Compensation claims in voluntary forest conservation: A case of private owned forests in Finland

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Abstract

A new marked-based voluntary program to preserve forest habitats on private land has been implemented for testing in Finland. It bases on nature conservation by fixed-term contracts between landowners and an authority that represents national government under a given budget constraint. This paper examines the cost-efficiency of the Experiment of Trading in Natural Values in forest conservation analyzing whether landowners’ environmental preferences reduce their compensation claims. We describe theoretically how the compensation claims of landowners having different preferences for biodiversity maintenance are determined in the context of forest conservation where the participation into a voluntary conservation program improves environmental quality but causes profit loss in terms of timber production. The preliminary empirical analysis shows some weak indications about the effects of owners’ preferences on the compensation claims in the market of natural values. Thus, a voluntary approach including a competitive bidding process may provide cost savings compared with a mandatory conservation program, where compensations are based on the market value of forests. In order to make stronger conclusions we have completed a survey among the owners who have participated in the experiment using a questionnaire with a set of detailed questions on their attitudes, preferences and other background variables.

Keywords: biodiversity protection, voluntary agreements, environmental preferences
1. Introduction

There has been a growing interest to use of voluntary agreements (VAs) as an environmental policy tool. Typically, they are praised for being politically feasible and more efficient than traditional mandatory approaches. Voluntary approaches have historically been used in several fields, but most notably, perhaps, they have been used in agriculture to reduce pollution in soil conservation and other erosion control programs such as the U.S. Conservation Reserve Program (see, e.g., Segerson and Miceli 1998). In Austria, VAs are used to protect forests for biodiversity maintenance (Frank and Müller 2003). A similar approach is experimented currently in Finland.

A new marked-based voluntary program, hereafter termed the Experiment of Trading in Natural Values (ETNV), to preserve forest habitats on private land has been implemented for testing in Finland. In this country non-industrial private forest owners possess over 14 million hectares of forests being about 53% of the total forestry land. These forests are primarily used for timber production which is the most important reason for endangering of species in Fennoscandia (Esseen et al. 1997, Rassi et al. 2001). Most of the non-industrial private forests are located in southern Finland, where protected areas (PAs) cover less than 1% of the forested land. Thus there is an urgent need to extend the conservation network in this part of the country (Hanski 2000). It is likely that a mandatory approach, such as land taking, would bump into an intense resistance expressed by displeased landowners. Therefore, a voluntary program seems quite attractive policy tool for conserving biodiversity maintenance in these circumstances.

This new practice bases on the concept of nature conservation by fixed-term contracts agreed between landowners and the authority that represents Finnish government under a given budget constraint. According to these contracts the forest owners produce biodiversity services in their lands and receive a compensation/incentive payment. The aim of ETNV is to create markets for biodiversity services in a manner that has a broad acceptance in society and in particularly among forest owners. Thus, not only being politically feasible ETNV may also be cost-effective.

Economic efficiency entails maximizing the difference between the conservation benefits of PAs and the costs of preserving them. The costs include not only the opportunity costs of protecting individual properties, but also the information and transaction costs paid by landowners and government. Many previous studies have brought out the potential advances of using voluntary-based instruments in nature conservation instead of regulatory approaches (e.g. Innes et al. 1998, Michael 2003). The main arguments are that transaction and opportunity costs can be lower under the voluntary approach. Transaction costs may be lower because of reduced reliance on formal legal procedures and reduced conflict. Lower opportunity costs may occur because VAs are generally thought to provide more flexibility in determining the means by which a target level of conservation would be met (Segerson and Miceli 1998). They also may improve the efficiency of conservation by reducing perverse incentives, which can occur under mandatory approach (Langpap and Wu 2004). In particular, the opportunity costs may be lower, if the conservation-minded landowners can be revealed in the voluntary regime (Smith and Shogren 2002, Michael 2003).

