Cash for cooperation? Payments for Ecosystem Services and common property management in Mexico *

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Abstract

This paper analyzes whether monetary incentives modify cooperative behavior in activities that have been traditionally unpaid. We provide a simple theoretical framework and exploit variation over time in community access to Payments for Ecosystem Services (PES) within Mexican common property communities to analyze whether payments increase work in forest protection activities, which are increasingly incentivized under PES, and also explore their effects on other community activities that remain unpaid. We find that cash incentives increase work, both in the intensive and extensive margins, in forest conservation activities; however, we claim that the framing of the incentive plays an important role in explaining cooperation in activities that remain unpaid. Our findings indicate that, as long as agents are exposed to sanctions resulting from deviant behavior and their actions are visible, lump-sum transfers without specific work conditionalities can be more effective than wages to promote cooperation. Given the increased popularity of PES initiatives as tools to combat climate change, our findings are important not only for environmental conservation but also for the sustainability and welfare of common property communities.

Keywords: Payments for Ecosystem Services, Cooperative Behavior, Common Property Management, Incentive Framing

1 Introduction

Traditional economic theory assumes that individuals are selfish and rational, and argues that higher monetary incentives will inevitably lead to more effort or higher performance. In recent years, a growing literature has argued that different non-pecuniary motives may shape human behavior and interact with economic incentives in unexpected ways (Akerlof 1980, Selten 1990, Rabin 1993, Ostrom 1998, Benabou & Tirole 2006). Unexpected behaviors in response to monetary incentives are often observed in activities that are traditionally unpaid, such as donations, contributions to charity, or community service (Gneezy & Rustichini 2000, Heyman & Ariely 2004, Ariely et al. 2009, Carpenter & Myers 2010). While there has been considerable experimental work analyzing these issues, studies exploring real-world situations are still rare. This study uses data collected

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in a non-laboratory setting to explore whether monetary incentives for forest conservation, a traditionally unpaid activity in our setting, modify cooperative behavior within common property communities. Moreover, it explores whether the framing of the incentive has a differential impact on behavior.

We exploit a unique situation currently happening in Mexico, where approximately 80 percent of the forest land is managed by common property communities (Bray et al. 2005), and where also one of the largest Payments for Ecosystem Services (PES) programs is currently being implemented(Muñoz-Piña et al. 2008). In recent years, PES programs have become increasingly popular as mechanisms to mitigate climate change by providing landowners with cash or in-kind incentives in exchange for changing their land-use practices to provide an environmental service (Wunder et al. 2008). One unique feature of communal PES funds in Mexico is that they are increasingly being used to promote work in forest conservation activities, which have historically been uncompensated. The literature so far has given little attention to the possibility that PES might change the logic of collective action (Kerr et al. 2011, Vatn 2010), harming or encouraging cooperation both in activities that become paid due to PES and those that remain unpaid. Mexico also provides an ideal setting in which to study the behavioral effects of incentive design, since there is heterogeneity in the distributional arrangements adopted by community leaders after a PES contract.

The paper begins by modeling a simple principal-agent framework, where leaders decide the optimal allocation rule for PES income anticipating households' behavior, and households choose the extent of their cooperation based on the type of incentive. We distinguish two types of distributional arrangements: an equal distribution of funds among all members without specific work conditionalities, and the provision of wages to members that work in some specific forest conservation activities. Assuming non-individualistic utility functions, we show that certain monetary incentives change the enforcement of social norms of cooperation making free riding behavior more or less acceptable. This hypothesis is based on empirical studies that suggest that providing economic incentives to people for obeying social norms may actually weaken norm enforcement (Fehr & Falk 2002). Model predictions indicate that, as long as households are exposed to sanctions and their actions are visible, transfers without clear work conditionalities reinforce social norms of cooperation and increase the time allocated to all types of community work. In contrast, wages signal the market value of community labor and lead households to reallocate time to paid work.

To test model predictions, we use community and household-level data collected from 2008 applicants to the Payments for Hydrological Services program (PSAH) in Mexico. This novel dataset is one of the first large-scale datasets available to study the impacts of a PES program. Moreover, it is complemented with qualitative case studies that help clarify the reasons underlying behavior. To analyze the impacts of monetary incentives on cooperation, we exploit variation in time and community access to PSAH and quantify effects both in the decision and intensity of work in community activities. We distinguish two types of community work: one related to forest conservation, which is incentivized under PSAH, and one that remains unpaid but benefits the entire community, such as building and maintaining communal infrastructure. The counterfactual case is constructed using data from matched rejected applicants, which allows us to control for key unobservable characteristics that may simultaneously influence program enrollment and collective action at the community level. This empirical strategy constitutes an improvement over recent impact evaluations of PES programs around the world, which have used non-applicants as their control group (Uchida et al. 2009, Pfaff et al. 2008, Sanchez-Azofeifa et al. 2007, Arriagada 2008). To the best of our knowledge, this is also the first study testing the impacts of PES on cooperative behavior within common property communities.

To analyze the impact of different incentive schemes on cooperation, we exploit variation in distributional arrangements across communities that participate in the PSAH. The data available allows us to first analyze how different communities determine the internal distribution of PES benefits. We account for the endogeneity in distributional decisions by using two alternative parametric and non-parametric approaches. First, we use instrumental variables estimation and instrument the proportion of program funds distributed as lump-sum transfers at the community level with the average proportion distributed by communities within the same state but excluding the closest geographical neighbors to reduce the possibility of spillover effects. As a second approach, we use nearest neighbor covariate matching to select communities in the control group that would have adopted a similar distributional rule if they had benefited. This second strategy is inspired by work that looks at the impacts of microfinance on certain groups of the population (Banerjee et al. 2010) and allows us to exploit the control group data to identify these effects.

Our findings indicate that monetary incentives increase cooperation in forest conservation activities, both in the intensive and extensive margins. More specifically, we find an increase of 15% in participation rates and 34% in the number of days worked. In spite of these positive effects, monetary incentives don't have positive spillover effects on community work that remains unpaid. The results on incentive design are robust and consistent across both parametric and non-parametric methodologies and show that, as long as agents are exposed to sanctions and their actions are visible, transfers without clear work conditionalities are more effective than wages to increase the intensity of work not only in the forest, but in other unpaid community activities. Full redistribution approximately doubles the days worked in the forest and increase days worked in other unpaid community activities by 55%. Finally, the empirical evidence shows that the increase in cooperation lead to small reductions in households' participation in own production activites, but there are no differential effects when considering the framing of the incentive.

Findings from this study enrich the current literature in two ways. First, within the behavioral economics field, they reinforce the idea that when behavior is driven by non-pecuniary motives monetary incentives could have unexpected effects. Therefore, understanding how incentive design interacts with behavior is essential. Second, within the environmental economics field, we provide evidence of how recent strategies that promote the conservation of natural resources in the marketplace can change collective action within common property communities. Future financial flows from developed to developing countries for REDD programs, within wich PES are key tools, are predicted to be close to US $30 billion a year (UN-REDD-Programme 2012). Our results are relevant for the efficiency of PES, as they suggest that in contexts with strong institutions payments without specific work conditionalities could be more effective to promote forest conservation. Moreover, they are relevant for the sustainability of common property communities, particularly when the provision of public goods depends on households providing free labor to the community, and indicate that PES could be important tools to reinforce or weaken cooperation.

The paper is organized as follows. In the next section, we discuss how the paper fits into the current literature. In section 3 and 4, we provide an overview of the PSAH Program and describe the data. Section 5, we present the theoretical framework. Section 6 discusses the empirical approach and results, and section 8 concludes.

2 Relation to existing literature

Following Titmuss (1971) argument that individuals are more willing to donate blood voluntarily than when they are offered a monetary compensation, a growing literature has argued that different non-pecuniary motives may shape human behavior and interact with cash incentives in unexpected ways. A first group of studies discusses, both theoretically and empirically, the crowding-out effect of intrinsic motivation by extrinsic incentives. The main argument is that individuals undertake certain activities because they derive satisfaction from doing them; therefore, monetary compensation may reduce the effort or the time devoted to them (e.g Deci 1971, Lepper et al. 1973, Andreoni 1990, Frey & Oberholzer-Gee 1997, Frey & Jegen 2001). Many of the authors within this literature have used reduced-form models assuming a direct negative link between incentives and motivation. As Benabou & Tirole (2006) argue, a more discriminatory analysis is needed, as it is difficult to always assume that incentives will crowd-out motivation, and there are many examples, particularly in the labor literature, showing that incentives do work (Prendergast 1999, Lazear 2000).

A second group of studies highlights the importance of social norms as drivers of behavior. Within this literature, several authors have pushed forward the construction of a new behavioral theory where individuals are boundedly rational, there is moral behavior, and concerns about social approval (Akerlof 1980, Selten 1990, Rabin 1993, Ostrom 1998, Lindbeck et al. 1999, Benabou & Tirole 2006). There are multiple social norms that interact with economic incentives in unexpected ways. Some empirical studies discuss norms of reciprocity under a principal-agent framework and show that if the agent perceives the actions of the principal as kind then she values the pay-off positively. On the contrary, if the actions are perceived as hostile then she values the pay-off negatively (Fehr et al. 1997, Fehr & Falk 2002). Other authors discuss concerns of social reputation or self-image. In this case, individual behavior should follow closely what society rewards or defines as appropriate (Fehr & Gachter 2000, Ariely et al. 2009, Carpenter & Myers 2010). Then, if monetary incentives reduce the social rewards attributed to a specific activity[1], reducing the effort you put into it could be a strategy to preserve one's reputation.

The present paper finds itself in the second group of studies proposing that social norms drive behavior. This theory of behavior is particularly important for collective action problems (Ostrom 1998, Vatn 2009) and characterizes natural resource management in many rural areas of the developing world (Baland & Platteau 1996). The main argument behind our theoretical approach is that cash incentives change the enforcement of social norms by making free riding more or less acceptable. A survey of the literature presented by Fehr & Falk (2002) suggests that rewarding people monetarily for obeying social norms may weaken norm enforcement and lead to the gradual erosion of norm-guided behavior. More specifically, Gneezy & Rustichini (2000) show that introducing a monetary fine for late-coming parents at day-care centers increases the number of late-coming parents. In this case, the fine changes the rules of behavior making it more acceptable to leave your child beyond the official collection time. Finally, Fuster & Meier (2010) present laboratory experimental evidence, based on public goods games, and show that free riders are punished less harshly when incentives are in place, which in fact leads to reductions in the average contribution to public goods.

This study also explores how incentive design affects cooperative behavior. Within this literature, some studies discuss the impacts of the incentive's nature (kind versus cash). For example, Heyman & Ariely (2004) propose that in situations that are framed as social, such as helping someone to move, monetary incentives might diminish the perceptions of the interaction as social, reducing the help provided. The framing of incentives has also been discussed within the literature related to contract theory. Some studies have shown that, in the presence of reciprocally fair actors, implicit contracts work better than explicit contracts in promoting higher levels of cooperation (Fehr & Schimdt 2000, Fehr & Gachter 2002).[2] A closely similar finding is presented by Rand et al. (2009) who show that reward outperforms punishment in repeated public goods games. The work at hand is most closely related to the contract literature since we compare two different types of monetary incentives: lump-sum transfers, which could be conceived as implicit contracts, and wages, which are more closely related to explicit contracts.

[1]For example, by providing a monetary compensation for blood donation, then the act of donating may be not as socially valuable as before. It is actually possible that those that donate could be seen as interested only in money.

[2]In the explicit contract the principals explicitly conditioned a fine on the agent's deviation from a desired effort level. In the implicit contract they promised a bonus after the effort was observed. The promise was not binding and it was just considered cheap talk.

In contrast to the studies reviewed before, most of which have used laboratory or field experimental evidence, this study looks at real-life behavior. Although experiments have the advantage of offering a clean identification of the effects, there is considerable debate around the external validity of these findings. This skepticism is based upon two observations. First, populations studied (usually college students in laboratory experiments) might behave very differently from the populations of interest. Second, even if populations are very similar, as it is the case of field experiments, the behavior of people in games can differ from their real-life behavior. In this sense, by using data collected in a non-game non-lab setting, our results constitute an improvement in terms of external validity. It is also important to mention that in most experimental evidence incentives are exogenously given and set by the researcher. In this paper, we exploit the unique situation in Mexico where the incentive design emerges organically from the relationship between community leaders and households. We acknowledge, however, that this may come at the cost of a less clean identification strategy.

