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Impact of Weather Insurance on Small Scale Farmers: A Natural Experiment

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Impact of Weather Insurance on Small Scale Farmers: A Natural Experiment

Stephan Dietrich and Marcela Ibanez*

Abstract

This paper explores the impacts of traditional agricultural insurance that offers protection against climatic shocks on small-scale tobacco farmers in Colombia. We analyze the impacts of access to the insurance on household financial outcomes after a period of severe climatic events that caused substantial crop failures. Our identification strategy benefits from a natural experimental setup of the form in which the insurance was launched. We find that tobacco producers with access to the insurance program were less likely to acquire informal loans, were less likely to use loans to repay debts, and had access to loans with lower interest rates and longer maturation periods. Moreover, access to this program was positively associated with increased savings and accumulation of liquid assets.

Keywords: Insurance; Credit; Natural Disasters; Risk Management; Colombia

JEL No.: G22; G23; O13; O16; Q14

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1 Introduction

In 2012, weather-related disasters affected about 100 million people and caused an estimated damage of more than 130 billion US dollars worldwide.[1] Small-scale farmers were particularly vulnerable to the effects of such disasters, which could induce chronic poverty (World Bank, 2013). For example, Datt and Hoogeveen (2003) show that in the Philippines, a drought related to "El Nino" was the main driver of increase in poverty, whereas evidence from South Africa and India suggests that children living in households affected by environmental shocks exhibited lower school attendance rates, weight-for-height ratios, and height-for-age ratios than children in non-affected households (Carter and Maluccio, 2003; Jacoby and Skoufias, 1997).

Agricultural insurance is regarded as a promising tool to improve household risk management capacity and reduce vulnerability to poverty (Churchill and Matul, 2012). The risk reduction associated with insurance can promote investment in more productive technologies and help to expand credit access. On the other hand, indemnity payments can decrease the need to rely on costly informal loans, which can create dependencies and a vicious circle of increasing indebtedness (Carter and Olinto, 2003; Bose, 1998)). Agricultural insurance can also reduce the need to sell assets, the loss of which would damage producers' ability to engage in future production and undertake investment opportunities (Barnett et al., 2008; Macours, 2013). In this paper we investigate the impacts of agricultural insurance on small holder farmers well-being after a period of severe climatic events.

For the analysis, we focus on an agricultural insurance program in Colombia, a country that has been adversely affected by climatic shocks over the last decade and is expected to be particularly affected by climatic change (IDEAM, 2001).[2] The Center for Research on the Epidemiology of Disasters (CRED) estimates that about 4 million people (10% of the Colombian population) were affected by weather-related events between 2000 and 2009.[3] The agricultural insurance program that we analyze is a traditional form of insurance where indemnity payments are determined on a case-by-case basis upon field verification.[4] The insurance covers the main climate risks and up to 60 percent of the premium is subsidized by a public fund. The Colombian government implemented this program in 2004 as a strategy

[1] http://www.emdat.be/ (access 1.11.2013)

[2] The Institute of Hydrology, Meteorology, and Environmental Studies -IDEAM- predicts that increases in temperature due to climate change could lead to a desertification of 3.1% of the territory.

[3] http://www.emdat.be/result-country-profile (access 1.11.2013)

[4] Attempts to implement index based insurances have been frustrated by the lack of historical weather data.

to reduce the need for emergency help as well as foster agricultural investments. By 2010, insurance possession had increased significantly, covering 45,000 hectares for an insured value of US $261,068,000.

In this analysis, we focus on the impacts on tobacco farmers, a group highly vulnerable to poverty. Approximately half of Colombian tobacco producers are landless and cultivate in share cropping agreements. Their productive investment is co-financed by the farmer (normally through loans) and the tobacco company, which offers individual contracts determining the number of hectares to be cultivated, the value of the productive credit, and the final tobacco prices to be paid. Under this contracting scheme, production risks are assumed directly by the tobacco farmers, who are required to repay the production loans at the end of the harvest cycle or, in case of negative shocks, over the next cropping seasons. Furthermore, tobacco is highly sensitive to weather variability, and farmers experience large yield fluctuations that often require ex-post coping mechanisms to deal with the resulting losses.

To identify the impacts of the insurance on household loans and financial assets, we explore a natural experimental set-up. Two companies dominate the tobacco production in Colombia: Protabaco and Coltabaco. Both companies produce tobacco under equal contract farming conditions and operate in the same areas working with a comparable group of farmers. However, Protabaco commenced offering the insurance to their contracted farmers in 2008, whereas Coltabaco only implemented such a program in 2011. In the analysis, we explore this temporal variation in the program implementation time frames. As we show in detail later, farmers in both companies were comparable in terms of socioeconomic characteristics as of 2005, before the insurance was implemented. Moreover, as farmers maintain long-term relations with and produce for the same company for years, self-selection into the program is unlikely to occur. We observe households after two consecutive years of climatic shocks and thus have the rare opportunity to quantify the program's impact in times of need.

This paper contributes to the empirical literature examining the impact of agricultural insurance in several ways. Over the last few years, a new body of empirical literature has emerged that examines the impact of agricultural insurance upon poor households. The low demand for insurance products, especially among the most vulnerable households, is found to limit this instrument's scope to reduce poverty (Gine et al., 2008; Churchill and Matul, 2012; Cole et al., 2013; Liu and Myers, 2014). Recent randomized control trials find that access to

index-based insurance is associated with investment in more profitable and risky technologies (Cai et al., 2009; Cole et al., 2013; Hill and Viceisza, 2012) and with consumption smoothing (Janzen and Carter, 2013). In contrast, we investigate the impact of a traditional insurance program. As many developing countries have limited historical weather data, the implementation of index-based insurance is often not a feasible alternative. Hence, an evaluation of the potential of a traditional insurance to reduce household vulnerability is very important when planning how to establish this type of programs in other developing countries.

We contribute to the research on the impact of agricultural insurance by considering the impact of insurance on formal and informal financial access. In a cross sectional study on the effect of a life insurance product in Ghana, Giesbert et al. (2011) find a mutual reinforcing relationship between access to insurance and formal loans and savings. As this insurance is distributed by banks, the authors suggest that the effect is related to an increased familiarity with other financial products. A positive effect from insurance on financial access was also found by Galarza (2009) who use an artefactual field experiment that revealed that offering insured loans increased loan take up. In contrast, Gine and Yang (2009) and Karlan et al. (2011) find insurance has either a negative or non-significant effect on loan uptake. Unlike previous papers, our study allows the insurance provider to be clearly separated from the financial services and hence is able to identify the impact of insurance upon the relaxation of financial access constraints. Looking at the insurance impacts on loans and financial assets sheds novel light on the effect of agricultural insurance on household coping strategies in the aftermath of shocks.

One advantage of our study compared with previous studies is that it explores a natural experimental set up in the insurance program's implementation. The main benefit of this type of analysis is that participants in the program are unaware that they will be monitored.[5] Therefore, the evaluation does not induce strategic behavior from program participants. Unlike randomized control evaluations where insurance companies might have an incentive to show positive results, in our study, neither the insurance company, the tobacco companies, nor the farmers were aware that the evaluation would take place. We evaluate the program under every day conditions, not under the lime light circumstances of an experimental approach. This allows us to capture the program's effectiveness, even when its implementation was not

[5]During the survey we do not mention that we were interested in evaluating the insurance program, and rather explained participants that the survey was about living conditions of tobacco producers.

perfect. For instance, we find that 11% of insured farmers did not receive a verification visit despite having claimed damages.

The paper is organized as follows: Section 2 presents a description of the insurance program and the natural experiment's setup. Section 3 describes the data and provides descriptive statistics. Section 4 explains the empirical methodology. In Sections 5, we discuss the estimation results for household loans and financial assets. Section 6 presents our robustness checks. In the last section, we conclude.

2 Background

The agricultural insurance program started in Colombia in 2004, and since 2008 it has been offered by Mapfre insurance group. The insurance policy protects agricultural producers from the main climatic risks: excessive rain, flooding, hail, excessive wind, drought, land slides, and pests related to climatic events. Insurance holders benefit from a public subsidy of 30 to 60 percent of the premium, depending whether take up is individual or in groups. Table 1 presents a summary of the program's evolution in terms of products covered, hectares and value insured, and loss ratios since the insurance started in 2004. The program expanded rapidly, and by 2010, it covered a value equivalent to 10% of the agricultural GDP. Before 2009, the indemnity payments were higher than the premiums, but in 2009, the loss ratio dropped below 1.