Several studies have analyzed the effectiveness of using VAs (Stranlund 1995, Polasky and Doremus 1998, Segerson and Miceli 1998, Wu and Babcock 1999, Innes 2000, Smith and
Shogren 2002, Langpap and Wu 2004). In general, they have found that the efficiency of VAs may depend on several factors, such as the background threat of regulation, the contract scheme, the supporting public services, the deadweight losses of government expenditures, the number of participants in the program, the cost advantage offered by VAs, and the allocation of bargaining power. However, only a few studies have included empirical analysis (Bizer 1999, Nickerson and Lynch 2001, Michael 2003, Tikka 2003). Thus we are largely lacking empirical evidence for these theoretical findings.

This paper examines the cost-efficiency of ETNV in forest conservation. In particular, we analyze whether landowners’ environmental preferences reduce their compensation claims. The cost-efficiency of ETNV depends strongly on how effectively the conservation-minded landowners, those who have low compensation demands and own ecologically valuable sites for conservation, can be attracted to and revealed in ETNV. We first describe theoretically how the compensation claims of landowners having different preferences for biodiversity maintenance are determined in the context of forest conservation where the participation into a voluntary conservation program improves environmental quality but causes profit loss in terms of timber production. Being a suitable tool for this case we will use a standard framework of measuring effects of quantity or quality change of a commodity on consumer’s welfare (see e.g. Varian 1992, 160-168 and Kolstad 2000, 298-309) but adding to that analysis another change, an increase in consumer income. Then, we present a preliminary numerical analysis on how the compensation claims were set in ETNV investigating the relationship between the compensation claims and the property attributes. The data set of the study includes a total population of participants of ETNV. The population is not big as the regulator has a limited annual budget constraint and so far the experiment has continued only two years. Finally, we give some short conclusions of the paper and present avenues for future work.

2. Analytical framework

2.1 General market description

This section analyzes how the forest owner’s compensation claim is determined in the voluntary program where the owner and the regulator make a contract that the owner produces biodiversity services in his or her land and receives a compensation payment from the regulator. However, to present the overview of the problem at hand we start the discussion by considering the factors that effect demand and supply of biodiversity services in the context of contractual mechanism.

Hereafter we name the conservation targets as forest stands. For simplicity, we assume that the stands are either strictly protected (temporarily or permanently) or used for timber production. This is a typical situation considering, for example, old-growth boreal forests. Each stand has different ecological characteristics and timber production possibilities. We assume that the aim of the regulator is to maximize net social benefits of conservation. Also, we assume that the regulator can pay different payments for each landowner. The aim of a forest owner is to maximize the net benefits from his or her land. These benefits include both commercial and subjective values as forests provide many products and services. Many of these products and services, such as biodiversity, do not have market price.
The most important factor affecting the demand and supply in this market is the ecological characteristics of the potential conservation target. First, the stand must fulfill the specific ecological criteria before it can be accepted as a target for conservation, because all types of forests do not need protection. Thus, in this sense, there is no free entry into the market. In practice, these criteria can include several general factors, such as the amount and quality of decaying wood found in the stands, the share of deciduous trees, and the presence of threatened or rare species. Second, the regulator is willing to pay more for higher quality stands that lower quality stands, but the interpretation of quality depends, however, on more specific local goals of conservation. Anyway, this indicates that the regulator has to solve a difficult problem: how to precisely define and measure biodiversity (see, e.g., Weitzman 1992 and Pearce and Moran 1994). Regulator’s willingness to pay (WTP) for the protection of the particular stand also depends on the other stands that are available for conservation. Obviously, if there are a lot of similar stands available, the regulator’s WTP for this type of stand is lower than in the case that there are no close substitutes for the stand. Moreover, regulator’s WTP depends on the existing conservation network, because the regulator may prefer the stands that situate near existing PAs to avoid fragmentation of the forest landscape, for instance. To sum, the goal of conservation in biological terms is not fixed in this program, but it is updated as the program proceeds. Consequently, regulator’s WTP for a particular type of stand may change during the process.

Also, supply of biodiversity services and the compensation claims of the forests owners depend on several factors. One important factor is the timber production possibility of the particular stand. This affects how big losses the protection of the stand will cause to the forest owner, i.e., the monetary loss for giving away a possibility to harvest his or her own forest stand and sell timber for money. These losses depend also on wood market, which determines timber prices. However, the goals and preferences of a forest owner affect the compensation claim, too. In practice, the forest management decisions are done and the goals for timber production are set at forest holding level (or at household level), not at stand level. Therefore, the timber production possibilities of a given stand can not solely determine the losses incurred from its protection.

