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Be the Change You Wish to See: National Attitudes and Climate Change Policy

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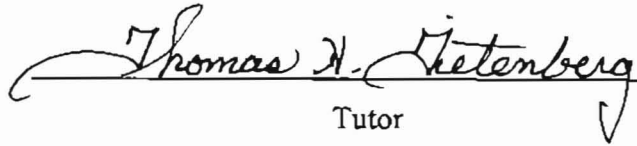
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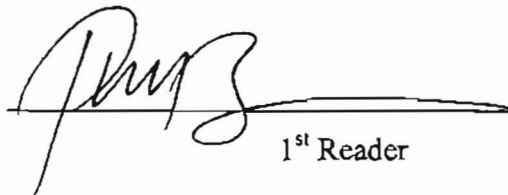
Be the Change You Wish to See: National Attitudes and Climate Change Policy

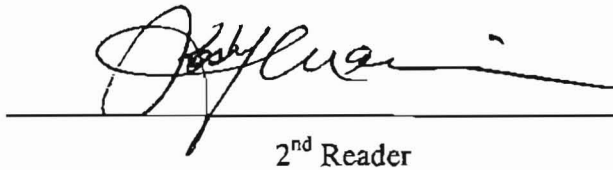
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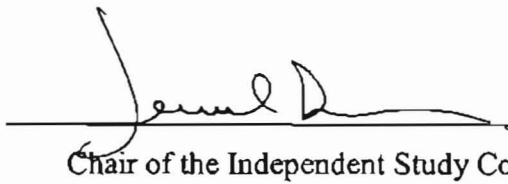
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Abstract

A multitude of views characterize what should or should not be done about climate change, and in the past decades, nations have acted very differently in the face of climate change. This study explores factors that affect individuals' attitudes and concerns towards the environment and how those attitudes ultimately affect climate change policy. One model investigates the link between individual attitudes and countries' actions on climate change, and the results show that attitudes indeed matter in the implementation of policy. Different measures of democracy such as freedom of the press also prove to be important as channels for these attitudes. A second model identifies a number of political, socio-economic and demographic characteristics that matter for people's attitudes towards climate change.

Acknowledgements

I cannot overstate my gratitude to my advisor on this Senior Scholars project, Professor Thomas H. Tietenberg. During my third semester at Colby, his class on Environmental Economics gave me a taste of how Economics can be used to perceive the world more clearly, and even to change it for the better. Since then, he has been a source of constant support, perceptive advice, and valued direction. He has allowed this project to be my own work, all the while steering me in the right direction, and helping me articulate things I didn't even know how to begin thinking about.

I would also like to thank Professor Brown for the care with which he read and commented upon my drafts, and for conversations that clarified my thinking on this and so many other matters. I am grateful to him for welcoming even the fifteenth question in one day, for being contagiously enthusiastic about econometrics, and for making me feel proud of being a fellow dork. Several other professors in the Economics department have also been helpful and always open to questions, in particular Professors Donihue and Waldkirch.

I want to thank the wonderful reference librarians, and in particular Chuck Lakin. He trained me to be a good researcher, and made me feel wiser just by being around.

I feel very indebted to my friends for supporting me, and for remaining my friends throughout this year, especially after the numerous negative externalities that this project imposed on them.

Be the Change You Wish to See*:

National Attitudes and Climate Change Policy

"Unless someone like you cares a whole awful lot,
Nothing is going to get better. It's not."

— Dr. Seuss, "The Lorax"

1. INTRODUCTION

The continuous and rapidly increasing overuse and destruction of natural resources are a serious threat both to human beings and to the planet we inhabit. Climate change is one such threat, and because it is closely linked with our current lifestyles, it is also a very contentious issue. A multitude of views characterize what should or should not be done about climate change, and some nations have done much more about climate change in the past decades than others. For example, the European Union countries have taken a lead in the development of climate change policy and emissions trading, although many of them will have trouble meeting their reduction commitments (WBCSD, 2006). America, by contrast, as one of the world's largest economic units, as well as the most energy and carbon intensive economy on a per capita basis, has yet to commit to significant reductions of greenhouse gas emissions and has in fact increased emissions

* "You must be the change you wish to see in the world"
~ quote by Mahatma Gandhi

since 1990. China, as the world's biggest producer of coal and a country with soaring oil consumption has rapidly increasing greenhouse gas emissions and many experts expect China's total emissions to overtake America's by the middle of the century. Japan is committed to reducing emissions by 6% from 1990 levels, and is hoping to capture emerging markets for new, cleaner energy.

Since climate change may have extraordinary and probably irreversible impacts on society and the planet, an interesting question to investigate is why countries behave so differently. Are actions this diverse because people in different countries have different attitudes towards climate change? Do actions differ because of differences in the translation of these attitudes into action? Is it some combination of the two, or some other factor altogether? This project sets out to investigate the effect of a number of social, economic and political characteristics on individuals' attitudes and concerns about the environment, and the effect of such individual attitudes on countries' actions on climate change. It seems important to understand what makes individuals and countries more likely to be concerned with protecting the environment, since such an understanding might allow us to imagine policies that will balance out the costly struggle between humanity and the environment.

Climate change represents a particularly interesting and difficult area of environmental policy because it involves a global public good that has a long latency period between actions and consequences. Public goods exhibit two important characteristics for our purposes: they are *non-rival* and *non-excludable*. Non-rivalness means that the consumption of a public good by one individual does not decrease the amount of the good available to others, and non-excludability means that it is impossible to exclude anyone from consuming the good. Because of these two characteristics, an individual who helps produce a public good can never fully take advantage of the benefits of that production, i.e., there are positive externalities to its production. The other side of this issue, often called the "free rider" problem, is that individuals can reap the benefits of a public good without contributing to its creation, since they cannot be excluded from consuming the good.

A global public good is one that has universal benefits, so that the benefits of its production spill over to countries and populations all over the world. For "national"

public goods, national policy intervention can, to a certain extent, correct for these externalities. For global goods, however, no national policy mechanism is present, and no international organization has the force to impact change in the same way that a nation can, which makes these goods even more likely to be undersupplied.

As a policy target, climate change also has an important temporal component. The implications of the long-lived aspect of climate change will be discussed in depth in the section about time discounting. We will see that because of these three characteristics, it is far from obvious that linkages between attitudes and environmental behaviors that might characterize a problem with more immediate and local consequences would similarly characterize the relationship with climate change.

I estimate two different models to examine these issues. The first model uses survey data to empirically examine what factors matter in determining the formation of environmentalism. Three examined dimensions include the formation of environmental attitudes, environmental behavior, and willingness to pay for the environment. The second model employs macro data to examine the relationship between the attitudes of a country's citizens and the magnitude of its action on climate change. In both of these models, I attempt to tease out the net effects of the three attributes (global, public, and long-term) of climate change.

The economic literature to date has focused on the relationship between wealth and environmental concerns as the main determinant of environmental concerns and attitudes. Little consensus has emerged on the topic, with some authors finding that the increase of environmental concern is a global phenomenon, occurring in developed and developing countries alike, and others arguing that environmental concern is highly correlated with GDP per capita.

What sets this project apart from the previous literature is not only that the attitudes model is based upon survey data, but also that these micro data allow me to examine the influences of individual characteristics such as information, socio-economic characteristics, political and religious values, time preferences, and risk perception on the formation of environmental attitudes or on action on greenhouse gas emissions. Stern (1992) notes that individual choices merely account for a small part of the proximate causes of global environmental change, and that the study of consumer behavior thus can

yield only partial knowledge about the causes of large-scale environmental change. He acknowledges, however, that "a neglected, but potentially important area for psychological research concerns the role of individuals in determining what firms, communities, and governments do to the global environment." (p 285) To my knowledge, the link between individuals' attitudes and their countries' actions has still to be investigated, and this project sheds some light on precisely that question.

This paper shows that individual concerns about climate change in a country are significantly associated with lower greenhouse gases. The share of total energy consumption from coal in 1990 also results in a significant reduction in greenhouse gas emissions, as does the proportion of people who trust government information about pollution. Individuals' attitudes also have a stronger effect on greenhouse gas emissions when their countries have a freer press.

I also find that demand for global, public and long-term goods are significant determinants of individuals' attitudes towards climate change. Education and familiarity with climate change, liberal political views and urban residency are all positively related to the probability of being concerned about climate change, whereas household income and respondent age have the opposite effect. Interesting differences emerge for the two other models: support for public goods, positive environmental attitudes, years of education, and liberal political views increase both the probability of cutting down on driving for environmental reasons, and of being willing to pay to protect the environment. While household income leads to a fall in the probability of cutting down on driving for environmental reasons, and has a positive effect on the respondents' willingness to pay higher prices to protect the environment, it doesn't affect the other measures of willingness to pay.

Section 2 presents a summary of the economic, psychological and sociological literature on the topic of environmental attitudes and behaviors. Section 3 presents the different models used to investigate these links, and Section 4 gives an overview of the data. Section 5 presents the results of the econometric estimations, and Section 6 concludes and discusses the findings of this study.

2. LITERATURE REVIEW

The existing research on environmental concerns consists of two main branches: most economists focus on country-wide trends, and often on the relationship between economic activity and environmental concerns or environmental quality; other social scientists focus on the determinants of individual attitudes towards the environment and the link between people's attitudes and their behavior. Since many of these investigations are based on an interest in the factors that affect environmental quality, it would seem like a logical next step to raise the question of whether individual attitudes matter in terms of national policy. To explore this relationship, we need to examine not only how individual attitudes are formed, but also how they translate into countries' actions. The different reasons why people care about the environment would seem a logical place to begin such an investigation.

Environmental Concerns

Why Do We Care About the Environment?

Fransson and Gärling (1999) provide a thorough overview of the psychological literature on environmental concern. For the purposes of this paper, it is interesting to note that concern about environmental issues can stem from two rather different value orientations: instrumental values and intrinsic values. Whereas instrumental values are based on how the environment contributes to human welfare, intrinsic values are derived from a deeper respect for nature, quite apart from the role it plays in improving human lives. Two types of instrumental values motivate environmental concern: anthropocentric altruism (caring about consequences for all humans) or self-interest (caring only about consequences for yourself) – people care about the environment because they believe that a degraded environment is a risk to human health or to their person, respectively. Intrinsic values can be derived from underlying beliefs, such as religious beliefs or post-materialist values. As Stern (1992) notes, individuals can be motivated by several of these concepts at the same time.

Different kinds of motivations for environmental concern might produce different results, depending upon the type of environmental good in question. The self-interest motivation might result in very strong concerns for current, localized environmental problems, and indifference toward problems far away in time or in space; someone who sees the maintenance of a natural balance as a goal in and of itself would care equally about the two cases.

The economic literature on attitude formation tends to implicitly assume an egoistic, or at least an anthropocentric, driving force behind environmental concerns, and examines how people discount issues that are distant in time or in space. These assumptions have recently been questioned, particularly because they imply certain things about who is likely to demonstrate environmental concerns, and researchers have found evidence that seems contradictory to these predictions.

Affluence and the Environment

To date, the economic literature on environmental awareness has focused on the relationship between affluence and environmental awareness and quality. Much of the literature has concerned itself with supporting or contesting the Environmental Kuznets Curve (EKC). The EKC is a hypothesized relationship between per capita income and environmental degradation, the environmental counterpart to the relationship between income and inequality proposed by Kuznets in 1955.

This hypothesis has been subjected to a considerable amount of empirical analysis. One of the earliest studies, conducted by Grossman and Krueger in 1995, found the hypothesized inverted-U shaped relationship: at low levels of economic activity, environmental quality worsens as income rises, but, after reaching a turning point, it ultimately improves with continued income growth. They even attempted to pin down the level of welfare associated with the turning point, and argued that, for several air pollutants, the turning point would occur before a country reaches a per capita income of \$8,000. At these later stages, economic development is thought to lead to a structural transformation in what an economy produces, and how it produces it. In addition, the higher income facilitates the passage of more stringent environmental laws, and new technologies are utilized to conserve natural resources. Due to a high income elasticity of

demand for environmental goods, the wealthier society shifts its attention from basic needs to less immediate goals, including environmental quality.

