

# Environmental Values - What's the Point?

Essays on Compliance with Environmental  
Regulations and on the Meaning of  
Environmental Values

J. Fredrik Holstein

*Faculty of Natural Resources and Agricultural Sciences*

*Department of Economics*

*Uppsala*

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# Environmental Values - What's the Point? Essays on Compliance with Environmental Regulations and on the Meaning of Environmental Values

## Abstract

Environmental policy aims at preserving environmental values. But what is the point... i) of the concept of environmental values and ii) of environmental values that will actually be reached? This thesis focuses on both these questions.

Setting an environmental target requires a, implicit or explicit, trade-off between values. Even though economics offers a theoretical foundation as well as methods for this, it might be argued that other values should be considered. Paper I investigates the meaning of, and relation between, different value related terms. The value perspective is crucial: *biological objects* might have an economic value whereas biological values, interpreted as *intrinsic*, are incommensurable with economic values.

Paper II discusses potential implications of differences between the value perspectives asserted by respondents of stated preference (SP) surveys and the perspective implied by the valuation question. It is concluded that implied and asserted rights are incompatible in most of the potential situations and that this offers a coherent explanation to anomalies often found in SP-surveys.

Paper III and IV apply econometric tools for explaining why firms violate or comply with environmental regulations. In both studies it is shown that the frequency of inspections are important to encourage compliance. In Paper III results from non-parametric methods revealed that smaller, and less environmentally harmful, firms have higher frequency of violation in the absence of inspections but that they increase their compliance more as a response to increased inspection frequency. In none of the papers it can be excluded that the inspections affect behaviour both through the deterrent effect and by the increased knowledge following from the information from the inspectors.

In Paper IV is the potential effect of social capital and environmental consciousness in focus. It is shown that the effect social capital, measured as trust, has on compliance is non-linear and partly negative. A possible explanation to this counter-intuitive result is that trust, in a naïve form, is exploited by firms governed by calculated rather than social or normative motives.

*Keywords:* values, valuation, stated preferences, anomalies, property rights, landscape, compliance, inspections, inspection style, social capital, Sweden

*Author's address:* Fredrik Holstein, SLU, Department of Economics,  
P.O. Box 7013, 750 07 Uppsala, Sweden  
*E-mail:* Fredrik.Holstein@ekon.slu.se

# Dedication

To Helene, Ylva and Vidar.

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## List of Publications

This thesis is based on the work contained in the following papers, referred to by Roman numerals in the text:

- I Holstein, F. (1998). The Values of the Agricultural Landscape: a Discussion on Value-related Terms in Natural and Social Sciences and the Implications for the Contingent Valuation Method. In: Dabbert, S., Dubgaard, A., Slangen, L., and Whitby, M. (eds.) *The Economics of Landscape and Wildlife Conservation*. CAB International, Wallingford, 37-52.
- II Holstein, F. Perceptions of Rights and Environmental Valuation - Incompatible Opinions About Rights as Explanation to Anomalies in SP-surveys. (Manuscript).
- III Holstein F. and I.-M. Gren. *Inspections and violations of environmental regulations in Sweden - a non-parametric approach*. (Manuscript)
- IV Holstein F., 2009. *Social capital and compliance with environmental regulations in Sweden*. (Manuscript)

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# 1 Introduction

What is the point of environmental values that will be reached with environmental regulations? Moreover what is the point of environmental values? One of the central subjects in environmental economics is the design of policy measures for achieving a more desirable use of the environment and of the natural resources. This thesis focuses on two groups of questions, both in different ways related to the broader question of policy measures.

First, in order to formulate an environmental target towards which the policy should aim the question of environmental values is unavoidable. Dealing with environmental values in an economic perspective is just one of many possible bases for discussing, analysing and potentially setting an environmental target. Paper I and II deal with the relation between different perspectives of values in general and especially the meaning of and assumptions behind the term economic value. In Paper I this subject is analysed from a value theoretical perspective and in Paper II potential implications for the estimation of values through stated preference methods are analysed.

Second, in order to fulfil the aims of an environmental policy it is necessary to guarantee a sufficient level of compliance. Paper III and IV deal with the driving forces behind the decisions to comply or to violate. Paper III presents the results from an empirical study where the effects of inspection related variables are estimated for different type of firms in Sweden 1992 and 1995. In Paper IV data from 2005 – 2007 have been used to investigate the effects of both inspections and social capital.

In this introductory chapter these topics are put into a broader context of environmental economics. Thereafter the four papers are summarised separately before a concluding discussion.

This is a thesis in environmental economics, especially microeconomics. Economics in general deals with human use of scarce resources and even if traditional micro and welfare economics start from quite specific assumptions about human behaviour there are, in the economic discipline,

different assumptions and different interpretations about how human behaviour can be understood. Moreover, in today's society much of the human behaviour has environmental relevance; indeed almost every action can be analysed from the viewpoint of environmental impact. This means that environmental economics does not have any clear demarcations. However, the central questions in environmental economics are:

1. How should we, as a society, use the environment and other scarce natural resources?
2. How do we, or will we, use the environment and the natural resources under different institutional settings?