Among the crops covered by the agricultural insurance, tobacco is particularly interesting as the way in which the program was implemented can be regarded as a natural experiment allowing a clear identification of its impacts. Moreover, as beneficiaries in the tobacco sector are relatively poor, there is a larger scope for the insurance to serve as a poverty reduction strategy.

In Colombia, about 13,000 hectares of tobacco are cultivated per year, generating about 15,000 jobs. Most tobacco production is destined for local markets, yet a small fraction is exported.[6] The main production areas of tobacco are located in Santander and Huila, with 51% and 22% of production, respectively. Two companies dominate local tobacco production: Coltabaco, incorporated by Philip Morris in 2005, and Protabaco, which was acquired by British American Tobacco in 2011. Both companies are comparable in terms of employee

[6] Colombian tobacco exports represent around 0.5% of global production.

Table 1: Insurance Program Development, 2004-2010

Year	Covered Crops	Hectares Insured	Value Insured (approx. US $)	Loss Ratios (indemnity/premiums)	Insurance Company
2004	cotton	1 157	4 019 507	0.02	La Previsora
2005	cotton	4 216	14 610 375	1.54	La Previsora
2006	cotton, banana	2 789	4 217 340	3.09	La Previsora
2007	cotton, banana, maize	30 102	86 353 432	1.24	Mapfre
2008	cotton, banana, maize, tobacco, rice, sorghum	35 900	80 520 536	1.17	Mapfre
2009	cotton, banana, maize, tobacco, rice, sorghum, potato, tomato, onions, forestry	29 250	63 523 721	0.81	Mapfre
2010	cotton, banana, maize, tobacco, rice, sorghum, potato, tomato, onions, forestry, peanut, catastrophic	45 740	261 068 000	1.25	Mapfre

Source: Ministry of Agriculture and Rural Development. Numbers for 2010 from Fasecolda.

numbers, estimated revenue, and market share.[7] Moreover, both companies produce tobacco under equal contract farming schemes. They negotiate individual contracts with the farmers that set the the prices and the number and type of plants to be grown. Based on this contract, the companies allocate credit in the form of input material and cash, which is repaid when the farmers hand in the cured tobacco leaves. During the production cycle, the company offers technical assistance and monitors cultivation. In exchange, farmers are required to sell their complete harvest to the company.

Tobacco is mainly produced by poor small holder farmers. In Santander, our research area, the average tobacco field is one hectare. According to our field interviews, more than 90% of the tobacco farmers earned lower income per adult household member than the region's prescribed minimum wage.[8] Many tobacco producers do not own their land, with about half cultivating under share cropping agreements, paying about one-fifth of the farm returns to their landlord. The main varieties of tobacco are Burley and Black tobacco, which are typically cultivated in rotation over three-month production cycles. Tobacco cultivation is, however, very sensitive to weather shocks. The timing of rainfall is essential to the quality of the tobacco leaves; if the rainy season sets in too late or too heavily, the tobacco plants

[7] Protabaco employs around 1 000 workers while Coltabaco employs around 900. See www.bat.com and www.pmi.com (access 8.10.2013).

[8] The minimum wage is approx. 3,200 US$ per year compared to approximately 1,500 US$ income per adult for tobacco production.

suffer from pests or underdevelopment, and possibly even die. Under the agricultural contract scheme, farmers assume the default risk associated with crop failures. Hence, after losses, they are held responsible and must repay the full value of the loan from the tobacco company in the next cropping season. This can lead debts to pile up, pushing already-poor farmers even further into poverty.

In 2008, agricultural insurance was introduced in the tobacco sector. Protabaco took the lead and established contacts with the insurance company to negotiate the conditions under which the insurance contract would operate. Coltabaco assumed a more passive attitude and only implemented insurance in 2011, just after we had conducted the survey.[9] This exogenous variation in the access to the program for tobacco farmers allows us to identify its impacts on households well-being.

One potential treat of our identification strategy is self-selection of farmers into the different companies. We show in Table 2 that farmers producing for both companies were very similar in terms of a large set of observable socioeconomic characteristics before the insurance program was implemented. This set up allows us to compare farmers living in the same areas but with different access to insurance.

Another potential concern with our identification strategy is the possibility that farmers could have self-selected into different companies once the insurance program became available. However, we find that farmers maintain long-term relations with their company. About 90% of farmers who cultivated tobacco in the main harvest of 2005 continued to produce tobacco for the same company in 2010. Moreover, about 94% of farmers remained with the same tobacco company between 2007 and 2008, following the program's initial implementation. Furthermore, we find no systematic pattern in company flows after the insurance was introduced nor differences in characteristics for households who changed company compared with the majority who maintained a stable relationship with their tobacco company.[10]

The Insurance Policy

In our research region, insurance was voluntary, with the decision to purchase left up to individual farmers. Once farmers signed the production contract, they were informed about

[9] The majority of the farmers in Coltabaco (75 percent) did not know about the program. Also they were not aware that the company was planning to implement an insurance program.

[10] About 5.6% of our sample changed company in the research period 2009-2010

the insurance program and could decide whether or not to purchase it. In 2008, about 17 percent of the eligible farmers bought the insurance; by 2010, take up had reached around 83 percent.

The insurance premium totals 6.8 percent of the estimated production costs. Accordingly, 60 percent is subsidized by the public fund, 20 percent by the tobacco association (Fondo del Tabaco) and another 6 percent by the tobacco company, so that farmers only have to pay 14 percent of the premium plus value-added taxes (16 percent). This amounts to approximately 100,000 Colombian Pesos (COP; approx. 50 US$) per hectare for Burley tobacco. All administrative work is performed by the tobacco company so that farmers only need to sign the papers during the contracting phase with the tobacco company. The insurance cost is paid at the end of the cropping season. The banks are not directly involved in the roll out of the program and do not promote insurance contracts among farmers. In cases of a loss, farmers inform tobacco company officials, who then forward the claim to the insurance company. Within eight days after receiving the report, an inspection should take place. The independent inspector estimates how the damage will affect the final yield based on his experience. Indemnification payments are triggered when weather events reduce the yield, y_i, below 70% of the historic yield, h_i.[11] The insurance covers production costs, c, after the plots have been established, hence risks associated with plant transplantation or the curing phase are not covered.[12] In cases of damage, a deductible of 15 percent of the estimated costs is applied. The following formula is used to estimate the value of indemnity payments:

$$Indemnification = (0.7 * h_i - y_i) * \frac{c}{h_i} - 0,15 * c$$

Regarding the exposure to shocks, the region was struck by adverse weather events in two consecutive years. During the main harvest of 2009, a major drought caused substantial damages and in the second harvest of 2010, excess of rain led to significant crop failures. After the program had been implemented, indemnities were triggered in several cases. In our sample, around 35 percent of the insured households received an indemnity in either 2009 or

[11] The historic yield represents the average of the last four production periods. If no historical data exist, regional information is used as reference.

[12] In 2010, the production cost per hectare was estimated to be 6.7 mil. COP for Burley tobacco. The indemnification considers the cost per production unit. Hence, the cost per hectare is divided by the historical yield.

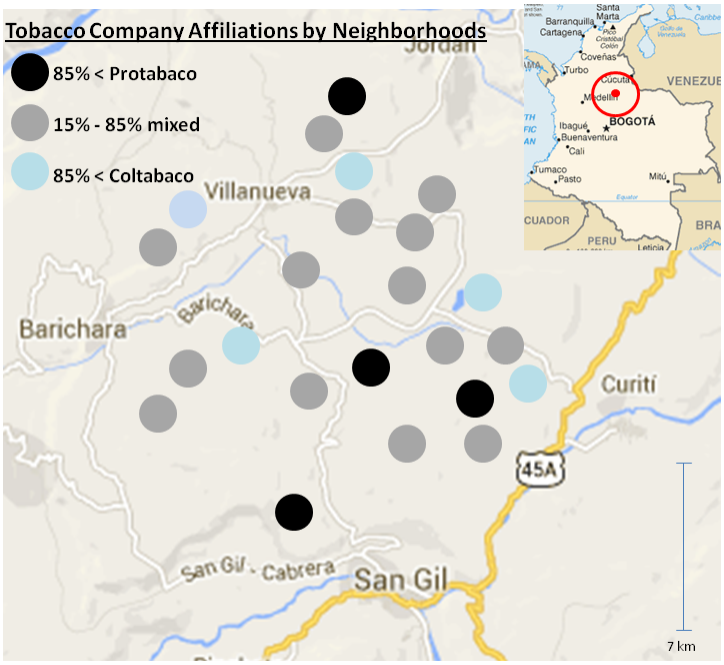
2010. Yet, the verification processes have not been problem-free. In our sample of producers, the verification only took place 20 days after the claim, and every tenth claim never had an inspection.

