21.26	-0.0578	21.20	182.8	1,901	-197.6	392.1	-9.120**	-33.42**	0.000902	0.00709	-0.00724	-1.093	0.0205	-0.814
	(3,735)	(3,663)	(39.72)	(683.0)	(0.516)	(3,456)	(227.7)	(112.7)	(283.7)	(150.8)	(3,201)	(163.5)	(699.2)	(3.681)	(16.92)	(0.0331)	(0.0137)	(0.117)	(6.028)	(0.107)	(0.618)
Televisor	3,769	3,978	-6.831	-203.1	0.290	4,268	122.7	5.370	128.1	-45.84	4,260	-61.21	710.9	4.035	28.80	-0.00556	0.0108	0.00389	13.06	-0.000604	0.663
	(4,924)	(4,829)	(52.36)	(900.5)	(0.680)	(4,557)	(300.1)	(148.5)	(374.0)	(198.8)	(4,220)	(215.6)	(921.8)	(4.853)	(22.31)	(0.0437)	(0.0181)	(0.154)	(7.946)	(0.142)	(0.815)
Refrigeradora	-6,495	-6,115	-4.465	-375.4	-0.929	-5,181	-279.1	-361.8*	-640.9	325.9	-5,474	-153.4	-595.9	9.037	21.17	-0.0981*	0.0454*	-0.141	-3.410	-0.0682	-1.010
	(6,532)	(6,406)	(69.46)	(1,194)	(0.902)	(6,044)	(398.1)	(197.0)	(496.1)	(263.7)	(5,598)	(285.9)	(1,223)	(6.438)	(29.59)	(0.0579)	(0.0240)	(0.204)	(10.54)	(0.188)	(1.081)
Moto	26,768***	27,499***	-172.5**	-555.3	-2.902***	23,592***	101.4	-1.964	99.42	91.98	24,731***	-530.2	3,399**	1.059	28.81	-0.000882	-0.0792***	-0.153	-20.98*	-0.183	-2.395*
	(7,460)	(7,317)	(79.33)	(1,364)	(1.030)	(6,903)	(454.7)	(225.0)	(566.7)	(301.2)	(6,394)	(326.6)	(1,397)	(7.353)	(33.80)	(0.0661)	(0.0275)	(0.233)	(12.04)	(0.214)	(1.235)
feminino	10,998**	7,576	-0.809	3,423***	-0.158	6,595	567.3*	553.2***	1,120***	-93.85	3,752	-138.8	829.7	-12.22**	-51.11**	0.00990	-0.0155	0.255*	117.3***	0.0636	-0.0882
	(4,857)	(4,764)	(51.65)	(888.2)	(0.671)	(4,494)	(296.0)	(146.5)	(368.9)	(196.1)	(4,163)	(212.6)	(909.2)	(4.787)	(22.01)	(0.0431)	(0.0179)	(0.152)	(7.838)	(0.140)	(0.804)
edu_primaria	-6,208	-5,553	-10.62	-644.3	0.258	-6,620	-285.5	-102.8	-388.3	-253.7	-1,863	154.9	-43.18	-4.672	-18.13	-0.143***	-0.0207	-0.0265	4.988	0.0874	-0.285
	(4,831)	(4,739)	(51.38)	(883.6)	(0.667)	(4,471)	(294.5)	(145.7)	(367.0)	(195.1)	(4,141)	(211.5)	(904.5)	(4.762)	(21.89)	(0.0428)	(0.0178)	(0.151)	(7.797)	(0.139)	(0.800)
edu_prima_grad	-6,275	-6,616	53.05	287.9	0.241	-7,160	-150.9	387.7*	236.8	-159.5	452.3	264.9	593.3	2.385	18.05	-0.207***	-0.0104	-0.116	14.44	-0.0702	-0.857
	(7,235)	(7,096)	(76.94)	(1,323)	(0.999)	(6,695)	(441.0)	(218.3)	(549.6)	(292.1)	(6,201)	(316.7)	(1,354)	(7.131)	(32.78)	(0.0642)	(0.0266)	(0.226)	(11.68)	(0.208)	(1.198)
edu_secundaria	3,977	2,338	71.52	1,566	1.087	2,932	-11.89	-147.3	-159.2	-259.5	3,732	341.6	471.7	9.939	44.56	-0.139*	0.0417	0.0281	-2.015	0.353	2.588*
	(8,597)	(8,432)	(91.42)	(1,572)	(1.187)	(7,956)	(524.0)	(259.3)	(653.0)	(347.1)	(7,368)	(376.4)	(1,609)	(8.473)	(38.95)	(0.0762)	(0.0316)	(0.268)	(13.87)	(0.247)	(1.423)
edu_secund_grad	-14,412	-13,465	-131.9	-815.4	0.407	-11,229	126.9	-363.5	-236.6	814.8	-10,083	-948.2	-838.8	21.49	17.79	-0.245**	0.0232	-0.187	-33.51	0.0362	2.678