The first question is a normative question that can only be answered in relation to a specific value premise (Ariansen, 1992). In welfare economics the normative criterion is usually that human welfare, subjectively defined by individuals, should be maximised (Malinvaud, 1972; Ng, 1979; Randall, 1987; Sagoff, 1994; Spash & Hanley, 1995). Other norms may be used as value premises for how resources should be used, e.g. GDP or the growth in GDP should be maximised, wealth should be fairly distributed, the wealth of the poorest should increase or the resources should be used so that a sustainable development is achieved. All of these value premises can be interpreted differently and need to be clarified to become practically useful as guidance for how resources should be used (Lockwood, 1997). Common for all these, and other value premises is that they are, explicitly or implicitly, based on more fundamental ideas about what is valuable and, even more fundamental, what constitutes a "value" (Ariansen, 1992). Paper I deals with the meaning of different value-related terms. In Paper I the value perspective of welfare economics is put into a broader value theoretical perspective to compare it with the meaning of other value related terms, such as "biological values". Hence, Paper I deals with the normative part of environmental economics and the results are useful for dealing with questions such as *should an economic analysis be used when biological values are threatened?*

The first central question stated above raises fundamental philosophical questions about e.g. how the term *value* can be interpreted (Beckerman & Pasek, 1997; Brown, 1984; Gren *et al.*, 1994; Jones, 1993; O'Neill, 1992; Sagoff, 1994; Vadnjal & O'Connor, 1994). Once this question is, at least preliminary or conditionally, answered on a general level a decision about real resource use usually requires that the relevant values are measured and taken into account. A general conclusion in economics is that the institution, usually called the market, under some specific circumstances leads to a use of resources that maximises social welfare, as defined in

normative economics (Eggertsson, 1990; Randall, 1987). On a market, consumers, who are assumed to know their own preferences and thus the subjective values of goods and services, communicate these values through their market behaviour. Since resources are scarce the competing desires will result in prices signalling the relative scarcity of resources, goods and services. This guarantees that the relevant values are actually measured, by each actor herself, and taken into account by others as prices on markets.

However, it is a general conclusion in environmental economics that markets tend to fail to efficiently allocate the use of goods or resources that are non-exclusive and/or non-rival, just as many environmental and natural resources are (Pearce & Turner, 1990; Perman *et al.*, 1996; Randall, 1987; Tietenberg, 2006). This is so since the non-exclusiveness means that resources can be used without payment, which in turn means that the user neither has to communicate her own valuations nor take others' valuations into consideration. Moreover, the non-rival quality means that it is not desirable to make the resource exclusive even if it is possible. The second central question stated above is a positive question about how resources are or will be used. The general answer to that question, from an environmental economic analysis, is that markets sometimes guide the resource use as desired (according to normative economics) but that market failures often lead to an inefficient use of natural resources and to an undesirable degradation of the environment.

This raises the positive question whether the resources will be used in a more desirable way if the markets are complemented with some kind of policy measures? Before designing and eventually implementing policy measures the normative question about how resources should be used has to be considered. What is the target of the policy measure? How much pastoral landscape or how much pollution is desirable? Still assuming that the idea of welfare maximisation should be guiding the resource use it should now be noted that the values are to be communicated to the actors through a policy measure. Hence, the values are not communicated directly by the consumers, as on a market, but indirectly through the authorities' implementation of policy measures (Perman *et al.*, 1996; Randall, 1987; Tietenberg, 2006). This raises a need to collect information about the values that individuals attach to the natural resource in question. The branch of environmental valuation aims at doing this; to measure the value that individuals attach to environmental goods (Freeman, III, 2003; Hanemann, 1994). Paper II deals with questions related to environmental valuation in the light of the results of Paper I.

Paper II starts from the assumption that the value theoretical perspective of welfare economics is, at least conditionally, accepted and that the values people attach to environmental goods have to be measured. Since people in

many cases do not have possibilities to express their values entirely through their behaviour on any markets, a range of stated preference methods have been developed and used (Freeman, III, 2003; Hanemann, 1994; Vatn, 2004). The basic idea of these methods is to ask people to hypothetically express their values, as willingness to pay (WTP) or willingness to accept (WTA), for specific changes environmental quality. Among the problems with these methods is that it can be questioned whether respondents take their budget restriction into account, as they are forced to do when communicating their valuations through markets, or if the hypothetical situation leads to a *hypothetical bias* where respondents e.g. overstate their true WTP (see e.g. Braga & Starmer, 2005; Curtis, 2001; Hanemann, 1994; Hanley & Shogren, 2005; Stevens *et al.*, 1991; Sugden, 2005; Söderqvist, 1998 for discussions about these and other problems). Without rejecting this or other potential biases in the stated preference methods Paper II concludes that different value perspectives among respondents, e.g. as described in Paper I, offer a common explanation for many anomalies found in stated preference investigations. Disregarding that more basic value-related questions have to be clarified before e.g. a WTP question can be answered, the answers to stated preference questions may be interpreted as the intended WTP statement even though the respondents have taken the opportunity to express opinions about a more fundamental question such as how the rights *should* have been distributed.