To the best of our knowledge, this study is the first to formally test the effects of PES on cooperation decisions in common property management. Given the limited availability of household and community-level data from beneficiaries and non-beneficiaries of PES programs, we still know very little about the socioeconomic impacts of these programs. There is an emerging literature, mostly using data from the China's Sloping Lands Conversion Program that shows that, by releasing credit constraints, cash incentives promote more off-farm labor (Groom et al. 2007, Uchida et al. 2009). In this particular paper, we focus on the specific labor decision of cooperating in community work. Although we discuss the effects of this decision on time allocated to own production activities, we don't provide a detailed analysis of all the labor impacts resulting from the PES program as we leave this for future work. In terms of the distributional arrangements of PES funds, there are a few studies that discuss how the distribution of these incentives within communities influences households' perceptions about benefits and their use of environmental resources. Sommerville et al. (2010) use qualitative data and semi-structured interviews in Madagascar and look at changes in attitudes and behavior related to forest use using information from households living in communities that participate in a PES program. Their main finding is that changes in behavior were not caused by higher monetary incentives, but by more intensive monitoring and punishment. Vatn (2010) discusses the possible effects that PES programs can have on cooperative behavior by changing households' logic from doing what is considered appropriate to what is individually best to do. The author highlights the importance of the institutional context and the framing of the incentives, but does not use any particular data to support his argument.

A recent study by Kerr et al. (2011) suggests the possibility that incentive payments coming from PES might influence collective action to manage common property. To evaluate this, authors run experiments in communities participating in a PES program, both in Mexico and Tanzania[3], and conclude that providing cash incentives raises participation where people are otherwise uninterested, but that participation is always high when social norms about cooperation are strong. Our study differs from theirs in three ways. First, although Kerr et al. (2011) is looking at real-life behavior, there is an important element about principal-agent interaction missing. In particular, in their study the researcher sets the incentive and interacts with households directly; moreover, the payment is offered for a single day of work. In real-life, community leaders are the ones who design the incentive and cooperation is repetitive. There are reasons to believe that households might behave differently when confronted by an outsider and also when cooperation is only related to a single day of work. A second distinction is that Kerr et al. (2011) only consider participation decisions, while this study looks at both the participation decision and the intensity. Analyzing both outcomes is important in contexts where community work has a long history, since it might be difficult for households to shirk completely, therefore only changes in the intensity of their participation are expected. Finally, the present study looks not only at how incentives change participation in activities where monetary compensation is provided but, most important of all, how they affect cooperation in activities that remain unpaid. As suggested theoretically by Holmstrom & Milgrom (1991), when individuals are confronted with multiple tasks but incentives are given only for some of them, we might observe a reallocation of labor, particularly when performance in unpaid tasks is difficult to measure.

3 The Payments for Hydrological Services Program and common property communities in Mexico

The Payments for Hydrological Services program (PSAH) was first implemented by the National Forestry Commission (CONAFOR) in 2003 with the objective of increasing the production of hydrological services by promoting forest conservation.[4] For this, five year renewable contracts are signed both with individual and communal landowners. To set payments, forests are classified according to their importance for aquifers and watersheds. During the period studied (2008-2011), annual payments of US$ 27 per hectare of forest enrolled and US$ 36 for cloud forests were given[5]. The minimum amount of land required to enroll is 20 hectares and the maximum is 3000 hectares. Participants need to maintain forest cover and monitoring is conducted by satellite image analysis and ground visits[6]. To maintain forest cover, participants are encouraged to perform some forest

[3]For example, in their experiments in Mexico, they provide some randomly selected households living in communities participating in a PES program three different treatments. In the first one, a payment was never offered or mentioned; in the second one, an individual cash payment was offered for their cooperation; in the third one, a payment to support the village was offered for each participant.

[4]Hydrological services coming from forest protection are all those benefits that forests can bring to hydrological resources, such as regulating the hydrological regime, maintaining and improving water quality, controlling erosion and sedimentation, reduction in soil salinity, etc.

[5]Payment rates were originally based on approximate calculations of the average opportunity cost of land conversion from forest to maize crops. They have been updated taking into account inflation (Shapiro & Castillo 2012).

[6]Landowners are removed from the program or payments are reduced if there are signs of deforestation in the enrolled land; moreover, payments are reduced if there is forest loss caused by natural causes, such as fires or pests

conservation activities, such as constructing firebreaks, doing forest patrols, or constructing fences to avoid cattle coming into the forest. The program does not impose specific requirements on the types and intensity of forest conservation activities, which results in significant heterogeneity across beneficiaries in the effort they put into these activities.

The Mexican PSAH program is currently one of the largest PES schemes in the world. Between 2003 and 2011, approximately 2.7 million hectares of forestland were entered into the program and more than US$450 million of federal funds were distributed to 3,979 communal or smallholder private property participants (CONAFOR 2012). In 2008, approximately 45% of PSAH program recipients were common property communities, including "ejidos", which are federally recognized common property holdings with land tenure and governance rights granted to a set number of households, and "comunidades", which are indigenous lands. For this reason, the program is not only unique in terms of its poverty reduction potential[7], but offers the opportunity of examining how cash incentives for forest conservation interact with common property management decisions. Program payments are given at the community level and there are no conditions on how communities should allocate funds at the local level. The only condition is that the forest cover needs to remain unchanged and communities should perform the forest conservation activities they propose to do when they enroll in the program.

Mexican common property communities resulted from a land reform that extended from the end of the 1910 Revolution until the early 1990s. During this time, an area equivalent to half the country was redistributed to peasants organized in communities, most commonly known as ejidos (Assies 2008). Ejidos are composed of two different kinds of property rights over land: private parcels and commons. Private land is mostly used for agricultural activities, while the commons are mainly dedicated to pasture and forest. Many people who are not full ejido members live within these communities, usually descendants of the original members who are denied membership rights by the legal restriction on inheritance to only one child. Non-members do not formally have voting rights or land, but in practice they often farm on lands ceded by others or illegally taken from the commons (Alix-Garcia et al. 2013). Authority in Mexican common property communities is well defined and divided into three bodies. The first one is the "asamblea", which is the principal decision-making body and where all members participate and vote. The second one is the "comisariado", which is the executive body and is composed by a president, a secretary, and a treasurer. The third one is the "consejo de vigilancia", which monitors the activities of the comisariado.

In most Mexican common property communities there is an old tradition of performing com-

(Muñoz-Piña et al. 2008)

[7]PES programs in many countries benefit private landowners which are not necessarily at the bottom of the income distribution. In the Mexican case, communal property allows very poor households to access these benefits. According to data presented by CONAFOR, in 2006, 78% of payments went to forests owned by people living in population centres with high or very high marginalization rates. Moreover, according to data from the National Institute of Statistics, in 2004, 31% of the PSAH recipients had incomes below the extreme poverty line.

munity work, which consists of non-paid activities that benefit all (VanWey et al. 2005)[8]. Some examples of community work are cleaning roads, painting schools, or building communal infrastructure. For communities that possess large amounts of forest land, forest conservation activities are usually important components of community work. In general, participation seems to depend on what community rules dictate about households' participation in community work and their enforcement. Over time, community work has proved to be very important for the provision of many public goods and for the subsistence of communities (Mutersbaugh 2002).

4 Data

We collected household and community-level data in 4 different regions of Mexico between June and August of 2011. The data collected is part of a larger project that evaluates the environmental and socioeconomic impacts of PSAH ((Alix-Garcia et al. 2013)). The survey covers both beneficiaries and non-beneficiaries from the 2008 PSAH cohort. A stratified random sampling strategy was applied both by region and land-use rights. In a first step, four regions were selected (north, center, south west, and south east) based on dominant ecosystem type and socio-economic groupings. Within each region, and based on the availability of good quality past satellite images, to monitor for deforestation over time, several Landsat footprints (areas of 180X180 sq km) were randomly selected in each region out of the subset of footprints with sufficient satellite imaginery available to measure past land-use change.[9] Within the geographical areas covered by these footprints, a sample of beneficiary communities that entered the program in 2008 was randomly selected. Then, a nearest neighbor covariate matching estimator was used to select the non-beneficiary communities from the pool of those that applied to the program in 2008 but were rejected.[10] Reasons for rejection from the program are mostly based on observable characteristics. According to program data, some of the most important reasons for rejection are having less than the required minimum forest cover (50%)[11], limited funds from the program (35%)[12], being outside of the eligible zone (6%)

[8]Uncompensated community work receives different names in different regions, some of the most used names for these activities are: tequio, faena, fajina, fatiga, etc.

[9]We can think of a footprint as a picture or an image of a certain area or portion of the earth which are continuously taken by the Landsat satellites as they pass around the earth.

[10]Matching was conducted applying the Mahalanobis metric within region and on the basis of the following covariates: distance to the nearest locality with population greater than 5000, elevation, slope, the area of the property submitted to be enrolled, the density of roads within a 50 km buffer, the average locality poverty level in 2005, and the percentage of submitted forest in coniferous forest, oak forest, cloud forest, upland rainforest and lowland rainforest. Matches with high distance measures between covariates in each region were eliminated from the possible sample. Within region, priority then was given to possible survey properties which had multiple good matches among the controls and vice versa.

[11]The minimum forest cover required in 2008 was 50% (Add reference of paper on policy evolution in Mexicos PSAH program which is in progress)

[12]The criterion used by the program to select properties when funds are restricted is based on the applicants score. This score is constructed taking into account the forest cover, whether the property is located in a natural protected area, the level of exploitation of aquifers, the index of risk of deforestation, the level of poverty and indigenous population in the municipality where the property is located, whether the applicant is a woman, among others. When multiple applicants have the same score, priority is given to common properties and then to those located in municipalities of high social interest as defined by the Secretary of Social Development, among the most important

and missing documentation (9%). In a second step, surveyors further stratified the sample within common property communities by land-use rights. Based on lists provided by program officers or community leaders, surveyors randomly selected 5 households with full land-use rights ("members") and 5 without them ("non-members"). The final sample is composed of 1056 households (557 beneficiaries and 499 non-beneficiaries) distributed over 111 common property communities[13]. Figure 1 and Table 1 show how the sample is distributed across regions and the footprints selected.

Both household and community surveys are quite comprehensive. In order to have baseline measurements, surveys included recall questions from 2007, which is the year previous to program implementation. No reference to the program was made when asking questions from the past in order to reduce potential recall bias. By having information from two different points in time (i.e. 2011 and 2007) we are able to construct a panel data set. In most cases, the household head responded to the survey [14]. Most questions are related to household-level information, such as household assets, access to land, and production decisions, among the most important. We also collected detailed individual-level information about education, migration, and employment decisions. Questions related to community work and participation in forest conservation activities were asked at the household level. For forest work we have data for both years, for non-forest unpaid community work we only have data for 2011. The community survey was applied to a group of community leaders and included questions about community characteristics as well as questions about decisions related to the use and distribution of PSAH funds. The community survey also included questions about the number of activities and the number of households that participate in community and forest conservation activities.

5 Theoretical framework

To provide intuition about the possible mechanisms driving behavior, the relationship between community leaders and households is modelled within a simple and single period principal-agent framework. The model is specific to the context of the study, but borrows ideas from multiple models in the literature, such as those looking at incentives social norms and behavior (Akerlof 1980, Lindbeck et al. 1999, Huck et al. 2001, Benabou & Tirole 2006), collective action within common property management (Baland & Platteau 1996), and leader-household interaction within Mexican common property communities (Alix-Garcia et al. 2005).

criteria (Alix-Garcia et al. 2013)

[13]This is a subsample of the total number of households surveyed. The total sample includes private landowners, which are excluded from this analysis. We also drop households for whom we do not know their land-use rights status. It is important to mention, that despite having a land-use rights stratification at the community level, the final number of households in the sample is not divisible by 10 and the number of members and non-members is not exactly the same. There are two explanations. First, in some small communities there were less than 10 households in total. Second, some communities only had households with land-use rights.

[14]When the household head was not present, surveyors tried finding him or her in the field or in the forest, or went back later during the day or the week to the house. If this was not possible, the survey was applied to the partner. When none of them was available, the survey was responded by an adult member in the household.