	(13,434)	(13,175)	(142.9)	(2,457)	(1.855)	(12,431)	(818.8)	(405.2)	(1,020)	(542.4)	(11,513)	(588.1)	(2,515)	(13.24)	(60.87)	(0.119)	(0.0495)	(0.419)	(21.68)	(0.386)	(2.224)
edu_tercia	-14,985	-15,549	6.039	556.8	0.362	-9,454	1,650	-477.4	1,172	-887.8	-12,096	1,151	-753.8	6.891	-71.09	-0.133	-0.0364	0.185	8.084	0.123	3.281
	(16,497)	(16,180)	(175.4)	(3,017)	(2.278)	(15,266)	(1,006)	(497.6)	(1,253)	(666.1)	(14,139)	(722.2)	(3,088)	(16.26)	(74.74)	(0.146)	(0.0607)	(0.515)	(26.62)	(0.474)	(2.731)
ln_Dist_Carrt_km	2,275	2,086	-36.64*	225.6	0.406	2,376	-16.56	1.502	-15.06	3.708	1,138	-139.4	357.9	0.332	1.120	-0.0115	-0.00528	-0.0592	-4.268	-0.109*	-0.104
	(2,075)	(2,035)	(22.07)	(379.5)	(0.287)	(1,920)	(126.5)	(62.60)	(157.6)	(83.79)	(1,779)	(90.85)	(388.5)	(2.045)	(9.402)	(0.0184)	(0.00764)	(0.0648)	(3.349)	(0.0597)	(0.344)
ln_Dist_merc_km	5,902**	5,621**	-8.594	289.1	0.405	5,869**	144.2	-3.527	140.7	-110.3	5,314**	114.0	550.8	-5.236**	-25.26**	-0.0496**	-0.00227	0.118	0.903	0.0944	0.825*
	(2,561)	(2,512)	(27.24)	(468.4)	(0.354)	(2,370)	(156.1)	(77.27)	(194.6)	(103.4)	(2,195)	(112.1)	(479.5)	(2.525)	(11.61)	(0.0227)	(0.00943)	(0.0800)	(4.134)	(0.0736)	(0.424)
ln_Dist_Cdd_km	-3,487	-2,892	43.82*	-638.3	-0.292	-3,357	-137.8	57.76	-80.02	14.43	-3,323*	12.84	-155.0	1.833	10.09	0.0349*	-0.00235	0.113	-5.587	-0.0521	-0.141
	(2,322)	(2,277)	(24.69)	(424.6)	(0.321)	(2,149)	(141.5)	(70.05)	(176.4)	(93.76)	(1,990)	(101.7)	(434.7)	(2.289)	(10.52)	(0.0206)	(0.00855)	(0.0725)	(3.747)	(0.0668)	(0.384)
ln_area_cltvd_P_29	19,112***	19,273***	4.317	-165.4	0.0187	10,425***	-31.73	46.50	14.77	276.9**	24,194***	-156.2	342.3	3.791	36.13**	-0.00385	-0.112***	0.210**	22.05***	0.209**	0.978*
	(3,113)	(3,053)	(33.11)	(569.3)	(0.430)	(2,881)	(189.8)	(93.92)	(236.5)	(125.7)	(2,668)	(136.3)	(582.8)	(3.069)	(14.11)	(0.0276)	(0.0115)	(0.0972)	(5.024)	(0.0895)	(0.515)
Constant	-27,779***	-30,867***	-40.55	3,129	-0.164	-22,339**	1,400**	298.5	1,698**	584.5	-18,134**	91.21	1,662	106.5***	465.0***	0.760***	0.260***	-0.391	-14.17	0.765**	2.398
	(10,702)	(10,497)	(113.8)	(1,957)	(1.478)	(9,904)	(652.3)	(322.9)	(813.0)	(432.1)	(9,173)	(468.5)	(2,003)	(10.55)	(48.49)	(0.0949)	(0.0394)	(0.334)	(17.27)	(0.308)	(1.772)
Observations	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140
R-squared	0.072	0.073	0.047	0.025	0.016	0.043	0.019	0.072	0.041	0.142	0.109	0.021	0.011	0.145	0.186	0.085	0.136	0.174	0.227	0.287	0.075
Number of Boleta	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070
Standard errors in parentheses																					
*** p<0.01, ** p<0.05, * p<0.1																					

Appendix 6. Outcome- Model II