Paper I and II thus point out that the welfare economic perspective of values is just one of many potential value perspectives, but that many other value related terms are compatible with and can be interpreted from that perspective. Moreover, empirically measuring the values people attach to environmental quality offers a possibility for respondents to express values from perspectives that are not necessarily compatible with the specific welfare economic assumptions underlying the economic interpretation of the answers. Hence, defining the desirable goal for an environmental policy measure requires both a choice of value perspective *and* that this perspective, at least conditionally, is accepted by the respondents asked to state their preferences. This conclusion may be interpreted as precluding the possibilities to formulate environmental targets or even environmental policies. However, environmental policy can be based on any environmental target independently if it is based on a stringent analysis of values and an appurtenant estimation of values. Moreover, environmental economics offers tools for analysing environmental policy even if the target for the policy is formulated from other value perspectives than welfare economics<sup>1</sup>.

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<sup>1</sup> One should however be careful to uncritically apply e.g. a cost efficiency analysis when the environmental target is based on values not compatible with the welfare economic

Environmental policy can be analysed from question 2 above, i.e. as a positive question. What is the outcome of different policy measures? What will the effects on the environment and on the use of other resources be when applying different policy measures? The desirability of different policy measures can then, in a normative analysis, be compared to different objectives or values. In such analyses different types of policy measures (e.g. command and control, economic incentives and tradable permits) are compared to objectives such as cost efficiency, goal fulfilment, dynamic efficiency and distributional effects. It can be noted that complying with any environmental policies normally entail additional costs to e.g. polluters or producers of public goods such as biodiversity<sup>2</sup>. Hence, there are incentives to violate any policy measures (Becker, 1968; Cohen, 1999). One of the differences between different policy measures is that the incentives to violate are of varying strength; the more costly it is to comply with the measure, the more profitable it is to not comply and the stronger is the incentive for violation. However there are also incentives for complying with environmental policies, and if these outweigh the opposite incentives, the individual business will choose to comply. Paper III and IV deal with the question of what kind of incentives encourage the compliance with environmental regulations. Three kind of motives behind the decision to comply can be distinguished and labeled: normative, social and economic motives (Bouvier, 2009; Burby & Paterson, 1993; McGraw & Scholz, 1991; Winter & May, 2001).

The normative motive is based on a desire to fulfil moral beliefs or obligations whereas the social motive is the desire to fulfil expectations from others (Arora & Gangopadhyay, 1995; Foulon *et al.*, 2002; Gunningham *et al.*, 2004; Hatcher *et al.*, 2000; Stafford, 2007). Such expectations may also be based on moral beliefs, but the moral of e.g. employees or customers rather than the managers. Finally, the economic motive is based on the desire to maximize profit and hence influenced by the costs of compliance and of violation (Becker, 1968; Cohen, 1987; Gray & Scholz, 1993; Magat & Viscusi, 1990; Nadeau, 1997; Nostbakken, 2008; Nyborg & Telle, 2006; Stafford, 2002). Compliance normally entails costs, such as abatement costs, but also possibly the payment of pollution taxes etc. Violation, on the other hand, potentially entails costs of decreasing sales (if demand decrease e.g. as a moral statement from consumers) and costs of legal sanctions. The latter has

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perspective of values. Since all costs are opportunity costs, i.e. forgone values, even the analysis of costs is based on a specific perspective of values.

<sup>2</sup> A subsidy means that financial means, sometimes more than enough to cover the costs, is transferred to the business. It is, however, in principle possible to accept the subsidy without fulfilling the requirements. Hence, as long as violation of the agreement does not involve any costs, such as fines, it is costly to actually fulfil the aim of a subsidy.

been in focus in the economic analysis of compliance, where the general claim is that potential penalty and probability of detection influence the expected cost of violation (e.g. Burby & Paterson, 1993; Eckert, 2004; Gray & Deily, 1996; Harrison, 1995; Laplante & Rilstone, 1996; Magat & Viscusi, 1990; Nadeau, 1997; Nyborg & Telle, 2006; Stafford, 2002). Hence, the authorities should complement any policy measures with supervision and penalties for violation in order to encourage and, at least to a certain level, guarantee compliance. In Paper III and IV the effects of the authorities' inspection activities in Sweden are investigated. According to the theory more frequent inspections should, *ceteris paribus*, lead to higher compliance since the probability of detection will increase with the frequency of inspections. This conclusion is confirmed by both of the empirical studies reported in Paper III and IV. However, both studies also support the idea that other factors affect compliance, such as the type of firm regulated (Paper III) and the level of social capital (Paper IV).

To sum up the introduction, the core of this thesis is different aspects related to environmental policy, especially questions that, in a sense, surround the questions about what kind of policy measures should be used and their effects. First, all policies are based on some values. The meaning of value related terms and the effects of different value perspectives for environmental valuation are thus important when discussing and defining the environmental targets for environmental policies. Second, the compliance with any environmental policy is dependent on the incentives to comply and violate. The inspection activities are found to be one important incentive to comply. Moreover, as will be further developed in the summary of Paper IV, the environmental interest and the social trust among the public also affects the compliance with environmental regulations.