In voluntary preservation of private forests, preferences of forest owners are in a crucial role. Preferences may be environmentally friendly so that a forest owner would not need any or a very small compensation for preserving his or her own forest stand. In the opposite extreme case he or she may not value environment at all and would claim a compensation for preservation that covers all losses from timber production.

2.2 Definition of compensating demands

Let us next consider this issue more closely using two types of forest owners which own similar stands (Fig. 1). Suppose that the first one, the owner $a$, has strong environmental preferences signifying that environmental changes have an influential impact on his or her welfare (Fig. 1(a)). In the figure this is shown by steeply downward sloping indifference curves indicating that a change in environmental quality should be compensated by a large change in income $y$ (or private goods) in order to keep the owner on the same utility level. The second one, the owner $b$, has weaker environmental preferences meaning that environmental changes have smaller impact on his or her welfare (Fig. 1(b)). This means, correspondingly, that he or she should get less $y$ to compensate a decrease of environmental quality to keep his or her welfare constant. We can
write the same relationship by comparing marginal rate of substitutions \((MRS)\) between \(y\) and \(q\) and between the two owners as follows:

\[
MRS_a(q, y) > MRS_b(q, y)
\]  

(1)

Figure 1. Impact of a change of environmental quality caused by a cutting of an own forest plot to welfare of a forest owner with (a) strong or (b) weak environmental preferences.

Assume that the utility of the forest owners originally is on the level \(U_0\), i.e., the owner \(a\) is on \(U_a^0\) and the owner \(b\) on \(U_b^0\) (see Fig. 1(a) and 1(b), respectively). Further, suppose that both forest owners consider to cut a similar plot of their forests which would decrease environmental quality including deterioration of landscape view and recreational benefits in the forests, for example. This would decrease utility of the forest owners from \(U_0\) to \(U^1\).

In order to return to the original level of utility we have to define the value of the compensating surplus. Using an indirect utility function this can be written as

\[
v(q^0, y) = v(q^1, y + CS^1)
\]  

(2)

where \(CS\) is compensating surplus, a Hicksian measure of a welfare effect caused by a quality or quantity change. In the case of quality decrease compensating surplus \(CS^1\) as defined in Eq. (2) is the income needed to keep the original level of utility at the new environmental quality. In Fig. 1(a) \(CS^1\) equals the line segment \(AB\) and in Fig. 1(b) to \(DE\).
So far we have only considered the quality change of harvesting a stand. The owners would,
however, harvest the stands in order to sell timber to forest industry for increasing their
harvesting income from \( y \) to \( y' \). This would compensate the original utility loss of quality
decrease and it is illustrated in Fig. 1 as the movement of utility from \( U^i \) to \( U^2 \). If we take the
increased income into account in the welfare measurement, we can write

\[
v(q^0, y) = v(q^1, y + \Delta y + CS^2)
\]

where \( \Delta y = y' - y \) and \( CS^2 \) is compensating surplus if the owners decided to harvest and get the
income. For the owner \( a \) who prefers strongly environmental quality the increased income would
not be able to compensate the loss of environmental quality of the cutting (i.e., \( AB > BC \))
whereas for the owner \( b \) the relation would be opposite (\( DE < EF \)).

A comparison of the total effects of these two changes (i.e., the first one caused by the
environmental decrease from \( U^0 \) to \( U^i \) and the second one by the income from sales from \( U^i \) to
\( U^2 \)) between the two owners shows that the net change from \( U^0 \) to \( U^2 \) is negative for the owner \( a \)
and positive for the owner \( b \), i.e., \( U_a^0 - U_a^2 < 0 \) and \( U_b^0 - U_b^2 > 0 \), respectively (see Fig. 1). This
means that the increased income from timber sales would not totally compensate the decrease of
environmental quality for the owner with strong preferences (\( a \)) but would do that more than
completely for the owner with weak environmental preferences (\( b \)). With respect to voluntary
preservation this has an important consequence: it indicates that the former type of the forest
owner is willing to set aside a plot of his or her forest without any repayment until \( AB = BC \) or
\( U_a^0 - U_a^2 = 0 \) whereas the latter type of the owner should be paid a positive compensation if \( DE < EF \) or \( U_b^0 - U_b^2 < 0 \) in order to make him or her willing to make an agreement.