VARIABLES	total Income	Crop Sales Income	Animal Product Sales Income	Other Income	Consumption of own Production	Net Income	Agricultural Input	Hired Labor Input	Ag Input+Labor Input	Livestock Input	Value of Agricultural Production	Value of Livestock Production	Net Value Productivity-Crop	Food Expenditure per Capita	Food Expenditure per HH	Food Shortage	Ratio Livestock / Agriculture	Total Livestock Unit	Days of Farm Working	Technology Adoption - Livestock	Reproduction Skills
int_dXperiod	-7,042	-6,249	212.8***	-1,006	0.244	-10,240**	397.0	282.0*	679.0*	2,071***	-4,628	-608.2***	-900.7	11.79**	63.40***	0.135***	0.0898***	1.472***	7.037	2.318***	0.631
	(5,209)	(5,111)	(55.44)	(952.2)	(0.720)	(4,814)	(317.6)	(156.8)	(395.4)	(208.0)	(4,461)	(226.0)	(974.5)	(5.127)	(23.54)	(0.0460)	(0.0192)	(0.162)	(8.392)	(0.149)	(0.861)
int_convXperiod	7,856	6,081	-18.19	1,794	-0.00498	11,897**	-367.4	-461.2**	-828.7*	-1,198***	9,814*	1,180***	1,969*	-12.63**	-72.08***	-0.155***	0.0195	-0.466**	-22.66**	-0.482***	-2.048**
	(6,016)	(5,903)	(64.03)	(1,100)	(0.832)	(5,560)	(366.8)	(181.1)	(456.7)	(240.3)	(5,152)	(261.1)	(1,126)	(5.922)	(27.19)	(0.0532)	(0.0222)	(0.187)	(9.692)	(0.172)	(0.995)
period	-338.0	-1,147	-34.95	844.0	0.216	3,951	-460.9**	-428.3***	-889.2***	-51.38	-4,490	-71.48	-352.4	-30.13***	-157.7***	-0.186***	-0.0429***	0.0800	40.25***	-0.388***	-2.409**
	(3,323)	(3,260)	(35.37)	(607.5)	(0.459)	(3,071)	(202.6)	(100.0)	(252.2)	(132.7)	(2,846)	(144.2)	(621.7)	(3.271)	(15.02)	(0.0294)	(0.0122)	(0.104)	(5.353)	(0.0953)	(0.550)
Piso_tierra	10,366*	11,178**	53.97	-866.8	0.0903	9,325*	196.4	-96.46	99.94	-44.87	4,212	-78.09	319.8	4.162	1.373	-0.0343	0.00102	-0.192	-2.397	-0.160	-0.397
	(5,578)	(5,473)	(59.37)	(1,020)	(0.771)	(5,155)	(340.1)	(167.9)	(423.4)	(222.8)	(4,776)	(242.0)	(1,044)	(5.490)	(25.21)	(0.0493)	(0.0205)	(0.174)	(8.986)	(0.160)	(0.922)
Celular	2,683	2,725	93.42**	-135.0	0.230	1,121	25.38	-0.208	25.17	269.4*	46.18	-42.79	-272.8	7.301**	63.73***	-0.00321	0.0112	0.0922	3.158	0.134	-1.498**
	(3,707)	(3,637)	(39.45)	(677.6)	(0.512)	(3,426)	(226.0)	(111.6)	(281.4)	(148.0)	(3,174)	(160.9)	(693.5)	(3.649)	(16.75)	(0.0328)	(0.0137)	(0.115)	(5.971)	(0.106)	(0.613)
Radio	4,415	3,131	13.26	1,271*	-0.0664	3,967	24.83	4.422	29.25	194.4	1,805	-209.1	373.0	-8.998**	-32.72*	0.00240	0.00690	-0.00272	-0.873	0.0252	-0.795
	(3,734)	(3,664)	(39.74)	(682.6)	(0.516)	(3,451)	(227.7)	(112.4)	(283.4)	(149.1)	(3,198)	(162.0)	(698.6)	(3.676)	(16.88)	(0.0330)	(0.0138)	(0.116)	(6.016)	(0.107)	(0.618)
Televisor	3,812	4,012	-6.931	-193.3	0.290	4,333	120.7	2.854	123.6	-52.38	4,314	-54.77	721.7	3.966	28.40	-0.00640	0.0109	0.00135	12.93	-0.00323	0.652