5.1 Community leaders' problem

In every period leaders observe the total funds available to the community. We assume the community only gets funds from the PES program, which encourages an increase in forest protection activities[15]. Therefore, the total income is given by $p^f F$, where p^f is the program payment per hectare of forest land and F is the total area of forest in the community. For simplicity, we assume all forest is enrolled in the program. Therefore, we do not model the decision on how much land to enroll, but focus on how PES funds are allocated. Within the period, leaders also determine the total number of days of community work $L^t(p^f F, Z_t)$ required for the well-functioning of the community. Community work involves both forest and non-forest activities; this is why this decision depends not only on the total payment received from the program ($p^f F$) but also on other community characteristics (Z_t)[16].

Leaders can choose from two strategies when deciding how to allocate funds. The first is to divide equally the payment among households, making an implicit agreement of cooperation but without specifying which activities should be performed. The second is to pay a daily wage to households for working in some pre-determined community activities. Choosing a mixed of these two strategies is possible[17]; therefore, the main decision leaders confront involves choosing the proportion of funds that will be distributed directly to households as lump-sum transfers (γ) or, inversely, the proportion of program's income that will be used to provide wages ($1-\gamma$).

Leaders spend all funds available in a given period, this means there are no savings considerations in the model. Given the proportion of funds distributed directly as lump-sum transfers (γ), the total number of community work required (L^t), the funds available ($p^f F$), the local wage (w), which is assumed to be fixed, and the number of households in the community (N), leaders calculate the amount they can transfer to each household (B), the maximum number of working days that can be paid (L^p_{max}) and those that will have to be done unpaid (L^u_{max}):

$$B = \frac{\gamma p^f F}{N} \tag{1}$$

$$L^p_{max} = \frac{(1-\gamma)p^f F}{w} \tag{2}$$

$$L^u_{max} = L^t(p^f F, Z_t) - L^p_{max} \tag{3}$$

[15]This work includes activities such as: opening or maintaining firebreaks, constructing fences to avoid cattle coming into the forest, doing reforestation, and forest patrols, among others.

[16]These could be not only geographical characteristics that affect the need for more or less work, such as the weather, slope, total area, but also social characteristics, such as how cooperative is the community or how ambitious are leaders.

[17]This is a simplified description of leaders' problem, but follows what the majority of communities surveyed in our sample do. We rule out the possibility of investing in public goods or of leaders keeping the money for themselves. As explained before, authority in Mexican communities is well structured and composed by different groups that continuously monitor each others' work; therefore, we assume leaders' decisions cannot be driven by private interests.

Given this information, leaders need to choose the optimal proportion of funds that will be distributed (γ) in order to maximize community's net benefits. Benefits are represented by a function g, which is increasing in the total number of days worked, both paid and unpaid, by households in the community ($g(\sum_{i=1}^{N} l_i^u + \sum_{i=1}^{N} l_i^p)$)[18]. To calculate benefits, leaders must anticipate households' labor reaction functions[19]. They know that paid labor decisions are determined by the maximum number of paid days they can offer per household $l_i^p(\frac{L_{max}^p}{N})$ and are increasing in the days offered ($\frac{\partial l_i^p}{\partial \frac{L_{max}^p}{N}} > 0$). The number of unpaid days are also determined by the maximum number of unpaid days per household established by leaders ($\frac{L_{max}^u}{N}$). In addition, they depend on how exposed to sanctions, resulting from deviant behavior with respect to the maximum number of unpaid activities required, households perceive to be (θ_i). In our setting, we can think of sanctions as either material costs (e.g. fine) or social costs (e.g. stigma or shame) resulting from deviant behavior. Unpaid work also depends on how visible the activities they are assigned to do are (α), and the quantity of the transfer that they receive (B). This means $l_i^u(\frac{L_{max}^u}{N}, \sigma_i, \alpha, B)$, where θ_i and α are parameters distributed between zero and one. Leaders know that unpaid labor is increasing when households feel more exposed to sanctions ($\frac{\partial l_i^u}{\partial \theta_i} > 0$), when their actions are more visible ($\frac{\partial l_i^u}{\partial \alpha} > 0$) , and when they receive monetary incentives to cooperate ($\frac{\partial l_i^u}{\partial B} > 0$).

The allocation decision does not only bring benefits but also comes with some costs. First, there are monitoring costs $C(\theta_i, \alpha, \gamma)$, which are household specific, and are a decreasing function of a household's level of exposure to sanctions ($\frac{\partial C}{\partial \theta_i} < 0$), they are also decreasing in the visibility of work ($\frac{\partial C}{\partial \alpha} < 0$) and increasing with the proportion distributed ($\frac{\partial C}{\partial \gamma} > 0$). Second, there are costs of designing explicit labor contracts $D(\gamma, Z)$, such as deciding which activities are going to be paid and who is going to do work. These costs are a decreasing function of the proportion of funds distributed directly ($\frac{\partial D}{\partial \gamma} < 0$) and are a decreasing function of a community characteristic (Z_c) that measures the level of information, assistance, or capacity leaders have to design explicit labor contracts ($\frac{\partial D}{\partial Z_c} < 0$). To summarize, the community's net benefit function is given by:

$$\Phi = g(\sum_{i=1}^{N} l_i^u + \sum_{i=1}^{N} l_i^p) - D(\gamma, Z_c) - \sum_{i=1}^{N} C_i(\theta_i, \gamma) \quad (4)$$

[18]We can think of this function as mapping the intensity of work into some kind of welfare outcome, for example, better environmental quality or improved access to basic services.

[19]This assumes leaders have full information about households' behavior. Moreover, we assume households cannot individually manipulate the distributional rule choice except through their labor supply decision. Although households participate in community meetings and have the right to vote for some important community decisions, there is heterogeneity in their involvement and participation in these meetings. In general, leaders seem to be the ones proposing and making the most important decisions for the community. Fieldwork has shown that many households living in communities that participate in the PSAH program are not familiar with it. Approximately, only 50% of households in these communities are aware of the program, and the majority don't know the details about payment size or how the program operates. Moreover, households don't have direct contact with outside organizations. Within this context, the common practice is for leaders to decide how to allocate program funds, then they present their proposal in the asamblea, and usually most households accept it.

The leaders' maximization problem, after replacing all the information presented above, is:

$$\max_{\gamma} \quad g[\sum_{i=1}^{N} l_i^u(\frac{L_t(p^f F, Z_t)}{N} - \frac{(1-\gamma)p^f F}{wN}, \theta_i, \alpha, \frac{\gamma p^f F}{N}) + \sum_{i=1}^{N} l_i^p(\frac{(1-\gamma)p^f F}{wN})] - D(\gamma, Z_c) - \sum_{i=1}^{N} C_i(\gamma, \theta_i, \alpha) \tag{5}$$

$$s.t. \quad 0 \leq \gamma \leq 1$$

With no binding constraints, the first order conditions (FOC) are:

$$\sum_{i=1}^{N} \frac{\partial l_i^u}{\partial \gamma} - \frac{\partial D}{\partial \gamma} = \sum_{i=1}^{N} \frac{\partial l_i^p}{\partial \gamma} + \sum_{i=1}^{N} \frac{\partial C_i}{\partial \gamma} \tag{6}$$

The FOC indicate that leaders will choose to distribute the proportion of income that will allow them to equalize the marginal benefits of increasing distribution, which are derived from promoting unpaid community work and reducing contract design costs, with the marginal costs, which come from the reduction in labor devoted to paid activities and the increase in monitoring costs needed to sustain the cooperation agreement. Solving equation (6) gives the optimal distributional rule:

$$\gamma^* = \gamma(p^f, F, w, N, Z, \Theta) \tag{7}$$

where Z aggregates all community characteristics that affect both costs and labor decisions, and Θ is an summary measure of the level of exposure to sanctions of households in the community. If constraints are binding, it is easy to see that those that decide to distribute all funds ($\gamma = 1$) are those for whom benefits from distribution are larger than costs, probably because the probability that households will deviate from the required activities is low and/or because it is too costly for them or difficult to design an schedule of payments or contracts. As opposed, communities that choose not to distribute any of the funds ($\gamma = 0$), are those whose costs exceed the benefits of distributing. These are probably communities where households are not exposed to sanctions, actions are not very visible, and therefore monitoring costs are very high.

Leaders' distributional decision is not an easy one and multiple issues are in place. Based on this simple framework, we can see that if households are not truly exposed to sanctions (i.e. low value of θ_i) then providing lump-sum transfers might be a risky strategy since households could free ride and not do the community work required. Even if households feel truly exposed to sanctions, when their actions are not visible (i.e. low value of α), then leaders best response is probably not to give transfers as the incentives to free-ride could be high. On the other hand, if leaders decide to provide lump-sum transfers but the population is large it is possible that the amount they transfer to each household is so small that they cannot sustain a cooperation agreement. Therefore, given local characteristics, choosing an intermediate value of γ could be good strategy to allocate risks and have both paid and unpaid community work.

5.2 Households' problem

A household i decides how much time to allocate to paid community activities (l_i^p), unpaid community work (l_i^u), and own production activities (l_i^o) to maximize its net benefit. The total endowment of time is given by T and no leisure is assumed to exist. Participating in any type of work entails a cost of $c_o(l_i^o)$, $c_p(l_i^p)$, and $c_u(l_i^u)$. Cost functions are convex in the amount of time allocated to each activity ($c_j'(l_i^j) > 0$, $c_j''(l_i^j) > 0$ and $j = \{o, p, u\}$).[20] Paid community activities yield a monetary reward w, which is fixed and determined at the community level based on local labor markets. Households get benefits from aggregate community work, and this is represented by a concave function $g(\sum_{i=1}^N l_i^p + \sum_{i=1}^N l_i^u)$ on the amount of time allocated, by all N households, to paid and unpaid community work ($g'(.) > 0$, $g''(.) < 0$). The function of benefits from community work $g(.)$ is the same that leaders observe, but here we assume there is heterogeneity in how much households can gain from these benefits. This is captured by a variable a_i, distributed between 0 and 1, that scales up or down the benefit function $g(.)$[21].

Households can also get benefits from own production activities. The production function is given by $q(l_i^o)$ and, for simplicity, we assume it only uses labor as an input. This function is smooth and satisfies $q'(l_i^o) > 0$ and $q''(l_i^o) \leq 0$ for all l_i^o. We can think broadly of own production activities as work that is done in agriculture, livestock activities, or off-farm employment. Households can sell their production for a unit price of p, which is assumed to be fixed[22], and can be considered a measure of outside wage or opportunity costs. B is the amount of lump-sum transfers the household receives from community leaders, and it is given by equation (1); therefore, it is increasing in the share of PES funds that leaders distribute ($\frac{\partial B}{\partial \gamma} > 0$), but decreasing with the population size ($\frac{\partial B}{\partial N} < 0$).

We assume the community has a cooperation social norm that indicates that households should perform all unpaid community work required by leaders ($l_i^u = \frac{L_{max}^u}{N}$). Deviations from this norm negatively affect households' benefits and, from now on, we refer to them as sanctions. As mentioned before, we can think of sanctions as either material or social costs. There is heterogeneity in the level of sanctions households experience and this is represented by a function $v_i(\theta_i, \alpha, B)$, which is increasing in the level of exposure to sanctions ($\frac{\partial v_i}{\partial \theta_i} > 0$), the visibility of actions ($\frac{\partial v_i}{\partial \alpha} > 0$), and the amount of lump-sum transfers received ($\frac{\partial v_i}{\partial B} > 0$)[23].

[20] The convexity assumption for the costs functions is usually used the in literature, such as Benabou & Tirole (2006), Holmstrom & Milgrom (1991), Carpenter & Myers (2010)

[21] For example, if work in forest protection results in increased water supply or water quality, then the value of a_i will be higher for households working in agriculture when compared to those working off the farm.

[22] Since this is a partial equilibrium model, we rule out the possibility that changes in households' time allocation decisions may change local prices.

[23] This closely follows the model of Huck et al. (2001), where the reference point is given by the team's optimum effort and disutility of norm deviation depends on other workers' average effort. Here we assume the reference point is the maximum established by leaders and disutility is determined by the level of exposure to sanctions, the visbility of actions, and monetary incentives.

The sanction function is a central element in the model and it is inspired by models that propose a non-individualistic perspective of utility. In these models social sanctions enter the utility function to help enforce social norms or codes of behavior (Akerlof, Lindbeck). In this model, we further assume an explicit relation between the level of sanctions and certain types of monetary incentives. The basic intuition is that when leaders increase the transfers provided to households, and given that they involve an implicit agreement of cooperation, leaders not only gain more power to sanction deviators but households may feel more embarrased if they deviate. Inversely, when leaders reduce B and offer more days of paid work, they are signalling the market value for community labor, which could reduce not only households' incentives to perform community activities without compensation any more, but also leaders' capacity to punish deviators.