3 Data

In order to evaluate the impacts of insurance, we conducted a survey with tobacco producers in Santander, Colombia. Following a pilot study, we interviewed households between February and March 2011. The survey was carried out in four municipalities: San Gil, Barichara, Villa Nueva, and Curiti. After identifying the production nucleus in each municipality, farmers were randomly selected using producer lists from the two tobacco companies for 2008. Out of 2,242 tobacco farmers in the research region, 587 were randomly selected to be interviewed. Indemnified households were oversampled in order to get a sufficient amount of treated households.[13] After excluding untraceable households and duplicates (selected farmers living in the same household), 468 households in total were interviewed. Out of these, 306 produced for Protabaco and 130 for Coltabaco in 2010 main harvest. To have comparability, we randomly selected farmers who worked with different companies but who lived in the same neighborhoods. Figure 1 displays a map of the selected neighborhoods. We classify villages according to whether the proportion of producers from Protabaco is below 15 percent, between 16 percent and 84 percent, or above 85 percent. It can be observed that in most of the neighborhoods, we have a fairly good overlap of producers from both companies. Therefore it can be expected that producers who work for different companies, but live in the same neighborhoods, are equally exposed to weather shocks.

To examine the comparability of farmers with and without access to insurance, we included several questions on household characteristics in 2005, when the insurance program had not yet been implemented. To analyze the impact of insurance on households' well-being, we included detailed questions on household loans for the years 2009 and 2010. This includes information on whether households used loans from banks, cooperatives or informal sources, loan values, nominal interest rates, and maturity as well as the main motivation for taking up the loan. Moreover, we asked for households' aggregated debts, savings, assets, income, and

[13] The findings are robust to including probability weights that regard company, insurance, and indemnification likelihoods.



Source: google maps and http://atlasdesantander.blogspot.de/ (8.10.2013)

Figure 1: Research Neighborhoods and Tobacco Company Affiliation

expenditures at the time of the interview.

4 Methodology

Our identification strategy benefits from a natural experimental setup in which one of two groups of comparable farmers had access to an insurance program while the other did not. Farmers for both companies were similar in almost all socioeconomic characteristics before the program was implemented. As farmers maintained long-term relations with their tobacco company, access to the program can be considered exogenous. This assumption implies that the expected value of variable Y, before the program was implemented ($T = 0$), is the same for farmers who took up the program, $Y(1)$, and those who did not, $Y(0)$, or that there is no self-selection.

$$E\left(Y_i\left(1\right) \mid T = 0\right) = E\left(Y_i\left(0\right) \mid T = 0\right) \tag{1}$$

As eligible farmers were not required to participate in the program, we use access to the insurance program as treatment variable. By doing so, we compare households with and

without access to the insurance regardless of their treatment participation decision. This Intent-to-Treat (ITT) approach is less restrictive than using actual insurance status as it avoids self-selection issues related to the decision to purchase the insurance. When access to the program is exogenously determined, a OLS regressions of the outcome variable Y_i on a dummy variable T_i that takes a value equal to one for participants with access to the program and zero otherwise, can be estimated to quantify the program's effects. Differences in observable characteristics between eligible and non-eligible farmers can be controlled for by including those characteristics X_i in the regression:

$$Y_i = \beta_0 + \beta_1 T_i + \beta' X_i + u_i \tag{2}$$

The coefficient β_1 reflects the impact of access to program, while β' refers to the coefficients of the control variables and u_i to the error term. For the variables where we have information covering two years, we make use of the panel structure and estimate random effects models to account for possible serial correlation of outcome variables. The estimated β_1 yields only a lower bound estimate of the average treatment effect, as several households did not enroll in the insurance program despite having access to it (Angelucci and Attanasio, 2006).

As the research region was adversely affected by climatic shocks in the analyzed period, we further present results for the sub-group of households that were affected by a shock. Shocks are defined according to the self-reported exposure.

Additionally, we look at heterogeneous effects by poorer and wealthier households. Therefore we define sub-groups by median assets in 2005. Low-asset households reported average assets worth 379,000 COP (approx. 190 US$). In contrast, the wealthier sub-group had on average 17.8 mio. COP (approx. 9,000 US$).

5 Results

5.1 Descriptive Statistics and Balance Test

To compare the socioeconomic characteristics of producers in each company, we conducted a randomization test and regressed the characteristic Yi on dummy variable (Ti) that takes a value of one for farmers who produced with Protabaco and therefore had access to the

insurance program. The first column of Table 2presents the mean value for producers in Coltabaco (non-treated) farmers while the second column presents the estimated coefficient on Ti. This coefficient indicates if there are significant differences between farmers with access to insurance (Protabaco) compared to those without access.

Comparing household characteristics, we find that farmers for each company were very similar before the program's implementation in 2005. Most survey participants were male (91 percent) with an average age of 47 years. Participants in the survey have a relatively low education level, with three years of schooling completed on average. Participants lived relatively close to populated areas with an average distance from their homes to the next town of 35 minutes. Participation in community associations was relatively high, with 62 percent belonging to at least one organization. About half of the farmers owned their plots while the rest engaged in share cropping agreements. Households have accumulated relatively little wealth and reported on average assets worth 17.7 mio. COP (approx. 8,800 US$), which was mainly driven by land property. Liquid assets excluding land property totaled on average up to 1.5 mio. COP per household. A large proportion of the farmers had debts (80 percent) and for 39 percent of the respondents, debts were above the average value of liquid assets (2.5 mio. COP). Farmers with access to insurance were more likely to fall into the high-debt category than farmers in the control group. Farmers were rather experienced, having cultivated tobacco for more than 20 years on average. Tobacco was the main source of income, with about half of the cultivated hectares were planted with this crop.

About 83 percent of farmers cultivated Burley tobacco in the main harvest (January–March). We find that farmers with access to the insurance have on average larger plots with other crops as well as tobacco and cultivated more hectares with Burley in 2005 than the control group. These differences seem to be related to differences in company demand rather than inherent dissimilarities between farmers for each company. The index of technology innovation indicates that on average, farmers have adopted two to three of the new production techniques such as the use of certified seeds, construction of water reservoirs, use of soil studies, implementation of seedling techniques, and use of system of registers.

Regarding the exposure to shocks, more than 80 percent of sampled households reported a shock, which was mainly driven by climatic events. In our sample, these shocks triggered insurance indemnifications for 35 percent of the insured farmers in 2009 and 2010. The de-

scriptive statistics suggest that tobacco losses were similar for farmers with and without access to the insurance.