	(4,923)	(4,829)	(52.39)	(899.8)	(0.680)	(4,549)	(300.1)	(148.2)	(373.6)	(196.6)	(4,215)	(213.6)	(920.9)	(4.845)	(22.25)	(0.0435)	(0.0181)	(0.153)	(7.930)	(0.141)	(0.814)
Refrigeradora	-6,400	-6,041	-4.684	-353.7	-0.929	-5,037	-283.5	-367.3*	-650.9	311.4	-5,356	-139.1	-572.2	8.885	20.30	-0.1000*	0.0456*	-0.146	-3.683	-0.0740	-1.035
	(6,530)	(6,406)	(69.49)	(1,194)	(0.902)	(6,034)	(398.1)	(196.5)	(495.6)	(260.8)	(5,591)	(283.3)	(1,222)	(6.427)	(29.51)	(0.0577)	(0.0240)	(0.203)	(10.52)	(0.187)	(1.080)
Moto	26,786***	27,513***	-172.5**	-551.1	-2.902***	23,619***	100.5	-3.029	97.50	89.22	24,754***	-527.5	3,403**	1.030	28.64	-0.00124	-0.0791***	-0.154	-21.04*	-0.184	-2.400*
	(7,457)	(7,316)	(79.37)	(1,363)	(1.031)	(6,892)	(454.7)	(224.5)	(566.1)	(297.8)	(6,386)	(323.6)	(1,395)	(7.340)	(33.70)	(0.0659)	(0.0275)	(0.232)	(12.01)	(0.214)	(1.233)
feminino	10,558**	7,236	0.209	3,323***	-0.158	5,929	587.9**	579.0***	1,167***	-26.78	3,203	-204.9	719.5	-11.51**	-47.08**	0.0186	-0.0166	0.281*	118.5***	0.0905	0.0264
	(4,867)	(4,775)	(51.80)	(889.6)	(0.673)	(4,498)	(296.7)	(146.5)	(369.4)	(194.4)	(4,167)	(211.2)	(910.5)	(4.790)	(22.00)	(0.0430)	(0.0179)	(0.152)	(7.840)	(0.140)	(0.805)
edu_primaria	-6,532	-5,804	-9.871	-718.4	0.258	-7,111	-270.3	-83.78	-354.1	-204.2	-2,268	106.2	-124.5	-4.150	-15.15	-0.137***	-0.0215	-0.00732	5.923	0.107	-0.200
	(4,836)	(4,745)	(51.47)	(884.0)	(0.668)	(4,469)	(294.9)	(145.6)	(367.1)	(193.2)	(4,141)	(209.9)	(904.8)	(4.760)	(21.86)	(0.0427)	(0.0178)	(0.151)	(7.791)	(0.139)	(0.800)
edu_prima_grad	-6,232	-6,583	52.95	297.7	0.241	-7,095	-152.9	385.2*	232.3	-166.0	505.8	271.4	604.1	2.316	17.65	-0.208***	-0.0102	-0.119	14.32	-0.0728	-0.869
	(7,233)	(7,096)	(76.98)	(1,322)	(1.000)	(6,684)	(441.0)	(217.7)	(549.0)	(288.9)	(6,193)	(313.9)	(1,353)	(7.119)	(32.69)	(0.0639)	(0.0266)	(0.225)	(11.65)	(0.207)	(1.196)
edu_secundaria	3,247	1,773	73.22	1,399	1.087	1,826	22.27	-104.4	-82.15	-148.1	2,820	231.8	288.6	11.11	51.26	-0.125	0.0398	0.0714	0.0907	0.398	2.779*
	(8,612)	(8,449)	(91.66)	(1,574)	(1.190)	(7,959)	(525.1)	(259.2)	(653.7)	(344.0)	(7,375)	(373.7)	(1,611)	(8.477)	(38.92)	(0.0761)	(0.0317)	(0.268)	(13.87)	(0.247)	(1.424)
edu_secund_grad	-15,414	-14,240	-129.6	-1,044	0.407	-12,746	173.7	-304.7	-130.9	967.6*	-11,334	-1,099*	-1,090	23.10*	26.98	-0.225*	0.0207	-0.128	-30.63	0.0976	2.939
	(13,451)	(13,197)	(143.2)	(2,459)	(1.859)	(12,430)	(820.1)	(404.8)	(1,021)	(537.2)	(11,518)	(583.7)	(2,516)	(13.24)	(60.79)	(0.119)	(0.0495)	(0.419)	(21.67)	(0.386)	(2.224)
edu_tercia	-15,566	-15,998	7.383	424.2	0.363	-10,334	1,677*	-443.3	1,234	-799.2	-12,822	1,064	-899.4	7.825	-65.77	-0.121	-0.0378	0.220	9.759	0.159	3.432
