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**Bequest motive for conservation in timber production
communities**

**Alejandro Guevara
Juan Manuel Torres Rojo**

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BEQUEST MOTIVE FOR CONSERVATION IN TIMBER PRODUCTION COMMUNITIES

Abstract

The study identifies the existence of a bequest motive, or intergenerational value, closely related with the conservation of forests in poor rural communities with communal forests under logging. A survey with the contingent-valuation question type was applied to the households of two populations living in two contrasting forest communities. Results show that 83 and 71% of head of households declared a willingness to make an altruistic sacrifice for the subsequent enjoyment of their children of this forest resource, measured in different ways. Variables such as age, gender, income, education, and forest type are closely related with the bequest motive, as other literature has found to be the case regarding private forest owners. Differences among communities show that the larger the benefits they obtain from the forest resources they own, the larger the bequest motive.

Keywords: bequest motive, poor communities, forest conservation.

1. Introduction

Bequest refers to the altruistic value that a human generation assigns so that future generations may enjoy an acceptable quantity and quality of the natural resources that now exist (van Kooten and Bulte, 2000; Amacher *et al.*, 2002). The concept was conceived by Krutilla (1967) as part of a collection of values that includes existence and option, which together comprise what is known as non-use values of natural resources (Pearce, 1993).

The literature suggests that the higher the value assigned to this intergenerational transference, the greater the effort to conserve a natural resource (Conway *et al.*, 2003). Such conservation has its costs, often associated with a reduction of profits derived

from exploitation of the resource, thus, lower present consumption. The study of these costs has been related with the analysis of public policies for the provision of public goods among generations and, in particular, to the conservation of natural resources. The results of these studies show that when the welfare of future generations is an important element in the definition of public policies, optimal policies should support programs ensuring environmental conservation, ascribing costs to present generations (Riddel and Shaw, 2003). Therefore, much of the decision of whether or not to bequeath the environmental resource depends on the resource's characteristics and the present generation's welfare level. The characteristics of the goods will determine the preferences for use of resources in the present generation, while their welfare level will determine the necessities of use of the goods and the possibility of conserving the environmental resource.

Decisions regarding costs of willingness to accept, or sacrifice, profits in order to bequeath public property have been strongly challenged. Some authors have even stated that there is no basis for this type of altruism in the provision of public goods (Deacon and Shapiro, 1975). Contrariwise, there are various studies that support the existence, theoretically and empirically, of a bequest motive and a value (on occasion, a relatively high value) associated with it. What is interesting about these experiences is that the bequest value associated with natural areas has been found in populations equivalent to a state, groups of states (Greenley *et al.*, 1981; Walsh *et al.*, 1984; Lockwood *et al.*, 1993; Popp, 2001), in localities or regions (White and Lovett, 1999; Mallawaarachchi *et al.*, 2001), or even at the level of an individual owner of natural resources (Hulkrantz, 1992; Tahvonen, 1998; Conway *et al.*, 2003; Thompson *et al.*, 2012). In the case of large populations, it has been difficult to separate the bequest value from that assigned to the existence of option values, which has given rise to enormous controversies. Nevertheless, at this level of analysis the existence of a bequest motive is undeniable (Cummings and Harrison, 1995; More *et al.*, 1996). In the case of private forestry producers, the bequest motive has been well identified. It has even been associated with the resource's characteristics, market conditions, and the intrinsic characteristics of the producer, among other relevant variables. When bequest has been studied at locality or regional levels, a bequest motive for environmental protection, or conservation of forest

areas, has been found. However, in all of the reported studies, the locality or community neither owns nor depends economically on the natural resource. This means that the bequest motive is not well valued in order of magnitude and is not comparable with use values.

However, communities that possess ownership rights over natural resources and occupy the territory of the natural area, forest communities in particular, are cases different from the three previously mentioned levels of analysis. These communities have some degree of economic dependence on the natural resources that they possess and must make decisions concerning the management and use of these resources collectively. It was recently argued that communities managing common property forests through community forest enterprises require an extension of theories of the firm (Antinori and Bray, 2005). The case is attractive due to that the estimation of a bequest value is isolated from an option or existence value, with which the community is perfectly familiar, because it depends on the forest and lives within its limits. The study of the bequest value of these communities becomes more attractive in the case of Mexico, where 80% of forests are located in communal lands (Larson and Sarukhán, 2003) and where decisions of use are collective and communities incorporate high levels of poverty. It has been argued that bequest, or intergenerational values, is one of the factors that causes these communities to value their forests differently from, for example, industrial foresters on concessioned public lands (Bray, 2004).