## 2 Summaries of appended papers

In the previous section the questions dealt with in the separate papers have been put into a broader concept of environmental policy and environmental economics. In this section the appended papers, Paper I – IV, are summarized separately.

### 2.1 Summary of Paper I

In Paper I the value perspective of welfare economics is put into a broader value theoretical perspective and related to some non-economic value-related terms. The main objective of the paper is to place different value-related terms into a common value theoretical framework, and thereby improve the possibility of understanding the relations between the terms.

One rationale for the purpose is the extensive use of different value-related terms in the debate about the changes of the agricultural landscape. It is for example stressed that these changes threaten biological, cultural historical, recreational, economic and aesthetical values attached to the landscape. However, as an analysis in the paper shows, the meanings of the value-related terms are often unclear. This means that the relations between the terms are unclear and that comparisons between different values becomes incoherent which, in the end, may result in less suitable policy measures.

The analysis of the terms shows that clear connection to theory of values often is missing. It is suggested that many value-related terms do not have a clear normative meaning and that such terms would be clearer if the word “value” were omitted. I.e. instead of “biological values”, terms such as “biological functions” and “biological objects”, both of which may have value, will improve the understanding.

The term “economic value” has however, at least for an economist, a clear and normative meaning. The term indicates an anthropocentric value subjectivistic perspective and it is possible to interpret other value-related

terms within that perspective. For example, biological functions may have an economic value. To emphasize that other values should not be added to the economic value the term Economic Measure of Total Value (EMTV) is suggested.

The analysis shows that it is important to be clear about the definition of values. An economic analysis implies a specific value perspective that, in principle, comprises “biological values” if that term refers to “biological objects” or “biological functions”. In that case no biological values should be added to the economic value. Of course, some values may, in practice, be difficult or not possible to measure. In that sense it can be said that “the (economic) value of some biological objects should be added to an incomplete estimation of an economic value”.

The economic value does not, on the other hand, comprise “biological values” if that term refers to “intrinsic biological values”. Neither in that case can the “biological values” be added to the economic value since the values, interpreted in this way, are logically incommensurable.

## 2.2 Summary of Paper II

In Paper II the value perspective of welfare economics is accepted as a normative assumption for economic analyses. Instead, the theoretical analysis in the paper focuses on the possible diverging value perspectives among respondents in SP surveys. More generally, the main aim of the paper is to suggest a framework for interpretation of people’s value expressions and to analyse if this framework can explain some of the “anomalies” found in stated preference surveys (e.g. the occurrence of lexicographic preferences, protests, preference reversals and respondents opposing the economic interpretation of WTP or WTA answers).

There are two rationales for the purpose. The first rationale is to try to find a common explanation and understanding for different anomalies, i.e. value expressions that do not fit into economic theory and that have been explained by diverging *ad hoc* explanations. The second rationale is the conclusion from Paper I that, from the economic perspective, many different value perspectives can be interpreted as opinions about the initial distribution of rights.

The framework is based on three assumptions. First, that people may have opinions about how initial rights should be distributed. Second, that acceptance of property rights is a necessary precondition for preference formation. Third, that property rights may be accepted only if they i) cannot be affected or ii) in the case they can be affected that they are regarded as morally legitimate.



From these assumptions it is concluded that SP surveys place people in a situation where they may perceive that property rights can be affected and where they may find the implied rights morally illegitimate. Hence, the implied rights may not be accepted and consequently the respondent may not have formed any preferences and can therefore not express any relevant WTP or WTA. However, since the respondent may have opinions about how the rights should be distributed she may take the opportunity to express this value. In the paper it is stressed that such value expressions should be interpreted as non-preferential value expressions and that such an interpretation can serve as a general explanation for different anomalies.

Hence, if respondents are to express preferences (or rather WTP/WTA measures) in SP surveys it is crucial that they, at least conditionally, accept the rights implied by the WTP or WTA question. For example a WTP question implies that the respondent does not have the right. If the respondent confronted with such a question asserts that she has or should have the right, she may report this opinion instead of any WTP measure based on preferences. This means that concordance between the rights implied by the question and the rights asserted by the respondent is necessary for the formation and expression of preferences. In case of incompatibility no preferences may be formed. This can explain previous anomalies, such as refusals to answer, protests or “lexicographic preferences”.

Possible asserted rights are categorized into five classes and the possible reactions to SP surveys are discussed in relation to WTP and WTA questions. The result of the analysis is, as summarised in *Table 1*, that perfect concordance will occur only in two or three out of ten cases of combinations between implied and asserted rights.

Table 1. *Relations between asserted and implied rights. Incompatibility (INC) means that respondents may have problems to form preferences and concordance (CON) means that preferences may be formed.*

	Respondent asserts that she has the right		Respondent asserts that other party has the right		Respondent asserts that “third party” has private or collective right
	Privately	Collectively	Privately	Collectively	
WTP-quest.	(I <sub>WTP</sub> ) INC	(II <sub>WTP</sub> ) INC	(III <sub>WTP</sub> ) CON	(IV <sub>WTP</sub> ) INC	(V <sub>WTP</sub> ) INC
WTA-quest.	(I <sub>WTA</sub> ) CON	(II <sub>WTA</sub> ) INC	(III <sub>WTA</sub> ) INC / CON	(IV <sub>WTA</sub> ) INC	(V <sub>WTA</sub> ) INC

This result offers an argument against the recommendation to always use the WTP format. Moreover, for amenities where the respondent asserts collective rights, both the WTP and the WTA question imply rights that

may be incompatible with the asserted rights. This means that, for many environmental goods, neither the WTP nor the WTA question may imply rights that can be accepted by the respondents. If a right means that the owner explicitly must agree on selling, and if people assert that future generations, which cannot agree explicitly, have rights, then respondents may refuse to get involved in any exchanges at all.