This idea that intergenerational changes are shifting the basic value priorities of given generations towards postmaterialist values has its roots in the psychology literature. Starting from Maslow's 1954 "basic need hierarchy" (p 15), Inglehart (1971a) argues that once basic physiological needs, such as access to food and the need for physical safety, have been taken care of, humans begin to pursue other goals – the search for love and respect, and intellectual and aesthetic pursuits are examples of such higher needs. Inglehart (1971b) labels this concept of higher needs "post-bourgeois" values (p 991), but subsequent authors have discussed it under the term "postmaterialist values."

The post-materialist thesis assigns the credit for rising environmental concern almost exclusively to these changing values. A corollary of this view suggests that environmentalism is a predominantly rich-world phenomenon. According to this view, developing nations haven't yet experienced the affluence and security that are preconditions for postmaterialist values, which in turn are prerequisites for environmental concern.

This assumption has been subject to much debate and critique over the past decade. Martínez-Alier (1995) posits an alternative explanation for why rich countries may exhibit an increased appreciation for environmental resources and services, namely that their economic activities are placing an increasing burden on the environment. He calls this scenario the "effluents of affluence" (p 220), and states that if this is the case, then wealth might lead to a paradoxical increase in environmental degradation, in turn leading to rising awareness and concern for environmental issues.

Brechin and Kempton (1994) use data on grassroots environmental organizations and public opinion surveys in developing countries to argue that environmental values are not merely a product of postmaterialism. They find, contrary to the assumptions of the previous work, that people from poor countries are as concerned about environmental threats as citizens in richer countries. They identify several contributing factors, including first-hand observation of the dangers of environmental degradation. Humanity's impact on the environment has become so tangible and visible in our lives that most of the worlds' peoples witness it on a daily basis, and therefore develop a concern about it.

Dunlap and Mertig (1997) also criticize the postmaterialist theory on the basis that it assumes a very simple mechanism of "environmental perception" (p 27). Whereas many authors have focused on the validity of the postmaterialist thesis, Dunlap and Mertig reason that the dichotomy typically put forth between postmaterialist values or exposure to environmental degradation as explanations for environmental concern is a false one, and that research should concentrate on "unpacking" (ibid, p 27) the complex ways in which environmental attitudes are formed. They mention several other psychological and demographic factors that should be considered in any analysis of what influences environmental concern, and argue that the different geographic and temporal dimensions of various environmental problems should be taken into account. It appears that the wealth-driven environmentalism thesis is significantly weakened if the assumption of a self-interested motivation for caring about the environment is questioned. We continue our discussion by looking at additional reasons for caring about the environment that may or may not be products of self-interest.

Discounting - Time and Space

The proximity of a risk, both in time and in space, turns out to be crucial to how much we care about a particular environmental issue. Since there is a large delay between our actions and the effects of climate change, the question of discounting is very important: excessively high discount rates will result in too low levels of precaution and action on climate change. Investigating both temporal and spatial discounting will set the stage for our discussion of the question of what individual characteristics might influence environmental attitudes, drawing upon both the economic and sociological literature.

Private Time Preferences

We begin this investigation by considering the effects of timing of the environmental risk on attitude formation. Since climate change is such a long-lived problem, time preferences are potentially a very important aspect.

Time preferences play a key role in economic decisions. Where and when to invest or save or spend, the most obvious connection, is only a small part of the role that

time preferences play. We are all faced with a wide range of important choices on a day-to-day basis that force us to evaluate tradeoffs between consequences occurring today, tomorrow and further in the future. Whether we are aware of it or not, we constantly compare the benefits (or costs) of our actions, and how their utility varies depending on whether they occur today or in the future.

The theory of discounted utility is one framework commonly used for the evaluation of such delayed payoffs. It has been proposed both as a normative model of behavior, i.e. a description of what people *should* do, and a descriptive theory, telling us what people *actually* do when faced with intertemporal decisions. Both of these applications are controversial.¹

Discounted utility models assume that consumption or rewards in the future are less desirable than immediate consumption or, similarly, that deferred costs are less burdensome than costs today. One example of this logic may be that delayed rewards are perceived as riskier since we cannot know if we will live to reap them. It might also be the case that we perceive the future as more abstract, and future rewards are therefore harder to appreciate in advance.

To formalize the role of time preference in a discounted utility framework, assume that a consumer's well-being depends on the sum of consumption or utility today and in the future. At each point in time, t , the decision-maker consumes goods $c(t)$. These goods might be summarized by a single consumption budget for period t , or they might be represented by a vector. Then the subjective value given to the consumer is $u(c(t))$, a measure of utility at time period t .

For future consumption, $F(\tau)$ is the function that describes how the consumer discounts utility, and τ is the delay between the current time period and the time of future consumption. For example, if t is measured in years, the discounted utility function for consumption in six months would be $F(1/2)u(c(t + 1/2))$.

$F(\tau)$ is usually assumed to be decreasing over τ , since future consumption is assumed to be less worth than current consumption. And the more utility is delayed, the less it is worth.

¹ The following formal discussion closely mirrors Laibson (2003)

Since utility is desirable, by definition, $F(\tau)$ is ≥ 0 for all values of τ . We assume $F(0) = 1$, so $1 = F(0) \geq F(\tau) \geq F(\tau')$, with $\tau' > \tau > 0$

We can then describe an intergenerational indifference curve, the slope of which corresponds to the utility discount rate. $r(\tau) \equiv \frac{-F'(\tau)}{F(\tau)}$ where $F'(\tau)$ is the derivative of F with respect to time, and $r(\tau)$ the rate of decline in F , i.e., the rate of time preference. Higher discount rates imply greater decision-maker concern with utility in the current period relative to future periods.

Most models of discounting involve a constant discount rate regardless of the length of the delay, but this is not the only option, and it is often used largely for analytical convenience. The assumption of a constant discount rate implies that preferences depend only on calendar time, and it is increasingly being questioned. Bishai (2004) finds little evidence to support a constant discount rate, and discusses the reasons for why functions allowing for dynamic inconsistency would be more realistic. For example, it is easy to imagine young individuals who might be unable to foresee changes in their time preferences that could lead to changing concerns regarding their future well-being as they get older. Psychological development during the course of a person's life, which most people believe (or at least hope) occurs, forces us to reevaluate the constant discount rate.

Whether preferences are exogenous, as is conventionally assumed, might also be important. Becker and Mulligan (1997) discuss one endogenous model of time preferences, similar in some senses to the more familiar theories of human capital investment. According to this model, people consciously *invest* in their time preferences in order to decrease their discount rate because they think that they would be better off if they were more patient than they currently are. These investments may involve time spent producing mental images of future pleasures, spending on certain goods, such as newspapers, which might direct one's attention away from current pleasures towards future ones, or the purchasing of disciplinary devices such as piggy banks, which assist a person in sacrificing current consumption.

Although my analysis does not formally depend upon any specific estimate of the rate of time preference, or assume a particular functional form for discounting, it is hoped

that the above discussion will inform the reader as to why the long-lived attribute of climate change makes it different from environmental issues with more immediate effects. Also, some of the variables that are included in this analysis of determinants of environmental attitudes, such as age and years of education, can be thought of as related to the life-stage discount rate inconsistency that some of the above models imply.

Private Spatial Preferences

Peoples' attitudes towards the consequences of their actions can also be affected by *where* these consequences will occur. When we set out to analyze individuals' decisions concerning environmental issues, we realize that they often have an impact on persons distant both in time and in space. Where time discount rates are motivated by positive rates of growth of capital stock, Perrings and Hannon (2001) explain that a positive spatial discount rate can be rationalized by the diffusion of environmental externalities in space. They argue that preferences over space can be summarized in a rate of geographical preference analogous to the rate of time preference, and that it affects *intragenerational* equity in the way that time preferences affect *intergenerational* equity. In other words, a positive rate of time preference implies that current generations assume only limited responsibility for the effects their actions might have on future generations. A positive rate of spatial preference similarly implies that people care more about those who are geographically close to them than about those who are far away.²

The EKC inverted-U shaped relationship between environmental quality and per capita income (outlined above), has been found to be less robust and even absent for pollution with effects that are distant in space, or not uniformly nearby. With respect to my focus, climate change, Steining (2002) cites evidence that CO₂ emissions in fact have *risen* continuously with income. Arrow et al. (1995) point out that most of the institutional reforms that have led to lower emissions with rising incomes have been in the form of legislation to reduce local environmental impacts, often ignoring both international and intergenerational consequences. Spatial discounting may well be a place

² Perrings et al. develop a formal model of spatial discounting, the details of which will not be discussed here.

to look for an explanation of these phenomena, as well as an explanation for the environmental attitudes investigated in this thesis.

Empirical studies provide some support for the role of spatial discounting. For example, in his cross-sectional study of people's willingness to pay for air quality improvements in connection with a new waste incineration plant in Graz, Austria, Steininger (2002) finds clear evidence that people seem more concerned with the environmental risks in their neighborhoods than with those far away. Interestingly, he also observes that different income classes' spatial discount rates appear to be different, and in particular that high income classes discount distant effects more than lower income classes. This indicates that between income classes, the concern for "the close" rises with income, as the importance of "the distant" declines. Note, however, that this is a cross-sectional result, and as such does not say anything about how, as people get richer over time, their concern for distant environmental impacts changes. Further investigations of this result are of particular relevance for an issue like climate change, especially considering the positive correlations found between income and CO₂ emissions.

Social Preferences

Private and social discounting preferences may of course be different. The optimal social time discount rate is one that can be seen as sustainable or ethically neutral, and it should not exceed the net growth rate of the population and of the capital stock. In applying this principle, however, the measurement of capital stock matters. Mäler (1995) points out that the rate of discounting should reflect the future productivity of *all* capital assets, and not just human-made real capital. Perrings and Hannon (2001), argue similarly that spatial discounting can be ethically neutral if the discount rate is equal to or less than the rate at which environmental effects diminish or are diffused with distance.

Bishai (2004) argues that market economies will have an actual rate of investment equal to the sum of the individual investment decisions, which, in turn, are the result of individuals' rates of time preference. This may or may not be equal to the social optimum, but it is clearly a complex construction. The policy model expanded in this paper empirically examines a complex aggregate of individual preferences, and whether or not individuals' attitudes and preferences add up to an influential factor on a national

level. More precisely, it examines whether individuals' attitudes influence countries' actions on climate change.

Determinants of Individual Attitudes

Van Liere and Dunlap (1980) and subsequently Fransson et al. (1999) reviewed the empirical evidence supporting five hypothesized relationships between environmental concern and socio-demographic variables, specifically *age*, *social-class*, *residence hypothesis*, *political ideology hypothesis*, and *gender*. Van Liere and Dunlap (1980) mention that these variables are the most commonly investigated as determinants of environmental concerns largely because they are routinely included in most surveys. Still, the authors put forth appealing theoretical explanations for each of the correlates.

Below, we will go into some detail concerning the first four of these relationships. The fifth, the gender hypothesis, will not be discussed further, as the theoretical foundations for it is largely missing, and any empirical evidence for it disappears when general political or cultural values are controlled for.

The age hypothesis states that younger persons tend to be more concerned about the environment than older persons. One explanation for this is that younger persons are less integrated in a nation's economic system, or the dominant social order. Solutions to environmental problems are often seen as threatening to this established order, and therefore younger people are on average more likely to be in support of such measures than older individuals. Although the proportion of older people concerned about the environment seems to be increasing (Fransson et al. (1999) suggest that this is perhaps due to the media focus on environmental issues, which escapes no age group), the posited relationship between age and environmental concern remains strong. Another possibility is that people who care about the environment because of the direct personal benefits that they will receive from preventing environmental degradation will take into calculation the amount of time that they will be around to take advantage of those benefits. In other words, younger people have a longer remaining lifetime, and will therefore reap more benefits from a healthy environment.

The social class hypothesis is the idea, discussed in depth in the section about the EKC, that income is positively related to environmental concerns. Education is often included in that concept of social class. As we have already stated, the evidence for this hypothesis is relatively weak, with wealth having ambiguous effects on environmental concerns. The nature of the good in question certainly appears to matter, since Steininger (2002) finds that high income individuals tend to discount environmental problems more than lower income classes if these problems are occurring far away from home.