Table 2: Descriptive Statistics and Randomization Test

		Constant	**Insurance Access**	
	N	Coeff.	Coeff.	t-value
Male HH Head (d.)	468	0.90***	0.01	(0.26)
Age (years)	465	47.56***	-0.72	(-0.57)
Education HH Head (years)	463	3.59***	0.09	(0.38)
Children	468	1.18***	-0.19	(-1.66)
Remoteness (min. to next town)	457	35.57***	-0.61	(-0.28)
Memberships in Associations	468	0.57***	0.09	(1.27)
Shared Cropping 2005 (d.)	468	0.48***	0.05	(1.08)
Owner 2005 (d.)	468	0.41***	-0.04	(-0.82)
Other Land Possession Status 2005 (d.)	468	0.10***	-0.03	(-0.97)
Rooms 2005	468	2.77***	-0.02	(-0.13)
Assets 2005 (mio. COP)	468	17.34***	0.06	(0.02)
Liquid Assets 2005 (mio. COP)	468	1.49***	0.73	(1.47)
Productive Assets 2005 (mio. COP)	468	0.91***	0.37	(1.20)
Debt Categories 2005				
\$0 COP	455	0.21***	-0.04	(-1.16)
\$1 - \$0.5 mio. COP	455	0.03*	0.01	(0.61)
\$0.5 - \$1 mio. COP	455	0.14***	-0.05	(-1.48)
\$1 mio. - \$2.5 mio.COP	455	0.21***	-0.03	(-0.80)
\$2.5 mio.- \$4 mio. COP	455	0.19***	-0.04	(-1.01)
>\$4 mio. COP	455	0.20***	0.15**	(3.27)
Experience Tobacco (years)	464	21.60***	1.17	(0.88)
Tobacco Hectare 2005	429	1.64***	0.12	(0.96)
Non Tobacco Hectare 2005	439	1.18***	0.29**	(3.02)
Burley main Harvest 2005 (d.)	429	0.83***	0.13***	(4.61)
Prod. Technology 2005[1]	429	2.72***	-0.03	(-0.27)
Irrigation System 2005 (d.)	429	0.04*	0.00	(0.10)
Land Diversification 2005[2]	444	0.43***	0.02	(1.04)
Tobacco Losses per hectare 2009[3]	468	1.70***	0.13	(1.60)
Tobacco Losses per hectare 2010[3]	465	1.73***	-0.03	(-0.31)
Non-Tobacco Losses 2009[4]	468	1.07***	0.31	(1.59)
Non-Tobacco Losses 2010[5]	468	1.60***	-0.11	(-0.36)

* $p<0.05$, ** $0.05<p<0.01$. d. if dummy variable.[1] Production index 0-5 measures degree of adoption of technological innovations like certified seeds, dikes, soil studies, seedling technique, and system of registers.[2] Share of tobacco land to total cultivated hectares.[3] Mean self reported tobacco losses per hectare at the neighborhood (vereda) level in millions. COP. [4] Non-tobacco losses including agricultural and non agricultural losses in millions at the individual level. COP.

Table 3 presents the descriptive statistics of the outcome variables used in our analysis and compares farmers with and without access to insurance. The first set of outcome variables

refers to financial services and considers access to loans in 2009 and 2010. As farmers finance tobacco cultivation with productive loans from the tobacco companies, all households in our sample use loans. Protabaco farmers received on average 3.5 mio. COP per hectare of Burley tobacco in the main harvest whereas Coltabaco farmers received on average 4.1 mio. COP. Yet we find no significant differences in the value of the productive loans (t-Test $|Pr(|T| > |t|) = 0.34$). Ideally, one would consider the effect of the insurance program on productive loans. However, as the company determines the technological cultivation package and the value of the loan per hectare, the estimated ITT coefficient could potentially reflect technological differences. For that reason, our analysis considers the effect on other forms of loans beside the tobacco company loans, which we refer to as private loans. The data indicate that about 54 percent of households had at least one private loan. The most common sources of funding were cooperative loans (33 percent) followed by bank loans (24 percent) and informal loans (9 percent). On average, each household reported loans worth 2.5 mio COP, which is only slightly less than the average annual income per household member in 2010. The mean bank and cooperative loans were similar in size whereas the value of informal loans reached on average only one third the value of formal loans. Without controlling for other characteristics, a simple comparison of farmers with access to the insurance program to those without access shows no significant differences in loan values.

Private loans were typically used to finance additional production inputs for tobacco and non-tobacco crops (65 percent), consumption (21 percent), repay pending debts (21 percent) or for other purposes (15 percent). Simple differences indicate that farmers with access to the insurance less often reported using loans to repay debts in 2010.[14] Regarding loan conditions, we find that the average loan was conceded over 18 month with an interest rate of about 2%. Yet, farmers with access to the insurance were associated with significantly larger maturities than the control group.

The second set of outcome variables refer to financial assets. Information on households savings was collected using a categorical variable that included the following saving ranges: No saving or savings of less than 1 month's minimum wage (500,000 COP), savings of 1 to 2 months' minimum wages (500,000 COP to 1 mio. COP), and savings of more than 1 mio. COP. The descriptive statistics indicate that most households had either depleted or never

[14] As prevalence of these categories is low we combined them into one category.

managed to build up savings, and about 77 percent of households reported being in the lowest category at the end of 2010. However, farmers with access to the insurance were on average more likely to have savings compared with farmers without access. In addition, we collected detailed information on assets including land property, machines, livestock, and other assets. Yet, especially for those households that owned their land, large variations in asset values was reported, which was often related to farmers having problems assigning values to their land.[15] Therefore, we decided to use log values of assets to reduce the impacts of outliers on the estimation results. Liquid and productive assets in 2010 were significantly larger for the group of farmers that had access to insurance. Furthermore, we asked for household expenses so that we could aggregate a consumption measure per household member and year. The average value of per capita consumption was 2.9 mio. COP (approx 1,460 US$), which was similar for eligible and ineligible farmers. Lastly, we collected information on household income per-capita, which totaled on average up to 2.4 mio. COP in 2010. This is slightly less than reported expenses, which could suggest that household aggregated debts during this year. Farmers with access to insurance reported on average higher total and tobacco incomes than farmers without access to insurance.

[15]To effectively handle outliers, we excluded 20 observations above a two standard deviation range, which corresponded to assets worth 140 mio. COP.

Table 3: Descriptive statistics and randomization test of Outcome Variables

	2009				2010			
		Constant	Insurance Access			Constant	Insurance Access	
	N	Coeff.	Coeff.	t-value	N	Coeff.	Coeff.	t-value
Loans								
Loan Value (mio. COP)								
Loan (total)	467	0.97***	0.20	(0.98)	468	2.47***	0.62	(1.67)
Bank Loan	467	0.36**	0.13	(0.92)	468	1.10***	0.43	(1.60)
Cooperative Loan	468	0.54***	0.09	(0.66)	468	1.00***	0.32	(1.49)
Informal Loan	468	0.07*	-0.01	(-0.39)	468	0.37***	-0.13	(-1.45)
Loan Motive								
Investment	177	0.74***	-0.08	(1.05)	325	0.65***	0.05	(0.94)
Repay Debt	177	0.13**	-0.02	(-0.37)	325	0.21***	-0.10*	(-2.30)
Consumption	177	0.21***	-0.01	(-0.07)	325	0.25***	-0.05	(-0.98)
Other	177	0.09	0.05	(0.83)	325	0.15***	0.03*	(0.75)
Loan Conditions								
Interest Rate (%)	85	3.19***	-1.36	(-1.96)	235	2.30***	-0.28	(-0.83)
Maturity (Month)	143	18.28***	2.60	(0.83)	280	18.71***	5.24**	(2.60)
Financial Assets[1]								
Savings								
\$0 - \$0.5 mio. COP					468	0.85***	-0.13**	(-3.07)
\$0.5 mio. - \$1 mio. COP					468	0.08**	0.06	(1.77)
>\$1 mio. COP					468	0.06*	0.07*	(2.24)
Assets								
log Assets					434	1.55***	0.25	(1.13)
log Liquid Assets					409	-0.29*	0.52***	(3.41)
log Productive Assets					369	13.32***	0.43**	(2.25)
Consumption								
Consumption					452	2.92***	0.21	(1.29)
Food Consumption					452	1.75***	0.03	(0.04)
Non-Food Consumption					433	0.51***	0.02	(0.80)
Income								
Income per capita					464	2.36***	0.75**	(2.95)
Tobacco Income per capita					447	1.26***	0.56***	(3.52)

* $p<0.05$, ** $0.05<p<0.01$. Loans do not include loans from tobacco companies. Loan motives transformed to dummies that are not mutually exclusive. Interest rate refers to monthly nominal rate.[1]Information on financial assets is only available for 2010.

5.2 Econometric Results

Impact on Financial Services

Access to insurance could affect household use of financial services in several ways. First, by reducing the risk associated with productive investments, it could increase access to credit. Second, by reducing exposure to risk, access to insurance could decrease the need to take up

loans to deal with emergencies or to repay debts. The first part of the analysis considers the impact of access to insurance on the total value of loans held by households.