	(16,497)	(16,185)	(175.6)	(3,015)	(2.280)	(15,245)	(1,006)	(496.5)	(1,252)	(658.9)	(14,126)	(715.8)	(3,086)	(16.24)	(74.56)	(0.146)	(0.0608)	(0.514)	(26.58)	(0.473)	(2.728)
ln_Dist_Carrt_km	2,220	2,043	-36.51*	212.9	0.406	2,292	-13.96	4.762	-9.203	12.18	1,069	-147.8	344.0	0.421	1.630	-0.0104	-0.00541	-0.0559	-4.108	-0.106*	-0.0900
	(2,075)	(2,036)	(22.08)	(379.3)	(0.287)	(1,918)	(126.5)	(62.45)	(157.5)	(82.87)	(1,777)	(90.04)	(388.2)	(2.042)	(9.378)	(0.0183)	(0.00764)	(0.0646)	(3.343)	(0.0595)	(0.343)
ln_Dist_merc_km	6,067**	5,749**	-8.977	326.9	0.405	6,119***	136.5	-13.23	123.3	-135.5	5,520**	138.9	592.2	-5.501**	-26.77**	-0.0528**	-0.00186	0.109	0.426	0.0843	0.782*
	(2,564)	(2,515)	(27.29)	(468.6)	(0.354)	(2,369)	(156.3)	(77.16)	(194.6)	(102.4)	(2,195)	(111.2)	(479.6)	(2.524)	(11.59)	(0.0227)	(0.00944)	(0.0799)	(4.130)	(0.0735)	(0.424)
ln_Dist_Cdd_km	-3,696	-3,054	44.31*	-686.1	-0.292	-3,674*	-128.0	70.06	-57.93	46.38	-3,585*	-18.63	-207.5	2.170	12.01	0.0390*	-0.00287	0.126*	-4.983	-0.0392	-0.0863
	(2,327)	(2,283)	(24.76)	(425.3)	(0.322)	(2,150)	(141.9)	(70.03)	(176.6)	(92.93)	(1,992)	(101.0)	(435.3)	(2.290)	(10.52)	(0.0206)	(0.00857)	(0.0725)	(3.748)	(0.0667)	(0.385)
ln_area_cltvd_P_29	19,018***	19,200***	4.536	-186.9	0.0188	10,282***	-27.32	52.03	24.71	291.3**	24,076***	-170.4	318.7	3.943	37.00***	-0.00200	-0.112***	0.215**	22.32***	0.214**	1.002*
	(3,113)	(3,054)	(33.13)	(569.0)	(0.430)	(2,877)	(189.8)	(93.70)	(236.3)	(124.3)	(2,666)	(135.1)	(582.4)	(3.064)	(14.07)	(0.0275)	(0.0115)	(0.0970)	(5.015)	(0.0892)	(0.515)
Constant	-27,341**	-30,528***	-41.56	3,229*	-0.164	-21,676**	1,379**	272.8	1,652**	517.7	-17,587*	157.0	1,772	105.8***	461.0***	0.752***	0.261***	-0.417	-15.44	0.738**	2.284
	(10,704)	(10,502)	(113.9)	(1,957)	(1.479)	(9,892)	(652.7)	(322.2)	(812.5)	(427.5)	(9,166)	(464.5)	(2,002)	(10.54)	(48.38)	(0.0946)	(0.0394)	(0.333)	(17.24)	(0.307)	(1.770)
Observations	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140
R-squared	0.074	0.074	0.047	0.028	0.016	0.047	0.020	0.078	0.044	0.161	0.112	0.040	0.014	0.148	0.192	0.092	0.137	0.179	0.231	0.293	0.079
Number of Boleta	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070
Standard errors in parentheses																					
*** p<0.01, ** p<0.05, * p<0.1																					

Appendix 7. Outcome - Model III

VARIABLES	total Income	Crop Sales Income	Animal Product Sales Income	Other Income	Consumption of own Production	Net Income	Agricultural Input	Hired Labor Input	Ag Input+Labor Input	Livestock Input	Value of Agricultural Production	Value of Livestock Production	Net Value Productivity-Crop	Food Expenditure per Capita	Food Expenditure per HH	Food Shortage	Ratio Livestock / Agriculture	Total Livestock Unit	Days of Farm Working	Technology Adoption - Livestock	Reproduction Skills