Both Van Liere et al. (1980) and Fransson et al. (1999) largely discredit education as an explanatory factor because they think of it as part of the larger social class hypothesis, for which we have only weak evidence. Education might matter for other reasons, however. Sunstein (forthcoming) suggests that judgments about precautions are based both on intuitive cost-benefit analysis and on what he calls the "availability heuristic" (p. 2). If the costs of precaution are high, or the benefits low, these precautions will appear less appealing. Also, if a particular risk is "cognitively available" (ibid), then people will be more concerned about that risk.

Cognitive availability has several dimensions. *Familiarity* with a risk will affect how available it is, as will *salience*. Knowledge of a particular issue will, according to this logic, increase individuals' concerns with the issue. Salience can instead be seen as a measure of one's experiences with an issue: seeing a picture of a burning house will have a smaller impact on the risk that you associate with fires, compared to witnessing the fire first-hand. Education is thought to increase the likelihood of being repeatedly exposed to a wide range of different issues, therefore also increasing one's concern.

This concept can also be linked to time and space discounting. Sunstein (ibid) suggests that the availability heuristic can help explain high discount rates, particularly those associated with issues such as climate change, where the risks are great, but where they may not be cognitively available (i.e., familiar) to people until it is too late. If salient events, such as hurricane activity or tidal waves, can be associated with climate change, the likelihood of a concern for climate change is greatly increased.

The residence hypothesis suggests that urban residents are more environmentally concerned than their rural counterparts, mainly because they are more exposed to the detrimental effects of environmental problems such as air pollution. The empirical

evidence cited by Fransson et al. (1999) seems to support this hypothesis, more so than the studies reviewed by Van Liere et al. (1980). It appears, in fact, that area of residence has become increasingly important as a determinant of environmental attitudes since the 1980s.

The political ideology hypothesis discussed by Van Liere et al. (ibid) is primarily based on American partisan affiliations. Although their results are weak, they find some support for the hypothesis that Democrats tend to be more pro-environmental than Republicans. In general, liberal self-identification has more empirical support than party affiliation in the literature. Fransson et al (1999) note that business and industry, which are typically associated with conservative political ideologies, often oppose environmental efforts due to the costs they have to bear. They also mention as an explanation the fact that environmental protection entails a certain amount of government intervention and regulation, to which conservatives are generally opposed.

Weaver (2002) also finds support for a connection between liberal political views and postmaterialist values. As mentioned before, post-materialists are thought to shift their attention from economic and physical security to concerns higher up in Maslow's (1970) "hierarchy of needs." This would serve to reinforce the idea that political values might predict individuals' environmental preferences.

Some additional variables are suggested by the sociology literature. A religion variable is particularly appealing as a test for intrinsic values. During the past three decades, the debate surrounding the relationship between religion and environmentalism has been very lively. It has not made its way into the economic literature concerned with environmental attitudes, however. Dekker, Ester and Nas (1997) note the possibility that the West's environmental problems stem from an inherently anthropocentric Judeo-Christian worldview. Several authors have argued this, the most commonly cited being Lynn White (1967), who states that "our present science and our present technology are so tinctured with orthodox Christian arrogance toward nature that no solution for our ecologic crisis can be expected from them alone." (p. 6) In their empirical analysis, Dekker et al. (1997) reject the "White hypothesis" and conclude that the relationship between Christian beliefs and environmental attitudes is not unique. One drawback of this analysis, however, is that although they had micro-level data available, they

evaluated it at the country level, potentially missing some useful distinctions within the Christian community.

Channels

The question of how individual preferences are related to social preferences, as expressed by a political system, is an important one, but attitudes themselves are unlikely to be the only factors in the translation process. One can easily imagine a setting where individuals in a country are very concerned about the environment, but have a government that is insulated in some way from their beliefs. Different information and political channels might play an important role in the transformation of individual attitudes into policy.

Due to the EKC, a sort of conventional wisdom has been established (although it is increasingly being questioned) around the idea that an induced policy response constitutes the main mechanism behind the downward sloping portion of the inverted U-shape. With increasing prosperity, citizens demand less tangible goods to increase their welfare, and thus governments are under pressure to form policy and regulations that improve things like environmental quality.

Barrett and Graddy (2000) point out that the posited improvement in environmental quality rests on much more than economic growth. It also depends on citizens' ability to acquire information about the quality of their environment, their right to voice what preferences they might have for environmental services, and on their government's accountability towards its citizens. Without these, governments would not have the incentive to satisfy these preferences through policy. Barrett and Graddy find through an empirical re-analysis of Grossman and Krueger's 1995 data that increasing the level of freedom in a country, at fixed income levels, can have as large an effect on environmental quality as raising the income per capita. It would seem, then, that basic civil and political freedoms are a crucial vehicle for the attitudes a country's citizens, without which a population could have all the good intentions in the world that still would not be transformed into policy.

3. THE MODELS

3.1 The Attitudes Model

The determinants of individuals' attitudes towards climate change will be investigated in three parts: with an *attitudes model*, an *action model*, and a *willingness to pay model*. The three parts correspond to three different dependent variables, and the explanatory variables are the same, with one exception. The main model is the attitudes model, and it investigates the determinants of individuals' attitudes toward climate change. The global, public, and long-lived aspects of climate change set it apart from other environmental goods, and individuals' preferences for goods with similar attributes are therefore expected to be good predictors of individuals' attitudes. A few additional broad categories of individual characteristics that might matter in attitude formation are also included, specifically information, values, socio-economics, and risk preferences.

The following probit model is estimated³:

$$P(y = 1 | x) = G(\text{Affinity for the global community, Support for public goods, Low demand for long-term goods, Information, Values, Socio-economic characteristics}) \quad \text{Eq. 1}$$

where the independent variables are the different factors that are believed to have an impact on the dependent variables, as expanded upon below, and *Information*, *Values* and *Socio-economic characteristics* are vectors of demographic and explanatory variables.

³ A probit model is an econometric model where the dependent variable takes on a one or a zero, and the coefficients on the independent variables reflect a change in the probability of the outcome associated with a change in the left-hand side variable. It is possible to estimate a linear relationship between the categorical dependent variable and the independent variable, but some limitations are associated with that approach: the fitted probabilities that result can be less than zero or greater than one, and the partial effect of any variable is constant. Probit models rule out negative or greater-than-one probabilities, and allow for a non-linear relationship between the outcome and the explanatory variables.

Dependent Variables

In Eq. 1, G is a cumulative distribution function that for the attitudes model takes on the value 1.0 for individuals who think that "a rise in the world's temperature caused by the 'greenhouse effect' is either extremely or very dangerous for the environment" and 0 for all others. This variable is called *Greenhouse attitudes* in what follows. *Greenhouse attitudes* is constructed such that those respondents indicating that the greenhouse effect is *Somewhat dangerous*, *Not very dangerous*, *Not dangerous at all*, and those who can't choose or decline to answer are assigned a 0. The estimation is not sensitive to this specification, but those respondents who answer *Somewhat dangerous* aren't believed to have particularly strong attitudes and are therefore coded as a 0.

A second equation will investigate whether the same characteristics have an effect on individuals' actions, where G will take on the value 1.0 for individuals who report that they *always* or *often* cut back on driving a car for environmental reasons, and 0 for those who report that they *Sometimes* or *Never* cut back on driving, as well as those who answer that they don't have a car. It is important here to acknowledge the possibility that the survey responses may perfectly reflect actual behavior. Respondents might feel good about answering that they cut down on driving to protect the environment, the "warm glow effect" which would result in an upward bias of the number people who respond affirmatively to this question. This is one of the reasons that individuals who respond that they *Sometimes* cut down on driving are categorized as negative answers (i.e., as not driving less).

A third line of inquiry will be pursued by examining three different kinds of willingness to pay for environmental protection: the willingness to pay much higher prices to protect the environment, the willingness to pay much higher taxes to protect the environment, and the willingness to accept cuts in one's standard of living to protect the environment. The dependent variable here is also a categorical variable that takes on a value of 1.0 for respondents who answer that they are *Very willing* or *Fairly willing* to pay, and a 0 for those who are *Neither willing nor unwilling*, *Fairly Unwilling*, or *Very unwilling*, as well as those who cannot choose. The "warm glow effect" is quite likely to affect respondents' answers to these questions also, and this motivates the above

categorization. The opposite may be true, referred to as “protest voting” where respondents may value the environment highly, but state that they would not pay for it, because they don’t agree with one aspect or another of the question – they might object to the idea of converting the environment into a monetary figure, for example. It is therefore unlikely to cause a serious bias of the estimates.

With only one exception, the explanatory variables for the three different models are the same, and they will be described below. The exception is that the action and willingness to pay models also include greenhouse attitudes as an explanatory variable.

Independent Variables

TABLE 1 – INDEPENDENT VARIABLES, ATTITUDES, ACTION AND WILLINGNESS TO PAY

VARIABLE NAME	UNITS	EXPECTED SIGN
<i>Affinity for the global community</i>	1 or 0	+
<i>Support for public goods</i>	1 or 0	+
<i>Low demand for long-term goods</i>	1 or 0	-
<i>Years of education</i>	years	+
<i>Familiarity with climate change science</i>	1 or 0	-
<i>Belonging to an Abrahamic religion</i>	1 or 0	-
<i>Buddhism or Hinduism</i>	1 or 0	+
<i>Liberal political views</i>	1 or 0	+
<i>Per capita household income</i>	\$	+
<i>Age of respondent</i>	years	-
<i>Urban residence</i>	1 or 0	+
<i>Greenhouse attitudes</i>	1 or 0	+

As discussed above, the fact that climate change is a global public good with delayed consequences mean that externalities are present in its production, no policy tools correct for these externalities, and its effects are time discounted. This sets climate change apart from many other local or short-term environmental services. I therefore seek to test whether preferences for other global public and long-term goods will be good predictors of individuals' attitudes about climate change. The concept that climate change has unique attributes is an important one for two common methods employed to place dollar values on environmental services: the conjoint and hedonic analysis approaches of environmental valuation. The hedonic price method for estimating how much people value environmental goods is based upon the assumption that the value of a good is related to its attributes. Conjoint analysis looks at how consumers choose among different combinations of product attributes to determine the relative importance of each attribute.

Affinity for the Global Community

The variable measuring the global aspect of climate change, *Affinity for the global community*, is based on a survey question about whether or not an individual agrees with the statement "for environmental problems, there should be international agreements that [the survey country] should be made to follow." The variable measures a willingness to accept restrictions imposed by an international environmental agreement – a dimension that purely national policies do not need to confront. It is a categorical variable that assigns the value 1.0 to individuals who strongly agree or agree with this statement, and a 0 to all others.⁴ The variable is expected to be positively related to an individual's attitudes about climate change.

Support for Public Goods

The variable measuring preference for public goods, *Support for public goods*, is based on whether or not respondents strongly agree or agree with the statement "It is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes." It is a categorical variable that assigns the

⁴ Other options were *Neither agree nor disagree*, *Disagree*, *Strongly disagree*, and those respondents who answered *Can't choose*, *Don't know*, or refused to answer were also assigned a value of 0.

value 1.0 to individuals who strongly agree or agree with this statement, and a 0 to all others (see footnote 4). Income inequality is used here as a representative non-environmental public good. The literature on individualism suggests that a dichotomy exists between individualism and collectivism. As a public good, that exhibits the free rider problem, I would expect climate change to be valued differently than a private good. Since a reduction of income inequality in this context involves acquiring more of a public good, albeit perhaps an imperfect one, this variable is expected to isolate the public goods aspect of climate change.

Reducing inequality has benefits beyond those of the individuals who benefit personally from it, and even for those who give up some of their income. This would be the case if, as Thurow (1971) argues, the distribution of income is an argument in individuals' utility functions, as it may prevent crime or increase political and social stability. If we accept this argument, each individual in a society faces the same amount of income distribution. One person's consumption of whatever benefits arise does not rival anyone else's consumption, and it is impossible to exclude anyone from the consumption of income distribution. The variable *Support for public goods* is thus expected to have a positive sign. It might, however, not be as clean a measure of demand for a public good as we would want, as it also measures one's attitude towards the poor, the ability of the government to make a difference, and government intervention in general.