As discussed previously, a large fraction of respondents (46 percent) reported having zero private loans. To account for censoring in zero, we use two different estimation methods. First, we consider the self-selection process to explain take up using a two stage Heckman selection model. In the first stage, we model loan take up L_i as a function of the observed differences X_i and the distance to the next lending institution Z_i. The distance to the next lending institution approximates the transaction cost, which is expected to affect the likelihood of taking up a loan regardless of the loan source or borrower motivation. In order to proxy the distance to the next lending institution, we use the time it takes households to get to the next town and dummies for the municipality in which the household lives. Hence, in the first stage, we estimate the following model:

$$L_i = \gamma' Z_i + \delta' X_i + u_{is} \qquad u_{is} \sim N(0,1) \tag{3}$$

In the second stage we estimate the impact of access to the insurance on loan outcomes Y_i adding the inverse Mills ratio to Equation 2.[16]

The second estimation method assumes that the mechanisms that explain the decision to take a loan and the value of the loan depend on the same underlying process. Hence we estimate a random effects Tobit model and report the estimated marginal effects at the mean.

The estimated ITT coefficients on financial services are displayed in Table 4. Panel A considers the ITT effects on the value of private loans. Results of the Heckman selection model indicate that households who had access to insurance have significantly lower private loan amounts. Considering the source of funding, we find that the effect on loan values is manly driven by less informal loans. The estimations of the random effect Tobit model confirm a significant negative effect of access to insurance on use of informal loans. The estimated marginal effect suggests that access to insurance was related to a reduction of about 200,000 COP (approx. 100 US$) in informal loans. Once we break up the sample and consider whether households reported being affected by a negative shock, we find similar effects: farmers with access to insurance who were affected by a shock had fewer informal loans than farmers without

[16] Appendix A presents the complete estimation including the selection model. We find that there is persistence in indebtedness, with households that used private loans in 2005 being more likely to report larger loan values in 2009 and 2010 than household with lower debts in 2005. We also find that producers living in Barichara municipality are more likely to have used private loans. We find no significant effects for the other variables included in the selection model.

insurance access. Furthermore, considering heterogeneous effects on poor and more well-off households, the ITT coefficients on informal loan values are similar in size for these two groups of farmers, indicating that both groups benefited equally from access to insurance.

Why would eligible households use fewer informal loans? To answer this question, it is important to consider the motivation for taking out loans. Panel B in Table 4 presents the results considering the reasons for loan take-up. In the analysis, we consider loan motives independently of the funding source as breaking down the analysis by loan type significantly reduces the number of observations in each category.[17] The econometric results indicate that access to insurance did not affect the use of loans for productive investments nor for consumption purposes. However, access to insurance reduced the need to take loans to repay debts. This result could indicate that the insurance reduces the vulnerability to falling into debt traps. When we disaggregated the analysis by households that were affected by a shock, or by wealth level, we find that the direction of the effect is similar, although due to the smaller number of observations, it is not significant. For low-asset households, access to the insurance is associated with an increase in the use of loans for other purposes.

Panel C presents the estimated ITT coefficients on loan conditions. We test if access to insurance led to better credit conditions approximated with the nominal interest rate and credit maturity. In the analysis, we consider the weighted average of the interest rate and maturity for all loan sources. Generally, access to the insurance was associated with lower interest rates and larger maturities compared to the control group. Poorer households with access to insurance used credit with lower interest rates than households in the control group. Richer households had access to credit with longer maturities.[18]

Impacts on Financial Assets

For the outcome variables on financial assets, we only have information for one point in time as we considered that it would be too difficult for interviewees recall exact values for past years. We estimated equation (2) using either OLS models for continuous variables or Multinomial Logit coefficients for the categorical variables. As control variables, we include variables where we observed differences in 2005 among producers from both companies and

[17] As a robustness test we look at the effect by funding source and found that while the direction was consistent, the effects were no longer significant (results not presented).

[18] Estimations of the selection models do not converge for subgroups so we only present the Tobit random effects coefficients.

Table 4: Insurance ITT Impact on HH Loans

	All HH				HH with SHOCK				LOW ASSET HH				HIGHER ASSET HH			
	Heckman [1]		R.E. Tobit[2]		Heckman [1]		R.E. Tobit[2]		Heckman [1]		R.E. Tobit[2]		Heckman [1]		R.E. Tobit[2]	
	N	Coefficient	N	Mg Effect	N	Coefficient	N	Mg Effect	N	Coefficient	N	Mg Effect	N	Coefficient	N	Coefficient
A. Loan Value (mio. COP)																
Loan	889	-0.60*	909	-0.13	745	-0.64	758	-0.22	439	-0.59*	447	-0.21	450	-0.68	461	-0.00
		(-1.66)		(-0.83)		(-1.60)		(-1.19)		(-1.67)		(-1.27)		(-1.16)		(-0.01)
Bank	889	-0.15	909	0.03	745	-0.13	758	0.03	-	-	447	-0.12	450	0.02	461	0.19
		(-0.50)		(0.17)		(-0.39)		(0.17)				(-0.68)		(0.04)		(0.73)
Cooperative	890	-0.20	910	-0.08	746	-0.25	759	-0.18	440	0.08	448	-0.02	450	-0.46	461	-0.15
		(-0.84)		(-0.69)		(-0.94)		(-1.38)		(0.27)		(-0.15)		(-1.20)		(-0.79)
Informal	889	-0.26**	909	-0.19**	745	-0.27**	758	-0.21**	440	-0.28**	447	-0.08	449	-0.28*	461	-0.30*
		(-2.53)		(-2.03)		(-2.41)		(-2.05)		(-2.19)		(-0.73)		(-1.73)		(-1.94)
B. Loan Motive (Dummy)																
Investment	890	-0.13	910	-0.04	746	-0.15	759	-0.07	440	-0.20	448	-0.09	450	-0.04	462	0.01
		(-0.93)		(-0.80)		(-1.13)										
Repay Debt	890	-0.29*	910	-0.01	746	-0.23	759	-0.01	440	-0.29	448	-0.01	450	-0.25	462	-0.01
		(-1.76)		(-1.44)		(-1.34)		(-1.37)		(-1.26)		(-0.90)		(-1.45)		(-1.04)
Consumption	890	-0.11	910	-0.01	746	-0.09	759	-0.01	440	-0.25	448	-0.02	450	0.00	462	0.01
		(-0.78)		(-0.71)		(-0.54)		(-0.72)		(-1.09)		(-1.04)		(0.01)		(0.37)
Other Motives	890	0.10	910	0.01	746	0.10	759	0.01	440	0.69**	448	0.04	450	-0.25	462	-0.03
		(0.62)		(0.74)		(0.56)		(0.58)		(2.19)		(1.55)		(-1.26)		(-1.13)
C. Condition																
Interest (%)	705	-0.34	812	-0.12	-	-	596	-0.12	-	-	360	-0.26*	-	-	363	0.02
		(-1.60)		(-1.28)				(-1.28)				(-1.93)				(0.17)
Maturity (Months)	794	3.94**	723	0.73	-	-	674	0.41	-	-	397	-0.27	-	-	415	2.15
		(2.03)		(0.81)				(0.42)				(-0.24)				(1.55)

* p<0.1, ** 0.<p<0.05. (T-statistic in parenthesis). Coefficients missing in cases where Maximum Likelihood estimations do not converge.[1]Estimated coefficients on access to insurance from the second stage of the Heckman Selection models. Control variables: Tobacco hectares 2005, Ha. Burley cultivated 2005, highest debt category 2005, aggregated input and cash loans from tobacco company. Selection equation on loan take up controls for Municipality and remoteness. [2]Estimation of Random Effects Tobit models. Marginal effects reported. Marginal effects reported for logit models. Control variables: tobacco hectare 2005, Burley cultivated 2005, highest debt category 2005. Respondents who changed company between 2009-2010 are excluded. HH shock are classified according to self reported shocks. Low asset households are defined according to the median assets in 2005 (0.37 mio. COP).

the loans granted by the tobacco companies. Table 5 displays the estimated ITT coefficients. Marginal effects of the Multinomial Logit regression suggest that having access to insurance reduced the likelihood of being in the lowest savings category by 11 percent. Once that we consider only households affected by a shock, we find that the positive effects of access to insurance on saving are significantly higher for households affected by a shock compared to all households in the sample. The results indicate that access to insurance particularly benefited poorer households. We find that households with fewer assets in 2005 who had access to insurance were significantly less likely to fall in the low savings category and significantly more likely to fall in the high savings group than households without insurance access. We find no significant effects from access to insurance on high-income households. This result suggests that, in the absence of insurance, poor households tended to deplete their savings, whereas relatively richer households use alternative strategies. Regarding the effect on total value of assets, we find no significant effects from access to the insurance. If we exclude land property and only look at liquid asset values, we observe a positive and significant effect for access to the insurance program. This effect is robust once we consider only households who reported being affected by a shock. The effect of the insurance varies for poor and rich households. For the poor, insurance does not have an effect on the value of assets, whereas for relatively richer producers, the effect is positive and significant. Moreover, for households with high asset levels, the effect of the insurance is also positive on productive assets.