The present document explores various alternatives for empirically proving that despite experiencing high poverty levels, rural communities are willing to relinquish part of the present consumption of a resource of common ownership, in order to bequeath an acceptable amount of natural capital to the following generations. The work was carried out of means of a survey for all heads of household, or their spouses in two forest communities in Mexico: *Laguna Kaná*, an indigenous Maya community situated in a tropical zone of the southeastern State of Quintana Roo, and *El Balcón*, localized in a temperate area of the Sierra Madre Occidental in the State of Guerrero (Torres-Rojo *et al*, 2005; Bray and Merino, 2004). Survey results demonstrate evidence of the existence of “bequest motive,” which varies according to the populations’ socioeconomic characteristics and aligned with the results obtained with other communities (White and

Lovett, 1999; Mallawaarachchi *et al.*, 2001) or at property level (Hulkrantz, 1992; Tahvonen, 1998; Conway *et al.*, 2003).

The paper is divided as follows: the second section consists of a general review of the bequest value and its relation to sustainability; the third section describes the characteristics of the data and the base model; the fourth section includes the results of the behavior of these communities, with respect to bequest value and, finally, the fifth section presents the conclusions of the study.

2. Theoretical Considerations and Context

The concept of bequest has played a central role in economic models of generational exchange. Some authors argue that bequest possesses a fundamental role in the formation of savings (Kotlikoff and Summers, 1981) and as a mechanism for economic interaction between generations (Cox, 1987; Bernheim *et al.*, 1985). However, other authors minimize the economic role of this concept (Yaari, 1965). In the first context, the literature regularly explores the strategies of the parents in the distribution of private goods among their children (Becker and Tomes, 1976; Bernheim *et al.*, 1985; Behrman and Rosenzweig, 2002), as well as compensatory mechanisms among generations (Wilhelm, 1996). In these models, transfers are always of private goods, with a defined market and different assumptions of the parents' altruistic characteristics (Flores, 2002). However, these models do not incorporate the effect of intergenerational transfer of public goods and services, which is highly relevant in the case of the externalities related with the use of natural resources.

The first reference to these types of environmental goods and services transfers was made by Krutilla (1967). He considered the existence of the tastes, preferences, and motives that can lead a non-user of natural resources to be willing to sacrifice his income, maintain an irreplaceable asset, or bequeath it to future generations. Greenely *et al.* (1981) provided the first empirical evidence of the bequest value, which has been followed by various works of the same nature (Walsh *et al.*, 1984; Lockwood *et al.*, 1993; Mallawaarachchi *et al.*, 2001; Popp, 2001; Conway *et al.*, 2003; Riddle and

Shaw, 2003). In spite of these experiences, the concept of bequest value has been a controversial one, both for its significance and for the methodologies employed in estimating it. With reference to its significance, some authors have pointed out that there is no basis for the concept, given that it is associated with altruism in the provision of public goods (Deacon and Shapiro, 1975). In addition, the methodologies employed for its evaluation have been questioned on the level of precision with which it can be measured (i.e., the intrinsic weaknesses of the evaluation mechanisms employed in the appraisal of non-use values), and for its level of comparison with other measures of value (Stevens *et al.*, 1994).

Despite this debate, it is undeniable that a person can have a “motive-related reason” for sacrificing part of their wealth in environmental conservation (Cummings and Harrison, 1995; More *et al.*, 1996). This motive has frequently been confused with a value, which has caused problems of interpretation, especially when it has involved a comparison with the use value of this environment, or when it has reflected some market value. The bequest motive or value has been analyzed depending on the form in which it is used (More *et al.*, 1996). For example, it is considered perfectly valid and legitimate for an individual to value nature and be willing to pay to preserve it for future generations. However, it is not considered valid to speak on behalf of future generations for the purpose of conservation, given that it relegates personal value and gives priority to the supposed value that future generations may place on the environment. Thus, the existence of the bequest motive is not in doubt, but the assigned value indeed is, given that it can be confused with an existence, or option value, of natural goods. Therefore, the present document refers to the bequest motive without attempting to make a precise evaluation of it.