### 2.3 Summary of Paper III

In Paper III the influence of inspections on the compliance behaviour with environmental regulations is investigated. To take possible non-linearities and interaction effects into account non-parametric methods were used, and the results from these estimations were compared with results from OLS and semi-parametric estimations.

Other factors, previously shown to potentially affect the compliance behaviour, were included in the statistical models. The rate of unannounced visits in relation to total number of visits were used as a measure of inspection style where a more frequent use of unannounced visits indicated a more confronting inspection style. Variables indicating enforcement budget, the type of firms, year, inspection authority and community characteristics were also included in the models. Type of firms were indicated by the A, B and C classes as defined in the Environmental Protection Act and the appurtenant Environment Protection Ordinance (SFS (1989:364), 1997), where A objects typically have the potentially highest, and C objects the lowest, impact on the environment. The variable for authority indicated whether municipalities or counties were responsible for the inspections. Of the two variables on community characteristics one was a variable for income and the other a variable for the frequency of members of the largest environmental organization in Sweden.

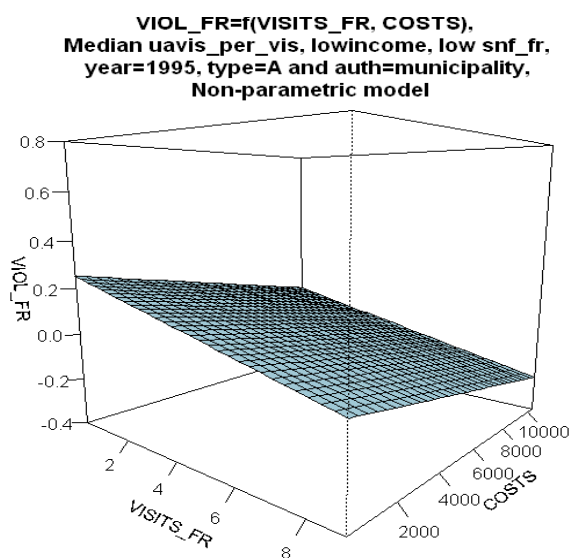
The results indicate that visit frequency, budget resources and type of object had a significant impact on the violation frequency, but that the other variables had no significant impact (*Table 2*).

Table 2. Significant variables (at the 10 level) in non-parametric, semi-parametric and ordinary least squares (OLS) estimations.

Model	R <sup>2</sup>	P-values for estimates significant at the 10 level			
		visits_fr	costs	ord_type	
Non-parametric	0.20	0.000	0.005	0.000	
Semi-parametric	0.20	0.000	0.000	0.000	
				B objects	C objects
OLS	0.14	0.093	0.092	0.010	0.000

The results concerning the effect of inspection frequency confirm that inspections have a positive effect on compliance but that the effects differ between the types of firms. The violation frequency among A objects decreases, as shown in *Figure 1*, with increasing frequency of inspections. C objects, with a higher frequency of violation when inspection rate is low, are more sensitive to the inspection rate, see *Figure 2*. The result for B objects, which is not illustrated here, is similar to the result for A objects. One possible explanation to this difference is that C objects generally are smaller and presumably do not have the same possibilities of keeping themselves informed about environmental regulations and obligations. Since the inspectors partly act as advisors, it cannot be excluded that the decreased frequency of violation is an effect of increased knowledge after more visits.

The results from the non-parametric model also revealed that increased budget resources affect violation frequency differently depending on type of firm. While violation frequency decreased in budget resources for A object (see *Figure 1*), and was unaffected for B objects, it increased for C objects (see *Figure 2*). The unexpected result for C objects may be because authorities responsible for more A objects both have more resources and tend to devote relatively more effort to the A objects with possibly larger environmental impacts. Thus they have fewer resources for inspections of C objects, which may decrease the quality of the inspections. As an effect of the subsequent smaller deterrent effect and/or less information and advice, the violation thus increases among C objects when the budget increases.



*Figure 1.* Violation as a function of visit frequency and budget resources for A objects.