Formally, the household maximization problem can be represented as follows:

$$\max_{l_i^p, l_i^u} \quad \{pq(T - l_i^p - l_i^u) - c_o(T - l_i^p - l_i^u) + wl_i^p - c_p(l_i^p) - c_u(l_i^u) + B$$

$$+a_i g(\sum_{i=1}^{N} l_i^p + \sum_{i=1}^{N} l_i^u) - v_i(\theta_i, \alpha, B)(\frac{L_{max}^u}{N} - l_i^u)\} \tag{8}$$

$$s.t. \quad 0 \leq l_i^p \leq \frac{L_{max}^p}{N}$$

$$0 \leq l_i^u \leq \frac{L_{max}^u}{N}$$

$$L_{max}^p = \frac{(1-\gamma)p^f F}{w}$$

$$L_{max}^u = L^t(p^f F, N_t) - \frac{(1-\gamma)p^f F}{w}$$

$$B = \frac{\gamma p^f F}{N}$$

The equilibrium conditions for the interior solutions are:

$$l_i^p: \quad w + a_i \frac{\partial g}{\partial l_i^p} + \frac{\partial c_o}{\partial l_i^p} = p \frac{\partial q}{\partial l_i^p} + \frac{\partial c_p}{\partial l_i^p} \tag{9}$$

$$l_i^u: \quad a_i \frac{\partial g}{\partial l_i^u} + v_i + \frac{\partial c_o}{\partial l_i^u} = p \frac{\partial q}{\partial l_i^u} + \frac{\partial c_u}{\partial l_i^c} \tag{10}$$

The previous conditions show that the optimal amount of labor allocated to both paid and unpaid community work is the one that equates the marginal benefits to the marginal costs of participation. We can see from equation (10) that the marginal benefits from doing unpaid community work are derived not only from the benefits of increasing the availability of the public good or the reduction in the cost of time allocated to own-production activities, but households also benefit from the reduction in sanctions that result from increasing unpaid work. We can see that corner solutions arise when either marginal benefits are greater ($l_i^{u,p} = \frac{L_{max}^{u,p}}{N}$) or lower ($l_i^{u,p} = 0$) than marginal costs. More specifically, there are three types of households in equilibrium: non-cooperators, for whom the marginal costs of participation exceed the marginal benefits; unconstrained cooperators, for whom equalities (9) and (10) hold; and constrained cooperators, for whom the marginal benefits exceed the marginal costs of participation but are limited by the maximum number of working days determined by leaders.

To get testable predictions we assume simple functional forms and solve the households' problem. For own production activities we assume a constant returns to scale function ($q(l_i^o) = l_i^o$). For the labor costs, we assume convex functions ($c(l_i^j) = \frac{(l_i^j)^2}{2} \quad where \ j = \{o, p, u\}$). For the community work benefit, we assume a linear function that aggregates both total paid and unpaid community work ($g(\sum_{i=1}^N l_i^p + \sum_{i=1}^N l_i^u) = \sum_{i=1}^N l_i^p + \sum_{i=1}^N l_i^u$). This implies that all types of community work contribute in the same way to overall benefit, increasing it constantly. Finally, for the sanction function we assume the following form: $v_i = (1 + B)\theta_i\alpha$. The intuition of this function is simple. Lump-sum transfers (B) increase the level of sanctions, but in the absence of transfers households may still be exposed to them, depending on their exposure to sanctions (θ_i) and visibility of their actions (α).

The solutions to the maximization problem are given by:

$$l_i^{p*} = \frac{T - p + a_i + 2w}{3} - \frac{\theta_i\alpha}{3}(1 + \frac{\gamma p^f F}{N}) \tag{11}$$

$$l_i^{u*} = \frac{T - p + a_i - w}{3} + \frac{2\theta_i\alpha}{3}(1 + \frac{\gamma p^f F}{N}) \tag{12}$$

$$l_i^{o*} = \frac{T + 2p - 2a_i - w}{3} - \frac{\theta_i\alpha}{3}(1 + \frac{\gamma p^f F}{N}) \tag{13}$$

5.3 Main predictions about cooperative behavior in Mexican communities

Prediction 1: *Cash incentives for forest conservation increase the time allocated to work in forest conservation activities.*

Cash incentives increase the total number of community activities required ($\frac{\partial L^t}{\partial P^f F} > 0$) and, depending on how leaders distribute these funds, there will be an increase either in the number of paid or unpaid days of work. If leaders distribute a high proportion of PSAH funds (i.e. choose a high value of γ), households' sanctions from deviation increase ($\frac{\partial v_i}{\partial \gamma} > 0$); therefore, there are fewer incentives to deviate. Moreover, since the number of unpaid activities increases, this promotes a further increase in the number of days worked in unpaid activities. Then, overall, the increase in the proportion distributed increases the number of days of unpaid community work ($\frac{\partial l_i^{u*}}{\partial \gamma} > 0$), and forest work is included in this category. Inversely, if leaders use most of the PSAH funds to pay wages for days worked in the forest (i.e. choose a low value of γ), sanctions for deviators decrease and households have more incentives to deviate and reduce the time allocated to unpaid community work. However, leaders also increase the amount of paid community activities available ($\frac{\partial \frac{L^p_{max}}{N}}{\partial \gamma} < 0$), which incentivizes households to devote more time to paid activities, as long as their outside option given them less benefits. Therefore, providing wages will also increase the amount of work in the forest ($\frac{\partial l_i^{p*}}{\partial \gamma} < 0$).

Prediction 2: *As long as some community activities remain unpaid, the higher the proportion of funds that are distributed as lump-sum transfers, the higher the amount of time that households allocate to all types of unpaid community work.*

Given that when leaders provide lump-sum transfers (high value of γ) they do not specify the activities that should be done, and that transfers increase the levels of sanction, households' best response is to allocate more time to all types of unpaid community work required. Therefore, we should expect to see not only a higher intensity of work in forest conservation activities but also in other unpaid community activities. As opposed, since reducing the value of γ increases the amount of paid work available, then households' best strategy is to reallocate their time to paid activities. This effect is even amplified by the fact that a lower γ reduces sanctions from deviations making it easier for households to free-ride from work that remains unpaid.

Prediction 3: *To the extent that households are exposed to sanctions and their actions are visible, providing lump-sum transfers will have the desired effect both on forest work and on other types of unpaid community work.*

When households are more exposed to punishment (higher value of θ_i) their deviations are more costly, therefore they allocate more time to all types of unpaid community work ($\frac{\partial^2 l_i^{u*}}{\partial \gamma \partial \theta_i} > 0$). Similarly, when actions are more visible (higher value of α) any deviation generates higher sanctions, therefore the best response is to increase the time allocated to unpaid community work to match the level required by leaders ($\frac{\partial^2 l_i^{u*}}{\partial \gamma \partial \alpha} > 0$).

Prediction 4: *Cash incentives reduce the time allocated to own production activities, regardless of how they are framed. However, to the extent that there are some remaining unpaid activities and households are exposed to sanctions, lump-sum transfers will lead to a stronger reduction in time allocated to own production activities.*

When leaders decide to allocate funds as wages and increase the time allocated to paid community work, then households reduce the time allocated to own production activities $\frac{\partial l_i^{o*}}{\partial w} < 0$ as long as the wage is at least as high as the price they could get from their own production. Similarly, if leaders decide to allocate funds as lump-sum transfers then households allocate more time to all unpaid community work and reduce the time they devote to own production activities $\frac{\partial l_i^{o*}}{\partial B} < 0$. Following prediction 3, as long as there are more unpaid than paid activities, and given that households face more sanctions from deviation, the higher intensity of work in contexts with lump-sum transfers implies less work in own production activities. Note that this result is driven by the lack of leisure in the model.

6 Empirical analysis

The empirical analysis is divided into three subsections. First, we provide some descriptive statistics and suggestive evidence. Second, we formally explore the impact of cash incentives on cooperative behavior. Third, we evaluate whether there are differential impacts based on the framing of the incentive. As stated in the theoretical predictions, two types of community work are distinguished. The first, is forest conservation work, which is incentivized under PES, such as constructing fire breaks, doing forest patrols, reforestation, etc. The second, is work related to non-forest activities that remain unpaid, such as cleaning roads, building communal infrastructure, etc. We also look at work in own production activities, such as agriculture or off-farm employment.

For both types of community work (forest and non-forest), we look at participation decisions and the intensity of participation, which is measured by the average number of days per year that each male adult member in the household devotes to these activities[24]. For own production activities, we also use data about participation and intensity of work but use information reported by the head of the household[25]. Given that for work in forest conservation activities (FCA)and in own production activities we have information for both 2007 and 2011, but for other unpaid community work we only have data for 2011, we use different identification strategies in each case that we explain next.

To capture exposure to sanctions we divide the sample for estimation between households with land-use rights, from now on called "members", and those without these rights, called "non-members".[26] We believe that land-use rights is an exogenous and appropriate measure of exposure to sanctions given that, in some cases, sanctions for not complying with community rules and labor

[24]Male adult members are defined as those that are between 14 and 65 years old.

[25]We focus on head of households that were between 18 to 72 years old in the baseline. This is based on sample statistics about the approximate average age of entry and exit from the labor force. In addition, the lower bound is the majority of age in Mexico and also when most young people finish high school. The upper bound is the value reported by OECD for males as the average age of exit from the labor market (72.2) (OECD 2011).

[26]Separating the samples of members and non-members for estimation is not only useful for analysing exposure to sanctions, but it is also recommended by a Chow test that confirms that the coefficients of covariates in all regressions are different across both groups of households.

could go as far as losing your rights. Based on field work we have also seen that members feel very proud of their position within the community and therefore might feel more pressure to comply with leaders' requirements and to provide a good example for others. It is important to mention that, even if non-members may not be as exposed to sanctions as members, we still see in our data some of them receiving lump-sum transfers. Approximately 20% of communities providing lump-sum transfers indicate they distribute money also to non-members. Also, within the sample of beneficiaries, 35% of members indicate they received transfers and 13% of non-members report getting them.

6.1 Description of the context and suggestive evidence

Table 2 shows that community characteristics are well balanced across treatment and control groups.[27] The average area of communities in the sample is 8,080 hectares. The average population is approximately 2,000 people, but there is significant dispersion with the largest community having 40,000 people and the smallest 11. Communities are, on average, 30 Km. away from large localities, and many of them are poor, as measured by an average asset based community wealth index that takes into account households' assets[28]. In terms of the composition of the population, few women have land-use rights (18%), approximately 60% of members have less than primary education, and the majority work in agriculture (77%). Forest is one of the main assets for most communities in our sample. The average hectares of forest per capita is 3.6. The average number of hectares of forest enrolled by beneficiary communities is 1,030. Assuming no costs of program implementation, the program per household payments are approximately 657 US$ per year, which is more than 6 times the monthly minimum wage in Mexico.[29]

Table 3 shows that household characteristics are also very well balanced. To obtain our final sample we previously matched households to make sure they are as similar as possible in terms of their baseline cooperation decisions[30]. The average household is a family of 5. Almost 80% of household heads know how to read and write, but only 23% have more than primary education.

[27]We report both, the t-statistic and the normalized difference statistic. The second statistic is the difference in averages by treatment status scaled by the square rood of the sum of the variances. This is a scale-free measure of the differences in distribution. Imbens & Wooldridge (2009) suggest as a rule of thumb one quarter.

[28]The index ranges from -2.46 to 4.10 and was constructed using household-level data and Principal Components Analysis (PCA). It takes into account different household assets (e.g. TV, stove, phone, car) and dwelling characteristics (e.g. material of floors and walls).

[29]The mean per household payment is 7,695 pesos. This was calculated assuming a household size of 5, taking into account the annual payment each community receives from the PSAH program and excluding the payments they give for technical support. The final amount was converted to US dollars using the exchange rate reported for the 15th of July of 2011 (11.72 pesos/ US$). The monthly minimum wage was calculated taking into account the daily minimum wage reported by CONASAMI. The average daily minimum wage in 2011 for the whole country was 58.1 pesos. Assuming there are 20 working days within a month, the monthly minimum wage is 1,161 pesos. Using the previous exchange rate, this is equivalent to 99 US$

[30]More specifically, we match households based on their baseline participation decisions and number of days worked in forest conservation activities (FCA). We also match them considering the average participation in FCA at the community level. We use Mahalanobis metric and matched exactly by region. We trim the sample based on the distance obtained after matching and keep those below the 95th percentile.