The principles of altruism and intergenerational equity establish that a person will be willing to reduce his present consumption so that his heirs may also satisfy at least a certain level of consumption in the future. This implies that the present generation considers part of the future generations’ interests of as its own, which can be interpreted in two ways: 1) the present generation knows the tastes and preferences of the future generations and can estimate a value for them that, as we have seen, can be questioned, and 2) there is a frame of reference for which the present generation considers the

permanence of a minimum quantity and quality of environmental goods and services for the future generations to be important, regardless of their technological level, institutional framework, and level of welfare. This latter interpretation implies that an individual who displays some willingness to pay for conserving the environment for future generations will be unable to decide whether or not these generations can use the environment, which constitutes a form of altruism known as non-paternalistic (Flores, 2002), and it is the closest to the concept of “bequest motive” defined by Krutilla (1967).

For a bequest motive to exist within this context, three premises must be fulfilled. The first and most obvious consists of the adoption of sustainability as a commitment of equity with generations-to-come. The second, the need to take into account that the costs and benefits resulting from present decisions will be faced by various generations and, finally, that there is a need for an institutional base that recognizes and ensures the rights of future generations with respect to the capacity to enjoy the ecological and economic resources involved (Padilla, 2002). The first and third premises are relevant to the reference framework of “intergenerational transfer,” whereas the second is directly linked with the benefits and costs of this transfer. The costs have frequently been referred to as “bequest value.” However, as has been pointed out, it is extremely difficult to differentiate whether this bequest implies a simple wish for the environment to remain as it is (something akin to the existence value), in the absence of any human function, or whether it is related with the fact that future generations will be able to enjoy it, whether or not they use it. Hence, such a value will be referred to in the remainder of the paper as a bequest motive.

3. Collection of Data

Data were obtained from a survey conducted in all households of the two previously mentioned forest communities: Laguna *Kaná*, and *El Balcón*. Each survey interview

was applied to the head of the family¹ or to his/her spouse in the locality with the largest population of each forest community. An average of 11% of the homes was unoccupied in each locality because the occupants were traveling or performing agricultural activities.

In order to present a frame of reference for the questionnaire and to know the typical conservation and management activities in each community, preliminary research was conducted by gathering documentation and carrying out interviews with different focal groups in the community. In addition, control questions at the household level were added besides the various questions to capture the existence of a value associated with a well defined bequest motive; that is, that the next generation should enjoy the same quantity and quality of forest resources, in order for these resources might be used and enjoyed in the same way as by the present generation. For this purpose, a frame of reference was presented to each person surveyed in which the direct benefits (income derived from timber harvesting, public services, extraction of Non-timber forest products [NTFP], and hunting, among others) were indicated, and indirect benefits (protection, recreation and landscape), which the heads of household obtained from the forest that they own, were pointed out as well. Once this frame of reference had been defined, questions were asked related with the intensity of use of the natural area on a non-monetary scale. For example, questions were asked about frequency of use, participation in the NTFP activity, frequency of hunting activities, the proportion of these products in the daily diet, frequency of recreational activities, and the use or protection of some sections of the forest. These questions had two objectives; the first was to clearly establish a frame of reference for the individual surveyed so that he or she could estimate the amount of benefit obtained from their forest, while the second was to aid the individual in identifying an anchor, or reference, value (Kahneman *et al.*, 1999) for the open question of willingness to pay or to accept.

Analysis of the information consisted of defining basic statistics and relating response variables (integrated by the different alternatives of evaluation of the bequest motive) with socioeconomic variables by means of econometric models. The reduced forms of

¹The interview was applied to the heads of household, regardless of whether or not they had property ownership rights of the community forest.

the tested models were based on the general model of behavior of a forest landowner (Conway *et al.*, 2003) that, in turn, is based on classical decision models (Johansson and Lofgren, 1986). The model has the following general form:

$$B = B(\beta, \alpha, p, \rho, m, s, \Omega) \quad (1)$$

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where the bequest motive (B) is explained by variables such as site parameters (β), elements of preference for bequest (α), price of the timber product (p), rate of time preferences (ρ), income (m), savings (s), and other elements important for utility (Ω), and the signs correspond to the expected tendencies of comparative statistics (Conway *et al.*, 2003). For our model, site parameters (β) were substituted by controlling both communities with a dummy variable, and bequest preferences (α) by their participation in use of forests and their level of poverty, with the latter measured according to the classification of the Mexican government human capital investment program *Oportunidades*². The price of the product (p) was substituted by the value of the timber harvest, given the enormous differences of timber quality and quantity between the two communities studied. The discount rate was not used, although it was assumed to be closely related with the poverty level. Savings were considered to be all of these assets and livestock and, finally, the (Ω) group integrated demographic characteristics (gender and age), condition of the community member (whether he/she had property rights on the land or not), environmental preferences, and perception of risk.