We can write the same conditions with help of indirect utility functions. For the owner \( a \) the
condition is

\[
v_a(q^0, y) > v_a(q^1, y + \Delta y)
\]

meaning that he or she is better off on the original situation and will not choose to harvest his or
her stand. For the owner \( b \) we can write

\[
v_b(q^0, y) = v_b(q^1, y + \Delta y - CS_b^2)
\]

representing that he or she should be paid a negative compensation or taken off the amount of
\( CS_b^2 \) in order to keep him or her as well off as in the original situation. Inversely, without a
positive compensation equal to \( CS_b^2 \) the owner \( b \) would decide to cut his or her stand, get the
income from the timber sales and move to the higher utility level \( U_b^2 \).

If a regulator of environmental policy could identify the types of preferences of the forest owners
he or she could find the most environmentally friendly owners. Combining this information to a
data set on environmentally valuable forest plots the regulator would be able to make an optimal
combination of preservation areas and a socially efficient solution of environmental protection.
There is, however, a problem of asymmetric information between a regulator and forest owners in voluntary preservation of private forests because the regulator does not know owners’ preferences. Moreover, forest owners do not have an incentive to tell the truth about their preferences to the regulator. Instead of telling them truthfully a forest owner with environmentally friendly attitudes may have an incentive to behave strategically and reveal untrue preferences in order to get money for preservation although he or she would be willing to preserve the stand without any repayment.

Another source of asymmetric information may be goals of owners with respect to timber production which, after all, determines how big timber sales and income are. One owner may maximise his or her income by harvesting as much as it is possible in the long run while another one may postpone harvesting in order to leave the property for next generations, for example. Now the former would need a full compensation for an agreement but the latter might refrain from harvesting in any case and would be satisfied with a minimal repayment. Thus it is difficult for the regulator to find an optimal solution since he or she does not know the motives of the owners.

A solution for the problem of asymmetric information may be found if a competitive bid process could be developed for voluntary preservation including bargaining in which several forest owners offer their forest plots for preservation. In this kind of trade the owners compete for agreements with each other and take into account their own preferences for environmental quality and other motives as well as that a too high compensation claim may not result in agreement. This is a market of VAs where owners with strong environmental preferences or those who are not intending to harvest a valuable stand in a contract period anyway may claim smaller compensations and will conclude an agreement in place of owners with weak environmental preferences or those who wish to maximize timber production.

3. Empirical case

In this section we examine empirically the compensation claims of forest owners by using information from the Experiment of Trading in Natural Values (ETNV), which started at May 2003 in Satakunta region in southern Finland and will continue as an experimental project to the end of the year 2007. However, let us first describe the key features of ETNV.

3.1 Description of the Experiment of Trading in Natural Values

The basic idea of ETNV bases on landowners initiative to protect his or her own forest. The process starts when a landowner offers his or her land into the program by submitting a specific declaration form to the regulator, the regional Forest Centre. The form includes a description of the ecological characteristics of the offered conservation target, which can include several stands. Landowners are also expected to submit an asking price for the beginning of the negotiations. Typically, the protection means abstaining from timber management but it can also cover tasks improving the ecological quality of the stand in the long run. In the experiment the contracts are in force for a limited period lasting 10 years. Compensation payments are paid off at once at the beginning of the contract period and they are exempt from taxes.
In the next phase of ETNV the regulator checks the declaration form and assesses preliminarily whether the offered target is feasible to be a potential target for conservation or not. If it seems that the quality of the offered target is high enough, the nature value expert from the Forest Centre makes an inventory in the forest and checks if the forest fills the biological criteria of nature protection. Otherwise the regulator informs the landowner that the offered target is not worth of protection and there will be no agreement.