Approximately, 50% of the sample indicate they speak an indigenous language. Dwelling characteristics are poor. 75% of the households have electricity at home and the average number of rooms is a little bit less than 2[31]. In terms of employment, the majority of household members(81%) work on the farm. Community work seems to be important, approximately, 54% of households participated in forest conservation activities in the baseline, where they worked on average 8 days per year.

Figure 2 explores both the labor impacts of cash incentives in general and the differential effects resulting from the framing of the incentive. We can see that cash incentives seem to increase the number of days worked in FCA but only for members. Moreover, members living in communities where lump-sum transfers are given work more days over time when compared to those in communities where wages are provided. For non-members we don't see differences between the two types of incentives. The theory indicates that lump-sum transfers reduce households' deviation from the required unpaid community work. We explore this by looking both at work in the forest that remains unpaid and other non-forest unpaid activities. Figure 3 plots changes in the proportion of unpaid FCA done in the community where households indicate they participated[32]. We can see that over time those receiving transfers, and particularly members, participate significantly more in all unpaid forest work, signalling that transfers could be reducing the incentives to deviate. Figure 4 shows the possible spillover effect to non-forest unpaid work. We can see again that members in communities with transfers work significantly more days on non-forest unpaid community work.

6.2 Impact of monetary incentives on cooperation

To look at the impacts of cash incentives on work in forest activities we exploit the time variation in community access to PES. This means, we compare changes observed over time in cooperation decisions between households that live in beneficiary and non-beneficiary communities. To do this, the following regression is estimated:

$$Y_{ijt} = \beta_0 + \beta_1 T_t + \beta_2 P_j + \beta_3 (T_t * P_j) + \varepsilon_{ijt} \tag{14}$$

where Y_{ijt} is the cooperation outcome of interest for household i, living in community j, in time t. T_t is a dummy variable that takes the value of 1 in the year 2011 and 0 in 2007, and P_j is a dummy variable that takes the value of 1 if the household lives in a community that participates in the program and 0 otherwise. The coefficient β_3 is the parameter of interest, the Difference-in-Difference (DID) estimator. We expect β_3 to be positive. Since standard errors may be correlated among households living in the same community, we allow them to be clustered at the community level.

[31]This number does not include the kitchen or the bathrooms, if there are any, but it is still low considering the average number of members in the household.

[32]We are able to construct this variable given that we asked for a finite but very exhaustive list of activities both to households and leaders, and we know in which of those activities leaders offered wages.

The estimator presented in equation 14 is an intent to treat estimator. This identification strategy relies on the fact that living in a beneficiary community implies a greater exposure to payments or monetary compensation in exchange for community work done in the forest. Table 4 shows that households in treatment areas increased their participation in paid activities by 52% and more than doubled the number of days worked in paid activities. There is also an increase of more than 70% in the number of different FCA done that were paid.

Although the DID approach eliminates unobservable time-invariant characteristics, there are two potential weaknesses remaining. First, we cannot control for unobserved temporal individual-specific or community-specific components that may influence treatment and that may also influence the outcome. Second, some macro effects can have differential impacts across treatment and control groups.[33] Our sampling technique helps, to some extent, to reduce problems of unobservable characteristics driving the decision to enter the program that could also affect cooperation over time. This is because the control group was selected from all those communities that applied to the program in 2008 but were rejected. As it was mentioned before, the reasons of rejection are mostly based on observable characteristics, some of which were used in the matching performed before sampling communities in the control group.

To further improve identification, we use a DID matching approach, which consists in using a subsample of treated observations together with their best matches to estimate equation 14. This strategy helps eliminate not only time-invariant unobservable variables but also time-variant factors that have parallel trends (Blundell & Costa-Dias 2002). After checking the balance of the sample, we matched households based on their baseline participation and number of days worked in forest conservation activities. We also match based on a baseline community measure of average participation in forest work. As Table 3 showed, there are no significant differences in baseline cooperation decisions after matching and the sample is well balanced.

Table 5 presents the estimation results for equation 14. Given that the variable of number of days worked is skewed, we use the log of this variable throughout the empirical analysis, results using the variable in levels are fairly similar. We estimate linear probability models for the participation decisions, as it imposes less parametric restrictions and we expect the marginal average effects to be closely similar to binary outcome models. Robustness checks are performed using probit models and results are also fairly similar. The results in columns (1) to (4) show that cash incentives increase cooperation in forest conservation activities, both in the intensive and extensive margins, but we only observe significant effects for member households. For them, there is an increase of 19% in their participation and the number of days worked increase by 34%.

[33] For example, if households in beneficiary communities and non-beneficiary communities have some (possibly unknown) characteristic that make them react differently to shocks.

To look at the impact of cash incentives on community work that remains unpaid, we follow two alternative strategies. First, we explore changes over time in the proportion of total forest unpaid activities done in the community in which households indicate they participated. We can think of this as a measure of the deviation from the total number of unpaid forest activities required by community leaders[34]. The regression we estimate here is similar to equation 14. Based on the theoretical framework, we would expect to see no impacts of cash incentives on this proportion given that households living in communities where a higher proportion of the funds are distributed would participate in most unpaid community work, but those in communities where wages are provided reallocate their time to paid activities. The results in columns (5) and (6) of Table 5 confirm this prediction showing no significant effects for both members and non-members.

The second approach is to look at work in non-forest unpaid community work. Since we only have information for 2011 for this type of work, the identification strategy relies on cross-sectional comparisons between beneficiaries and non-beneficiaries. The regression we estimate is the following:

$$Y_{ij} = \beta_0 + \beta_1 P_j + \alpha X_i + \gamma V_j + \varepsilon_{ij} \tag{15}$$

Where, Y_{ij} is the cooperation outcome of interest for household i in community j. P_j is a dummy variable that takes the value of 1 when community j participates in the PSAH program, and X_i and V_j are household and community characteristics, respectively. The coefficient of interest is β_1 and measures the differences in cooperation outcomes between households that live in beneficiary and non-beneficiary communities. We also expect to see no impacts of cash incentives on other unpaid community work, since households' time allocation decisions could go in opposite directions depending on how the incentive is framed. As with unpaid forest activities, we find that cash incentives don't have positive spillover effects on other unpaid community work (Table 6).

It is important to acknowledge the limitations of this last approach when compared to the DID estimation. The most important one is that there might be baseline differences in cooperation that we don't observe and affect our results. Using a matched subsample is useful for this analysis, as long as cooperation decisions in FCA and in other types of community work are correlated in the baseline. If this is true, then matching based on baseline levels of cooperation in FCA helps to reduce concerns that households might be too different in terms of their baseline cooperation in other types of community work. Under this assumption, the first difference estimator should be almost as valid as the DID estimator. Given that we find fairly similar results for unpaid community work, both in and outside the forest, we believe that the assumption mentioned above is not unrealistic.

[34] Looking at the total number of days worked in the forest without payment does not give much information for our analysis, since for communities providing lump-sum transfers this number is always higher than for those providing wages. The proportion, however, seems more adequate to capture deviant behavior.

Following model predictions, the next step is to look at own production activities. For this, we estimate again equation 14 but the outcome variable is participation or number of days worked by the head of household in her primary activity. We find small and significant decreases in participation (5%) but not in the number of days. This negative effect is only significant for members and it is consistent with the increase we observe in the levels of cooperation for these types of households (Table 7).

6.3 Impact of different incentive schemes on cooperation

We exploit the heterogeneity in the distributional rules adopted by community leaders related to the use of PES funds to analyze the impacts of incentive design, and propose two alternative approaches. First, using only the sample of households living in communities that participate in the program we look at the impact of the proportion of funds distributed as lump-sum transfers on households' time allocation decisions. The baseline regression is:

$$Y_{ijt} = \beta_0 + \beta_1 T_t + \beta_2 D_j + \beta_3 (T_t * D_j) + \beta_4 V_j + \beta_5 u_j + \varepsilon_{ijt} \tag{16}$$

where Y_{ijt} is the labor outcome of interest for household i, living in community j, in time t. T_t is a dummy variable capturing time that takes the value of 1 in the year 2011 and 0 in 2007, and D_j is the proportion of program funds that are given directly to households as lump-sum transfers in community j[35]. V_j is a vector of community characteristics the affect the adoption of a distributional rule, and u_j is the area of forest per capita, which we include as a proxy measure for per capita payments. The coefficient β_3 is the parameter of interest and is expected to be positive, particularly for community work that remains unpaid. As before, errors are assumed to be clustered at the community level.

Since the distributional rule adopted by leaders is a function of the level of cooperation, and households' level of cooperation is also a function of the distributional rule, the estimation of equation (16) results in inconsistent and biased estimates of β_3. To solve this simultaneity problem two alternative approaches are proposed.

The first approach is to use an instrumental variable (IV) estimator. The basic idea is to find a variable (instrument) that affects the determination of the distributional rule but that is not directly influencing households' cooperation decisions. We exploit the fact that within the vector of variables Z that appears in the optimal distributional rule (equation 7) there might be some variable that affects leaders' costs of choosing a certain distributional arrangement but that should not affect households' labor decisions directly. More specifically, we propose to use the proportion of program funds that are distributed directly to households in communities that are not so

[35]We use the proportion distributed instead of a dummy variable for whether the community distributes lump-sum transfers or not, because within communities providing lump-sum transfers there is heterogeneity in the proportion of funds distributed. The average proportion in 0.75.

close neighbors, as defined by geographical distance. For this, we calculate the average proportion distributed by communities within a given state excluding neighbors that are less than 10 miles away. The main argument is that community leaders interact with other leaders, usually at the state level, in meetings related to the PSAH program as well as during visits to offices providing technical assistance for program implementation, and in other political meetings[36]. During these meetings, leaders learn from each other and are curious to know what others are doing with the funds coming from the program, and might well decide to follow similar strategies. By looking at the not so close neighbors, we reduce the possibility of spillover effects which would violate the exclusion restriction. The main assumption is that, given the restriction on distance imposed, populations should not interact but only community leaders; therefore, the distributional choices of other leaders should be exogenous to households decisions to cooperate.

Table 8 shows how communities allocate program funds across regions. We can see that most of the communities providing lump-sum transfers are located in the south west and south east regions, which could be an indication of the existence of the learning or imitating effect we discussed. One possible argument against the instrument suggested is the possibility of having correlated effects (Manski 1993). This means that the geographical pattern of allocation is driven by some regions being more cooperative than others. If this was the case, then the IV would have problems satisfying the exclusion restriction since leaders will be choosing similar strategies to their neighbors not because they are copying them but because households in that region are particularly cooperative or non-cooperative. Table 9 helps to rule out this possibility by showing that the distributional arrangement is not correlated with baseline cooperation levels.

It is important to mention some remaining limitations of the IV estimation. First, it is difficult to rule out the possibility of having a reflection problem (Manski 1993) given that we don't have perfect information about the timing of events. In particular, we don't know exactly when leaders decide which distributional rule to adopt. Ideally, we would like to have data from communities that entered the program in previous years in order to avoid the simultaneity in leaders' decisions. By using the average at the state level, instead of only a small number of neighbors information, we hope to reduce this problem. A second limitation is that the distributional rule decision is done at the community level; therefore, since we only have 58 beneficiary communities in our sample, the finite sample bias could be pronounced (Cameron & Trivedi 2005). Given these limitations, we report results for both OLS and IV regressions and propose an additional identification strategy that will serve as a robustness check.

[36] Based on case studies' information and fieldwork experience, we know that the PSAH program is first promoted by regional offices within each state. In this case, leaders from all communities in the area are invited to attend to receive more information about the program. Once they decide to apply, leaders receive technical assistance to prepare their application from private or civil organizations, which are usually located in the "cabecera municipal" or main cities of the state. Moreover, once they enroll in the program, beneficiaries need to assist to a workshop to learn about their rights and obligations within the program. Finally, during program implementation, many leaders visit the technical assistance offices to ask information about payments and other aspects related to the program.