int_dXperiod	-11,714*	-9,994*	147.9**	-1,868*	0.344	-13,485**	599.0	30.53	629.5	1,351***	-7,380	-425.0	-1,540	4.423	13.49	0.138	0.0778***	1.099***	-9.800	1.019***	-0.188
	(6,125)	(6,012)	(65.22)	(1,119)	(0.848)	(5,663)	(373.0)	(184.9)	(464.8)	(247.2)	(5,247)	(267.6)	(1,147)	(6.055)	(27.82)	(0.111)	(0.0225)	(0.192)	(9.904)	(0.114)	(0.122)
duracion_1y	16,642	13,165	194.4	3,281	0.552	16,510	-303.8	-154.9	-458.7	-227.5	12,731	508.7	2,144	4.363	54.48	0.136	-0.0161	0.0317	-4.280	0.628**	0.388*
	(12,313)	(12,086)	(131.1)	(2,249)	(1.705)	(11,383)	(749.9)	(371.8)	(934.3)	(496.9)	(10,549)	(538.0)	(2,305)	(12.17)	(55.93)	(0.217)	(0.0452)	(0.385)	(19.91)	(0.261)	(0.233)
duracion_2y	5,698	4,018	35.49	1,645	-0.505	6,753	-502.6	97.17	-405.5	667.6**	4,884	159.1	1,256	2.285	22.81	-0.107	0.0291	0.317	17.39	0.873***	0.0939
	(7,627)	(7,487)	(81.22)	(1,393)	(1.056)	(7,051)	(464.5)	(230.3)	(578.8)	(307.8)	(6,534)	(333.3)	(1,428)	(7.540)	(34.64)	(0.137)	(0.0280)	(0.239)	(12.33)	(0.169)	(0.152)
duracion_3y	16,879**	12,602	130.0	4,147***	0.182	15,975**	-215.6	235.0	19.38	-83.52	14,770**	1,092***	2,944*	-0.260	10.76	-0.143	0.0150	0.107	5.454	0.706***	0.240
	(8,093)	(7,944)	(86.18)	(1,478)	(1.121)	(7,482)	(492.9)	(244.4)	(614.1)	(326.6)	(6,934)	(353.6)	(1,515)	(8.000)	(36.76)	(0.148)	(0.0297)	(0.253)	(13.09)	(0.170)	(0.159)
duracion_4y	21,020*	20,627*	26.37	366.4	-0.471	26,208**	-2,058***	-519.7	-2,578***	-79.98	21,140**	481.4	4,758**	6.404	37.58	-0.620***	0.135***	0.426	0.546	0.832***	0.220
	(11,954)	(11,733)	(127.3)	(2,184)	(1.655)	(11,051)	(728.0)	(361.0)	(907.0)	(482.4)	(10,241)	(522.3)	(2,238)	(11.82)	(54.30)	(0.229)	(0.0439)	(0.374)	(19.33)	(0.278)	(0.233)
period	-412.4	-1,193	-36.57	817.1	0.217	3,926	-461.9**	-436.1***	-898.0***	-68.49	-4,517	-67.89	-358.4	-30.28***	-158.7***	-0.450***	-0.0429***	0.0724	39.84***	-0.351***	-0.322**
	(3,321)	(3,260)	(35.37)	(606.7)	(0.460)	(3,070)	(202.3)	(100.3)	(252.0)	(134.0)	(2,845)	(145.1)	(621.7)	(3.283)	(15.09)	(0.0663)	(0.0122)	(0.104)	(5.370)	(0.0715)	(0.0745
Piso_tierra	9,466*	10,540*	49.38	-1,123	0.0847	8,249	214.4	-80.27	134.1	13.47	3,313	-171.4	145.2	4.841	4.429	0.119*	0.000643	-0.170	-1.507	0.0163	0.114
	(5,573)	(5,470)	(59.34)	(1,018)	(0.772)	(5,152)	(339.4)	(168.3)	(422.9)	(224.9)	(4,774)	(243.5)	(1,043)	(5.509)	(25.31)	(0.0698)	(0.0205)	(0.174)	(9.011)	(0.0757)	(0.0739
Celular	2,481	2,467	97.95**	-84.53	0.258	605.1	84.21	34.01	118.2	298.4**	-299.9	-59.12	-360.4	7.585**	65.64***	-0.137**	0.00757	0.0979	3.821	0.0972	-0.104
	(3,712)	(3,644)	(39.53)	(678.2)	(0.514)	(3,432)	(226.1)	(112.1)	(281.7)	(149.8)	(3,180)	(162.2)	(694.9)	(3.670)	(16.86)	(0.0596)	(0.0136)	(0.116)	(6.003)	(0.0638)	(0.0643