4. Characteristics of the forest communities under study

El Balcón is a community located in the Sierra Madre Occidental of the State of Guerrero, Mexico. The community received its land ownership rights in 1972 after a history of inter- and intracommunity land conflicts, finally achieving its current size of 25,565 hectares (Torres-Rojo *et al.*, 2005). The forest area is 15,190 ha, of which 72%

² *Oportunidades*, formerly known as PROGRESA, is a conditional cash transference program aimed at households whose living conditions are considered to be of extreme poverty.

is employed for timber production and the remaining surface, for conservation and restoration. *El Balcón* has successfully established a Community Forest Enterprise (CFE), which is based on the exploitation of the commonly owned forest by industrializing the raw material that it extracts. The current success of this forest community lies not only in the fact that it has become an exporting lumber company, thanks to its commercial partnership with the U.S. company Westwood Forest Products, but also in its ability to organize its community to preserve its forests, generate income, strengthen its social capital, and reduce violence. It is estimated that the CFE invests about 90% of the community's profits through the provision of public goods, which includes rehabilitation of roads and the provision of drinking water, energy, education, health services, and housing (Torres-Rojo *et al*, 2005). Some important demographic characteristics for both communities are presented in Table 1.

Laguna Kaná is a Maya community located in the State of Quintana Roo, south of the tourist corridor known as the Riviera Maya (Bray and Merino, 2004). Although this community was founded in 1942 it was, for many years, considered legally as an annex of a forest community known as Chunhuas. In 1999, *Laguna Kaná* was legally recognized as an independent community. The community has 18,495 hectares of territory, the majority of these covered by tropical forests with an average of up to 30 species per hectare, among which the chicozapote (*Manilkara zapota*), and mahogany (*Swietenia macrophylla*) are the most representative. Logging is carried out communally despite that the community does not have permanent working capital or its own equipment. There is no processing of the logwood and community labor works with outside logging contractors in the labor and supervision of harvest activities. In addition to logging, there exist other activities within the forest, such as the exploitation of chicle, hunting, agroforestry, sustainable agriculture, and the production of *palizada* (wood used for tourism activities) (Bray, 2004).

In contrast to *El Balcón*, this CFE generates few jobs for community members because the authorized logging volume in the management plan is much lower. It is estimated that tree felling provides jobs for only about one half community members with land ownership rights solely for 3 and 4 months a year. The benefits obtained from this activity derive mainly from profit-sharing from timber sales distributed in cash to

members with ownership rights, and only a small percentage is destined for reinvestment in forest areas or for provision of public goods. There is a small Communal Fund to which contributions are occasionally made; however, this is apparently no longer a significant amount. In 1985, the community decided to reserve 10,000 hectares of permanent forest areas for logging under management plans, where no land use change would be allowed³. However, contrary to what occurs in the *El Balcón* community, little is reinvested; in fact, the only reinvestment made in the forest is in the form of annual reforestation, which is required by Mexican environmental law.

The population comprises approximately 1,200 inhabitants, of whom 190 have land ownership rights. It is estimated that there are about 189 homes in the community, with an illiteracy rate of 8% within the population over 15 years of age, and with a high-school-equivalent educational level, considering that this is an indigenous population (See Table 1).

Household assets were defined by the amount of livestock and landholdings outside of communities' borders. The range for livestock holdings in *El Balcón* was between 7 and 12, while in *Laguna Kaná* livestock was insignificant as an asset. With respect to the additional hectares of land outside of the community owned by the household, *El Balcón* reported an average of 9 ha, in contrast with *Laguna Kaná*, where the average was around 2 ha.

5. Results

The parameters of a general model were estimated considering the exogenous variables suggested in the theoretical and the empirical models, as well as the different payment vehicles of altruistic willingness to conserve forest areas for future generations.

³ Evidence has been presented that these permanent forest areas, as a part of community forest regimes, have led central Quintana Roo, the State in which *Laguna Kaná* is located, to have the lowest rate of deforestation recorded in southeastern tropical Mexico (Bray *et. al*, 2004). See also Durán *et al* 2005 for evidence on low rates of deforestation in communities including *Laguna Kaná*, as well as the region of *El Balcón* in the State of Guerrero. This is important because it speaks to the sustainability of community logging, an issue not directly addressed in this paper.