So far, we have used only the sample of beneficiaries to identify the effects of different incentive schemes. A second approach is to compare households in the treatment group receiving a particular type of incentive (e.g. wages or lump-sum transfers) with households living in communities that do not participate in the program but that otherwise would implement a similar treatment.[37] Given the small sample of communities participating in the program, we exploit non-parametric techniques in this case. More specifically, we use a nearest neighbor covariate matching to predict the distributional rule that communities in the control group would adopt. We match exactly by region and take into account those characteristics that are more important in the determination of the distributional rule. We then estimate de following regression:

$$Y_{ijt} = \beta_0 + \beta_1 T_t + \beta_2 P_j + \beta_3 \hat{D}_j + \beta_4 (T_t * P_j) + \beta_5 (T_t * \hat{D}_j) + \beta_6 (P_j * \hat{D}_j)$$

$$+\beta_7 (T_t * P_j * \hat{D}_j) + \delta V_j + \eta u_j + \varepsilon_{ijt} \tag{17}$$

where $\hat{D}_j$ is the predicted proportion of program funds that are distributed directly to households in community j. V_j are community characteristics that affect the adoption of the distributional rule, and u_j is the area of forest per capita. β_7 is the parameter of interest and we expect this to be positive, particularly for forest work that remains unpaid. For non-forest unpaid work, we follow a similar strategy but use cross-sectional data.

Before presenting regression results it is important to identify those community characteristics that influence the adoption of a distributional rule. This information is important in two ways. First, it helps to identify the vector of community characteristics V_j that will be included in the regressions. Second, it tells us on which characteristics we should match in order to predict the distributional rule in the control group. Table 10 summarizes the differences in medians for multiple community characteristics. We focus on the median instead of the mean due to the small sample size and also because the distribution of several variables was skewed. We consider here some community characteristics that are usually discussed in the collective action literature, such as income inequality and the existence of rules. We can see that a lower population density, low elevation and educational levels, small number of households with land-use rights, and a higher intensity of work in the forest in the baseline characterize communities that provide lump-sum transfers. There are also pronounced differences in program per capita payments; communities providing transfers have payments that are 13 times higher than those with wages. As expected, we observe a similar pattern when we look at differences in area of forest per capita. Table 11 compares household characteristics after predicting the distributional rule in the control group. We can see the sample

[37] This strategy has been used by other authors, such as Banerjee et al. (2010), to predict and compare the behavior of similar types of individuals in treatment and control groups.

is well balanced. There are only important differences are related to access to basic services, such as electricity, and household wealth, therefore we control for those during estimation.

Columns (1) to (4) in Table 13 report results for work in forest conservation activities considering the proportion of funds distributed. We find that a higher redistribution of funds through lump-sum transfers increases the intensity of work but the impact is only significant for member households. When we estimate this impact using the full sample, we find very similar results. Columns (1) to (4) in Table 14 confirm that transfers increase not only the number of days but also participation among members. Full redistribution approximately doubles the number of days worked in the forest. There are two possible explanations for the increase in the intensity of work. The first is that households in communities where lump-sum transfers are given receive a larger amount of money for their work. We rule out this possibility by controlling for the area of forest per capita in all regressions, which should be a good proxy of program per capita payments. The second possibility is that not all forest work is paid in communities that provide wages. Therefore, it is possible that households reallocate their labor to paid activities and this is why we would expect to see a higher intensity of work in communities with lump-sum transfers.

In columns (5) and (6) of Tables 13 and 14 we explore this second hypothesis. In particular, we look at the impact of the proportion distributed on work in the forest that remains unpaid. The results are consistent with model predictions, indicating that transfers reduce households' deviation from unpaid forest activities but the effect is only significant for households with land-use rights. We find similar results using all the sample. On average, full redistribution of funds through transfers increases the proportion of forest unpaid activities done over time somewhere between 57% and 92% for members. For work in non-forest unpaid activities, we also see a higher number of days worked in members, but effects are not as strong as before. On average, full redistribution increases the number of days work by 50% (Tables 15 and 16).

Table 17 and 18 explore the impacts of the distributional rule on work in own production activities. Overall, results suggest that the framing of the incentive does not have any differential effect on behavior. This result suggests the possibility that households are using their leisure time to work in the forest and in other community activities and, therefore, the higher levels of cooperation observed in cases with higher redistribution of funds as transfers are not harming their own production activities.

We conclude by exploring the impacts of the framing of the incentive on more and less visible activities. For this, we exploit the detailed information available about work in different forest conservation activities and select two that the PSAH strongly promotes: maintaining and constructing firebreaks and doing forest patrols. We argue that work in firebreaks is more visible, since it is usually done in large groups of people and the outcome is observable. On the contrary, forest patrols are usually done in small groups of people and the outcome is not observable. Tables 19 and 20 show that cash incentives significantly increase the number of days worked only for members and for activities that are visible. These results are not only consistent with model predictions but help to reduce any concerns that may arise from using self-reported data and the fact that households might have incentives to overstate their cooperation both for visible and non-visible activities. They also help to reduce concerns about recall data, as we would expect to see a similar bias across all types of activities.

7 Conclusions

Using households and community level data from accepted and rejected applicants to the Mexican Payments for Hydrological Services Program (PSAH), one of the largest PES programs in the world, this study contributes to the emerging literature on the labor impacts of PES programs, and exploits a unique setting to analyze whether monetary compensation modifies cooperative behavior in activities that, for a long time, have been unpaid. So far, the PES literature has given little attention to the possibility that although payments might increase work in forest conservation activities, they might also change the logic of collective action harming or encouraging cooperation in activities that remain unpaid. We claim that the framing of the incentive can have an important role in explaining behavior.

We find that cash incentives increase work, both in the intensive and extensive margins, in forest conservation activities; however, effects are only significant for households with land-use rights. Our theoretical framework suggests that, to the extent that some community work remains unpaid, households that are more exposed to sanctions resulting from deviant behavior and whose actions are more visible, will increase their cooperation in all unpaid activities when they receive lump-sum transfers. In contrast, those that receive wages for specific forest activities reallocate their labor to paid work. We present evidence showing that transfers increase the intensity of work both in unpaid forest and non-forest work, but only for households with land-use rights and when activities are visible. We find no evidence that the increase in work in community activities is harming households' own production activities.

Our findings highlight the importance of understanding how incentive design interacts with behavior in contexts where non-economic motivations play an important role. Moreover, the evidence presented here confirms that recent and popular strategies that promote the conservation of natural resources in the marketplace, such as PES, can change collective action within common property communities and should be further studied given the important implications they can have, both on environmental and welfare outcomes. Some avenues for future research include analyzing the efficiency of our results. So far, we have focused only on labor outcomes; however, one important question is whether the increase in cooperation we observe is correlated with better forest conservation or improved public services provision. For this, data about changes in forest cover could be used. Moreover, detailed data about the types of unpaid community work performed as well as the related outcomes would be needed.

Before concluding it is important to acknowledge some of the limitations in this study. First, by using recall data there is the risk that estimated coefficients could be biased. Recall bias could arise from two different sources. First, if beneficiary households remember better past information given that they know when the program started. Second, if beneficiary households remember better because they have experienced a big change in income or labor as a result of the program. Since we did not give any reference about the program when asking the recall questions, plus the fact that many households don't actually know about the program since the treatment is given at the community level, we believe that if there are any memory errors, they are probably not systematic, which actually would bias our coefficients towards zero. Moreover, if it is actually the case that people do remember better past information due to the significant change in labor they experienced, this is actually the impact of interest. Finally, given the differences in our results looking at multiple types of forest conservation activities, we further reduce our concerns of systematic recall bias given that we would expect to see this for all types of activities.

Another possible limitation of this study is that we are taking a partial equilibrium approach by assuming prices are fixed in spite of the possibility that income and labor effects resulting from the program could change local prices. We show in a separate study that there are no large increases in consumption in beneficiary households that would lead to changes in local prices (Alix-Garcia et al. 2013). In addition, given that this is a conservation and not a reforestation program, we don't expect to see big changes in current agricultural practices; however, there might be some hidden heterogeneity depending on some geographic, social, or economic characteristics. Detailed data about prices is currently being collected to analyse this issue more carefully in the near future. It is important to mention that when we think about own production activities in this study, where changes in prices could be important, we also include activities that are several times done outside of the community and therefore should not be sensitive to price changes. Finally, we have not explored in detail all the labor choices that could emerge both at the household level and within the household resulting from program implementation. As we mentioned before, this is a topic that needs to be further explored in the PES literature, but lies outside the scope of this paper and is left for future work.

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Table 1: **Sample size**

	Beneficiary communities	Beneficiary households	Non-beneficiary communities	Non-Beneficiary households
Region 1 (North)	13	130	14	131
Region 2 (center)	15	141	14	127
Region 3 (South West)	15	150	13	127
Region 4 (South East)	15	136	12	114
Total	58	557	53	499

Note: Region 1 includes the states of Chihuahua, Durango, and Sinaloa. Region 2 includes Guanajuato, Michoacan, Nayarit, Queretaro, and San Luis Potosi. Region 3 has Chiapas, Guerrero, and Oaxaca. Region 4 includes the states of Campeche, Quintana Roo, and Yucatan

Table 2: **Community characteristics**

	Benef	Non-benef	Diff.	Norm. Diff.
Total population	2544.053	1958.462	496.591	0.074
Total area	6955.972	8999.044	-2043.072	-0.108
Distance locality $\geq$ 5000 people (km)	31.960	29.901	2.059	0.080
Elevation (mt)	1563.654	1488.136	75.518	0.050
Average wealth index 2007	-0.104	0.089	-0.193	-0.105
Indigenous in sample	0.484	0.474	0.010	0.016
Members with less than primary education	0.544	0.649	-0.104	-0.246
Members that are women	0.202	0.159	0.043	0.198
Members working agriculture 2007	0.726	0.817	-0.091	-0.099
Members migrated past 4 years	0.145	0.179	-0.034	-0.061
Number of members	383.086	172.226	210.860	0.245
Area of forest per capita	4.320	2.907	1.413	0.179
Observations	58	53		

Note: * $p<0.10$ ** $p<0.05$ *** $p<0.01$. All information related to ejidatarios (i.e. households with land-use rights) refers to the proportion of people within that group that have the specified characteristic. The area of forest refers to that one enrolled (beneficiaries) or that one that could have been enrolled (non-beneficiaries) in the PSAH program. The wealth index is an average of community households' indices. This index was calculated taking into account household assets and access to basic services and using principal component analysis. The range of the wealth index goes from -2.46 to 4.10.

Table 3: **Household characteristics**

	Benef	Non-benef	Diff.	Norm. Diff.
Household size	4.905	4.593	0.312	0.095
Wealth Index 2007	-0.151	-0.194	0.042	0.016
Speaks indigenous language	0.506	0.513	-0.007	-0.010
Distance to locality $\geq$ 5000 people	32.175	31.046	1.129	0.043
Knows how to read and write	0.820	0.798	0.022	0.039
Male head of household	0.874	0.879	-0.005	-0.010
Age head of household	48.233	49.014	-0.781	-0.037
No education	0.175	0.175	-0.000	-0.000
More than primary education	0.258	0.203	0.055	0.093
Agricultural employment 2007	0.673	0.719	-0.046	-0.071
Number of rooms in house 2007	1.882	1.917	-0.036	-0.020
Had electricity in house 2007	0.767	0.757	0.011	0.017
Participated in FCA 2007	0.549	0.533	0.016	0.023
Days worked in FCA 2007	8.871	6.948	1.923	0.077
Observations	517	364		

Note: * p<0.10 ** p<0.05 *** p<0.01. Wealth index ranges from -3.7 to 6.4. Statistics are reported on previously matched sample. Matching is performed on household participation decisions and number of days worked in FMA in 2007, and average community participation in 2007. FCA are forest conservation activities.

Table 4: **Changes in payments for forest conservation activities**

Dep. var.:	Number paid activities	Participation paid activities	Number paid days
Benef	0.381**	0.049	1.130
	(0.146)	(0.054)	(1.245)
Year	0.117	0.056	2.727**
	(0.091)	(0.040)	(1.358)
Year*Benef	0.496***	0.153***	6.353***
	(0.144)	(0.049)	(2.242)
Baseline mean	0.712	0.293	4.194
Baseline Std. Dev.	1.446	0.455	13.701
N	1752	1752	1752

Note: * p<0.10 ** p<0.05 *** p<0.01. Standard errors, reported in parenthesis, are robust and clustered at the community level.

