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Working Paper

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IZA Discussion Papers, No. 15620

Provided in Cooperation with:
IZA – Institute of Labor Economics

Suggested Citation: Lockwood, Ben; Powdthavee, Nattavudh; Oswald, Andrew J. (2022) : Are Environmental Concerns Deterring People from Having Children?, IZA Discussion Papers, No. 15620, Institute of Labor Economics (IZA), Bonn

This Version is available at:
http://hdl.handle.net/10419/267357

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ISSN: 2365-9793

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ABSTRACT

Are Environmental Concerns Deterring People from Having Children?*

Are 'green' environmental concerns -- about climate change, biodiversity, pollution -- deterring today's citizens from having children? This paper, which we believe to be the first of its kind, reports preliminary evidence consistent with that increasingly discussed hypothesis. Our study has a simple longitudinal design. It follows through time a random sample of thousands of initially childless men and women in the UK. Those individuals who are committed to a green lifestyle are found to be less likely to go on to have offspring. Later analysis adjusts statistically for a large set of potential confounders, including age, education, marital status, mental health, life satisfaction, optimism, and physical health. Because there might be unobservable reasons why those who are pro-environmental may be less likely to want a child, and to try to ensure that the finding cannot be explained by selection and omitted variables, the paper explores Oster's (2019) bounds test. The paper's final estimated effect-size is substantial: a person entirely unconcerned about environmental behaviour is found to be approximately 60% more likely to go on to have a child when compared to a deeply committed environmentalist.

JEL Classification: J1, Q50
Keywords: fertility, child-bearing, climate change, environment, green

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* DATA AVAILABILITY: The data set is publicly available. FUNDING STATEMENT: No explicit funding source. CONFLICT OF INTEREST: The authors declare none. ETHICS APPROVAL: Not applicable, although approval was gained by the original data-set collectors. PATIENT CONSENT STATEMENT: Not applicable. PERMISSION TO REPRODUCE FROM OTHER SOURCES: Not applicable. ACKNOWLEDGEMENTS: Amanda Goodall; Stefano Piano.

"The couples rethinking kids because of climate change". BBC October 1, 2019
https://www.bbc.com/worklife/article/20190920-the-couples-reconsidering-kids-because-of-climate-change

"To breed or not to breed?" New York Times November 21, 2021

"I am choosing child-free living. I don't want to have kids in a world that may end due to greed and stupidity"
"Won't be having more than two kids. There's already too many people for the planet to sustain"
Financial Times, Chrisostomo (2021)

"More than a third of millennials share Rep. Alexandria Ocasio-Cortez's worry about having kids while the threat of climate change looms." Business Insider, 2019, March 4.

"Climate change is making people think twice about having children" CNBC.com August 12, 2021
https://www.cnbc.com/2021/08/12/climate-change-is-making-people-think-twice-about-having-children.html

INTRODUCTION

One of the significant decisions that human beings make in their lives is whether to have children. This paper documents longitudinal evidence consistent with the hypothesis that committed environmentalists in today's rich nations are now reluctant to bring children into the world. To our knowledge, the current study is the first of its kind. Nevertheless, there is growing media discussion of such ideas. There is also a formal precedent for such an inquiry: we build upon a foundation of qualitative evidence and theoretical ideas provided by previous scholars.

Schneider-Mayerson and Leong (2020), for example, design a survey of 607 US-Americans between the ages of 27 and 45. Approximately 60% of respondents report being "very" or "extremely concerned" about the carbon footprint of procreation, and 96% of respondents are "very" or "extremely concerned" about the well-being of their existing, expected, or hypothetical children in a climate-changed world. This is due to an overwhelmingly negative expectation among participants of a future with climate change. Using the same data, Schneider-Mayerson (2021) concludes that the evidence suggests it is now necessary to add "reproductive plans and choices to the range of ways in which individuals conceive of themselves and act as environmental political actors." Gordon (2021) investigates whether extrinsic risk (i.e., external factors that pose a risk to an individual's life, e.g., COVID-19) and existential risk (i.e., risks with outcomes that

threaten the existence of humans as a species, e.g., climate change) have similar or different relationships with reproductive decision-making. In that study, approximately 300 young UK adults are asked to indicate their ideal number of children, ideal age to start having children, and whether their desire for a child has recently changed. Participants are also questioned about their experiences of COVID-19 and about their beliefs about climate change. Although the study finds that knowing people who have been hospitalized with or died of COVID-19 is associated with a greater ideal number of children, there is no clear empirical support for a relationship between climate-change beliefs and reproductive decision-making.