Radio	4,179	2,887	12.19	1,280*	-0.0585	3,685	53.34	8.880	62.22	179.9	1,601	-201.0	325.3	-9.252**	-34.35**	-0.0678	0.00523	-0.0148	-1.161	-0.0378	0.0713
	(3,736)	(3,667)	(39.78)	(682.4)	(0.517)	(3,454)	(227.5)	(112.8)	(283.5)	(150.8)	(3,201)	(163.2)	(699.3)	(3.693)	(16.97)	(0.0648)	(0.0137)	(0.117)	(6.040)	(0.0699)	(0.0670
Televisor	3,566	3,863	-10.42	-287.7	0.277	4,126	109.5	-0.475	109.0	-42.27	4,129	-76.11	694.6	4.049	28.40	-0.0165	0.0121	0.00642	13.06	0.251***	0.200**
	(4,922)	(4,831)	(52.41)	(899.1)	(0.682)	(4,550)	(299.8)	(148.6)	(373.5)	(198.6)	(4,216)	(215.0)	(921.3)	(4.865)	(22.36)	(0.0649)	(0.0181)	(0.154)	(7.958)	(0.0705)	(0.0679
Refrigeradora	-6,646	-6,237	-8.555	-398.7	-0.957	-5,296	-289.9	-353.6*	-643.5	345.9	-5,535	-151.7	-587.0	8.959	20.09	-0.144	0.0473**	-0.132	-2.837	0.0987	-0.0225
	(6,536)	(6,415)	(69.60)	(1,194)	(0.905)	(6,042)	(398.1)	(197.4)	(495.9)	(263.7)	(5,599)	(285.6)	(1,223)	(6.461)	(29.69)	(0.0964)	(0.0240)	(0.204)	(10.57)	(0.100)	(0.1000
Moto	26,500***	27,303***	-174.4**	-626.5	-2.913***	23,370***	95.46	-8.349	87.11	104.0	24,487***	-555.0*	3,353**	1.135	29.22	-0.254**	-0.0791***	-0.150	-20.88*	-0.202	0.0064
	(7,454)	(7,316)	(79.37)	(1,362)	(1.032)	(6,891)	(454.0)	(225.1)	(565.6)	(300.8)	(6,386)	(325.7)	(1,395)	(7.368)	(33.86)	(0.122)	(0.0274)	(0.233)	(12.05)	(0.125)	(0.126)
feminino	10,068**	6,785	-5.207	3,288***	-0.149	5,573	619.6**	556.5***	1,176***	-97.21	2,885	-178.9	643.3	-12.36**	-52.42**	0.0232	-0.0189	0.240	116.9***	0.0603	0.00679
	(4,868)	(4,778)	(51.84)	(889.2)	(0.674)	(4,500)	(296.5)	(147.0)	(369.4)	(196.4)	(4,170)	(212.7)	(911.3)	(4.812)	(22.11)	(0.0709)	(0.0179)	(0.152)	(7.871)	(0.0748)	(0.0706
edu_primaria	-6,453	-5,796	-12.33	-644.9	0.267	-6,962	-252.5	-90.41	-342.9	-265.7	-2,064	164.5	-87.19	-4.886	-19.88	-0.247***	-0.0220	-0.0360	4.815	-0.0197	-0.0079
	(4,839)	(4,750)	(51.53)	(883.9)	(0.670)	(4,473)	(294.7)	(146.1)	(367.2)	(195.3)	(4,145)	(211.4)	(905.8)	(4.783)	(21.98)	(0.0665)	(0.0178)	(0.151)	(7.824)	(0.0707)	(0.0692
edu_prima_grad	-6,666	-7,078	52.17	359.6	0.245	-7,736	-91.11	417.7*	326.6	-151.8	80.44	281.6	515.1	2.065	15.88	-0.272***	-0.0132	-0.124	14.83	0.0445	-0.100
	(7,245)	(7,112)	(77.15)	(1,324)	(1.003)	(6,698)	(441.3)	(218.8)	(549.8)	(292.4)	(6,207)	(316.6)	(1,356)	(7.162)	(32.91)	(0.0897)	(0.0266)	(0.227)	(11.72)	(0.0915)	(0.0949
edu_secundaria	3,725	2,053	69.56	1,602	1.070	2,616	8.650	-128.3	-119.6	-236.9	3,518	347.8	438.9	9.783	43.37	-0.324**	0.0412	0.0314	-1.349	0.238*	0.258**
	(8,595)	(8,436)	(91.52)	(1,570)	(1.190)	(7,946)	(523.5)	(259.5)	(652.2)	(346.8)	(7,363)	(375.5)	(1,609)	(8.496)	(39.04)	(0.130)	(0.0316)	(0.269)	(13.90)	(0.142)	(0.128)