Time Preference

I am also interested in how time preferences are related to individuals' attitudes towards climate change issues. This is particularly relevant since climate change is such a long-lived problem. The variable that captures time preferences, *Low demand for long-term goods*, is based on a survey question that asks about an individual's agreement with the statement "We worry too much about the future of the environment and not enough about prices and jobs today." It is a categorical variable that assigns the value 1.0 to individuals who strongly agree or agree with this statement, and a 0 to all others (see footnote 4). It clearly presents a dichotomy between the future and today, in an especially environmental context. Agreement with this statement reflects a low demand for long-

term goods, or a high discount rate, and the sign of *Low demand for long-term goods* is thus expected to be negative.

Information

The role of information in attitude formation is thought to have two components: general knowledge, measured by years of education (*Years of education*), and subject-specific scientific knowledge (*Unfamiliarity with climate change science*). Following Sunstein (forthcoming), familiar risks are seen as being more serious than risks that are not familiar. Education is expected to increase one's familiarity with a range of issues, and therefore be positively related to the dependent variable. *Unfamiliarity with climate change science* is designed to capture familiarity, and is based upon respondents' opinions about the following statement: "Every time we use coal or oil or gas, we contribute to the greenhouse effect" (a scientifically correct statement). The variable is a categorical variable that takes on a value of 1.0 if the respondent believes the statement is *Definitely* or *Probably false*, and a 0 if the answer is *Definitely* or *Probably true*, as this indicates a lack of subject-specific knowledge about the science of climate change. Ignorance about climate change is expected to decrease the availability of the risk, and therefore also one's attitudes toward that risk. Thus the sign of this variable is expected to be negative.

Underlying Values

Values are further divided into religious values and political values. Religious values are represented by two dummy variables: *Belonging to an Abrahamic religion* for 'Abrahamic religions' and *Buddhism or Hinduism* for those two religions. The term Abrahamic religion is used here to refer to the Semitic tradition attributed to Abraham, a patriarch described in the Torah, the Bible, as well as the Qur'an. This variable thus takes on the value 1.0 if the respondent belongs to some form of Christianity, Judaism, or Islam, and 0 for other religions. Consistent with the "White hypothesis," the dualism between humanity and nature existent in the Abrahamic religions is thought to establish that people can exploit nature for their own benefit, and this variable is therefore conceivably negatively related to environmental concern. *Buddhism or Hinduism* takes

on the value 1.0 for individuals belonging to one of those two religions, and a 0 for all others. The effect of religious beliefs on environmental attitudes is highly disputed, but it is thought that Buddhism or Hinduism might conversely increase the probability of considering climate change important, since they do not believe in a duality between humans and the environment.

Political values are captured by the variable *Liberal political views*, which measures political views. Respondents are asked about their political beliefs/affiliation, and an in-country analysis subsequently places them in one of a number of categories on a political left/right spectrum. *Liberal political views* is a categorical variable that assigns a 1.0 to individuals whose political affiliation places them in one of the following categories in the survey: *Far left (or communist)*, *Left/center left*, or *Center/liberal*. Conversely, individuals are assigned a 0 if placed in the categories *Right*, *Conservative*, or *Far right/fascist*. Based on the connection suggested by the literature between liberal political views and environmental concern, this variable is expected to be positively related to the dependent variable.

Socio-Economic Characteristics

The socio-economic characteristics that are thought to matter in attitude formation are *Per capita household income*, *Respondent age*, and *Urban residence*. *Per capita household income* is monthly household income divided by the number of people in the respondent's household, first converted to a common currency (USD) and adjusted for purchasing power parity using data from the Penn World Tables. The dominant theory in economics is that environmental concern increases with income, because the environment is thought to be a luxury good, and low-income families have other priorities more urgent than environmental concerns. *Respondent age* has generally in the literature been found to negatively influence individuals' concerns about the environment. *Urban Residence* is a dummy variable for urban living that, based on respondents' descriptions of the place where they live, categorizes "big city, small city or town", as urban, and "farm or home in the country" as non-urban. The variable takes on a value of 1.0 for those individuals in the 'urban' category, and 0 for the non-urban. It is hypothesized that urban living will, in fact, increase one's sensitivity towards environmental issues. Based on the salience

aspect of the familiarity criterion, urban residents might be more likely to have experienced things like pollution and other local environmental issues, and thus would be more likely to consider environmental issues a risk.

3.2 The Policy Model

In this analysis, I estimate a linear regression model of the effect of private attitudes on changes in greenhouse gas emissions, *Greenhouse gas emissions_i*, between 1997 and 2000, in country *i*, using Ordinary Least Squares.

$$\begin{aligned} \text{Greenhouse gas emissions}_i = f(\text{Greenhouse attitudes, Time preference, Per capita} \\ \text{GDP, Freedom of the press, Government trust, Share of coal, Share of nuclear,} \\ \text{PRESS*ATT}) \end{aligned} \quad \text{Eq. 2}$$

Dependent Variables

Greenhouse gas emissions_i is country *i*'s change in green house gas emissions per GDP (in constant US dollars) in the three-year period preceding the survey years: between 1997 to 2000.⁵

⁵ The specifics of the construction of this variable are provided in Appendix A.

Independent Variables

TABLE 2 – INDEPENDENT VARIABLES, *POLICY MODEL*

VARIABLE NAME	UNITS	EXPECTED SIGN
<i>Greenhouse attitudes</i>	%	-
<i>Time preference</i>	%	-
<i>Per capita GDP</i>	\$	-
<i>Share of total energy consumption from coal in 1990</i>	%	?
<i>Share of total energy production from nuclear in 1990</i>	%	?
<i>Freedom of the press</i>	#	-
<i>Government trust</i>	%	-
<i>PRESS*ATT – Interaction term between Press freedom and Greenhouse attitudes</i>		-

Greenhouse attitudes is the percentage of people in each country who, in the survey, report thinking that “a rise in the world’s temperature caused by the ‘greenhouse effect’ is either extremely or very dangerous for the environment.” This variable contains the global and public aspects of climate change and is my direct measure of how attitudes affect outcomes. Since the hypothesis is that larger proportions of agreement with this view would be associated with a reduction in emissions, the expected sign of this variable is negative.⁶

Time preference is included in this equation to isolate any separate effect that time preferences might have on policy in addition to their effect on attitudes, perhaps because they are more visible through households’ actual savings than other kinds of preferences. *Time preference* is a measure of adjusted private savings, my proxy for private time preference. Recognizing that private savings is a function not only of time preference, but

⁶ The aggregation of individual attitudes follows Bishai’s (2004) reasoning that in a market economy, the social rate of time preference is the aggregate of individual investment decisions governed by individual rates of time preference, so the actual social discount rate is a complex aggregate of individual rates of time preference. This would logically also apply to things like spatial discounting.

a host of other influences, an adjusted time preference variable is generated. Specifically, I regress savings on the dependency ratio and GDP and interpret the residual from this regression as a more pure form of time preferences. According to the life-cycle models of savings (see e.g. Schmidt-Hebbel, Webb and Corsetti, 1992), demographic variables such as the dependency ratio should have an effect on savings behavior. The dependency ratio – the share of the total population of a country that is made up of individuals under the age of 15 or over 65 – is the demographic variable employed here. It is typically believed that older people work less and live off past savings, and that children don't bring income to a household, thus decreasing overall savings. Schmidt-Hebbel et al. (ibid) also put forth an alternative explanation that households with many children may save less because the parents expect their children to support them in their old age. Since higher preferences for long-term goods would likely mirror a low discount rate, the expected sign of *Time preference* is negative.

Incomes should matter both in terms of setting priorities and in the availability of resources to implement those priorities. *Per capita GDP* is the per capita income of the countries in 2000 dollars. Since climate change, and therefore reductions in greenhouse gas emissions, is presumed to be normal (rather than inferior) goods, this is expected to have a negative sign (i.e. a greater reduction).

Freedom of the press is a measure created from Freedom House's reports on freedom of the press that have been conducted for almost 200 countries over the past 25 years. Countries are given a total score from 0 (best) to 100 (worst). In order to facilitate interpretation, however, the variable was recoded based on the original data, so that the worst score would be the lowest, and vice versa. The extent to which the press in a country is free will measure how well citizens have access to information, and also their right to voice their preferences for the environment. Consistent with the findings of Barrett and Graddy (2000), a higher score is expected to lead to greater reductions in greenhouse gas emissions, i.e., be negatively related to the dependent variable.⁷

One question from the survey asks how much trust the respondent would have in government departments to give them correct information about causes of pollution. The *Government trust* variable, then, is the percent of people who state that they would have a

⁷ Some details of how freedom of the press is scored can be found in Appendix A.

great deal of trust. Whereas the previous variable measures how accessible the information is, this variable would measure how trustworthy it is. If citizens do not have faith in their governments' information about the causes of pollution, they are also unlikely to believe that their government will act upon their environmental preferences. The transformation of citizens' attitudes into policy requires that governments act upon their citizens' preferences, but if individuals don't even have faith in the information that their government provides on relatively uncomplicated matters as pollution, they are unlikely to convey those preferences to representatives in the first place.

*PRESS*ATT* is an interaction term between *Freedom of the press* and *Greenhouse attitudes*. This variable is designed to capture the interaction between freedom of the press and attitudes. The general premise is that in the absence of a freedom of the press, attitudes have little chance of being formed and communicated so it would be less likely that attitudes would result in policy change. The reason for this variable is the possibility of a significant effect of attitudes on policy that is different for different levels of press freedom. Generally I expect a freer press to strengthen the effect of attitudes on public action.

Coal share controls for the share of total energy consumption in country *i* that came from coal in 1990. The role of coals is likely to be important, but its sign is ambiguous. On the one hand countries with a high proportion of coal-based energy could be expected to typically find it harder and more costly to reduce greenhouse gas emissions, meaning that the expected sign would be positive. An alternative line of reasoning, however, suggests that a low share of energy production from coal might mirror efforts already taken by the country to reduce environmental impacts. It is relatively easy to substitute natural gas for coal in electrical generation so in that sense coal might be an easy target of opportunity. If this is the case, we might speculate that the marginal costs of reducing emissions might be lower if countries can substitute other cleaner, widely available energy sources for their coal. These costs would then increase and make it harder to further reduce emissions as it potentially requires investments in new technologies, etc. This would imply the opposite sign. It is hard to predict the coefficient in this case.

Since the sign of *Coal share* is ambiguous, *Share of nuclear* is employed as an alternative. It is the share of a country's energy production in 1990 that is nuclear energy. Some countries with high amounts of nuclear energy have argued that treaties forcing them to reduce greenhouse gas emissions will put them at a disadvantage, because they have to date invested a great deal in nuclear energy to cut their emissions, and that reducing them further will be hard – they have already taken advantage of this window of opportunity and now would bear much higher costs. This variable is therefore expected to have a negative effect on how much countries manage to reduce their emissions, i.e., a negative sign.

4. DATA

4.1 Data Description

Attitude Models

For the three first models – the attitudes, action, and willingness to pay models – the data come from the International Social Survey program's 2000 module on the Environment, conducted in 26 countries on topics surrounding environmental concern. The participating countries are Austria, Bulgaria, Canada, Chile, Czech Republic, Denmark, Finland, Germany, Great Britain, Ireland, Israel, Japan, Latvia, Mexico, Netherlands, New Zealand, Northern Ireland, Norway, Philippines, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, and the USA.⁸

Policy Model Variables

In the policy model, the data for the dependent variable *Greenhouse gas emissions*; come from World Resources Institute, compiled from the International Energy Agency, the Carbon Dioxide Information Analysis Center and the Energy Information Agency, and GDP data from the World Bank. The data *CO₂ per GDP* measure the quantity of carbon

⁸ The details on how the independent variables correspond to variables in the ISSP survey are provided in Appendix A.

dioxide (CO₂) released into the atmosphere for each million dollars of Gross Domestic Product (GDP) in each country. The household savings data for the time preference come from the OECD Economic Outlook 2000. The GDP data are from the World Bank, and the data on dependency ratios comes from the Population Reference Bureau's 2000 World Population Data Sheet. The variables *Greenhouse attitudes* and *Government trust* both come from the ISSP survey.⁹

Table 3 presents summary statistics for the independent variables for the attitudes model, the action model, and the willingness to pay model. Table 4 shows summary statistics for the policy model.

