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Analysis

# The Complex Relationship Between Households' Climate Change Concerns and Their Water and Energy Mitigation Behaviour

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ABSTRACT

This study analyses household survey data on water and energy climate change mitigation behaviour from eleven OECD countries, and provides new evidence of a complex relationship between climate change concerns and mitigation behaviour. Results confirm other studies that climate change concerns positively influence specific mitigation actions. However we also find evidence that this relationship may be more complex in the sense that adoption of mitigation behaviour may negatively feedback on households' climate change concerns. This effect more likely occurs in 'environmentally-motivated' households. Conversely, economic incentives in driving energy and water mitigation work better in non-environmentally-motivated households. This highlights that a portfolio of policies is needed to drive mitigation behaviour.



## 1. Introduction

To address climate change and reduce carbon footprints, fundamental changes in consumer, producer and industry behaviour will be needed (Adger et al., 2005). There are many social, institutional, cultural, political and technological influences that shape countries climate change behaviour, which in turn influence subsequent consumer action. Consumer action is important because aspects of daily life, such as heating and cooling homes and patterns of water use, have a significant impact on greenhouse gas emissions (Gardner and Stern, 2008). This study extends the literature on household mitigation behaviour by seeking to understand further the complex relationship between environmental concerns and specific climate change mitigation actions in two key areas: water and energy.[1]

Individuals' environmental concerns, which are a reflection of a number of factors (including among others environmental attitudes, national policies, age, personal experience, location, education, gender, political beliefs and income) are often named as one of the most important influences on mitigation behaviour (e.g. Myers et al., 2012; Zaval et al., 2014; Kaesehage et al., 2014; Lo, 2016; van der Linden, 2017). Other determinants include values (e.g. Ajzen, 1991; Dietz et al., 2005; Oreg and Katz-Gerro, 2006) and contextual influences such as economic policies (Grafton et al., 2012; Ohler and Billger, 2014).[2] Early models of pro-environmental behaviour assumed a straight relationship between environmental knowledge, environmental attitude and pro-environmental behaviour, though this was soon shown to be incorrect and led to more sophisticated theories such as the *Theory of reasoned action* and the *Theory of planned behaviour* (Fishbein and Ajzen, 1975; Ajzen, 1991).

A comprehensive review of factors determining public climate change concern and its relationship with mitigation behaviour can be found in van der Linden (2017). This author notes that prior work has neglected to correctly specify the causal relationship between climate change concerns and mitigation behaviour. We contribute to fill this gap by studying the causal impact of households' climate change concerns on specific mitigation actions in the water and energy domains. We also advance the literature by investigating a possible feedback from behaviour back to climate change concerns.

The possibility of such a feedback loop was suggested in studies using aggregate, country-level data, such as Sandvik (2008) and Lo (2016), but we are not aware of any analyses of the possible feedback

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[1] Climate change mitigation gathers actions that involve reductions in human emissions of greenhouse gases, while climate change adaptation are actions that households take in response to climate change.

[2] Regarding values, a distinction is usually made between different types of people, such as altruists, who are more likely to evaluate environmental issues based on the costs or benefits to humanity as a whole; or egoists, who define nature purely in terms of a personal basis; and biospherics who judge environmental issues on the basis of costs or benefits to ecosystems (Milfont et al., 2006). Attari et al. (2010) also emphasised the importance of individuals' perceived impact of the effectiveness of action on their behaviour.

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effect from mitigation behaviour to climate change concerns at the household level.[3] Sandvik (2008), in an analysis of 46 countries, found that gross domestic product (and per capita carbon dioxide emissions) was negatively correlated with global warming concern. This author argued that this was an illustration of the 'tragedy of the commons', and suggested that the costs that an individual has to bear (relative to all others) have a direct negative impact on their motivations for action. These findings were recently confirmed in Lo (2016) which found that wealthier countries and countries which have a greater ability to cope with the consequences of climate change are less concerned in general.

Feedback effects from mitigation actions to climate change concerns also relates to discussions in the psychological and environmental literature about how performing particular forms of behaviour can influence/change people's attitudes and beliefs (Albarracín and Wyer, 2000; Poortinga et al., 2013). This is explained by well-established social psychological consistency theories, such as cognitive dissonance and self-perception theory (Bem, 1967). In particular, there is increasing research on 'spillover' effects, both positive and negative, where undertaking one environmental action can spillover to other areas of action. As an example of such research, Thøgersen and Noblet (2012) found a positive spillover from a person acting pro-environment, to their acceptance and support for wind power, above and beyond their environmental concerns. Another related study is Cornelissen et al. (2008), which found that when marketing for lower-diagnostic environmental behaviours (an activity is regarded as diagnostic the more a household undertakes/adopts it), there was less environmental behaviour found afterwards.