Table 5: **Work in forest conservation activities**

Dep. var.:	Participation		Log number of days		Prop. unpaid done	
	Member	Non-mem	Member	Non-mem	Member	Non-mem
	(1)	(2)	(3)	(4)	(5)	(6)
Benef	0.050	-0.043	0.289	-0.049	-0.001	-0.028
	(0.068)	(0.064)	(0.182)	(0.192)	(0.037)	(0.046)
Year	0.106**	0.171***	0.353***	0.343**	0.037	0.051
	(0.050)	(0.055)	(0.124)	(0.143)	(0.033)	(0.043)
Year*Benef	0.107*	0.036	0.336**	0.308	0.024	-0.019
	(0.061)	(0.064)	(0.164)	(0.192)	(0.040)	(0.050)
N	1126	636	1126	636	1105	622
Baseline mean	0.565	0.511	8.034	8.279	0.288	0.241

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. For participation we estimate a linear probability model. The baseline mean refers to participation rates and number of days worked. Members are households with land-use rights. Prop. unpaid done is the proportion of unpaid FCA done at the community level in which households participated.

Table 6: **Work in non-forest unpaid activities**

Dep. var:	Participation		Log number of days	
	Member	Non-member	Member	Non-member
Benef	-0.012	-0.011	0.073	-0.103
	(0.052)	(0.072)	(0.134)	(0.171)
N	546	311	535	309

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Controls include: Population density, number of ejidatarios, proportion of ejidatarios that are women, elevation, area of forest per capita, average of days worked in FMA in the community in 2007. Members are households with land-use rights. The baseline mean refers to participation rates and number of days worked.

Table 7: **Work in own production activities**

Dep. var.:	Participation		Log of number of days	
	Member	Non-member	Member	Non-member
Benef	0.028	0.001	0.058	-0.008
	(0.031)	(0.047)	(0.067)	(0.089)
Year	0.035***	0.040**	-0.059	-0.027
	(0.011)	(0.015)	(0.048)	(0.037)
Year*Benef	-0.044***	-0.035	-0.068	-0.059
	(0.015)	(0.026)	(0.060)	(0.071)
N	1085	620	1070	615
Baseline mean	0.900	0.864	5.108	4.787

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. For participation we estimate a linear probability model. Members are households with land-use rights. Own production activities refer to the head of the household primary activity and could be either on-farm or off-farm.

Table 8: **Distributional rule by region**

	Wages	Transfers	Prop. dist.
Region 1 (North)	92.31	7.69	0.05
Region 2 (center)	86.67	13.33	0.05
Region 3 (South West)	66.67	33.33	0.21
Region 4 (South East)	20.00	80.00	0.69
Total	65.52	34.48	0.26
Observations	38	20	58

Note: Uses only the sample of communities that participate in the program. Row percentages are reported in the first two columns. Prop.dist. is the proportion of PSAH funds distributed directly to households as lump-sum transfers.

Table 9: **Proportion distributed and baseline cooperation in forest activities**

	Participation in FCA 2007	Number of days in FCA 2007	Number of FCA 2007
Proportion distributed	0.119	2.684	-0.036
	(0.074)	(5.883)	(0.436)
N	58	58	58

Note: * p<0.10 ** p<0.05 *** p<0.01. Standard errors reported in parenthesis are heteroskedastic robust. FCA are forest conservation activities.

Table 10: **Community characteristics by distributional rule**

	Transfers (Median)	Wages (Median)	Difference
Population density	0.06	0.30	-0.24**
Distance locality $\geq$ 5000 people (km)	30.92	29.26	1.66
Elevation (m)	134.86	2455.49	-2320.63***
Average wealth index 2007	-0.26	-0.12	-0.14
Variance wealth index 2007	1.55	2.29	-0.74
Indigenous in sample	0.90	0.25	0.65
Members with less than primary education	0.73	0.42	0.31
Members that are women	0.07	0.25	-0.18***
Members working agriculture 2007	0.68	0.74	-0.06
Members that migrated past 4 years	0.06	0.05	0.01
Number of members	24.50	126.00	-101.50**
Days worked in FCA 2007	17.72	7.47	10.25**
Participation in FCA 2007	0.70	0.50	0.20
Number of FCA 2007	2.55	1.45	1.10
Rules for forest use 2007	0.00	0.00	0.00
PSAH per capita payments	6989.35	506.39	6482.96***
Area of forest per capita	4.07	0.26	3.81***
Observations	20	38	

Note: * p<0.10 ** p<0.05 *** p<0.01. The difference in medians is tested using a k-sample median test. The range of the wealth index goes from -2.46 to 2.82. FCA are forest conservation activities. Members are those with land-use rights.

Table 11: **Household characteristics by predicted distributional rule**

	Transfers			Wages		
	Benef	Non-benef	N.Diff.	Benef	Non-benef	N.Diff.
Household size	4.614	4.500	0.038	5.056	4.608	0.132
Wealth Index 2007	-0.469	0.311	-0.360	0.013	-0.451	0.177
Indigenous language	0.619	0.533	0.123	0.447	0.415	0.046
Distance locality $\geq$ 5000 people	32.812	30.431	0.181	31.846	27.626	0.170
Knows how to read and write	0.801	0.806	-0.009	0.830	0.784	0.083
Male head of household	0.938	0.952	-0.043	0.842	0.872	-0.060
Age head of household	46.108	49.387	-0.148	49.332	48.838	0.024
No education	0.184	0.164	0.037	0.170	0.182	-0.022
High education	0.167	0.131	0.070	0.306	0.238	0.109
Agricultural employment 2007	0.776	0.780	-0.006	0.619	0.771	0.237
Number rooms in house 2007	1.411	1.613	-0.147	2.124	1.932	0.112
Electricity in house 2007	0.761	0.952	-0.397	0.771	0.723	0.077
Participated in FCA 2007	0.648	0.661	-0.020	0.499	0.574	-0.108
Days worked in FCA 2007	11.701	8.820	0.103	7.411	8.933	-0.058
Observations	176	62		341	148	

Note: Wealth index ranges from -3.7 to 6.4. Statistics are reported on previously matched sample. Matching is performed on household participation decisions and number of days worked in FMA in 2007, and average community participation in 2007. FCA are forest conservation activities. N. diff. is the normalized difference. The rule of thumb for the normalized difference in 0.25 (Imbens and Wooldridge, 2009)

Table 12: **First stage regressions for cooperation in forest and non-forest activities**

	Members		Non-members	
	FCA	Faenas	FCA	Faenas
Population density	0.015	0.031	0.016	0.035
	(0.016)	(0.032)	(0.012)	(0.028)
Number of members	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Prop. members are women	-0.244*	-0.500*	-0.260	-0.513
	(0.144)	(0.296)	(0.047)	(0.344)
Days FCA 2007 com	0.002	0.004	0.000	0.000
	(0.001)	(0.002)	(0.000)	(0.001)
Area of forest per capita	0.001	0.001	0.006	0.012
	(0.004)	(0.008)	(0.004)	(0.009)
Elevation	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Prop. dist. Neighbors	-0.571***	0.439	-0.716***	0.101
	(0.175)	(0.459)	(0.280)	(0.635)
Year	0.122*		0.098*	
	(0.063)		(0.056)	
Year * Prop. dist neighbors	1.588***		1.538**	
	(0.351)		(0.769)	
Constant	0.201***	0.542	0.234***	0.568
	(0.062)	(0.160)	(0.070)	(0.171)
N	628	313	366	182
F first-stage	9.15	11.45	8.07	6.44

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level.

Table 13: **Work in forest conservation activities**

Dep. var.:	Participation		Log number of days		Prop. unpaid done	
MEMBERS	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Year	0.175***	0.195***	0.532***	0.476***	0.024	0.012
	(0.044)	(0.054)	(0.131)	(0.180)	(0.028)	(0.041)
Prop. dist.	0.029	0.244	0.260	0.173	-0.037	0.239
	(0.096)	(0.244)	(0.210)	(0.605)	(0.074)	(0.168)
Year*Prop.dist.	0.103	0.040	0.509*	0.689	0.118**	0.166*
	(0.088)	(0.146)	(0.299)	(0.473)	(0.057)	(0.096)
N	628	628	628	628	623	623
Baseline mean	0.582	0.582	9.610	9.610	0.285	0.285
NON-MEMBERS						
Year	0.198***	0.223***	0.621***	0.618***	0.021	0.053
	(0.040)	(0.054)	(0.157)	(0.203)	(0.033)	(0.041)
Prop. dist.	-0.111	-0.584	-0.290	-1.537	0.027	0.103
	(0.114)	(0.578)	(0.396)	(1.687)	(0.086)	(0.284)
Year*Prop.dist.	0.050	-0.079	0.144	0.160	0.055	-0.122
	(0.086)	(0.170)	(0.328)	(0.707)	(0.049)	(0.171)
N	366	366	366	366	361	361
Baseline mean	0.492	0.492	7.589	7.589	0.229	0.229

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Other controls include: Population density, number of ejidatarios, proportion of ejidatarios that are women, elevation, area of forest per capita, average of days worked in FMA in the community in 2007. Members are households with land-use rights.

Table 14: **Work in forest conservation activities**

Dep. var.:	Participation		Log number of days		Prop. unpaid done	
	Member	Non-mem	Member	Non-mem	Member	Non-mem
	(1)	(2)	(3)	(4)	(5)	(6)
Year	0.095	0.229**	0.271	0.281	0.058	0.075
	(0.074)	(0.092)	(0.215)	(0.210)	(0.058)	(0.054)
Benef	-0.038	-0.103	-0.045	-0.240	-0.006	-0.082
	(0.076)	(0.095)	(0.167)	(0.253)	(0.044)	(0.056)
$Pr\hat{op}.dist.$	0.161	-0.089	0.590	-0.169	0.119	-0.044
	(0.132)	(0.186)	(0.382)	(0.616)	(0.075)	(0.197)
Year*Benef	0.080	-0.032	0.261	0.340	-0.034	-0.054
	(0.086)	(0.100)	(0.251)	(0.263)	(0.064)	(0.064)
Year*$Pr\hat{op}.dist.$	-0.267**	0.092	-0.540*	0.282	-0.148	-0.112
	(0.115)	(0.271)	(0.319)	(0.867)	(0.116)	(0.168)
Benef*$Pr\hat{op}.dist.$	-0.119	-0.001	-0.410	-0.052	-0.157*	0.075
	(0.158)	(0.207)	(0.442)	(0.659)	(0.086)	(0.202)
Year*Benef*$P.\hat{dist}.$	0.370**	-0.042	1.049**	-0.137	0.266**	0.166
	(0.144)	(0.284)	(0.436)	(0.926)	(0.129)	(0.175)
N	920	494	920	494	911	483
Baseline mean	0.565	0.511	8.034	8.279	0.288	0.241

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Controls include: Population density, number of ejidatarios, proportion of ejidatarios that are women, elevation, area of forest per capita, average of days worked in FMA in the community in 2007, electricity 2007, and household wealth 2007. Members are households with land-use rights. Baseline means refer to participation rates and number of days worked.

Table 15: **Work in non-forest unpaid activities**

Dependent variable:	Participation		Log number of days	
MEMBERS	OLS	IV	OLS	IV
Prop. dist.	0.096	0.890	0.569**	-0.346
	(0.076)	(1.059)	(0.272)	(1.722)
N	313	313	304	304
Control mean	0.730	0.730	5.633	5.633
NON-MEMBERS				
Prop. dist.	0.222	-0.769	0.647*	5.377
	(0.150)	(8.694)	(0.373)	(16.843)
N	182	182	181	181
Control mean	0.712	0.712	5.322	5.322

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Other controls include: Population density, number of members, proportion of members that are women, elevation, area of forest per capita, average of days worked in FMA in the community in 2007. Members are households with land-use rights. Control means refer to participation rates and number of days worked.

Table 16: **Work in non-forest unpaid activities**

Dep. variable:	Participation		Log number of days	
	Member	Non-member	Member	Non-member
$\widehat{Prop.dist.}$	-0.032	0.172*	-0.010	0.486*
	(0.096)	(0.098)	(0.246)	(0.267)
Benef	-0.135**	-0.173*	-0.150	-0.487**
	(0.060)	(0.090)	(0.164)	(0.189)
Benef*$P.\hat{dist}.$	0.111	0.040	0.528*	0.282
	(0.108)	(0.122)	(0.290)	(0.414)
N	459	246	449	244
Control mean	0.730	0.712	5.633	5.322

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Controls include: Population density, number of members, proportion of members that are women, elevation, area of forest per capita, average of days worked in FMA in the community in 2007. Members are households with land-use rights. Control means refer to participation rates and number of days worked.