Arnocky and colleagues (2012) examine the relationship between individual environmental concern, fertility intentions, and attitudes toward reproduction in a sample of 139 Canadian university students. General environmental concern and pollution-related health worries predict a less positive attitude toward having children. Helm et al. (2021) and Nakkerud (2021) discuss the possible ethical and philosophical issues that a potential parent might internally debate. In early and more general work, Ghimire and Mohai (2005) use multiple data sets from Nepal to try to assess the impact of environmental views on contraceptive use in a rural agricultural setting. They show that perceptions about certain aspects of the environment are related to individuals' subsequent use of contraceptives. Individuals who think that their environment-agricultural productivity has deteriorated are more likely to use contraceptives than those who believe that their environment has improved or has remained about the same.

This previous research is important. Nevertheless, the literature is, first, cross-sectional in nature and, second, is able only to scrutinize people’s statements about attitudes to having children in the future. As far as we know, no previous study has been able to adopt a longitudinal regression-equation approach and to study actual births.

It should be recorded that our work fits, when viewed more broadly, within a longstanding literature on the factors that influence attitudes to fertility. *'Worry', rather generally, appears to deter fertility*. There is a great deal of published evidence -- consistent with natural intuition -- that fertility levels are influenced by feelings of security and insecurity about external factors in society (Yule 1906, Cain 1983, Pebley 1998). A review of the literature by Sobotka et al. (2011), for example, demonstrates how a rise in the unemployment rate can act to dissuade people from having children. The authors point out that the fertility rate tends to be pro-cyclical over the economic business cycle. These cyclical movements influence especially the timing of child-bearing, the authors argue, although they only rarely leave an imprint on overall cohort fertility levels. Further North American evidence for a connection between the economy and fertility decisions comes from the work of Currie and Schwandt (2014), Schneider's (2015) analysis of fertility across different areas of the USA after the Great Recession, Seltzer's (2019) work on the consequences of the loss of manufacturing and other goods-producing businesses, and from Hofmann et al. (2017), Alam and Bose (2020), and Glavin et al. (2020). There is equivalent evidence for other countries (Ahn and Mira 2001, Kohler and Kohler 2002, Arolas 2017, and Lyons-Amos and Schoon 2018). War and conflict also lead to reduced fertility. Much of the evidence comes from demographers' studies of birth rates in developing nations: as in Lindstrom and Berhanu (1999), Agadjanian and Prata (2002), Woldemicael (2008), Islam et al. (2016), Kraehnert et al. (2019), and Thiede et al. (2020). Trust in the nature of a society, more generally, is known to be conducive to greater fertility (Aassve et al. 2021). Barrett et al. (2020) discuss social influences, including externalities on other families' reproduction decisions, on human child-bearing.

EMPIRICAL ANALYSIS

The data set used in the study is the so-called 'Understanding Society' UKHLS (the annual United Kingdom Household Longitudinal Survey), which is explained at, and is downloadable from, site https://www.understandingsociety.ac.uk. This data set is a random sample, of size approximately 10,000, of the UK population, who are tracked through time.

The later analysis draws particularly on a sub-sample of approximately 6000 individuals. The study's main focus, however, is on approximately 2300 people who were all childless in Wave 4 of the survey (that was year 2012). To consider the typical timespan of fertility in human beings, this sub-sample was constructed so that it consisted of women, aged<=45, and men, aged<=60, who reported that they had no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. In Wave 4, they also reported for the first time their views and behaviour on environmental issues. The current paper then examines outcomes in Wave 10, i.e., in the year 2018.