⁹ *Greenhouse Attitudes* comes from the ISSP variable v38, and *Government Trust* comes from the ISSP variable v52.

TABLE 3 – DESCRIPTIVE STATISTICS, ATTITUDES ACTION AND WILLINGNESS TO PAY

VARIABLE	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
Greenhouse attitudes	0.628	0.483	0	1
Drive Less	0.130	0.337	0	1
Willingness to pay higher prices	0.066	0.248	0	1
Willingness to pay higher taxes	0.042	0.200	0	1
Willingness to accept lower standard of living	0.055	0.229	0	1
Affinity for the global community	0.898	0.303	0	1
Support for public goods	0.624	0.484	0	1
Low demand for long-term goods	0.368	0.482	0	1
Years of education	12.3	4.3	0	21
Familiarity with climate change science (A)	0.158	0.365	0	1
Familiarity with climate change science (B)	0.725	0.447	0	1
Belonging to an Abrahamic religion	0.599	0.490	0	1
Buddhism or Hinduism	0.016	0.127	0	1
Liberal political views	0.697	0.460	0	1
Per capita household income (\$)	1628.5	4040.3	3.0	83333.3
Log of per capita household income (\$)	6.372	1.350	1.1	11.3
Age of respondent	45.8	17.1	15	96
Urban residence	0.702	0.457	0	1

TABLE 4 – DESCRIPTIVE STATISTICS, *POLICY MODEL*

VARIABLE	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
<i>Greenhouse gas emissions</i>	-0.098	0.089	-0.329	0.063
<i>Percent who consider the green house effect dangerous</i>	0.639	0.145	0.406	0.879
<i>Private rate of time preference</i>	0.000	2.707	-4.065	5.049
<i>Per capita GDP in 2000 dollars</i>	21911.4	14177.3	1173.1	46815.5
<i>Share of total energy consumption from coal in 1990</i>	0.208	0.144	0.014	0.630
<i>Freedom of the press</i>	-20.3	12.3	-60.0	-5.0
<i>Percent who trust government information on pollution</i>	0.243	0.105	0.078	0.519

Tables 5 and 6 show pairwise correlations between the variables of the different models. In Table 5, the correlations for the attitudes models are shown, and it is not surprising to note that the correlations between the different kinds of willingness to pay are the highest – around .5. This is not worrying, however, since these measures are dependent variables in different models and would thus not result in multicollinearity. None of the other variables are very highly correlated. In Table 6, the correlations for the policy model are shown. The only high correlations exist between the variable measuring people's propensity to cut down on driving, per capita GDP and freedom of the press.

TABLE 5 – PAIRWISE CORRELATIONS, ATTITUDES ACTION AND WILLINGNESS TO PAY

VARIABLES	Greenhouse Attitude	Drive less	WTP - prices	WTP - taxes	WTA lower SOL	Global goods	Public goods	Long- term goods	Edu	Unfami- liarity	Abraha- mic religion	Buddhism Hinduism	Liberal	Household income	Age	Urban
Greenhouse Attitude	1															
Drive less	-0.06	1														
WTP - prices	-0.11	0.07	1													
WTP - taxes	-0.09	0.05	0.58	1												
WTA lower SOL	-0.10	0.07	0.43	0.48	1											
Global goods	-0.09	0.03	0.03	0.02	0.03	1										
Support for public good	-0.06	-0.01	0.02	0.02	0.03	0.07	1									
Long-term goods	0.06	-0.03	-0.03	-0.03	-0.03	-0.04	0.11	1								
Education	0.03	0.05	0.05	0.06	0.03	0.06	-0.14	-0.20	1							
Unfamiliarity	0.16	-0.02	-0.03	-0.03	-0.02	-0.12	-0.07	0.05	0.00	1						
Abrahamic religion	0.00	0.02	0.00	-0.01	0.01	-0.03	0.09	0.06	-0.10	-0.03	1					
Buddhism/Hindu ism	-0.03	0.01	0.01	-0.01	-0.01	0.00	-0.05	-0.03	0.01	0.00	-0.16	1				
Liberal political views	-0.07	0.03	0.01	0.02	0.03	0.03	0.16	-0.01	-0.05	-0.04	0.01	-0.08	1			
Household income	0.09	0.02	0.01	0.00	-0.02	-0.01	-0.10	-0.06	0.16	0.00	0.00	-0.03	-0.05	1		
Age	0.05	0.04	-0.01	-0.02	-0.02	0.04	0.06	0.12	-0.24	-0.03	0.02	0.07	0.01	0.01	1	
Urban residence	-0.02	0.00	0.03	0.03	0.02	0.04	-0.04	-0.04	0.18	-0.02	-0.10	-0.03	0.02	0.04	-0.03	1

TABLE 6 – PAIRWISE CORRELATIONS, *POLICY MODEL*

VARIABLES	Greenhouse gas emissions	Greenhouse attitudes	Time preference	Press freedom	Share of coal	pc GDP	% who trust gvt. Info	Press* attitudes
Greenhouse gas emissions	1							
Greenhouse attitudes	0.39	1						
Time preference	0.27	-0.09	1					
Press freedom	-0.02	-0.20	-0.13	1				
Share of coal	-0.22	0.11	0.13	0.02	1			
pc GDP	0.08	-0.34	0.00	0.71	-0.14	1		
% who trust gvt. Info	0.12	0.01	-0.03	0.20	-0.54	0.20	1	
Press*attitudes	-0.14	-0.46	-0.12	0.95	0.03	0.75	0.11	1

4.2 Cross-National Data Validity

Since this study relies heavily on cross-national survey data, it is important to acknowledge the problem of comparability that arises from the cross-cultural nature of the survey. In particular, the possibility of different interpretations of identical questionnaires should be recognized. A few issues that might arise are the possibility that meanings of answers to survey questions will be significantly different across different cultural contexts. This question cannot be answered easily, or definitively, as it also depends on how the survey is designed. However, by examining correlations between survey data and known geographic factors, Brechin and Kempton (1994, pp 260-261) present evidence that responses to environmental surveys measure something real about environmental views. Since these kinds of responses are a key factor in this examination, it is a comforting result.

4.3 Econometric Issues

In a study of something as complex as attitudes, it is almost inevitable that some variables will be left out of the estimated equation, either due to data availability problems or to the fact that the researcher has neglected to consider some influence and thus left it out. The inability to include an important explanatory variable leads to biases in the estimated coefficients. The error term then includes the influence of this omitted variable, making the error term correlated with the right-hand side variables, instead of being uncorrelated as is our assumption when we draw conclusions from OLS estimates. I have used a fixed effects approach in the attitudes models to help solve some of these omitted variable issues. Behrman and Oliver (2000) note that since fixed effects control for all fixed factors that are shared in common by groups, in this case nations, they eliminate omitted variable bias, at least at the country level.

Although I cannot eliminate the influence of omitted variables on my estimates, I will discuss some of the possible issues. One example of an omitted variable at the individual level is gender. Although the theory does not predict a systematic difference in attitudes by gender, it is possible that the data set contains systematic differences, whereby one gender is more concerned about climate change. If, simultaneously, there are systematic educational differences by gender, then the estimated effects of education on attitudes would be biased upward.

Differences between different kinds of urban areas may also be an omitted variable. There are some urban areas that have very good air quality and plenty of green areas. In these cities, the effects of environmental issues would seem much more remote than in dirty, polluted cities. Not controlling for environmental quality of the different urban areas would then weaken the predicted effect of urban residency on attitudes toward climate change, and bias the estimates downward.

Another omitted variable that might have an influence on the policy model is media coverage. We can imagine a scenario where the dangers associated with climate change get a lot of coverage in a nation's media, which influences citizens to think that climate change is dangerous. It is also plausible that the government at the same time

decides to take action in the face of the increased publicity, but it does not necessarily imply that citizens' attitudes were what lead to this change. One way in which I attempt to deal with the issue of media coverage is through the inclusion of variables measuring the freedom of the press in a country. It is believed that the freer the press is, the more likely it is to reflect the attitudes of a nation's citizens.

The use of survey data to determine attitudes might also include some bias. On a topic as morally loaded as environmental protection, the risk of response bias in the survey answers is always a possibility; that respondents may answer the way they believe the questioner wants them to answer, or the way they think they *should* answer, rather than according to their beliefs. This would lead to an upward bias of the estimates of how much people value the environment.

5. RESULTS

5.1 Attitudes Model

Determinants of Greenhouse Attitudes

Table 7 shows the results for the probit model with greenhouse attitude as the dependent variable. The first column includes the measure of unfamiliarity with climate change science mentioned above: a respondent's belief that the statement "every time we use coal or oil or gas, we contribute to the greenhouse effect" is false. Individuals who answered that this statement was definitely or probably false were assigned a value of one, and the variable takes on a zero otherwise. Column 2 contains a different unfamiliarity variable, based on whether or not the respondent thinks that the greenhouse effect is caused by a hole in the Earth's atmosphere (a scientifically incorrect belief). Since the hole refers to ozone depletion, not climate change, believing in that statement was at first also thought to be a reasonable measure of the respondent's ignorance of the science of climate change. Individuals who answered that this statement was definitely or

probably true were assigned a value of 1.0, and the variable takes on a value of 0.0 otherwise. The difference between the two measures will be discussed below.

Column 1 shows the preferred model, which has country fixed effects included. The coefficients of all variables are statistically significant and of the expected signs, apart from the religion variables and per capita income.

A higher level of education is associated with a higher probability of expressing concern about climate change, the expected result. One additional year of education at the mean (12.3) results in a .005 percentage point increase in the probability of thinking that the greenhouse effect is dangerous. The marginal effects of education were evaluated at different values than the mean, since it could be the case that an additional year of education matters more when going from five years to six years than from 12 years to 13. The effect of an additional year of education is, however, only very slightly decreasing over the different values, so an additional year of education matters a little less for your concern about climate change the more education you already have. The probability that urban residents are concerned about climate change is .034 higher than for their rural counterparts. When the country fixed effects are not included (see Appendix B), years of education exhibits an unexpected sign, which implies that the education variable in column 1 is picking up some systematic country differences that the fixed effects model controls for. In addition, urban residence is not statistically significant in the model without fixed effects. Both these results seem to confirm the decision to use a fixed effects model, and subsequent results will be presented only with the fixed-effects models.

Being unfamiliar with climate change science has the single largest effect on a the probability of being concerned about climate change: the probability of being concerned is .21 lower for individuals who respond incorrectly that using coal or oil or gas does not contribute to the greenhouse effect. This story coincides very well with the theoretical predictions of the model: individuals who are unfamiliar with a certain risk tend to be less likely to associate the risk with something that requires precaution.

One surprising result is the fact that household income appears to be negatively related to individuals' attitudes. One explanation for this phenomenon might be the argument that generational value changes towards postmaterialism only work through a

rising tide that is lifting all boats, not through individual increases in income. This would contradict standard economic theory, however, which predicts that demand for a non-inferior good should increase with income. It is possible that these results are consistent with Steininger's findings (2002) that concern for distant effects decreases with income. The Steininger effects might work against the typical expected wealth effects, in this case outweighing the income effect and resulting in a negative overall effect. In other words it seems as though the different attributes of climate change complicate the role of income.

Demand for global, public and long-term goods are also important, and respondents' demand for global goods matters a great deal: individuals with an affinity for the global community have a probability of being concerned about climate change that is .14 higher than those who do not. In general, this model strongly supports the expectation that the individual attributes of climate change do in fact matter in attitude formation.

The statistical significance of the coefficients on religious beliefs disappears when fixed effects are introduced, but liberal political values increase the probability of being concerned about climate change by .08. The lack of significance of religious beliefs may or may not be surprising to the reader. Religious beliefs have been discussed intensely, particularly in the sociological literature, but no consensus has been reached on their importance. These results would indicate that the differences in environmental attitudes that have sometimes been attributed to religious differences may be capturing systematic country differences due to other social, political, economic or cultural factors. Because the variation in religious beliefs is so heavily correlated with the countries it is difficult to isolate the separate effects of religious beliefs. For the purposes of this analysis the distinction is not of primary importance, but interesting to note.