In his review of the influences on the relationship between climate change concern (or climate risk perception) and behaviour, van der Linden (2017) also points out the difference between the intention to act environmentally (or having an 'environmental attitude') and actual behaviour. A meta-analysis conducted by Hornsey et al. (2016) also suggested that there was not much robust evidence to suggest a significant link between individuals' risk perceptions of climate change (especially at a global rather than personal scale) and their specific behavioural actions (they found slightly more evidence to support the link between beliefs and behavioural intentions). The gap between the plan to undertake a certain action (in relation to some environmental attitude or concerns) and actual behaviour can be observed if an individual does not have complete control to perform the action (Ajzen, 1991) for reasons that may be related, among other things, to responsibility (e.g. ownership issues) and practicality (e.g. resources available) (Kollmuss and Agyeman, 2002). The findings from these studies suggest that there may be some form of cognitive dissonance occurring in environmental attitudes after performing a substantial environmental action. In this article, we follow on from insights from social psychological consistency theories and try to discern whether households who invest in water and energy mitigation behaviour may, as a consequence, feel less concerned about climate change.

This question about the bi-directional relationship between climate change concerns and water and energy mitigation behaviour is addressed using a unique and highly detailed OECD (Organisation for Economic Co-operation and Development) household survey database across eleven countries. We test for the presence of a two-way causality (i.e. concerns driving behaviour and behaviour influencing concerns) using a control function approach. This approach, which relies on instrumental variables, is computationally simple and allows testing for the presence of endogeneity bias in the regression model of interest, and to quantify the size of the bias.[4] Our results suggest a plausible negative feedback between expensive mitigation behaviour and environmental concerns for households who declare strong environmental motivations.

## 2. Data Description

The data is from a 2011 household survey on Environmental Policy and Individual Behaviour Change conducted by the OECD Environment Directorate (see OECD, 2014). 12,202 households were surveyed in eleven OECD countries: Australia, Canada, Chile, France, Israel, Japan, Korea, the Netherlands, Spain, Sweden and Switzerland. In each country, the online survey sample was stratified according to age, gender, income and region. Households were surveyed on their opinions, attitudes and behaviour related to the environment in five areas: waste recycling, water use, energy use, transportation, and food.[5] The main variable of interest in this study is respondents' climate change concerns, which are measured on a scale from 0 (climate change is not serious at all) to 10 (climate change is extremely serious). We assess its influence on households' mitigation behaviour in the water and energy domains and test for a possible feedback effect (that is, the possibility that behaviour could in turn influence climate change concerns). Definitions and summary statistics are shown in Table 1.

One important aspect that needs considering when modelling mitigation behaviour is the cost of such behaviour. By cost we mean both the dollar cost of buying/installing a certain technology or product and also the opportunity cost of the time involved by households to install an equipment or adopt some behaviour. Some behavioural household change (e.g. curtailing habits) is very low-cost in terms of financial outlays, while other behavioural change (e.g. adoption of efficiency-improving solar panels) is very high-cost. This study adopts Gardner and Stern (2008) terminology of 'curtailment mitigation' (using equipment less frequently or intensively) and 'efficiency-improving mitigation' (e.g. installation of more efficient equipment) to delineate mitigation behaviour into two groups (primarily low-cost versus high-cost adoption).[6] By modelling specific mitigation actions, we are therefore attempting to avoid the problem that has been identified in the literature of trying to model an aggregate index of total environmental mitigation behaviour, as it is possible that climate change concern may impact differently on various behaviours (van der Linden, 2017).

Four measures of household mitigation behaviour are built: two curtailment behaviour indexes, one each for water and energy, that account for habits/routines or behaviour that does not cost much in terms of time or money (Table 2). Curtailment indexes include actions such as turning off lights when leaving a room and watering the garden in the coolest part of the day to reduce evaporation, for the energy- and water-related indexes respectively. Two efficiency-improving behaviour indexes are built that account for adoption of costly water-saving and energy-saving equipment/technology such as dual-flush toilets or energy-efficient windows.

Our indexes do not necessarily represent the 'ease' of adoption. For example, it may be easier for some households to install costly solar panels than it is to change their habits to turn off lights. Research has shown that many people repeat well-practiced actions regardless of intent. Even if their intentions change, changing their habits takes a lot of willpower and energy to override the habit response, and the

[3] Reverse causality has been found between irrigators' climate change concerns and their farm adaptation behaviour (Wheeler et al., 2013).

[4] Technically, in a statistical model of the form $Y = X\beta + e$, endogeneity arises when the X variable is correlated with the error term e. However, it is important to note that endogeneity may be present for other reasons than a two-way causality relationship, for example because of omitted variables or selection bias. In the environmental economics literature, several authors have shown the importance of correcting for the endogeneity of risk perceptions in models describing households' averting decisions: perceived risk about an environmental threat is a driver of averting decisions but averting decisions do, in turn, shape households' risk perceptions (see Bontemps and Nauges, 2016, for a discussion of this literature).

[5] This article first attempted to analyse all five areas of behaviour. Due to measurement issues for some areas (food and waste), space constraints, the synergy between energy and water behaviour and the fact that energy behaviour contributes the most to reducing greenhouse gas emissions (Gardner and Stern, 2008), we ended up focussing on water and energy.

[6] Gardner and Stern (2008) argued that efficiency-improving actions are more effective mitigation tools than curtailment actions (in the sense the one-off purchase has immediate lasting effects of reducing emissions while curtailment actions must be repeated continuously over time). But, it is important to note that both types of mitigation behaviour are seen as important in reducing greenhouse gas emissions because if curtailment mitigation behaviour is more widely adopted than efficiency-improving mitigation it may lead to greater reduction of emissions overall (Attari et al., 2010).