The paper's methodology uses a version of the 'prospective' approach common in disciplines such as epidemiology. It estimates longitudinal regression equations to examine whether people's environmental views and behaviour in time T, today, have predictive power for who does, and who does not, go on to have a biological child by a later period (especially, but not only, year T+6).[1]

To assess the 'green' environmental credentials of individuals, the analysis focuses especially people's answers to a set of questions about the following topics:

Do not leave TV on standby at night

Switch off lights in rooms that aren't being used

Keep the tap running while you brush your teeth

[1] The STATA code used in this paper's analysis can be downloaded from an online repository website: https://github.com/npowdthavee/proenvironchildren.

Put more clothes on when rather than turning on heater

Not buy something because of too much packaging

Buy recycled paper products such as toilet paper or tissues

Take your own shopping bag when shopping

Use public transport rather than travel by car

Walk or cycle for short journeys less than 2-3 miles

Car share with others who need to make a similar journey

Take fewer flights when possible

It is helpful to draw upon these to produce a summary measure -- a simple quantitative proxy for greenness -- from these different elements. The paper concentrates especially upon these data on what might be called actions rather than data on reported attitudes alone.

For the econometric estimation, principal factor analysis (PFA) is used. It is similar, although not identical in interpretation, to principal component analysis (PCA), which creates a weighted linear combination of a set of variables. A PFA approach instead generates a latent variable within the model. That latent variable can be thought as an underlying single factor that itself leads to the observed answers to the list of questions about environmental behaviour. [2]

Hence a principal factor is later calculated. This variable in the later regression tables is termed '*Pro-environmental behaviours/habits'*. Two other measures are included in the formal statistical analysis: they are also principal factors. These are derived from different sets of questions in the survey (described below) and primarily assess beliefs -- rather than actions -- about a person's green lifestyle and climate-change awareness. They are denoted '*Beliefs about own green lifestyle'* and '*Climate-change opinion and awareness'*.

[2] However, this is not crucial. A later Table 4A in the Appendix, which gives almost identical conclusions, could be seen as a basic version of the PCA.

Nevertheless, the spirit of the paper's analysis does not require the use of principal factors. The main analysis is repeated in the Appendix in a simpler and cardinal way as a check on robustness, without relying on any principal-factor calculations, by using a collection of variables covering each individual question.

RESULTS

The paper's central finding is reported in tables such as Table 1. This table gives regression equations (two Probit equations) in which the probability of having had a child by Wave 10 (which is six years after the person's green characteristics here were initially measured) is regressed on a large number of independent variables that are likely predictors of future fertility decisions. The sample here is restricted to those men and women who had no child in Wave 4 of the survey. A collection of robustness tests, under different assumptions, is available in the Appendix.

Table 1 contains two columns of results. The estimated coefficients are marginal effects obtained from the Probit model. In Model 1 of Table 1, given in the first column of the table, the probability function is allowed to depend on the three principal factors that measure environmentalism in different ways, and on an individual's gender, education, income, marital status, age, and (self-reported) health. The key variable, for pro-environmental behaviours, enters with a coefficient of -0.023 and a small standard error. Strong environmentalists are thus more likely to remain people who do not have children.

The size of the estimated effect in Table 1's first column can be thought of in the following way. Consider a one-standard deviation (SD) rise in pro-environmental behaviour as measured in Wave 4 of the survey. This would be associated, six years later, with a 2.3 percentage point reduced probability of having given birth to a biological child when compared to the representative person in the sample. The mean of the dependent variable here is approximately 0.2, which

corresponds to a 20% probability of having a child over the period. Thus, after subtracting the 2.3 percentage points, that estimate would imply a reduction to a 17.7% probability of having a first child during those six years.

That calculation is for a one-SD alteration around the mean (in people's measured 'greenness'). To think about the implications of a starker comparison, consider an extremely committed environmentalist, who is, for example, two-SDs above the mean.[3] At the other end of this hypothetical spectrum, consider someone who is greatly unconcerned with behaving in an environmentally conscious way, and is two-SDs below the mean individual. In this case, the comparison is striking. It is between a probability of having a birth of 0.154 for the former (the highly environmental person) and 0.246 for the former (the highly non-environmental person). That difference, admittedly based on a deliberately wide contrast, is a large one. It implies that, ceteris paribus, the highly non-environmental person's probability of producing offspring is approximately 60% greater than the committed environmentalist[4]. Put in an alternative way, highly environmental people can in an aggregate sense be estimated to have 154 first-borns compared to every 246 first-borns from extreme non-environmentalists.