TABLE 7 – PROBIT REGRESSIONS FOR GREENHOUSE ATTITUDE

Independent Variable	IGNORANCE A	IGNORANCE B
<i>Affinity for the global community^a</i>	0.140*** (0.058)	0.161*** (0.058)
<i>Support for public goods^a</i>	0.062*** (0.032)	0.062*** (0.032)
<i>Low demand for long-term goods^a</i>	-0.092*** (0.032)	-0.110*** (0.032)
<i>Years of education</i>	0.005*** (0.004)	0.006*** (0.004)
<i>Unfamiliarity with climate change science^a</i>	-0.209*** (0.040)	0.073*** (0.032)
<i>Belonging to an Abrahamic religion^a</i>	-0.005 (0.035)	-0.011 (0.036)
<i>Buddhism or Hinduism^a</i>	0.024 (0.155)	0.004 (0.170)
<i>Liberal political views^a</i>	0.080*** (0.033)	0.083*** (0.033)
<i>Per capita household income</i>	-0.024*** (0.020)	-0.026*** (0.021)
<i>Age of respondents</i>	-0.002*** (0.001)	-0.002*** (0.001)
<i>Urban residence^a</i>	0.034*** (0.033)	0.036*** (0.033)
	<i>n</i> 8934	<i>n</i> 8699
	Pseudo R2 0.1227	Pseudo R2 0.1126

Notes:

The above coefficients are the *marginal effects* of the independent variables on the probability of believing that the greenhouse effect is dangerous.

Standard errors in parentheses.

^a Coefficient is for a discrete change of the dummy variable from 0 to 1

*** 99% significance

** 95% significance

* 90% significance

Robustness of Estimates

The aforementioned results are robust to a number of changes in the model specification. In the results that are shown, the dependent variable is constructed from an answer with ordered categories (the greenhouse effect is extremely dangerous, very dangerous, somewhat dangerous, etc.), and takes on the value of 1.0 if the respondent considers the greenhouse effect extremely or very dangerous for the environment. The original motivation for constructing a dummy variable was the belief that belonging to the group of people who are concerned about the greenhouse effect is more important than the relative differences between answering extremely or very dangerous. The outcomes are consistent, however, if an ordered probit model is employed. They are similarly consistent if the dependent variable is recoded to take on a 1.0 only for individuals who indicate that the greenhouse effect is extremely dangerous, or if respondents who think the greenhouse effect is only somewhat dangerous are included. (see Appendix C) The only significant change is that *Years of education* is slightly less significant when the dependent variable only includes those respondents who think that the greenhouse effect is extremely dangerous. Similarly, all coefficients of binary independent variables in Table 7 are based on the respondent agreeing or strongly agreeing with the statement in question, but the results are robust if these variables are recoded. In other words, the results are insensitive to coding choices.

An additional robustness check was conducted using the two unfamiliarity variables: relating how coal and oil and gas impact the greenhouse effect, and relating climate change to a hole in the ozone layer. Column 2 contains a measure of unfamiliarity that is based on the respondent's belief that the greenhouse effect is caused by a hole in the ozone layer. At first, the significantly positive sign of this variable presented a paradox, since we expect respondents who are ignorant about climate change to be less worried about it.

Further reflection, however, offers a reasonable way to resolve the paradox. Consider a respondent who believes that the greenhouse effect is caused by a hole in the ozone layer, and keep in mind the fact that the Antarctic ozone hole has received a lot of media attention. If we think that the amount of media exposure that a particular environmental issue gets affects how concerned an individual is about the issue, then this

variable could in fact be capturing the fact that someone who believes that ozone holes and climate change are closely linked would essentially notice twice as much attention given to the issue than someone who knows that the two issues are separate. It therefore seems as though this measure of unfamiliarity is inadequate and my other measure is preferred, but it raises a noteworthy point about how having access to information and having access to accurate information are not necessarily identical.¹⁰

Determinants of Individual Actions

As a second perspective on the determinants of environmentalism, the dependent variable *Drive less* is investigated. This variable is based upon whether or not respondents report that they often or always cut back on driving a car for environmental reasons. This is a measure of personal actions, and it allows some consideration of the degree to which attitudes are complemented by personal actions. Grunert and Juhl (1995) make the case that values and attitudes are criteria that are used to justify actions. The authors argue that values can be viewed as representing motivations because of their function as social cognitions that help us know and understand – and consequently act upon – things in the world around us. They subsequently try to assess the potential of values to predict behavior by surveying Danish school teachers for environmental attitudes and their propensity to buy organic food. They find a clear correlation between the organic food buying frequency and environmental attitudes, but unfortunately do not control for many other variables in their analysis.

Duroy (2005), in his investigation of environmental attitudes and behaviors, lumps together a number of survey questions pertaining to both environmental attitudes and behavior to evaluate their determinants. What follows can be seen as a different way of examining the link between attitudes and behavior that Grunert and Juhl (1995) look at, and as a test of Duroy's approach.

¹⁰ Further, the above estimations use a normal probit model because the most important difference is thought to be rather dichotomous, and exist between individuals who believe and those who do not believe that climate change is dangerous. An alternative would have been to use an ordered probit model, since there are more than two responses to the question. The results do not change significantly if an ordered probit is employed for the estimation.

TABLE 8 – PROBIT REGRESSIONS FOR *DRIVE LESS*

Independent Variable	With Country Fixed Effects
<i>Affinity for the global community^a</i>	0.012 (0.069)
<i>Support for public goods^a</i>	0.022*** (0.037)
<i>Low demand for long-term goods^a</i>	-0.002 (0.037)
<i>Greenhouse Attitude</i>	0.045*** (0.037)
<i>Years of education</i>	0.002** (0.005)
<i>Unfamiliarity with climate change science^a</i>	-0.004 (0.048)
<i>Belonging to an Abrahamic religion^a</i>	-0.013* (0.040)
<i>Buddhism or Hinduism^a</i>	0.04 (0.158)
<i>Liberal political views^a</i>	0.019** (0.039)
<i>Per capita household income</i>	-0.016*** (0.024)
<i>Age of respondent</i>	0.001*** (0.001)
<i>Urban residence^a</i>	0.013* (0.037)
<hr/>	
	<i>n</i> 8898
	Pseudo R ² 0.0582

Notes:

The above coefficients are the *marginal effects* of the independent variables on the probability of being willing to pay or accept.

Standard errors in parentheses.

^a Coefficient is for a discrete change of the dummy variable from 0 to 1

*** 99% significance

** 95% significance

* 90% significance

Table 8 shows the results of a probit regression of the same independent variables as in the previous *attitudes* model, on a left-hand side variable that indicates an environmentally friendly action. The measure of unfamiliarity with climate change science is the measure that was deemed superior in Table 7 (a dummy variable for believing or not believing the statement "every time we use coal or oil or gas, we contribute to the greenhouse effect").

Some very interesting results emerge. Although we notice that the model overall produces a worse fit than when attitudes is the dependent variable, some of the determinants of attitudes also seem to predict environmentally friendly behavior in the expected directions. In addition, environmental attitudes are themselves a positive and significant determinant of individuals' decisions to drive less. Table 8 shows us that support for public goods, positive environmental attitudes, years of education, liberal political views, household income, as well as the age of the respondent are statistically significant determinants of whether or not a respondent will tend to cut down on driving a car for environmental reasons.

Age, however, has a positive (albeit small) sign, the opposite of what we find for attitudes towards climate change. One additional year increases the probability of cutting down on driving for environmental reasons by .001. One possible explanation for this, consistent with the age hypothesis, has to do with the nature of the environmentally friendly behavior in question. The age hypothesis states that older people are less likely to support solutions to environmental problems because the solutions are often seen as threatening an established social order, and older individuals are more integrated in that social order. Cutting down on driving, however, is a way of limiting one's impact on the environment that is rather uncontroversial and un-threatening to the social order, and therefore might appeal to older individuals, whereas younger individuals choose other means. In addition, the polluting effects of driving can be perceived as immediate, whereas the effects of climate change are delayed, perhaps beyond the lifetime of the senior respondent.

Also noteworthy is the fact that neither an individual's global concerns, as measured by a positive attitude towards binding international environmental agreements,

nor his or her attitudes towards the future, are statistically significant predictors of the probability that he or she will cut down on driving a car. A preference for public goods, however, is – it increases the probability of driving less by .022. This might in fact be due to people's perceptions of why they ought to drive less. While cars emit greenhouse gases into the atmosphere, they also account for a lot of local air pollution, such as nitrogen oxides and carbon monoxide. If people think of cutting down on driving as a way of reducing local air pollution, then they are acting in a way that contributes to a current public good, but they may not necessarily be acting upon preferences for long-term or global environmental services.

Household income is negatively related to this dependent variable too. Since the motivations for cutting down on driving seem to be more related to the local effects of pollution and congestion than the distant effects of climate change, the effects noticed by Steininger (2002) that environmental concern for distant environmental problems decreases with income do not apply. The negative effect of income on the probability of driving less is therefore harder to explain.

This model shows us that taking for granted a total similarity between environmental attitudes and behavior might lead to less informative results, as some of the determinants affect the two differently. On the whole, however, it does seem that people with positive attitudes towards the environment and those who actively behave in an environmentally friendly way have many characteristics in common. Whether this connection between attitudes and actions prevails in national actions to control climate change will be assessed in section 5.

Determinants of Willingness to Pay

Table 9 presents the results for the different types of willingness to pay (WTP) that were asked in the survey: willingness to pay much higher prices, willingness to pay much higher taxes, and willingness to accept a lower standard of living to protect the environment. Only the results of the fixed effects models are shown in the table, as an analysis of the differences between the models with and without fixed effects was found to be rather uninformative and the fixed effects models are preferred.

Duroy (2005) finds in a cross-country analysis of WTP for environmental services that very few of his demographic indicators are significant determinants of individuals' WTP for the environment. This could possibly arise from the fact that his measure of WTP is a general one, bringing together several different attributes. To investigate this, the models estimated here examine the differences between three different types of WTP. Also, since the independent variables are the same as in the model that explores the predictors of environmental attitudes, comparing how significant these are in determining willingness to pay gives us another way of looking at the similarities between determinants of attitudes and of willingness to pay.

Table 9 shows that several of the variables that predict an individual's environmental attitudes also predict their WTP to protect the environment. Preferences for global goods, preferences for public goods, cautious attitudes vis-à-vis climate change, liberal political views, and years of education are positively related to all three measures of WTP, and a low demand for long-term goods negatively affects the probability of being willing to pay for the environment. Being concerned about climate change increases the probability of all three WTP measures by between .023-.043.

Significantly, household income is statistically significant only in determining individuals' WTP higher prices for environmental protection, but has no significant effect on the two other measures. The effect of income is small, with a 1-percent increase in monthly income being associated with a .00005 change in the probability that the respondent declares that he or she is willing to pay higher prices to protect the environment. It is interesting to note that the WTP higher taxes and to accept a cut in one's standard of living are not associated with household income. One possible explanation for the measure that asks about taxes is that, although some wealthier individuals are more able and willing to deal with cuts in their disposable income, others might feel that it would hit them disproportionately, especially if they have a progressive tax scheme in mind. As for cuts in one's standard of living, there are no obvious reasons why it would be correlated with income, so the insignificance is not surprising.