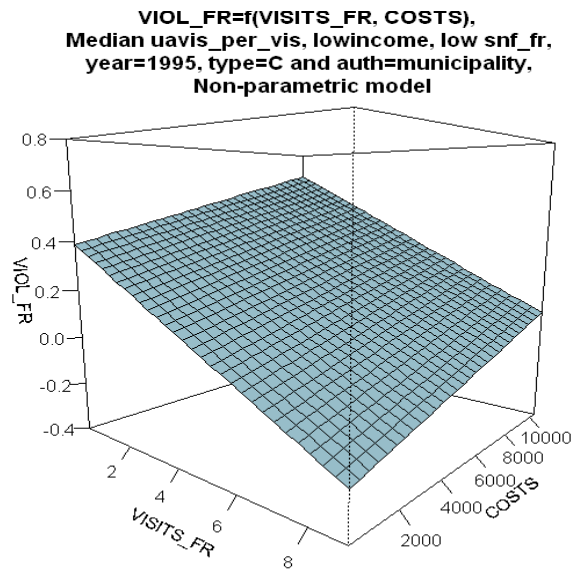


Figure 2. Violation as a function of visit frequency and budget resources for C objects.

## 2.4 Summary of Paper IV

In Paper IV the basic question is the same as in Paper III; i.e. why do firms comply with environmental regulations? However, the focus is on the effects of social capital and environmental consciousness among the population and whether inclusion of these factors in the model increases the understanding of compliance behaviour. The models hence comprise variables for inspection frequency, inspection style, social capital, environmental consciousness, inspection authority and year.

The statistical analyses in Paper IV are based on data for the years 2005–2007, i.e. after the Swedish Environmental Code (SFS (1998:808), 2009) had replaced the Environmental Protection Act, which occurred on January 1, 1999. To a considerable extent similar rules remain in force; activities are classified in relation to their “potential environmental influence”, both municipalities and county administrative board exercise supervision and the supervision authorities are responsible both for giving information and advice and for taking measures to ensure that violations are corrected. There are four kinds of sanctions that can be taken by the supervision authorities: *injunctions*, *prohibitions* (both possibly under a penalty of a fine), *environmental sanction charge* and *report to the police* or prosecution authorities. The *Environ-*

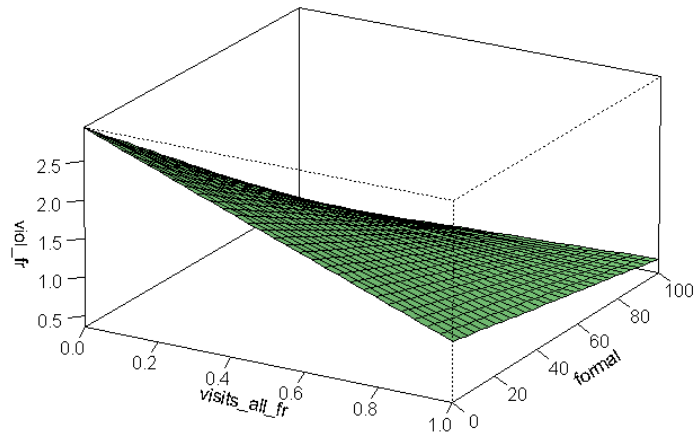
*mental Sanction Charge* was introduced in the Code in order to improve the compliance

In the empirical analysis the frequency of violation was used as dependent variable. The explanatory variables were *inspection frequency*, *inspection style*, *social capital*, *environmental consciousness*, *authority* and *year*. The *inspection style* was measured as the percentage of detected violations that result in a formal punishment. A higher percentage indicates a more stringent inspection style which presumably will affect the probability of punishments and thus increase the compliance. On the other hand, a “softer” inspection style may strengthen an atmosphere of mutual trust which also may have a positive effect on compliance. Two indicators of *social capital* were tested, namely the *degree of social trust* and the *degree of engagement in organisations*. *Environmental consciousness* was indicated by a variable for *environmental interest* among the population.

Three models were used to explain violation with the explanatory variables described above; a linear OLS, a quadratic OLS and a quadratic stepwise regression. Each of the models was tested with each of the two variables indicating social capital; *trust* and *engagement in organizations*. In the quadratic models squared variables and interaction terms were included. Since some of these were found to be significant, at the same time as the  $R^2$ -values were higher than for the linear models, it was concluded that the inclusion of non-linearities is important to capture more of the effects of the variables.

Both increased frequency of inspections and a more stringent inspection style were shown to have a positive impact on compliance, as illustrated in *Figure 3*. However, the effect of inspections is dependent on the inspection style; the higher the share of formal punishments, the smaller is the effect of inspections. When only formal punishments are used the frequency of visits seems to be of no effect; the violation frequency is low over the whole interval of visit frequency. It is also notable that the frequency of visits affects compliance even if no formal punishments are used. This may be explained e.g. by the importance of information and advice and/or by the fact that detected violation entails other kind of costs than formal punishments. While the variables for year were insignificant in all models the variable for authority was significant in the quadratic models with trust, indicating that compliance is higher where the counties are responsible for the inspections.