5.1 Bequest motive and long-term investment

The first variant for estimating the disposition of paying for the bequest value was formulated through the following question: How many workdays without payment would you be willing to donate for reforestation?

This question has to do with the perception of cost implied by sustainability (measured through reinvestment of the natural reserve) by means of the labor effort, particularly within the context of logging (in both communities) dependent on natural regeneration. Evaluation of the bequest motive through investment in reforestation is important for two reasons. The first is that the poor, with monetary limitations by definition, in the majority of cases are owners by virtue of their labor being one of their few productive assets; thus, this is the most direct form of evaluating their bequest motive. The second is that investment in reforestation is a long-term investment, given that maturation of the species planted may take longer than the life span of one generation. Therefore, if there is no land market⁴ that can compensate for long-term investment, there must be non-economic motives that justify such an investment. In this respect, Hulkrantz (1992) pointed out that in lieu of perfect land-market altruism for future generations, there is the fundamental motive of reforestation. This result is maintained even in the presence of forest land markets, given that empirical evidence shows that owners consider that the value of a piece of land does not increase with reforestation (Rom *et al.*, 1985; Carlen, 1990).

Results in both communities show that willingness to sacrifice free work is positive, averaging 10.2 and 3.8 workdays for *El Balcón* and *Laguna Kaná*, respectively. Among the total number of individuals interviewed, only 16.6% proved unwilling to collaborate with free workdays devoted to reforestation tasks; however, they exhibited a willingness to pay for conservation through other means of payment.

⁴These forest communities are obliged by law to conserve their forest lands in communal property without an option to sell.

Utilizing a linear model with the response variable defined as the number of workdays per year sacrificed to provide work for reforestation, the general model (1) was tested, along with combinations of transformations of the important exogenous variables. Ordinary least squares were used to fit the model, and estimates and goodness-of-fit statistics are presented in Table 2. This model suggests that the higher the age of the head of household, the fewer the number of days he is willing to work without pay for reforestation. In fact, an elderly person would not express much willingness to reinvest, knowing that his life horizon is reduced with the passing of the years (Riddell and Shaw, 2003). In other words, this individual would prefer present consumption to reinvesting in a project that would probably not produce benefits other than the satisfaction of his altruistic interests. This evidence of the reduction of the bequest motive with age has been reported by Popp (2001) and Riddell and Shaw (2003); however, contrary behavior has been reported by Conway *et al.* (2003). In the latter case, there is no control by income of owners, which evidently does not render the results comparable.

An interesting result of this model is that there is a gender-dependent difference in altruism. Women are on average willing to work more workdays than men without receiving payment, so that reinvestment through reforestation can be made to insure maintenance of the resource and continued utilization of the forest. This result probably reflects women's greater altruistic motivation toward their children with respect to that of men.

The effect of the poverty indicator (dichotomous variable that acquires the value of 1 if the household participated in the program *Oportunidades*⁵) reflects the aforementioned idea that a poor households will tend to reinvest less in assets that generate yields in a relatively distant time horizon, as is the case with forests, due to their high discount rate, which manifests the urgency to satisfy their present necessities. It is noteworthy that classification of poverty is not collinear with income, due to that poverty classification considers dimensions additional (and different) to that of current income.

Number of household members demonstrates interesting behavior in the fit, given that it suggests that, as the number of household members increases, the amount of workdays

⁵ This government program classifies families as above or below the poverty level for assigning resources (PROGRESA) through a program of conditional aid.

without pay will decrease to a minimal point (nine members per household, a figure higher than that of average household members of both communities) in which the tendency is reverted. This tendency suggests that, all else being equal, as the number of members increases, these will opt for present consumption to satisfy the growing needs within the household, reaching a critical point at which a sufficiently large number of members would contribute to generation of income for the household.