We compared reported consumption expenditures disaggregated between food and non-food consumption and find no significant effects due to the insurance. This could be due to a low elasticity of demand for food and the relatively low share of non-food consumption in household expenditures. This result could suggest that households reacted to shocks by reducing saving behavior and increasing debts without affecting consumption. Further research should consider whether their consumption level is already too low to be affected and thus leaves little scope for adjustments.

Finally, we compare the impacts of insurance on income. The results indicate that the insurance program had no significant effects on household income per-capita, which could be related to the fact that the insurance was relatively new and that changes in risk-taking behavior that could affect incomes need a certain amount of time and confidence in the insurance to emerge. Similarly, we find no significant effects on per capita income from tobacco.

Table 5: Insurance ITT Impact on Cross Sectional Variables, 2010

	ALL HH			HH with SHOCK Only			LOW ASSET HH			HIGHER ASSET HH		
	N	Coeff.	z-Val.	N	Coeff.	z-Val.	N	Coeff.	z-Val.	N	Coeff.	z-Val.
Savings[1]												
$0 - $0.5 mio. COP	438	-0.11**	(-2.40)	386	-0.14**	(-2.75)	222	-0.66**	(-3.89)	230	-0.06	(-0.83)
$0.5 mio. - $1 mio. COP	438	0.06*	(1.71)	386	0.06	(1.60)	222	0.01	(0.26)	230	0.02	(0.46)
>$1 mio. COP	438	0.05	(1.33)	386	0.08*	(1.85)	222	0.65**	(3.27)	230	0.03	(0.59)
Assets												
log Assets	434	-0.03	(-0.13)	364	-0.17	(-0.67)	213	-0.10	(-0.31)	210	-0.13	(-0.56)
log Liquid Assets	409	0.49**	(2.88)	340	0.36**	(1.98)	207	0.25	(1.01)	191	0.69**	(2.97)
log Productive Assets	369	0.32	(1.49)	304	0.12	(0.50)	164	-0.03	(-0.09)	195	0.51*	(1.70)
Consumption												
Consumption	452	0.15	(0.92)	376	0.22	(1.27)	217	0.15	(0.64)	224	0.11	(0.44)
Non-Food Consumption	433	0.01	(0.26)	363	-0.01	(-0.21)	210	-0.01	(-0.30)	213	0.02	(0.32)
Food Consumption	452	0.01	(0.14)	376	0.04	(0.39)	217	0.09	(0.59)	224	-0.06	(-0.43)
Income												
Income	464	0.24	(1.03)	384	0.15	(0.70)	224	0.31	(1.06)	228	0.30	(0.85)
Tobacco Income	447	0.22	(1.57)	374	0.03	(0.23)	212	0.18	(1.02)	223	0.32	(1.43)

* p<0.1, ** 0.<p<0.05. [1]Multinomial Logit (first category used as base). A dummy for access to the insurance is used as treatment variable. Marginal effects reported. Control variables: tobacco hectare 2005, burley cultivated 2005, highest debt category 2005, aggregated input and cash loans from tobacco company. Company changer between 2009-2010 are excluded. Robust variance estimated. HH shock are classified according to self reported shocks. Low asset households are defined according to the median assets in 2005 (0.37 mio. COP).

6 Robustness Checks

The analysis pools data from 2009 and 2010. Since the effect of access to insurance could differ for each year, we separate the analysis by year. Table 6 presents the results for each year independently. We find that access to insurance reduced the need for informal loans in 2010. Households with access to insurance were less likely to use the loan for repayments and had access to loans with longer maturities. We further find that for 2009, access to insurance reduced loan uptake from cooperatives and is associated with credit at lower interest rates.

Table 6: Insurance ITT Impact by year

	2009						**2010**					
	Heckman [1]			**Tobit**[2]			**Heckman** [1]			**Tobit**[2]		
	N	Coeff.	z-Val.	N	Mg Effect	z-Val.	N	Coeff.	z-Val.	N	Mg Effect	z-Val.
Loan Value (mio. COP)												
Loan	444	-0.95**	(-2.16)	454	-0.11	(-0.21)	445	-0.35	(-0.71)	455	-0.20	(-0.37)
Bank Loan	444	-0.08	(-0.20)	454	0.79	(0.73)	445	-0.11	(-0.27)	455	0.12	(0.16)
Cooperative Loan	445	-0.73**	(-2.22)	455	-0.24	(-0.44)	445	0.04	(0.14)	455	-0.20	(-0.40)
Informal Loan	-	-	-	455	-0.82	(-0.89)	444	-0.30**	(-2.03)	455	-1.18*	(-1.85)
Loan Motive (Dummy)												
Investment	445	-0.44	(-1.57)	455	-0.03	(-0.57)	445	0.03	(0.18)	455	-0.00	(-0.06)
Repay Debt	445	-0.03	(-0.11)	455	0.01	(0.23)	445	-0.40**	(-2.00)	455	-0.06*	(-1.94)
Consumption	445	-0.06	(-0.23)	455	0.00	(0.11)	445	-0.14	(-0.80)	455	-0.04	(-1.07)
Other Motives	445	0.19	(0.72)	455	0.02	(0.92)	445	0.07	(0.37)	455	0.02	(0.53)
Loan Condition												
Interest Rate (%)	353	-1.44**	(-1.75)	404	-0.99**	(-2.19)	-	-	-	361	-0.20	(-0.63)
Maturity (Month)	395	3.69	(0.96)	362	3.00	(0.63)	399	3.99*	(1.79)	408	3.41	(1.28)

* p<0.1, ** 0.<p<0.05. (T-statistic in parenthesis). Coefficients missing in cases where Maximum Likelihood estimations do not converge.[1]Estimated coefficients on access to insurance from the second stage of the Heckman Selection models. Control variables: Tobacco hectares 2005, Ha. Burley cultivated 2005, highest debt category 2005, aggregated input and cash loans from tobacco company. Selection equation on loan take up controls for Municipality and remotness. [2]Estimation of Tobit models. Marginal effects reported. Marginal effects reported for logit models. Control variables: tobacco hectare 2005, Burley cultivated 2005, highest debt category 2005.

In the main estimations, we have controlled for the set of socioeconomic characteristics where we find significant difference across both group of producers. The question then arises of whether the results could be biased due to omitted variable bias. To answer this question, we ran the analysis including a larger set of socioeconomic characteristics. Since access to loans can depend on household wealth, we control for land ownership, the value of the liquid assets in 2005, and education, age, and sex of the household head. As financial needs might

vary depending on the losses suffered, we also include controls on the value of tobacco losses at the neighborhood level. Finally, to account for access to credit we control for remoteness, measured as time needed to reach the next town. Column 1 in Table 7 presents the estimated effects on loans. The results of this model confirm previous results and indicate that access to insurance reduced informal loan use, reduced the take up of loans to repay debts, and had a significantly negative effect on the interest rate.

An additional robustness check explores the effect of access to insurance by the exposure to covariate shocks. Therefore, we consider the impact of insurance access in neighborhoods where more than 70 percent of survey participants reported being affected by a shock.[19] Column 2 in Table 7 presents these results. The estimations confirm previous results. In addition, we find that households with access to insurance received loans with better conditions (lower interest rates and longer maturities).

The last column in Table 7 presents the results considering only neighborhoods for which we have observations for producers from each company.[20] As the number of observations drops, the significance level is lower, yet the results confirm the significant negative effect of access to insurance for using informal loans to repay debts.