Table 17: **Work in own production activities**

Dep.var.:	Participation		Log number of days	
MEMBERS	OLS	IV	OLS	IV
Year	-0.009	-0.050	-0.148***	-0.316***
	(0.013)	(0.035)	(0.055)	(0.120)
Prop.dist.	-0.006	-0.071	0.010	-0.255
	(0.052)	(0.067)	(0.117)	(0.196)
Year*Prop.dist.	0.008	0.137	0.092	0.617*
	(0.017)	(0.099)	(0.070)	(0.331)
N	606	606	606	606
Baseline mean	0.908	0.908	5.171	5.171
NON-MEMBERS				
Year	0.020	0.008	-0.069	-0.189
	(0.026)	(0.048)	(0.077)	(0.144)
Prop.dist.	0.005	-0.027	-0.026	-0.339
	(0.097)	(0.146)	(0.175)	(0.364)
Year*Prop.dist.	-0.048	0.017	-0.006	0.631
	(0.039)	(0.240)	(0.097)	(0.709)
N	358	358	358	358
Baseline mean	0.865	0.865	4.798	4.798

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Other controls include: Population density, number of members, proportion of members that are women, elevation, area of forest per capita, average of days worked in FCA in the community in 2007. Sample considers information of head of households between 22-76 years old in 2011. Members are households with land-use rights.

Table 18: **Work in own production activities**

Dep.var.:	Participation		Log number of days	
	Member	Non-member	Member	Non-member
Benef	0.079*	-0.111**	0.118	-0.243**
	(0.047)	(0.048)	(0.096)	(0.096)
Year	0.047***	0.022	-0.051	-0.071
	(0.018)	(0.019)	(0.074)	(0.061)
$Prop.\hat{d}ist.$	0.066	-0.296**	0.025	-0.556***
	(0.072)	(0.115)	(0.176)	(0.208)
Year*Benef	-0.056**	-0.001	-0.097	0.001
	(0.022)	(0.032)	(0.092)	(0.098)
Year*$Prop.\hat{d}ist.$	0.011	0.039	0.181	0.197*
	(0.047)	(0.053)	(0.124)	(0.107)
Benef*$Prop.\hat{d}ist.$	-0.090	0.285**	-0.052	0.486**
	(0.072)	(0.112)	(0.178)	(0.203)
Year*Benef*$P.\hat{d}ist.$	-0.003	-0.088	-0.088	-0.201
	(0.050)	(0.065)	(0.143)	(0.145)
N	885	488	872	483
Baseline mean	0.900	0.864	5.108	4.787

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Other controls include: Population density, number of members, proportion of members that are women, elevation, area of forest per capita, average of days worked in FCA in the community in 2007. Sample considers information of head of households between 22-76 years old in 2011. Members are households with land-use rights.

Table 19: **Work in forest conservation activities (visible vs. less visible)**

Dependent variable:	Log of number of days worked			
	Visible activity		Not visible activity	
MEMBERS	OLS	IV	OLS	IV
Year	0.190***	0.063	0.069	0.133
	(0.070)	(0.125)	(0.068)	(0.102)
Prop. dist.	-0.243*	1.897	0.351**	1.127
	(0.132)	(2.537)	(0.142)	(1.459)
Year*Prop.dist.	0.653***	1.063**	0.294*	0.085
	(0.237)	(0.420)	(0.149)	(0.240)
N	628	628	628	628
NON-MEMBERS				
Year	0.269***	0.189	0.147**	0.108
	(0.091)	(0.133)	(0.063)	(0.092)
Prop. dist.	-0.364*	-4.216	0.172	-2.045
	(0.207)	(22.356)	(0.160)	(13.316)
Year*Prop.dist.	0.145	0.554	0.083	0.283
	(0.244)	(0.475)	(0.131)	(0.272)
N	366	366	366	366

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Other controls include: Population density, number of members, proportion of members that are women, elevation, area of forest per capita, average of days worked in FCA in the community in 2007. Members are households with land-use rights. Visible activities correspond to construction and maintenance of firebreaks, not so visible activities correspond to forest patrols.

Table 20: **Work in forest conservation activities (visible vs. less visible)**

Dep. variable:	Log number of days worked			
	Visible activity		Not visible activity	
	Member	Non-member	Member	Non-member
Year	0.071	0.004	-0.024	-0.031
	(0.099)	(0.118)	(0.060)	(0.121)
Benef	-0.034	0.168	0.036	-0.148
	(0.132)	(0.122)	(0.103)	(0.170)
$\widehat{Prop.dist.}$	0.173	0.488	0.035	-0.115
	(0.204)	(0.342)	(0.167)	(0.219)
Year*Benef	0.120	0.249	0.096	0.172
	(0.121)	(0.150)	(0.093)	(0.138)
Year*$\widehat{Prop.dist.}$	-0.128	0.038	0.213	0.014
	(0.206)	(0.541)	(0.198)	(0.128)
Benef*$\widehat{Prop.dist.}$	-0.432*	-0.805**	0.233	0.289
	(0.245)	(0.364)	(0.195)	(0.254)
Year*Benef*$\widehat{Prop.dist.}$	0.792**	0.125	0.066	0.075
	(0.318)	(0.594)	(0.245)	(0.184)
N	882	478	882	478

Note: * p<0.10 ** p<0.05 *** p<0.01. Robust standard errors clustered at the community level. Other controls include: Population density, number of members, proportion of members that are women, elevation, area of forest per capita, average of days worked in FCA in the community in 2007, electricity 2007, and household wealth 2007. Ejidatarios are households with land-use rights. Visible activities correspond to construction and maintenance of firebreaks, not so visible activities correspond to forest patrols.

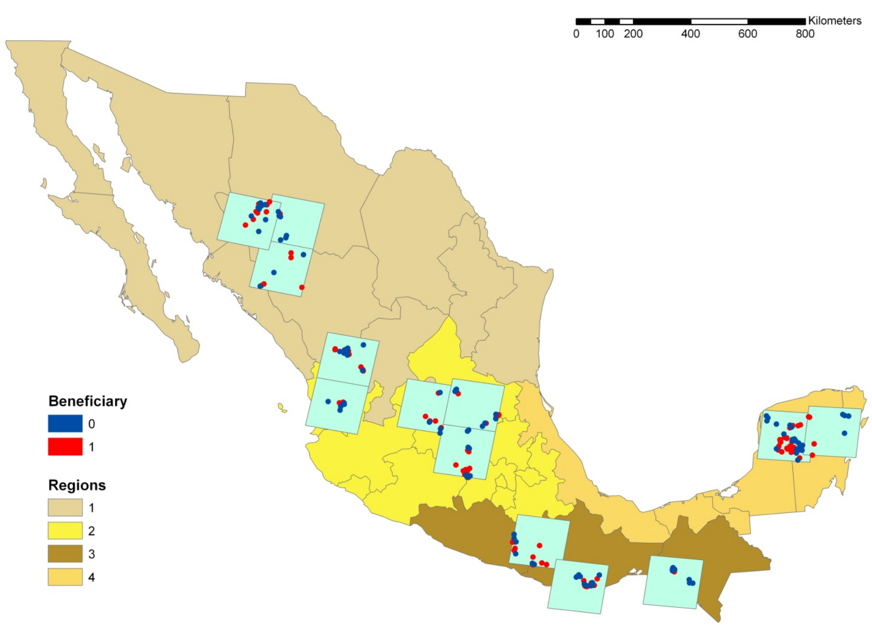

Figure 1: Centroid points for each property surveyed and footprints selected

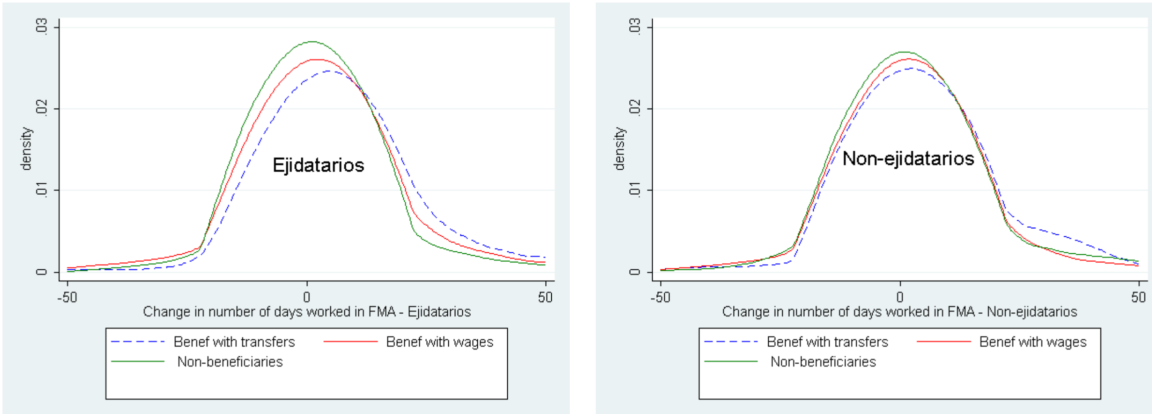

Figure 2: Changes in number of days worked in forest conservation activities 2011-2007

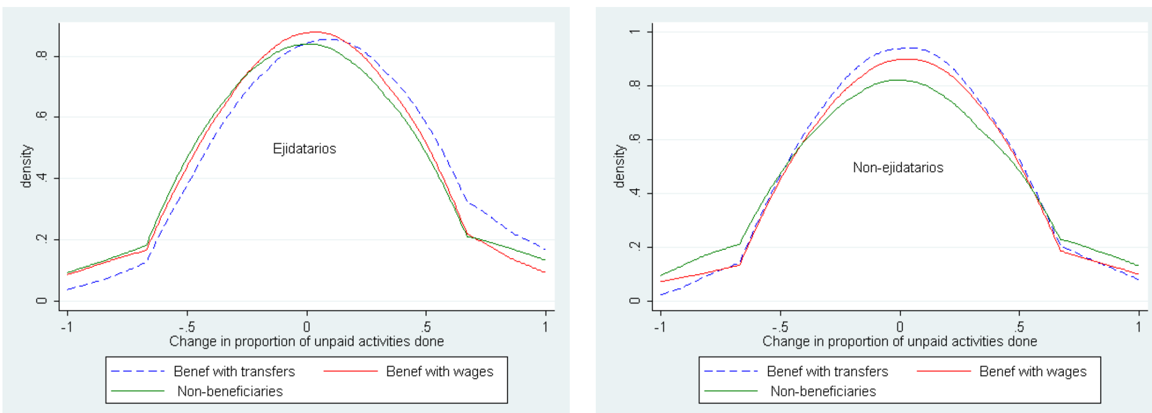

Figure 3: Changes in proportion of unpaid forest activities done by households 2011-2007

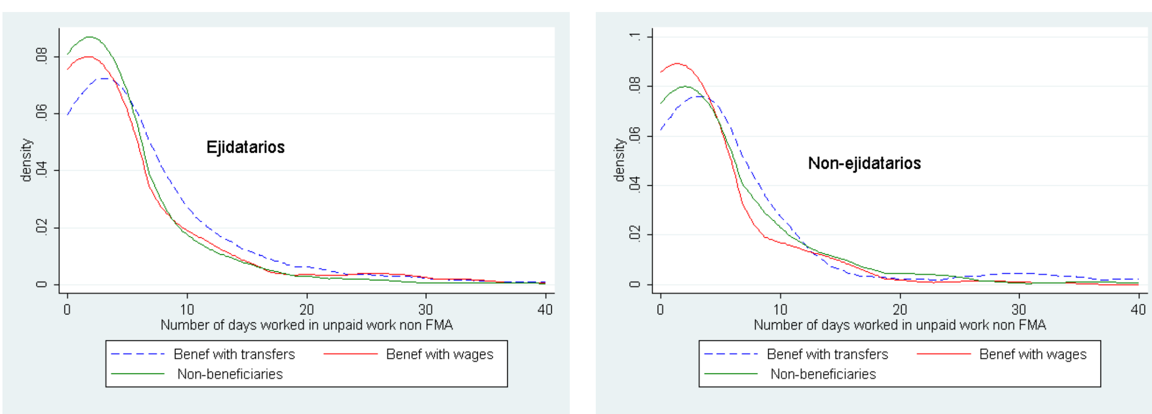

Figure 4: Days worked in non-forest unpaid activities 2011