After the field inventory, if the regulator is still considering the target good enough for conservation, he or she calculates the compensation value of the target by using a certain valuation mechanism, which includes subjective prices for different ecological characteristics. It includes also a capitalized value for the loss of delayed harvesting calculated by using 1% interest rate to forest value and expected decay of wood. Thus the regulator has a good knowledge on the timber production possibilities of the target due the field inventory.

Finally, the regulator and the landowner will negotiate about the compensation payment and the required protection activities. In most cases the protection means that no silvicultural activities are done in the forest but in some cases careful cuttings and treatment can be allowed. It should be noted that there is no explicit background threat for the landowner. He or she is free to withdraw from the process at any time and after ten years the forest owner can freely decide of the use of the forest according to principles of that time. However, it is possible that if the voluntary experiment does not perform well, a mandatory protection program will be implemented later to protect forest in southern Finland similarly than has previously been done in protecting forests in northern Finland. The negotiations can be interpreted as a competitive bid process, because several landowners are offering their forests for the program simultaneously and the regulator can pay different payments for each landowners. Moreover, the regulator works under a given budget constraint and therefore it is likely that all potential targets will not be included into the program.

ETNV creates market for biodiversity services, but it has limitations and faces several problems. Because ETNV bases on landowners voluntary participation and their initiatives, the best targets for conservation from ecological viewpoint may not be reached in the program. Thus ETNV may not achieve the goals of the conservation. For this reason, perhaps, the Forest Centre has been cautious to set specific ecological goals for ETNV. Also, the Forest Centre may not just maximize social welfare, but may have motive to promote landowners interest, which is the original aim of this organization. Obviously, landowners prefer a voluntary approach to mandatory conservation, and therefore, the Forest Centre may be unwilling to reveal that ETNV is not achieving the ecological goals. This problem may also reflect in the negotiations. The regulator may not be very anxious to use competitive bidding: this would lower the payments for landowners. If there is no competition between owners, they do not have an incentive to reveal their private information and may ask high compensations for protection of their properties.

One particular problem of ETNV came out in the beginning of the program. Most of the landowners did not submit asking prices for the negotiations, and therefore, the regulator showed his or her calculated compensation value as a starting point for negotiations. The regulator wanted to treat landowners equitably as there was only very little information on the value of biodiversity services available for landowners. Naturally, in this practice, the landowners that
originally would have a lower compensation claim than the regulator’s value had an opportunity not to reveal their preferences but claim a higher compensation than what they were told. For this reason, in what follows, we will divide the contracts into two groups, year 2003 and year 2004 and analyze them separately. Let’s now consider the actual compensation claims and payments.

3.2 Numerical results

From the beginning of ETNV in 2003 until the end of 2004 altogether 104 forest owners offered their lands, all in all 119 stands or 679.1 ha of forest, for preserving in the experiment in Satakunta region, Finland. In 2003 agreements were made with 30 owners on 47 stands (253.5 ha) and in 2004 with 35 owners on 43 stands (243.0 ha). The forest owners who submitted their land to ETNV but were not reached an agreement were 29 persons with 29 stands (182.6 ha).

In this analysis we will make calculations using a data set based on 119 stands, i.e., the statistical unit of observation is a forest stand. The data set includes following variables: year when a stand was submitted or agreement made (2003 or 2004), result of negotiations (agreement or non-agreement), surface area of a stand (ha), compensation claimed (€/ha/a), compensation paid (€/ha/a), forest value (€/ha; consisting land value and harvesting value of standing forest), age of forest of a stand (years), and regulator’s estimate of ecological value of a stand (points). The data set does not separate the forest owners without an agreement between the years 2003 and 2004. Some of the stands including into ETNV were burned-out, were located in a site with barren soil or does have a poor value of a standing forest for some other reason, all together 35 stands, were excluded from most of the following analyses leaving 84 observation units in the data set.