Finally, the dichotomous variable community attempts to capture characteristics that are not specified in the model, but that distinguish one population from another. In this case, although not radically, it is observed that there is lesser willingness to invest in the community of *Laguna Kaná* with respect to that of *El Balcón*, probably reflecting factors other than those considered. A probable reason for this difference is that logging is much more important as an income source for the population of *El Balcón*, reflecting the importance that this population affords to its care. Another likely reason is that *El Balcón* possesses superior social capital to that of *Laguna Kaná*, because in *El Balcón*, the community decides to invest logging profits in public goods. These two elements could influence the fact that *El Balcón* community members have a more positive attitude toward investment in public goods. It should also be noted that the result is consistent with results showing that tropical forest communities have a higher discount rate than temperate forest communities; therefore, there is more conservation in the latter (Velázquez *et al.*, 2002).

5.2 *Bequest motive and value of future use*

The second question analyzed is much more explicit in terms of linking the present sacrifice of earnings (or consumption) to bequeathing a reserve of natural capital to future generations that will allow them to continue a productive activity. Two models were constructed for this purpose: the first was to identify the existence of a bequest motive associated with use of the forest by future generations, that is, paternalistic altruism, while the second model, although similar to the first, sought to measure the “intensity” of this paternalistic altruism.

The first model was constructed with the following question: Do you believe the volume of the present harvest should be reduced to insure that your children will be able to continue to engage in forest extraction in the future?

The response to this question is dichotomous (Yes/No), which was analyzed by using a Probit model utilizing as exogenous variables those defined in (1), while the endogenous variable was the occurrence of “reduction of present harvest”. Results of the best adjustment model are illustrated in Table 3.

It should be mentioned that prior to asking this question, and regardless of whether the individual knew the present harvest volume, each was presented with harvest volume information and information on the distribution of benefits to be obtained from it in terms of direct income and public goods, if these were to exist.

The results suggest that inclination to reduce the volume of the present harvest is in the majority. Only 28.5% of those interviewed declared unwillingness to do so. Different variables such as age, gender, principal activity of head of household, livestock, number of individuals in household, among others, were incorporated into the analysis, although only household disposable income and ownership of agricultural land exerted a significant effect on the intentions of bequeathing the forests of one generation to another in order to continue the timber yielding activity.

As can be observed, the results show that a household owning agricultural land will have about 22% more likelihood of reducing its current harvest to favor the interests of the following generations, with respect to a household that does not own land. The explanation is evident, as the capacity to generate income by means other than that of forest exploitation permits such a sacrifice.

On the other hand, with movements of income, the effect can be ambiguous due to its quadratic effect in the model. As estimators indicate, at relatively small income levels, the likelihood of relinquishing an income derived from timber yielding activity will grow at decreasing rates until reaching a maximum (in this case, this point was estimated at around \$4,500 Mexican pesos per month, an extremely high income), from which point this probability begins to decline. This tendency concerns differentiated phenomena: the first explains the growing segment of the function and how that

responds to the conjecture under which, at higher income levels, persons can be more willing to sacrifice some of their present profits in favor of future generations; the decreasing segment involves the economic structure of the populations under study. As was observed, the saddle point corresponds to a very high income and is limited to the best paid forest-enterprise jobs of *El Balcón*. Thus, households that depend on this activity for a living are less willing to make decisions that will reduce the profits of this sector. The effect on this segment is comparable to that found in “non-industrial private forest” owners with forests in good condition and with high yield (Conway *et al.*, 2003) or with those reported by Thompson *et al* (2012) related to willingness to conserve.

An interesting result of this case comprises that there are no differences between the communities, or among community members, with or without land ownership rights. This result reveals that the bequest motive is not necessarily related with direct participation in profits associated with timber exploitation, but rather, there must be other perceptions regarding forest goods and services. The latter derives from the fact that not all of the individuals interviewed receive benefits from the timber exploitation activity, either directly or in the form of public services.

In an attempt to evaluate disposition to reduce the present level of timber harvest, a referendum-type question was asked, but was unanchored. The objective was to take advantage of the fact that the decision to determine harvest volume (at the lowest) lies in the hands of a community general assembly in which community members with ownership rights have a voice and vote, whereas members without ownership rights have only a voice. According to Hanemann (1994), this mechanism produces compatibility of incentives and does not entertain the problem of bias due to anchorage (Green *et al.*, 1998). Given that timber volumes and characteristics of these volumes are different in both communities, it was decided to present this question in terms of a percentage of timber-harvest reduction. In this manner, the measure of this disposition was approximated by means of the percentage of the community harvest volume the head of the household surveyed would ask the general assembly to reduce. Evidently, this approximation does not allow comparison of the monetary value between the two communities; however, it does permit a comparison of their perception in terms of the benefits that they obtain. In other words, we consider that this willingness to pay is

more an expression of attitude toward bequest (Kahneman *et al.*, 1999) than an indication of economic preference in the strictest sense (Mitchell and Carson, 1989). In this respect, the analysis did not attempt to estimate parameters of the distribution of the willingness-to-pay function, but only to define the determinants of this bequest attitude. The question employed in the analysis was the following: By what percentage do you think the assembly should be requested to reduce the harvest volume to insure that your children will continue to work in forest activity?