edu_secund_grad	-13,942	-12,949	-129.7	-863.6	0.419	-10,621	79.79	-392.1	-312.3	790.9	-9,653	-955.0	-758.0	21.76	19.68	-0.573***	0.0252	-0.186	-34.24	0.0898	0.366**
	(13,427)	(13,179)	(143.0)	(2,453)	(1.860)	(12,413)	(817.7)	(405.4)	(1,019)	(541.8)	(11,503)	(586.7)	(2,513)	(13.27)	(60.99)	(0.166)	(0.0493)	(0.420)	(21.71)	(0.169)	(0.164)
edu_tercia	-15,746	-16,258	5.966	505.6	0.397	-10,399	1,727*	-468.9	1,258	-904.7	-12,881	1,126	-941.8	6.707	-72.07	-0.349	-0.0420	0.163	7.484	0.382	-0.0831
	(16,484)	(16,180)	(175.5)	(3,011)	(2.283)	(15,239)	(1,004)	(497.7)	(1,251)	(665.2)	(14,122)	(720.2)	(3,086)	(16.29)	(74.88)	(0.245)	(0.0606)	(0.516)	(26.65)	(0.290)	(0.278)
ln_Dist_Carrt_km	2,539	2,264	-33.94	309.2	0.405	2,624	-19.55	7.012	-12.54	11.64	1,350	-124.2	400.5	0.354	1.644	-0.0131	-0.00527	-0.0550	-3.975	-0.0259	-0.0150
	(2,081)	(2,042)	(22.16)	(380.1)	(0.288)	(1,924)	(126.7)	(62.83)	(157.9)	(83.97)	(1,783)	(90.91)	(389.5)	(2.057)	(9.451)	(0.0361)	(0.00765)	(0.0651)	(3.364)	(0.0373)	(0.0351
ln_Dist_merc_km	5,519**	5,279**	-10.63	251.1	0.405	5,438**	167.5	2.377	169.8	-106.3	4,964**	102.1	478.8	-5.328**	-26.03**	-0.0386	-0.00355	0.114	0.943	-0.0345	-0.0087
	(2,564)	(2,517)	(27.30)	(468.4)	(0.355)	(2,370)	(156.2)	(77.42)	(194.6)	(103.5)	(2,197)	(112.0)	(480.0)	(2.535)	(11.65)	(0.0404)	(0.00942)	(0.0802)	(4.146)	(0.0431)	(0.0407
ln_Dist_Cdd_km	-3,568	-2,964	42.49*	-646.8	-0.306	-3,418	-143.2	60.36	-82.80	28.03	-3,381*	8.974	-158.3	1.834	9.980	0.118***	-0.00176	0.118	-5.262	0.0464	0.0491
	(2,323)	(2,281)	(24.74)	(424.4)	(0.322)	(2,148)	(141.5)	(70.16)	(176.3)	(93.76)	(1,991)	(101.5)	(434.9)	(2.297)	(10.55)	(0.0385)	(0.00854)	(0.0727)	(3.757)	(0.0413)	(0.0383
ln_area_cltvd_P_29	19,252***	19,407***	4.168	-159.1	0.0120	10,601***	-46.60	44.70	-1.906	279.3**	24,343***	-151.3	378.2	3.822	36.26**	-0.189***	-0.111***	0.214**	22.15***	0.232***	0.0898*
	(3,111)	(3,054)	(33.13)	(568.3)	(0.431)	(2,876)	(189.5)	(93.94)	(236.1)	(125.5)	(2,665)	(135.9)	(582.4)	(3.075)	(14.13)	(0.0443)	(0.0114)	(0.0973)	(5.030)	(0.0458)	(0.0453
Constant	-25,442**	-28,812***	-24.04	3,393*	-0.134	-19,776**	1,281*	259.5	1,540*	549.7	-16,093*	157.6	2,061	107.1***	470.8***	0.547***	0.265***	-0.373	-14.78	-0.805***	-0.777**
	(10,756)	(10,558)	(114.5)	(1,965)	(1.490)	(9,944)	(655.1)	(324.8)	(816.2)	(434.0)	(9,215)	(470.0)	(2,013)	(10.63)	(48.86)	(0.150)	(0.0395)	(0.336)	(17.39)	(0.158)	(0.152)
Observations	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140	2,140
R-squared	0.078	0.077	0.050	0.033	0.016	0.051	0.027	0.076	0.049	0.148	0.116	0.031	0.018	0.145	0.187		0.145	0.176	0.229		
Number of Boleta	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070		1,070	1,070	1,070		