Table 8 presents robustness tests on financial assets. The first model adds additional socioeconomic controls, the second model considers the effect over neighborhoods with more than 70 percent of the farmers were hit by a shock, and the last model restricts the analysis to neighborhoods where farmers from each company can be found. All three models confirm previous results and indicate that farmers with access to insurance have higher savings, accumulate a higher value of liquid assets, and earn higher incomes from tobacco. Moreover, one model indicates that households with access to insurance have higher consumption levels than households in the control group.

[19] The previous model considered the self-reported measure of being hit by a weather shock.
[20] 15 to 85 percent of the producers contract with Protabaco.

Table 7: Impact Insurance ITT on Financial Services Impact Robustness Checks

	Extended Control Variables[1]						**Cov. Shock Neighborhoods**[2]						**Mixed Neighborhoods**[3]					
	Heckman [4]			**R.E. Tobit**[5]			**Heckman** [4]			**R.E. Tobit**[5]			**Heckman** [4]			**R.E. Tobit**[5]		
	N	Coeff.	z-Val.	N	Mg Eff	z-Val.	N	Coeff.	z-Val.	N	Mg Eff	z-Val.	N	Coeff.	z-Val.	N	Mg Eff	z-Val.
Loan Value (mio. COP)																		
Loan	879	-0.64*	(-1.86)	879	-0.10	(-0.65)	749	-0.71*	(-1.72)	763	-0.23	(-1.29)	565	-0.46	(-1.01)	575	-0.36*	(-1.65)
Bank Loan	879	-0.19	(-0.67)	879	0.04	(0.28)	749	-0.25	(-0.76)	763	-0.08	(-0.49)	565	-0.08	(-0.21)	575	-0.14	(-0.68)
Cooperative Loan	880	-0.20	(-0.83)	880	-0.06	(-0.47)	750	-0.16	(-0.57)	764	-0.09	(-0.70)	566	-0.09	(-0.30)	576	-0.17	(-1.17)
Informal Loan	879	-0.27**	(-2.57)	879	-0.20**	(-2.03)	749	-0.30**	(-2.48)	763	-0.25*	(-2.50)	-	-	-	575	-0.24**	(-2.14)
Loan Motive																		
Investment	880	-0.12	(-0.81)	880	-0.02	(-0.47)	750	-0.16	(-1.24)	764	-0.08	(-1.44)	566	-0.07	(-0.42)	576	-0.08	(-1.23)
Repay Debt	880	-0.28*	(-1.71)	880	-0.01	(-1.49)	750	-0.24	(-1.40)	764	-0.01	(-1.43)	566	-0.26	(-1.31)	576	-0.01	(-1.32)
Consumption	880	-0.07	(-0.72)	880	-0.00	(-0.31)	750	-0.05	(-0.29)	764	-0.01	(-0.71)	566	-0.17	(-0.87)	576	-0.01	(-1.16)
Other Motives	880	0.09	(0.57)	880	0.01	(0.91)	750	0.10	(0.56)	764	0.01	(0.49)	566	0.21	(1.18)	576	0.01	(0.58)
Loan Condition																		
Interest Rate (%)	698	-0.40*	(-1.89)	698	-0.13	(-1.42)	591	-0.19	(-0.81)	604	-0.17*	(-1.70)	442	-0.22	(-0.87)	451	-0.24**	(-2.08)
Maturity (Month)	-	-	-	785	1.08	(1.18)	669	4.37**	(2.06)	681	0.40	(0.40)	508	3.46	(1.57)	517	-0.40	(-0.38)

* p<0.1, ** p<0.05. (T-statistic in parenthesis). [1]Model with extended control variables including land ownership, education of hh head, liquid assets in 2005, sex of hh head, covariate tobacco loss, age of hh head and remoteness.[2]Only neighborhoods where more than 70% of hh reported a tobacco shock.[3]Only neighborhoods where at least 15% and not more than 85% of households produced for Protabaco. Coefficients missing in cases where Maximum Likelihood estimations do not converge.[4]Estimated coefficients on access to insurance from the second stage of the Heckman Selection models. Other control variables: Tobacco hectares 2005, Ha. Burley cultivated 2005, highest debt category 2005, aggregated input and cash loans from tobacco company. Selection equation on loan take up controls for Municipality and remoteness. [5]Estimation of Random Effects Tobit models.

Table 8: Impact Insurance ITT on Financial Assets Robustness Checks

	Extended Control Variables[1]			Cov. Shock Neighborhoods[2]			Mixed Neighborhoods[3]		
	OLS			OLS			OLS		
	N	Coeff.	z-Val.	N	Coeff.	z-Val.	N	Coeff.	z-Val.
Savings[4]									
$0 - $0.5 mio.	437	-0.12***	(-2.62)	385	-0.12**	(-2.51)	287	-0.12**	(-2.07)
$0.5 mio. - $1 mio.	437	0.06	(1.57)	385	0.06	(1.59)	287	0.06	(1.26)
>$1 mio.	437	0.06	(1.62)	385	0.06	(1.57)	287	0.06	(1.36)
Assets									
log Assets	409	0.04	(0.20)	358	-0.10	(-0.38)	265	-0.14	(-0.48)
log Liquid Assets	385	0.39**	(2.53)	338	0.39**	(2.15)	248	0.38*	(1.73)
log Productive Assets	344	0.26	(1.38)	299	0.27	(1.18)	230	0.26	(0.99)
Consumption									
Consumption	428	0.16	(1.00)	374	0.16	(0.90)	276	0.41**	(2.06)
Non-Food Consumption	412	0.01	(0.21)	361	0.01	(0.21)	266	0.02	(0.55)
Food Consumption	428	0.01	(0.07)	374	0.01	(0.09)	276	0.01	(1.10)
Income									
Income	438	0.24	(1.03)	383	0.16	(0.68)	285	0.27	(0.98)
Tobacco Income	423	0.24	(1.70)	368	0.08	(0.57)	274	0.32*	(1.84)

* p<0.1, ** 0.<p<0.05. (T-statistic in parenthesis). [1]Model with extended control variables including land ownership, education of hh head, liquid assets in 2005, sex of hh head, covariate tobacco loss, age of hh head, and remoteness.[2]Only neighborhoods where more than 70% of hh reported a tobacco shock.[3]Only neighborhoods where at least 15% and not more than 85% of households produced for Protabaco. Coefficients missing in cases where Maximum Likelihood estimations do not converge. [4]Multinomial logit estimation. Marginal effects reported for logit models. Control variables: tobacco hectare 2005, Burley cultivated 2005, highest debt category 2005. OLS models estimated for outcomes in 2010.

Our empirical approach assumes that error terms for the outcome variables are not correlated and we have therefore estimated independent models for loan values and loan motives. However, as loan sources can be substitutes, taking a loan from the bank could act as a substitute for loans from other sources. As robustness check, we estimated loan outcomes simultaneously using Seemingly Unrelated Regressions. Table 9 presents these results. The estimated coefficients are consistent with the results from the Heckman and Tobit models. We find that access to insurance reduced the value of informal loans and decreased the need to use loans to repay debts. For poor households, the effect of access to the insurance was associated with a decrease in the need for loans to finance consumption. Wealthier households with access to the insurance had access to loans with longer maturities.