There is a potential flaw in this argument. An important, and rather human, consideration not captured in the first column of Table 1 is the general influence of optimism and morale (which are known, as common sense suggests, to influence child-bearing choices). It might be argued that the lower fertility of committed environmentalists is not actually about their environmental actions or views. It is, rather, would go this version of the argument, that they are less optimistic, and less cheerful, people in a general sense.

[3] Here, for illustrative purposes, we will ignore the fact that a Probit equation is a non-linear estimator.
[4] Derived from 0.246/0.154.

The second column of Table 1 checks for such a potential weakness. It includes, on the right-hand side of the equation, information from a feeling-optimistic variable that is collected in the Understanding Society data set, along with a life-satisfaction measure, and a mental-health measure. Reassuringly for the ideas put forward in this paper, the key coefficient is hardly affected by the inclusion of these extra 'morale' kinds of variables.

It is noticeable that in Table 1 the other two environmental principal factors (on beliefs and climate-change opinions) have small coefficients with large standard errors. Perhaps one possible explanation for this is that actions may speak louder than words: there may be more reliable information about the strength of a person's environmentalist credentials in questions asking them literally what they do in certain environmental situations.

The environmental-behaviour principal factor variable is derived from eleven underlying questions. To probe further the likely mechanisms, Table 2 reports a form of disaggregation that is simpler than, and does not depend on, PFA analysis per se. It can be seen in Table 2 that seven out of the eleven components of Pro-Environmental Behaviours/Habits enter negatively, and in four of the seven cases it is possible even individually to reject the null of zero at the 95% confidence level. The F tests, which offer an appropriately general check, confirm the relevance of the first of the principal factors in Table 2.

Tables A1 and A2 in the Appendix provide background information. The latter gives the mean values for the main variables used in the statistical analysis.

Table 2 focuses on individuals' lives after six ensuing years (period t+6). Might it be that there is something special, or potentially mistaken, about relying on a comparison over six years, namely between Wave 4 and Wave 10? To check for that, Figure A1 reports the equivalent results (to Table 1) for each of a number of different time lags. The key finding emerges as a robust one:

it is not dependent on the Wave 4 to Wave 10 contrast.

A further potential concern, as with any longitudinal study, is that of differential attrition from the panel. Table A3 in the Appendix considers that. In the second column, an Inverse Mills Ratio is included in the equation.[5] The coefficient on pro-environmental behaviours alters only slightly, and becomes if anything larger, at -0.028.

Table A4 switches to estimation with an elementary cardinal index of environmental behaviours (and similarly for the beliefs and awareness variables). This cardinal method simply adds up the integer points assigned, in an arithmetical way, when creating a sum of environmental behaviours from the various questions in the Understanding Society data set. Again, the key coefficient on pro-environmental behaviours is negative (at -0.025) and is significantly different from zero at the 95% confidence level.

Might this study's result be true only for first-borns? Another, and perhaps particularly important, extra check is included in the Appendix. Table A5 tests, and provides empirical support for, the idea that the estimated pattern discussed in this paper goes substantially beyond the birth of a first child. The dependent variable in Table A5 is instead the total number of biological children that a person has had – rather than whether there was at least one new child born. Here in Table A5, in two different samples of individuals, pro-environmental behaviours/habits enter once more in a negative and statistically significant way.

A different way to test the paper's hypothesis is to use time-to-event methods. As a

[5] We compute the Inverse Mills Ratio using a selection variable that equals one if the individual is observed in both T and T+6 and zero otherwise; this then forms the dependent variable in a selection equation. Our instrumental variable is a categorical variable representing the interviewer's observation on whether the respondent is cooperative at giving the interview. The exclusion requirement is thus that the attrition rate should be correlated with the interviewer's perception of how cooperative the interviewees are during the interview (i.e., people who do not seem to want to cooperate at t are taken to be more likely to drop out in T+6) but not be correlated with their sense of environmentalism in T.

robustness exercise, Tables A6 and A7 in the Appendix report Cox hazard models. The paper's conclusions continue to go through. In some cases, the finding becomes even stronger.