**Violation frequency as a function of  
visits and style  
STEPWISE REGR**

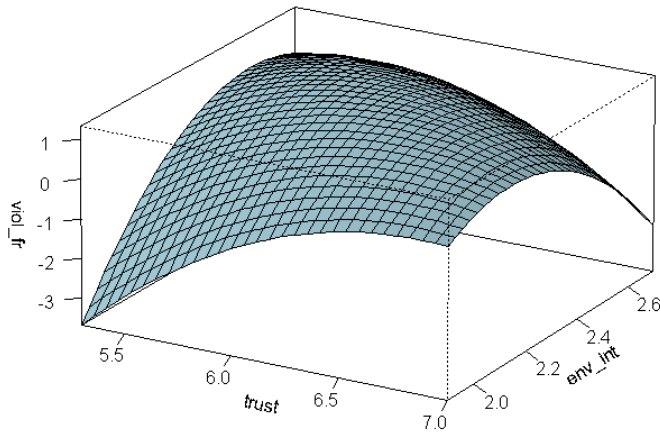


The effects of the interaction between  
the frequency of visits and inspection style  
Soc cap (trust) and env\_int at their mean

*Figure 3.* Violation frequency as a function of inspection frequency and inspection style (other variables at their mean).

Social capital was found, when indicated by *trust*, to have significant effect on compliance. The effect of social capital is non-linear and dependent on the level of environmental interest. When the population is more interested in environmental questions and the level of trust is low, the effect of increased trust is mainly negative on compliance, see *Figure 4*. When the interest in environmental questions is lower and the level of trust is higher, the effect on compliance does, however, become positive.

**Violation frequency as a function of  
soc cap and env int  
STEPWISE REGR**



The effects of the interaction between  
the level of social capital and level of env int.  
Visits and style at their mean

*Figure 4.* Violation frequency as a function of social capital, measured as trust, and environmental interest with other variables at their mean.

The result indicates that social capital does not necessarily encourage compliance but that the relationship is more complicated and that it sometimes encourages violation. Bearing in mind that the concept of social capital is vague, that the measure used has conceptual weaknesses and that there are imperfection in data, the variable nevertheless was found to be significant, which calls for possible explanations. The anticipation of positive effect relies on the assumptions that trust in others means that one pays more attention to the desires of others in one's own decisions and that the degree of trust among the public was representative for the business managers. If firm managers have less trust than the population in general and/or if they do not regard trust as a motive for responsible behaviour, a higher level of trust does not mean that they have any normative motive for compliance. However, if firms are punished for violations by a decreasing demand they have a calculated motive for compliance. Such punishment depends on consumers keeping themselves informed. A possible explanation for the negative impact on compliance is thus that trust may hamper the efforts to seek information, since trust means that a person believes that she already knows, and that more trust, at least in a naïve form, can be exploited by firms.

Environmental interest also had a significant non-linear effect on compliance, see *Figure 4*. The compliance is highest where the environmental interest is either high or low. There is no simple explanation for this relationship; it rather highlights the fact that the causality between the factors is not straightforward. Again, the effect may be partly explained by differences between the general population and firm managers. A possible explanation is also that the actual change in consumer behaviour, which may encourage compliance, only follows with the higher levels of environmental interest.



### 3 Concluding discussion

The two first papers deal with two questions, which could have been raised by e.g. a policy maker in order to formulate the target for environmental policy: is the elicitation of economic values i) desirable and ii) possible? The two other papers also deal with questions that are fundamental in order to design an environmental policy; why do firms comply with environmental regulations and how can the compliance be improved? Naturally there are no definitive answers to such questions but the analyses of this thesis may serve as input into an ongoing discussion about these and related questions.

Whether the elicitation of economic measures of values is desirable depends, ultimately, on whether one agrees on the normative assumptions of economics. The economic concept of values is, in a sense, complete. Conceptually it embraces, once the perspective is adopted, all values so that a normative weighing, taking all effects of for example a policy measure into consideration, can be made. In practice, i.e. empirically, there are still problems in eliciting the economic measure of value due to methodological shortcomings. On a conceptual level this is however not an argument against the desirability of eliciting economic measures of values, at least as long as methods can be improved to reduce the problems. Then, if the economic concept of values is complete, can other perspectives of values, other value premises than economic premises, be regarded as redundant? The answer is no. If one does not agree on the normative assumptions in economics, it may simply be rejected as irrelevant even though it is complete. As clarified in Paper I, the choice of value perspective is an important normative question and there are no objective arguments for why the economic perspective is better or worse than any other perspective of values. When adopting the economic perspective of values one should be aware of which normative assumptions the choice implies and how other value-related terms can be understood from this perspective.

Whether it is possible to elicit (correct) economic measures of values is a question that has been discussed in relation to SP methods as long as the

methods have been used. This thesis adds some arguments to that discussion. Since, as clarified in Paper II, individuals may defend other perspectives of values, the result of empirical economic analyses may depend on values that logically cannot be interpreted as preferences. The conclusion is that incompatibility between implied and asserted rights can explain many of the anomalies found in SP studies. It is therefore, even if the economic perspective of values is preferred and adopted, important to have some understanding of non-economic perspectives of values. Even when an economic perspective of values has been adopted the distribution of initial rights is a question that may be a ground for disagreements. If respondents assert that they have a collective right, both the WTP and the WTA question imply rights that may be incompatible with the asserted rights. This means that, for many environmental goods, neither the WTP nor the WTA question may imply rights that can be accepted by the respondents. If it is not possible to convince people that implied rights are legitimate or not possible to affect, it may be not be possible to elicit a correct measure of economic value. This may be the case e.g. for amenities where respondents assert that future generations have rights.