Although we are interested in owners’ compensation claims we will first consider if there is any difference in the structure between the groups of the owners, i.e., the ones with an agreement in 2003 and 2004 and the ones without an agreement. We analyzed four stand attributes with the independent samples t-test for equality of means and found that the mean of forest value (€/ha) and the mean age of the forest stands do not differ from each other between the groups. However, we found a statistically significant differences with respect to the mean surface area of the stands between the groups with an agreement and without an agreement (p = 0.082) indicating that the average area of the former group (4.1 ha) is smaller than the one of the latter (6.3 ha). Thus the regulator seems to prefer smaller areas for preservation. This may reflect the budget constraint of the Forest Centre and its aim to make more agreements with the limited funds. Also the mean ecological value of the stands differ statistically between the groups (p = 0.000) so that the stands with an agreement have a bigger value (121 points) than the ones without an agreement (81 points) indicating logical behavior of the regulator that ecologically more valuable stands got agreements.

Next we will analyze if the stand attributes have the same type of variation as do the compensation claims. Finding that the Pearson correlation coefficient between the claims and forest value (€/ha) is 0.248 (2-tailed sig. 0.061) we can show only weak dependence between the variables. The reason for this result may be that the owners who submitted valuable forest to ETNV have strong environmental preferences and therefore they were not claiming compensation that covers the losses from delayed harvesting. Another possible explanation may be that the owners are not maximizing timber production at stand level, i.e., they have not an
intention to harvest their stands for some other reason and therefore they did not tie their compensation claims in the forest values.

If we calculate correlation between regulator’s estimate of ecological value of a stand and the compensation claims we find a clear correlation of 0.545 which is statistically very significant with 2-tailed sig. of 0.000. This result is slightly surprising if we remind the former finding of missing correlation between claims and forest values. It seems that knowing that the regulator is willing to pay more for more ecologically valuable stands the forest owners are ready to behave strategically hiding their possible positive preferences for environment and trying to maximize monetary benefits.

Comparing the means of the compensation claims between the agreements of 2003 (231 €/ha) and 2004 (271 €/ha) we discover that they are not statistically different. If we, however, do the same for actual payments (200 €/ha in 2003 and 172 €/ha in 2004) we find that they are statistically different (independent samples t-test for equality of means, $p = 0.048$) although the ecological value of stands are statistically same. One possible reason for this may be that in 2003 the regional Forest Centre concentrated on for starting up the experiment trying to quickly show the first set of agreements to publicity. This might follow to a less effective competition between owners and “too big” payments during the first year of ETNV. In the second year the feeling of public pressure may have alleviated and the ability of the authority to conduct the experiment may have improved meaning more efficient competition in the new market and more efficient revelation of owners’ preferences leading to smaller repayments. A second explanation might arise from targets of environmental policy of the public authority. In 2003 the Forest Centre would have reached some goals with respect to conservation policy and would have taken this into account when making new agreements (i.e., the marginal benefits of conservation are decreasing). This might have followed to lower payments in 2004.

4. Conclusions

In this preliminary analysis we have found some weak indications about the effects of environmental preferences of forest owners on the market of natural values. The fact that we did not find any correlation between the compensation claims and forest values might indicate that the owners who submitted valuable forest to ETNV have strong environmental preferences and were claiming relative small compensation for an agreement. Thus, a voluntary approach including a competitive bid process may provide cost savings compared with a typical mandatory conservation program, where compensations are based on the market value of forests. Previous findings support also this conclusion (Michael 2003). Another result referring to the effect of owners’ environmental preferences might be that actual payments of compensation were smaller in 2004 than 2003 might follow to more efficient competition in the new market and more efficient revelation of owners’ preference in the second year of ETNV.

Importantly, however, our analysis does not allow us to make any strong conclusions from the compensation claims and the market process of VAs. The correlation coefficients and their statistical tests can give us only weak evidence about the landowners’ environmental preferences and their impact on to reduce compensation claims ending up us soon in fruitless speculations without more information of the forest owners. As many other things may explain differences in
compensation claims and real repayments, we have conducted a survey among the owners who have participated in ETNV using a questionnaire with a set of detailed questions on their attitudes, preferences and other background variables. Linking property attributes and landowner attributes we will be able to get deeper evidence and make stronger conclusions on compensation claims and actual payments in ETNV.

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