The average value of percentage of harvest that community members were willing to reduce was 30.36% (Min = 0; Max = 60%), with a Standard deviation (SD) of 14.27; 71% of the total heads-of-household sample exhibited willingness to reduce the current harvest flow on behalf of future generations.

After testing various models, those of best adjustment are very similar to those of the previous model, although this allows better identification of the donor. Clearly, for this analysis the “disposable income” turns out to be endogenous, because for many community members, the larger the reduction in harvest flow the lower the income received from forestry activities. Thus, models tested with the “income” variable utilized instruments (land ownership, days along the week having meat for dinner) for this variable in a first-stage equation. Best approximation for such an equation is depicted in Table 4.

The percentage at which a community member is willing to reduce current timber harvest flow is presented and was modeled as a Probit model with a set of instruments for the “income” variable. Best-fit results are shown in Table 5.

With respect to the previous econometric exercise in view of the present one, it is again observed that age is inversely related with willingness to sacrifice current consumption in favor of future generations. The model also suggests that educational level is a determinant in defining a wish to bequeath to future generations; the larger the numbers of years in school, the greater the percentage of current harvest to sacrifice in order to favor future generations. This effect has been documented by Lockwood *et al.* (1993) and Riddel and Shaw (2003), and is explained as better knowledge regarding environmental benefits from educated individuals.

For this fit, differences of both communities were also evident and once again, the community with lower social capital, with less investment in public goods and services, and with lower quality and quantity of resources is less willing to accept a cost in order to ensure a forest area for future generations.

Monthly income is a variable that does not appear to follow the expected trend. However, in this latter analysis, it was related with reduction in harvest flow, which entails some embedded endogeneity. Observe, monthly income exerts a relatively low marginal effect, and one with a negative sign. This implies that the larger the income the lower the willingness to accept a reduction in timber harvest flow. This behavior is expected for households receiving wages from the CFE, or for those with property rights and who participate in profit distribution, because those profit shares or wages directly depend on harvest flow. However, remaining community members should have an expected trend, namely, the higher the income the higher the willingness to pay, but only up to a certain limit, as was the case in the previous analysis. It turns out that all community members depend on logging, either directly or indirectly, through job-related activities, or for the provision of public goods and services from the CFE. This is what is driving an undefined trend to low and medium incomes, which ultimately is leveraged by large incomes that clearly are not willing to reduce harvest levels.

This behavior is interesting in that it demonstrates that poor forest communities are willing to contribute some additional labor to ensure the permanence of the forest, or to accept a reduction in their income from harvest activities to accomplish the same goal. However, when confronted with a real reduction in their “secure” income or benefits, they continue to exhibit willingness to accept a cost, but they estimate the trade-off between inheriting an asset and reducing their income.

6. Conclusions

In this study, the existence of a bequest motive, or intergenerational value, closely related with the conservation of forests for controlled logging under management plans by forest communities, has been confirmed. This attitude of bequest undoubtedly makes

it possible to mitigate the loss of forests in the hands of the rural communities that manage forest resources and that find themselves in a marginal situation. Depending on the modality of effort, an elevated figure that ranges between 83 and 71%, heads of household declared their willingness to make an altruistic sacrifice for the subsequent enjoyment of this resource by their children. It was detected that there is a greater propensity toward carrying this out in terms of work effort, which would allow future yields of natural capital (reforestation tasks), rather than sacrificing present profits (reduction of the volume of extracted harvest). In the study, arguments are confirmed that indicate that extreme poverty causes this altruistic disposition to become reduced, although without ceasing to be positive. However, when constructing a finer analysis and taking into account income as a continuous variable, it is observed that the bequest disposition is not related linearly with income. In our particular case, this surprising fact is due to that homes with higher incomes diminishes this sacrifice to some degree, to the extent that the logging activity is their principal source of income. In this regard, the study reveals that land reserves allow diversification of income sources and demonstrates that the bequest value may be increased with a greater amount and variety of productive resources. The political implications are relatively clear. An effort aimed at diversifying a population's income source and reducing their poverty can exert a significant effect on conservation through the effect of the value that persons place on the possibility that their children will be able to enjoy these resources in the future.