Another important conclusion based on the two first papers is that information about public opinions on environmental values and initial distribution of rights may be regarded as relevant in itself. Even if such opinions cannot be the ground for setting exact environmental targets they are important for the design of an environmental policy that is not “only” efficient but also regarded as legitimate. Therefore, e.g. the choice between taxes and subsidies, which can both be constructed to lead to cost efficiency, can be analysed in relation to opinions about how initial rights should be distributed.

The two papers dealing with compliance with environmental regulations both start from the question why firms comply with environmental regulations. Theoretically, the frequency of inspections should have a positive effect on compliance, which also has been confirmed by previous empirical studies. This result was also confirmed in both Paper III and IV of this thesis. In both studies the frequency of inspections was shown to have a significant and positive effect on compliance. It is worth noting that both studies suggested a linear relationship even though the models allowed for other functional forms. In Paper III a non-parametric estimation was used, which means that no functional form at all was presumed. Hence, the detected linear relationship is not constructed by any predefined assumption on functional form. In Paper IV the quadratic form of the variable was rejected whereas the linear form was significant.

Two other effects related to the frequency of visits were detected. First, in Paper III it was shown that firms classified as C activities, were more

sensitive to the frequency of visits than A- and B-classified firms (compare e.g. *Figure 1* and *Figure 2*). Whether this effect remained during 2005–2007, i.e. under the Environmental Protection Code, could not be detected from the data used in Paper IV. For this later time period the limited amount of data did not allow for either making use of non-parametric methods or distinguishing between types of firms.

The second important conclusion about the impact of visits, drawn from Paper IV, is that the impact depends on the inspection style. Whereas a higher frequency of visits is necessary to encourage compliance when a softer inspection style is adopted, an inspection style using formal punishments encourages compliance even with lower frequency of visits (see *Figure 4*). Is this a new phenomenon, compared to 1992 and 1995, following from the increased set of penalties in the Environmental Protection Code? It is possible but it cannot be confirmed from the present studies. In the study about the effects those earlier years, under the Environmental Protection Act, there is no data on the inspections style measured as relative emphasis on formal penalties. The rate of unannounced visits was insignificant in that study but unfortunately we do not know if formal/informal inspections style affected compliance during that time.

What is the causality behind the impact of frequency of visits? There are at least two possible explanations, which do not necessarily exclude each other. First, the increased probability of costly penalties will most probably have a deterrent effect that increases compliance. Second, information and advice will increase the ability, and perhaps the desire, to comply. Since the role of the Swedish inspectors, during both of the periods investigated, have been to act both as supervisors and as advisors both of the effects may have affected the compliance. No definitive conclusion on the relative importance of these two effects can be drawn from the studies presented here. However, there are some indications that the two effects are complementary. First, the frequency of visits has a positive effect on compliance even when few or no formal penalties are used (see *Figure 4*). The effect might be explained by the deterrent effect of *informal* penalties but it can also be interpreted as an effect of increased information and advice. Second, Paper III showed that C objects had a higher frequency of violations if no or few visits were made. There are no obvious reasons to assume that the managers of those firms would care less about environmental aspects but smaller firms may very well have fewer resources to keep up with juridical requirements. If this was the case, more information (via more visits) would lead to increased compliance, just as found in Paper III. However, the deterrent effect also seems to be important. Otherwise the inspection style, measured as relative importance of formal penalties, would not have any effect. In *Figure 3* it is shown that

an increase in the stringency of inspections, which will increase the expected cost of penalties, has a positive effect on compliance. Hence there is a deterrent effect that seems to be complementary to the effect of increased information and advises.

Three differences in the two studies should be noted. First, two different measures for environmental attitudes were used. In Paper III the relative number of members in the Swedish Society for Nature Conservation was used as an indicator of environmental interest and found to be insignificant as explanatory variable for compliance. In Paper IV a self-reported rating of environmental interest was used. This variable turned out to be significant but having a non-linear effect on compliance without an obvious interpretation. Second, in both studies a dummy-variable for authority were included. In Paper III the variable was insignificant whereas it had a significant effect on compliance for the period reported in Paper IV. Third, the effects of social capital found in Paper IV could neither be confirmed nor rejected in Paper III since there are no data on trust on municipal level available for the years studied in that paper.

Taken together the four papers have shown that valuations, in a broader sense than preferences, and beliefs that people hold are important for the design of environmental regulations. First, it is important to clarify what kind of values the policy aim to promote, how these values are related to each other and if and how they can be estimated. Second, opinions about values and, more specifically, about property rights are important to assess the legitimacy of different policy measures. Finally, different valuations affect the compliance with environmental regulations. Although it has been shown that the frequency of inspections is an important factor for increasing compliance, it seems as if this partly is an effect of the advise and information that the inspectors provide the business with. Moreover, it has been shown that the level of trust, a common indicator of social capital, have a significant impact on compliance behaviour. However, even if the effect is partly positive, it seems as if trust, perhaps in a naïve form, encourages violation rather than compliance.

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<sup>3</sup> Over the years I have had offices on the second and the first floors in the building, and now finally on the ground floor. I guess I end up in the basement if this thesis does not pass....

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Fredrik Holstein  
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