Table 9: Multivariate Probit and Seemingly Unrelated Regression of Insurance ITT Impact on HH Capitalization

	ALL HH			**HH with SHOCK Only**			**LOW ASSET HH**			**HIGH ASSET HH**		
	Pooled			**Pooled**			**Pooled**			**Pooled**		
	N	Coeff.	z-Val.	N	Coeff.	z-Val.	N	Coeff.	z-Val.	N	Coeff.	z-Val.
Loan Size (mio. COP)[1]												
Bank Loan	908	-0.08	(-0.48)	757	-0.08	(-0.43)	447	-0.28	(-1.64)	461	0.14	(0.50)
Cooperative Loan	908	-0.13	(-0.92)	757	-0.19	(-1.22)	447	0.01	(0.08)	461	-0.20	(-0.89)
Informal Loan	908	-0.13**	(-2.37)	757	-0.15**	(-2.33)	447	-0.14**	(-2.12)	461	-0.13	(-1.46)
Loan Motive (Dummy)[2]												
Investment	910	-0.07	(-0.67)	759	-0.13	(-1.17)	448	-0.22	(-1.46)	462	0.05	(0.35)
Repay Debt	910	-0.24*	(-1.73)	759	-0.26	(-1.72)	448	-0.32	(-1.49)	462	-0.18	(-0.94)
Consumption	910	-0.12	(-0.97)	759	-0.14	(-0.97)	448	-0.34*	(-1.78)	462	0.08	(0.44)
Other Loan Motive	910	0.10	(0.71)	759	0.07	(0.47)	448	0.59*	(2.34)	462	-0.25	(-1.38)
Loan Condition[1]												
Interest Rate (%)	668	-0.12	(-1.02)	550	-0.13	(-1.01)	333	-0.18	(-1.28)	335	0.02	(0.10)
Maturity (Month)	668	0.85	(0.72)	550	1.02	(0.77)	333	-0.47	(-0.34)	335	3.19*	(1.70)

* $p<0.1$, ** $0.<p<0.05$. [1]Seemingly unrelated regression. [2]Multivariate probit regression. Marginal effects reported. Control variables: tobacco hectare 2005, Burley cultivated 2005, highest debt category 2005, aggregated input and cash loans from tobacco company. Company changer between 2009-2010 are excluded. HH shock are classified according to self reported shocks. Low asset households are defined according to the median assets in 2005 (0.37 mio. COP).

7 Conclusion

In this study, we evaluate the impact of a traditional weather insurance on small scale tobacco farmers in Santander, Colombia. We identify the impacts of the program, exploiting a natural experiment in farmers' access to the insurance. The findings indicate that access to insurance generated positive effects for beneficiaries. In particular, we find that agricultural insurance improved household resilience to shocks. The results indicate that the insurance program was associated with a decrease in household loans, leading them away from costly informal loans that were more often used to repay debts and to deal with emergencies. The insurance was also associated with increased savings and an accumulation of liquid assets, both of which could have positive long term consequences. We find that poorer households benefited the most from the program in terms of increased assets.

Despite these positive effects from access to the insurance, we find that there was considerable dissatisfaction with the program, mainly due to problems with the program's administration. One aspect that is particularly weak in the analyzed insurance program is that the evaluation of the extent of damage is carried out by experts who use their experience to estimate the expected yield after a shock. This ad-hoc procedure seems to be very inaccurate. Closer cooperation between the insurance company and tobacco companies could contribute to improving evaluations of the impact of climatic effects. As the tobacco companies maintain historical records on all their farmers' productivity, combining this information with weather data could produce a dataset suitable for use as a basis to determine drops in productivity and to trigger payments. Alternatively, the use of an area yield index scheme could help address damage verification problems and reduce the administration costs.

Another limitation with the analyzed insurance program is that farmers do not properly understand how insurance works. Therefore, they make claims even when the magnitude of the shock is very small. Educational workshops could be required to improve farmer knowledge of the program. In this paper, we have considered the short-term effects of the insurance program, and future research should focus on evaluating its long-term impacts.

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Appendix

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Table 10: Heckamn Selection Models of Impact of Insurance Access conditional on Loans in the HH

	(1) Private Loan	(2) Bank Loan	(3) Cooperative Loan	(4) Family Loan	(5) Prod. Investment	(6) Repay Debts	(7) Reduce Consumption	(8) Other Motive	(9) Interest Rate	(10) Maturity
Main Equation										
Access to Insurance	-0.60^{+}	-0.15	-0.20	-0.26*	-0.13	-0.29^{+}	-0.11	0.10	-0.34	3.94*
	(-1.66)	(-0.50)	(-0.84)	(-2.53)	(-0.93)	(-1.76)	(-0.78)	(0.62)	(-1.60)	(2.03)
Burley 2005	-0.82	-0.93*	-0.15	0.21	0.16	-0.28	-0.15	-0.12	0.82*	-0.99
	(-1.54)	(-2.13)	(-0.41)	(1.34)	(0.76)	(-1.26)	(-0.75)	(-0.53)	(2.60)	(-0.34)
Tobacco Hectares 2005	-0.00	0.14	-0.06	-0.08	0.04	0.12	0.12^{+}	-0.08	0.24*	-0.36
	(-0.01)	(0.93)	(-0.48)	(-1.54)	(0.55)	(1.59)	(1.68)	(-0.92)	(2.36)	(-0.38)
Company Loans	0.19*	0.05	0.09^{+}	0.02	-0.01	-0.04	-0.06	0.03	0.01	-0.16
	(2.69)	(0.91)	(1.89)	(1.16)	(-0.21)	(-1.10)	(-1.50)	(0.68)	(0.19)	(-0.40)
>4 mio. COP Debts 2005	1.99*	1.06*	0.83*	0.03	0.21	0.01	-0.04	-0.03	0.11	4.24*
	(5.91)	(3.82)	(3.69)	(0.34)	(1.24)	(0.07)	(-0.29)	(-0.17)	(0.53)	(2.25)
Selction Equation (Private Loan)										
Remoteness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(1.05)	(0.96)	(0.93)	(0.93)	(1.11)	(0.90)	(0.20)	(0.79)	(0.00)	(0.62)
San Gil	0.41	0.45	0.38	0.30	0.31	0.35	0.24	0.28	-0.02	0.58
	(0.93)	(1.03)	(0.86)	(0.69)	(0.76)	(0.81)	(0.52)	(0.63)	(-0.05)	(1.14)
Villa Nueva	0.57	0.60	0.52	0.47	0.44	0.49	0.35	0.43	0.26	0.65
	(1.30)	(1.40)	(1.21)	(1.10)	(1.05)	(1.16)	(0.75)	(0.95)	(0.51)	(1.30)
Barichara	1.03*	1.07*	0.85^{+}	0.82^{+}	0.77^{+}	0.84^{+}	0.70	0.79^{+}	0.53	1.08*
	(2.32)	(2.46)	(1.95)	(1.93)	(1.81)	(1.95)	(1.48)	(1.76)	(1.06)	(2.14)
Curiti	0.32	0.41	0.22	0.20	0.18	0.24	0.10	0.17	0.05	0.52
	(0.73)	(0.95)	(0.50)	(0.47)	(0.43)	(0.56)	(0.22)	(0.38)	(0.11)	(1.04)
Jordan	0.46	0.42	0.38	0.31	0.33	0.39	0.05	0.27	0.02	0.29
	(0.88)	(0.82)	(0.74)	(0.61)	(0.67)	(0.76)	(0.09)	(0.53)	(0.03)	(0.48)
Access to the Insurance	0.16	0.16	0.15	0.14	0.13	0.14	0.14	0.14	0.05	0.12
	(1.53)	(1.46)	(1.38)	(1.36)	(1.23)	(1.28)	(1.36)	(1.35)	(0.40)	(1.08)
Burley 2005	0.19	0.19	0.20	0.22	0.22	0.21	0.19	0.20	0.16	0.18
	(1.35)	(1.33)	(1.47)	(1.58)	(1.54)	(1.48)	(1.35)	(1.45)	(1.04)	(1.20)
Tobacco Hectares 2005	0.00	0.01	-0.01	-0.00	-0.00	-0.00	-0.01	-0.00	-0.02	-0.00
	(0.04)	(0.12)	(-0.11)	(-0.07)	(-0.01)	(-0.02)	(-0.12)	(-0.05)	(-0.40)	(-0.09)
Company Loans	0.11*	0.11*	0.11*	0.11*	0.11*	0.11*	0.11*	0.11*	0.12*	0.11*
	(4.96)	(4.88)	(4.83)	(4.75)	(4.76)	(4.74)	(4.76)	(4.65)	(4.87)	(4.82)
>4 mio. COP Debts	0.21*	0.21*	0.22*	0.22*	0.21*	0.21*	0.22*	0.22*	0.24*	0.27*
	(2.12)	(2.09)	(2.20)	(2.17)	(2.08)	(2.12)	(2.21)	(2.20)	(2.07)	(2.58)
LR test of indep. eqns. (rho = 0)	0.01	0.03	0.11	0.54	0.40	0.30	0.33	0.58	0.71	0.47
Observations	889	889	890	889	890	890	890	890	705	794

t statistics in parentheses. Full Maximum Likelihood Estimation.
$^{+}$ $p < 0.10$, * $p < 0.05$