TABLE 9 – PROBIT REGRESSIONS FOR *WILLINGNESS TO PAY*

Independent Variable	WILLINGNESS TO PAY MUCH HIGHER PRICES	WILLINGNESS TO PAY MUCH HIGHER TAXES	WILLINGNESS TO ACCEPT LOWER STANDARD OF LIVING
<i>Affinity for the global community^a</i>	0.025*** (0.098)	0.015** (0.113)	0.032*** (0.116)
<i>Support for public goods^a</i>	0.020*** (0.047)	0.008** (0.054)	0.019*** (0.050)
<i>Low demand for long-term goods^a</i>	-0.015*** (0.049)	-0.010*** (0.057)	-0.011** (0.051)
<i>Greenhouse Attitude</i>	0.043*** (0.049)	0.023*** (0.056)	0.033*** (0.051)
<i>Years of education</i>	0.003*** (0.006)	0.003*** (0.007)	0.002*** (0.006)
<i>Unfamiliarity with climate change science^a</i>	0.002 (0.062)	-0.008* (0.076)	0.001 (0.066)
<i>Belonging to an Abrahamic religion^a</i>	-0.0005 (0.052)	-0.004 (0.060)	0.003 (0.056)
<i>Buddhism or Hinduism^a</i>	0.003 (0.193)	0.004 (0.237)	0.026 (0.202)
<i>Liberal political views^a</i>	0.010** (0.048)	0.011*** (0.056)	0.016*** (0.052)
<i>Per capita household income</i>	0.005* (0.028)	0.002 (0.032)	-0.003 (0.030)
<i>Age of respondent</i>	0.0004*** (0.001)	0.0001 (0.002)	-0.0002 (0.001)
<i>Urban residence^a</i>	0.004 (0.048)	0.002 (0.056)	0.0002 (0.050)
	<i>n</i> 8934 Pseudo R ² 0.064	<i>n</i> 8934 Pseudo R ² 0.089	<i>n</i> 8934 Pseudo R ² 0.081

Notes:

The above coefficients are the *marginal effects* of the independent variables on the probability of being willing to pay or accept.

Standard errors in parentheses.

^a Coefficient is for a discrete change of the dummy variable from 0 to 1

*** 99% significance

** 95% significance

* 90% significance

5.2 The Policy Model

The previous models established a number of political, socio-economic and demographic determinants of environmental attitudes, and the fact that environmental attitudes indeed seem to matter in determining whether individuals are willing to act individually to decrease their impact on the environment, and whether they are likely to be willing to pay in different ways to protect the environment. Other studies have also looked into this issue, but the model that follows asks the next logical question: do environmental attitudes matter in the implementation of national policies? If so, what factors affect the degree of influence? Even though the formation of attitudes is a fascinating topic in and of itself, it would certainly carry much more weight if we had some evidence that individuals' attitudes actually have an impact on the way countries behave with regard to environmental issues.

Table 10 shows the results from the OLS regression of countries' changes in greenhouse gas emissions in the three years preceding the ISSP survey on a number of independent variables. Column 1 shows the results of a basic model, Column 2 shows the preferred model, which includes variables measuring freedom of the press and the percentage of people in a country who trust government information on pollution, as well as an interaction term between the level of press freedom and environmental attitudes.

TABLE 10 – OLS REGRESSIONS FOR GREENHOUSE GAS EMISSIONS

Independent Variable	COLUMN 1	COLUMN 2
<i>Greenhouse attitudes</i>	-0.304*** (0.087)	-0.490* (0.301)
<i>Time preference</i>	0.012** (0.005)	0.006 (0.004)
<i>Per capita GDP</i>	-0.00000306** (0.000)	-0.00000152 (0.000)
<i>Share of total energy consumption from coal in 1990</i>	-0.311*** ^b (0.093)	-0.378*** ^b (0.083)
<i>Freedom of the press</i>		0.030** (0.012)
<i>Government trust</i>		-0.339** (0.160)
<i>PRESS*ATT</i>		-0.053** (0.020)
	<i>n</i> 18 <i>R</i> ² 0.588	<i>n</i> 18 <i>R</i> ² 0.744

Notes:

Standard errors in parentheses

^b Significance from a two-tailed t-test

*** 99% significance

** 95% significance

* 90% significance

Overall, given the number of observations and the fact that the data are cross sectional, the fit of the equation is noteworthy, and several of the theoretically important variables are statistically significant and of the expected signs. Briefly, individual concerns about climate change in a country are significantly associated with lower greenhouse gases. A one percentage-point increase of people in a country who think that climate change is an important issue is associated with a .49 percentage point reduction in

greenhouse gas emissions. Keeping in mind that the mean reduction in the sample over the three-year period is 9.8 percent, that is a significant reduction.

If a country's press freedom score increases by one point, it appears to be associated with a .03 increase in greenhouse gas emissions. The reader might be struck by the fact that the coefficient on freedom of the press is positive, implying that a higher level of freedom of the press would be associated with an increase, or a smaller reduction, in a country's greenhouse gases. However, it is a mistake to consider this variable independently of the interaction term. The effect of the press can only be considered by taking the two terms together. The variables *Press freedom* and the interaction term between *Press freedom* and *Greenhouse attitudes* are jointly significant and, the marginal effect of attitudes is negative over all values of *Press freedom*.¹¹ This implies that the magnitude of the marginal effect of environmental attitudes depends upon the level of press freedom in a country.

Also, the percentage of people who trust government information on pollution has a significant effect on greenhouse gas emissions. A one percentage-point increase in the number of people who trust their government is associated with a .34 percentage-point reduction in emissions. The share of total energy consumption from coal in 1990 has a similar effect – a one percentage-point increase in the share of coal is associated with a .38 percentage point reduction in greenhouse gas emissions.

Significantly, it appears from these results that attitudes do matter in the implementation of national policy, but that they are far from the only important factor, and that they do not operate in isolation. Different kinds of democratic channels also matter a great deal in the translation of these attitudes into policy – the access to a free press, and the existence of a government that you can trust – seem to be vital pieces in the puzzle. The variable that measures people's trust in governments' information on pollution is also significantly associated with a reduction in greenhouse gas emissions. This could indicate that, beyond the kind of information you have access to, and no matter what your preferences, whether you trust your government to act on your preferences is important. One story that could be told about the importance of this

¹¹ The marginal effect of attitudes for different levels of freedom of the press is calculated as follows:
 $\beta_1 + \beta_7 * \text{Press Freedom}$

variable is that a government that is not believed to supply trustworthy information on such basic issues as pollution is likely to fail its population on fulfilling other duties too.

Underlying structural differences also seem to matter in determining how successful a country is in reducing greenhouse gas emissions, since the share of energy consumption from coal turns out to be a crucial predictor of that success. It seems as though coal, rather than making it hard for countries to reduce their emissions, provides them with a window of opportunity for relatively low cost fuel switching, substituting other available technologies for coal in electrical generation.

Following a similar line of reasoning, some countries with high amounts of nuclear energy have argued that treaties such as the Kyoto protocol will put them at a disadvantage, as they have already invested in nuclear energy to reduce greenhouse gas emissions, and that reducing them further will be hard – they have already taken advantage of this window of opportunity and now would bear much higher costs. To test this, the importance of nuclear energy as a share of energy production was included instead of the *Coal share* variable, but was not found to be significant in any specification of the model. The reason for this might be the lack of variation in the sample, but it indicates that the difficulty for these countries to further reduce greenhouse gas emissions might have been exaggerated.

The per capita GDP of a country does not appear to matter in this specification, however. Since most of the economic literature to date has focused on the importance of country-level wealth in determining the degree of environmentalism, this is a remarkable result.¹²

¹² One insight that urges caution in interpreting this result, however, is that it may mainly be a product of the high correlation between per capita GDP and the amount of press freedom in a country. The percentage of people who drive less is also highly correlated with per capita GDP. Indeed, when freedom of the press, the interaction term with attitudes, and the percentage of people who drive less to reduce their environmental impact are excluded from the specification, country GDP gains some significance. The other variables are important to the model, however, and the fit of the equation drops radically if these variables are excluded so this specification does not seem interesting for our purposes. It does indicate, however, that wealth may matter more than we can see here.

6. DISCUSSION

National Policy

The most striking result of this study is the fact that individuals' attitudes towards climate change are in fact associated with lowered greenhouse gas emissions, and that democratic institutions and structural conditions have important functions in the implementation of climate change policies.

I will return to the discussion about the determinants of individual attitudes, but first want to focus on the role of attitudes in policy. No other study has investigated the effect of individuals' attitudes on national policies, and the finding that attitudes about climate change matter is an important one for anyone who takes an interest in climate change issues, attitude formation, or the implementation of national policy.

The role of attitudes is mediated by the democratic composition of a country. If a nation has a free press, the attitudes of its citizens are much more likely to be translated into action, as evidenced by the significance of the interaction term between press freedom and attitudes. This may be because a greater variety of information and more diverse ways of expressing one's opinion are available to citizens in countries with a freer press. A freer press in this context entails not only minimal political control over the content of news media, but also the existence of legal and constitutional guarantees for freedom of expression, and how media ownership is structured.

Thus, having a free press without state or self-censorship would ensure that the information that citizens receive is varied and multifaceted, but a corollary of this is that citizens will also be uninhibited in their rights to express their opinions. Having a free press in the sense that media ownership is transparent ensures that state or industry interests, for example, are not allowed to determine what is printed in the national media. Hence, we can see why attitudes would matter differently within different media frameworks.

Additionally, the results show that in countries in which citizens have a higher level of trust in their government, reductions of greenhouse gas emissions are more successful. This might be, in a sense, a self-reported measure of the actual, perceived democratic structure of a country.

In addition, channels and societal structures seem to matter for how successful countries are in reducing their emissions. The result that countries with a higher historical reliance on coal for energy production have been more successful in reducing their greenhouse gas emissions suggests that if substitutes are available, countries are much more likely to switch from dirty production processes to cleaner ones. It is important, however, to keep in mind that the sample is drawn mainly from OECD countries, as the wealth of a country will affect the resources that the countries have available to them in switching technologies. This may sound like common sense, but knowing the extent to which it seems to matter is a powerful incentive to invest in technologies that may provide countries with more easily available clean alternatives.

Most researchers who study attitudes, perceptions and preferences do so because they sense that what people believe matters beyond the individuals' lives. To my knowledge, little – if any – research has been carried out investigating to what extent attitudes about environmental protection actually matter, particularly on a national level. The finding that people's attitudes matter on a country-wide level is one that, to my mind, justifies the study of attitudes.

Individual Attitudes and Behaviors

Having established that attitudes are in fact an important component in how national policies are implemented, a better understanding of the factors that influence these policies seems even more important than before.

From the analysis of the determinants of individual attitudes toward climate change, several intriguing results emerge. It seems clear that individual demographic characteristics are, as expected, important predictors of environmental attitudes, but the characteristics of the environmental good in question do matter. A person's preference for the specific and somewhat unique attributes that characterize climate change turns out to be an important determinant of their concern for climate change. People who express a disregard for consequences occurring far in the future are less likely to be concerned about climate change. Similarly, having a high demand for global, public goods increases the probability that people will be concerned about climate change.

The results for the probability of consciously cutting down on driving to protect the environment are slightly different, but the differences in fact seem to provide additional support for the importance of attributes. Whereas in my results a high demand for public goods increases the probability of cutting down on driving, the demand for global and long-term goods have no effect on it. If we think about the attributes of the behavior in question, cutting down on driving might be perceived as contributing to a more local and short-term environmental good, since driving adds to local air pollution. Exhibiting concern for the global, long-lived aspects of environmental issues might therefore not be an important part of someone's decision to drive less, whereas the public goods aspect is still a highly related preference.

The finding that attributes matter is important not only for policy, but also for the practice of environmental valuation. One of the debates surrounding the use of environmental valuation methods for policy decision-making concerns the validity of the conclusions drawn from such examinations. Since both the conjoint and hedonic approaches to valuation of the environment assess consumers' values of environmental goods based on the characteristics of that good, support for the link between attributes and preferences reinforces the increasing emphasis being placed on those techniques. From a policy perspective, support for this link also implies that influencing people's preferences about certain issues may have implications for their preferences regarding other goods that exhibit similar characteristics.

This research also provides an empirical confirmation of the importance of Susnstein's concept of cognitive availability as it relates to both attitudes about and actions taken to reduce the risk of climate change. In this study, variables have been included to capture both respondents' familiarity with the risk, i.e. their education and their familiarity with the science of climate change, and the salience of the risk, measured by where respondents live. As expected, the results suggest that the familiarity gained through education is likely to both increase people's concern with the environment, to motivate personal actions, and to enhance people's willingness to pay to protect the environment.

Whereas general education has an important effect on all these three aspects of environmentalism, familiarity about climate change science affects only people's

concerns about that particular issue. Being ignorant about the specific science behind climate change diminishes individual concern about the issue. Individuals who are unfamiliar with the particular risk are less likely to associate it with something that needs to be dealt with. Unfamiliarity with climate change science is not a significant determinant of whether people cut down on driving to protect the environment. If we assume that individuals do not always make the connection between driving and climate change, this is in fact quite logical. Similarly, the different measures of individuals' willingness to pay to protect the environment are not influenced by a respondents' familiarity with climate change science. The survey question about willingness to pay asks about protecting the environment in general, and does not mention climate change specifically, this result is not very surprising, as general education is already controlled for.