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<i>Variable</i>	<i>El Balcón</i> <i>n= 66</i>	<i>Laguna Kaná</i> <i>n= 162</i>
Age of the household head (years)	38.8	43.6
Education (years)	3.6	5.5
Household members	6.3	5.5
Area of agricultural parcel (ha)	4.9	1.6
Monthly income (pesos)	2,836.8	807.2
Timber harvest volume (m ³ /a) in the community	20,000	750*
	<i>Percentages (%)</i>	
Owns agricultural plot	87.9	82.4
Beneficiary of PROGRESA**	81.8	64.9

Source: Personal elaboration, based on the surveys made in homes in 2002.

*/ Mahogany and red cedar

**/ The Programa de Educación, Salud y Alimentación (PROGRESA) consists of a system of subsidies aimed at households whose living conditions are considered to be of extreme poverty.

Table 1. Some descriptive statistics of studied communities

Dependent Variable: Number of days of work to reforest without pay (per year)			
Variable	Estimate	<i>t</i> Statistic	Prob > <i>t</i>
** Age (years)	-0.020	-5.278	0.000
** [Monthly income] ² (pesos)	8.46e-09	2.276	0.024
** Gender (1 = female)	0.427	3.335	0.001
** Poverty status (1 = beneficiary of PROGRESA)	-0.187	-4.363	0.000
** Number of household members	-0.145	-2.264	0.025
** [Number of household members] ²	0.008	1.983	0.049
** Community (1 = <i>Laguna Kaná</i>)	-0.443	-3.133	0.002
** Intercept	2.924	8.425	0.000

$R^2 = 33.78\%$, $n = 175$

* Significance level $\alpha \leq 10\%$

** Significance level $\alpha \leq 5\%$

Table 2: willingness to accept days of work to reforest without pay

**Dependent Variable: Willingness to reduce current harvest flow in favor of the
future generation (Yes = 1, No = 0)**

Variable	Estimate	t Statistic	Prob > t	Marginal change
** Monthly income (pesos)	4.11e-04	2.468	0.013	0.012%
** [Monthly income] ²	-4.51e-08	-2.305	0.021	-1.00 e-06%
** Agricultural plot (1= owns)	0.737	2.726	0.006	22.015%
Intercept	-0.272	-0.920	0.357	-

Concordant predicted probabilities = 72.41% , $n = 175$; $-2 \text{ Log L} = 1719.877$

* Significance level $\alpha \leq 10\%$

** Significance level $\alpha \leq 5\%$

Table 3. Likelihood to reduce current harvest flow

Dependent Variable: Monthly Income			
Variable	Estimate	<i>t</i> Statistic	Prob > <i>t</i>
* Age (years)	-11.378	-1.98	0.0500
** Agricultural Land (hectares)	122.044	2.61	0.0098
** Remittances (1=receive))	233.239	2.52	0.0127
** Livestock (number)	56.168	6.47	0.0001
** Forest Activities (1=employed by the CFE)	1390.021	3.54	0.0005
** Community (1 = <i>Laguna Kaná</i>)	-1684.44	-6.65	0.0001
** Intercept	3203.578	8.06	0.0001

$R^2 = 58.09\%$, $n = 201$, $F=24.09$

* Significance level $\alpha \leq 10\%$

** Significance level $\alpha \leq 5\%$

Table 4. Estimate of income

Dependent Variable: Percentage of reduction of current timber harvest flow.				
Variable	Estimate	t Statistic	Prob > t	Marginal change
** Monthly income (pesos)	-0.000270	6.8269	0.009	-0.01%
* Age (years)	-0.008740	3.7235	0.0537	-0.22%
** Education (years)	0.036500	4.034	0.0446	0.91%
** Community (1= <i>Laguna Kaná</i>)	-1.2344	27.7097	0.0001	-30.86%
Intercept	0.2952	0.4998		

Concordant predicted probabilities = 59.7% , $n = 175$; $-2 \text{ Log } L = 1688.9546$

* Significance level $\alpha \leq 10\%$

** Significance level $\alpha \leq 5\%$

Table 5. Percentage in which a community member is willing to reduce the current timber harvest flow