From a policy perspective, this has a number of important implications. First, education matters. The more we know about the world around us, the more likely we are to care about important risks facing the planet and humanity. Importantly, it also seems to matter what our education focuses on. Based on these results, increasing the amount of information about the environment that citizens receive, perhaps particularly through case studies, might have a significant impact on their concern for the environment.

The fact that urban residency matters, even after controlling for educational and income differences, lends support to the idea that the salience of a risk is also an important factor. According to this analysis, the immediacy of environmental risks appears to have greater weight than household income. It might be the case that the relationship between the different attributes of climate change and income work in different directions, and therefore complicate the role of income. On the one hand, according to standard economic theory, an increase in income would lead to an increased demand for normal goods, such as environmental services. On the other hand, Steininger's findings on spatially distant environmental effects imply that higher income groups are less likely to be concerned about these kinds of goods. The reasons for this reversed income effect warrant some further thought, and future research might investigate whether income differences occurring over time rather than in cross-sectional samples also lead to lower preferences for distant environmental goods.

Further, the age hypothesis finds support in this study. Older people are less likely to be concerned about climate change. Since some of the solutions proposed to halt climate change could be considered threatening to the prevailing social and economic order and current lifestyles, older people, who are more integrated in that order, might be less willing to accept it as a threat that needs to be dealt with. If we accept this explanation, we will also note that the status of solutions to environmental problems in the media and in political discourse becomes crucial to its acceptance by different age groups. Integrating environmental issues into a more mainstream dialogue, and presenting solutions that would be acceptable to different groups within society could be good strategies for increasing their support.

The same is true for political orientation. Whereas religion does not seem to play a role in determining environmental attitudes, liberal political views do matter. The fact that individuals exhibiting liberal political values are much more likely to demonstrate environmental concern could be seen as support for a link between liberal political views and postmaterialist values, as has been proposed in the literature. Another reason for this might be that the attributes of climate change become closely intertwined with political ideologies. Since attitudes toward public and global goods are so important in the formation of one's attitudes on climate change, and therefore also nations' policies, they will also be closely associated with people's beliefs about the role of government and of international organizations. This could be seen as an indicator of the need to present environmental issues in a nonpartisan framework, as they are problems that will affect all humans, regardless of political orientation.

Although no clear patterns become apparent that can explain all of the sample countries' behavior or their respective decisions to sign or not to sign the Kyoto protocol, stories can be told. The US, for example, is the largest emitter of greenhouse gases, and has yet to sign the Kyoto protocol or commit to any significant reductions. The percentage of people among the US respondents who report concern about climate change is below the mean in the sample. This is also true for the percentage of people who trust government information on pollution, another important factor climate change policy that emerges from this research. One of the reasons for the low level of concern about climate change may be that a disproportionate amount of the US respondents were

also unfamiliar with the science behind climate change, one of the most important predictors of individual attitudes toward climate change. Whereas attitudes are notoriously hard to affect, this last point is one that can (and should) be addressed by making available basic and accurate information about climate change.

The possibility of breaking down countries' policies and actions into smaller components as in the previous paragraph is, to my mind, one very important motivation for continuing research on the topic of attitude formation, and on the role of attitudes in policy. The finding that the role of income seems to be particularly complicated as applied to attitudes and actions on climate change warrants further research. Other directions for future research might be studies of individuals' willingness to pay for climate change, keeping in mind the three unique attributes of climate change discussed in this study.

It has always seemed to me that one of the biggest obstacles for activism, or even getting citizens to vote in their countries' elections, is a severe coordination failure. Most individuals don't think that they can make a difference. Because they don't think they can make a difference, they choose not to act upon their beliefs or attitudes or political preferences. Because they don't act upon their beliefs, there aren't enough votes or people or acts to make the votes or actions or mobilizations of other citizens effective. So, in effect, the belief that individuals can't make a difference becomes a self-fulfilling prophecy. What this study does is provide evidence against this crippling idea that individuals don't matter. Individuals' attitudes do have an effect on countries' policies on something as complicated as climate change policy. This, if anything, is an empowering finding – what you believe matters.

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Appendix A – Data

Below are all the variables in the Attitude models, and their corresponding variables in the ISSP Codebook.

VARIABLE	ISSP VARIABLE
<i>Greenhouse attitudes</i>	v38
<i>Drive Less</i>	v57
<i>Willingness to pay higher prices</i>	v19
<i>Willingness to pay higher taxes</i>	v20
<i>Willingness to accept lower standard of living</i>	v21
<i>Affinity for the global community</i>	v46
<i>Support for public goods</i>	v5
<i>Low demand for long-term goods</i>	v11
<i>Years of education</i>	v204
<i>Familiarity with climate change science (A)</i>	v32
<i>Familiarity with climate change science (B)</i>	v31
<i>Belonging to an Abrahamic religion</i>	v242
<i>Buddhism or Hinduism</i>	v242
<i>Liberal political views</i>	v246
<i>Per capita household income (\$)</i>	v241
<i>Age of respondent</i>	v201
<i>Urban residence</i>	v63

Household Income:

There were differences in how the different survey countries asked about household income, ranging from yearly to weekly, with the most common being monthly. Consequently, the yearly income figures were divided by 12 to approximate a monthly income measure, even though this cannot take into account issues like recall bias. Further, the incomes were divided by the exchange rate in 2000 (data from the Penn

World Tables), again by the PPP adjustor (also from PWT), and multiplied by 100, to facilitate interpretation of the coefficients since the scale would otherwise be in cents rather than dollars.

Greenhouse gas emissions:

Data are in metric tons of CO₂ per million constant 1995 United States dollars. is on CO₂ per GDP in 1997 and in 2000, the three years preceding the survey. From this, a percentage change in greenhouse gas emissions is constructed as follows:

$$\frac{CO_2 \text{ per GDP } 2000 - CO_2 \text{ per GDP } 1997}{CO_2 \text{ per GDP } 1997}$$

Again, the data *CO₂ per GDP* measure the quantity of carbon dioxide (CO₂) released into the atmosphere for each million dollars of Gross Domestic Product (GDP) in each country. CO₂ emissions data used here represent the mass of CO₂, a greenhouse gas produced during the combustion of solid, liquid, and gaseous fuels, as well as from the manufacture of cement and gas flaring. CO₂ emission values presented here do not include emissions from land use change or emissions from bunker fuels used in international transportation. Values were converted to CO₂ equivalent values from original values showing the mass of elemental carbon; WRI multiplied the original carbon mass by 3.66419 (the ratio of the molecular mass of CO₂ to that of carbon).

Freedom of the press:

Freedom House scores countries' press freedom on the basis of a set of 23 methodology questions, divided into three subcategories: "Legal Environment," "Political Environment," and "Economic Environment". The degree to which each country permits the free flow of news and information determines the classification of its media as "Free," "Partly Free," or "Not Free." Countries scoring 0 to 30 are regarded as having "Free" media; 31 to 60, "Partly Free" media; and 61 to 100, "Not Free" media.¹³ This variable was constructed by inverting the order of the scores so that the highest score is the country with the freest press.

¹³ From Freedom House – Publications – Freedom of the Press – Methodology.
URL: <http://freedomhouse.org/template.cfm?page=56&year=2005>

Appendix B – Regressions without country fixed effects

Independent Variable	Dependent Variable - Greenhouse Attitudes					
	Unfamiliarity A			Unfamiliarity B		
	Marginal Effect	Standard Error	P-value	Marginal Effect	Standard Error	P-value
<i>Affinity for the global community</i>	0.132	0.055	0.000	0.159	0.055	0.000
<i>Support for public goods</i>	0.039	0.030	0.001	0.042	0.030	0.000
<i>Low demand for long-term goods</i>	-0.062	0.030	0.000	-0.082	0.031	0.000
<i>Years of education</i>	-0.003	0.004	0.025	-0.002	0.004	0.000
<i>Unfamiliarity with climate change science</i>	-0.206	0.038	0.000	0.096	0.031	0.000
<i>Belonging to an Abrahamic religion</i>	-0.019	0.028	0.078	-0.018	0.029	0.000
<i>Buddhism or Hinduism</i>	0.179	0.119	0.000	0.189	0.130	0.000
<i>Liberal political views</i>	0.072	0.030	0.000	0.075	0.031	0.000
<i>Per capita household income</i>	-0.059	0.011	0.000	-0.055	0.012	0.000
<i>Age of respondent</i>	-0.001	0.001	0.000	-0.001	0.001	0.000
<i>Urban residence</i>	0.013	0.031	0.254	0.015	0.031	0.000
	<i>n</i>		8934	<i>n</i>		8699
	Pseudo R ²		0.053	Pseudo R ²		0.044

Dependent Variable - Drive Less

Independent Variable	Marginal Effect	Standard Error	P-value
<i>Affinity for the global community</i>	0.007	0.067	0.672
<i>Support for public goods</i>	0.013	0.035	0.131
<i>Low demand for long-term goods</i>	0.002	0.036	0.776
<i>Greenhouse attitudes</i>	0.054	0.035	0
<i>Years of education</i>	0.000	0.004	0.692
<i>Unfamiliarity with climate change science</i>	-0.003	0.047	0.769
<i>Belonging to an Abrahamic religion</i>	0.021	0.033	0.01
<i>Buddhism or Hinduism</i>	0.048	0.120	0.126
<i>Liberal political views</i>	0.027	0.036	0.002
<i>Per capita household income</i>	0.030	0.014	0
<i>Age of respondent</i>	0.001	0.001	0
<i>Urban residence</i>	-0.003	0.036	0.75
	<i>n</i>	8898	
	Pseudo R ²	0.0199	

Appendix C – Robustness Checks

Results for ordered probit regression

Dependent Variable – Greenhouse Attitudes

Independent Variable	Coefficient	Standard Error	P-value
<i>Affinity for the global community</i>	-0.377	0.046	0.000
<i>Support for public goods</i>	-0.148	0.026	0.000
<i>Low demand for long-term goods</i>	0.248	0.026	0.000
<i>Years of education</i>	-0.010	0.003	0.002
<i>Unfamiliarity with climate change science</i>	0.530	0.033	0.000
<i>Belonging to an Abrahamic religion</i>	0.021	0.029	0.472
<i>Buddhism or Hinduism</i>	0.025	0.121	0.836
<i>Liberal political views</i>	-0.189	0.027	0.000
<i>Per capita household income</i>	0.063	0.016	0.000
<i>Age of respondent</i>	0.005	0.001	0.000
<i>Urban residence</i>	-0.088	0.026	0.001
	<i>n</i>	8934	
	Pseudo R ²	0.0728	

Probit Regression, Dependent Variable Recoded

	1 = Extremely Dangerous, Very Dangerous, and Somewhat Dangerous			1 = Only Extremely Dangerous		
	ME	Standard Error	P-value	ME	Standard Error	P-value
<i>Affinity for the global community</i>	0.065	0.069	0.000	0.104	0.068	0.000
<i>Support for public goods</i>	0.009	0.046	0.098	0.048	0.033	0.000
<i>Low demand for long-term goods</i>	-0.045	0.045	0.000	-	0.034	0.000
<i>Years of education</i>	0.002	0.006	0.025	0.002	0.004	0.123
<i>Unfamiliarity with climate change science</i>	-0.119	0.048	0.000	-	0.046	0.000
<i>Belonging to an Abrahamic religion</i>	0.003	0.051	0.585	-	0.037	0.187
<i>Buddhism or Hinduism</i>	0.026	0.277	0.338	-	0.143	0.308
<i>Liberal political views</i>	0.030	0.047	0.000	0.043	0.035	0.000
<i>Per capita household income</i>	-0.008	0.029	0.017	-	0.021	0.004
<i>Age of respondent</i>	-0.001	0.001	0.000	-	0.001	0.000
<i>Urban residence</i>	0.001	0.048	0.910	0.035	0.034	0.000
		<i>n</i>	8934		<i>n</i>	8934
		Pseudo R^2	0.1523		Pseudo R^2	0.0809