CHECKING FOR SELECTION AND ENDOGENEITY

This paper uses observational data. Following the spirit of the prospective methodology used in much of the epidemiological and medical literature, it relies on a regression-adjusted correlation between lagged environmentalism[6] and much-later child birth.

How serious is it that we are unable here to run an experiment in which people's environmental views are randomly assigned? Might it be that voluntary childlessness in the data set is because of some unmeasured personality or other variable, Z, which is merely correlated with feelings of concern with the environment? If that were the case, it could appear, erroneously, that environmentalists were opting for 'green' reasons to have no children.

It is possible to probe this, as in Table A8, by using a recent testing technique due to Emily Oster (2019). Oster points out that a traditional approach to evaluating robustness to omitted-variable bias, and one implicitly referred to in the current paper's earlier discussion, is to observe whether there are marked changes in coefficients after the inclusion of controls. Statistical investigators across a wide range of literatures take stability in their key coefficient of interest as evidence in their empirical study that selection-bias problems are likely to be minor. There is, the author argues, building partly on Altonji et al. (2005), an inherent difficulty with this (common) method. The reason is that what matters is the potential influence of variables that statistical investigators are, by definition, unable to observable. As Oster explains, the routinely used method is informative only under particular conditions, namely, if selection on observables is also informative about selection on unobservables.

[6] The paper's approach is also related to the economist's notion of Granger causality.

Oster (2019) sets out an extension of the theory that connects bias explicitly to coefficient stability. She shows that it is necessary to take into account both coefficient movements and R-squared movements. Oster develops a formal statistical 'bounding' approach, and provides various validation exercises. It is important to note that Oster's test of coefficient stability is run using a linear regression model (so the estimates look superficially different from those obtained using the Probit model in Tables 1 and 2).

Table A8 implements the test procedure of Oster (2019). Using her method, Oster (2019) argues that results should be considered robust where $\delta>1$, while a negative δ implies that the unobservables have to correlate with the treatment in the opposite direction as the observables to drive the coefficient to zero. It can be seen in Table A8 that that the estimated δ for pro-environmental behaviour suggests that for the true value of the key coefficient here to be zero would require selection on unobservables to be correlated in the opposite direction as the observable characteristics, and be half as large as selection on observed controls (which is, however, smaller than the recommended cut-off statistic in Oster 2019). As a further check, Table A9, which is presented for brevity in compressed form, provides estimates with three different methods (OLS, Probit, Logit). The results are almost identical under each estimation technique.

CONCLUSIONS

Are environmental concerns now deterring citizens [7] in rich nations from having children? We provide some of the first formal econometric evidence consistent with that idea. The paper tests for, and documents evidence of, a longitudinal link between a person's environmentalism and their later (reduced) fertility.

Although the current study is, as far as we know, the first of its kind, there has been previous

[7] As discussed in, for example, the newspaper and media references given at the start of this paper.

conceptual and empirical discussion (described in this paper's introduction) on the possibility that there might be such a link between environmental worry and the desire not to procreate. It includes important early research by, for example, Matthew Schneider-Mayerson (2021) and Sabrina Helm and colleagues (2021). Nevertheless, the existing published work is cross-sectional and records people's statements about attitudes to having children, rather than measuring whether children are actually born. No earlier research, to our knowledge, has been able to draw upon data on births within a longitudinal research design.

The paper's principal contribution is illustrated in Table 1, on a sample of 2300 childless adults from the United Kingdom, and in Table A5, on a sample of 6000 UK adults with or without prior children. Further checks and robustness tests are provided in Table 2, in Figure A1, and in the online Appendix. The conclusion is that people who are strong environmentalists in year T are less likely to have children by year T+6[8]. That may be because they fear those children will have a bleak future or because the act is consistent with a pro-environmental lifestyle. The calculated effect-size is substantial. After holding constant a range of other influences, a person entirely unconcerned about environmental behaviour is estimated here to be approximately 60% more likely to have a child when compared to a truly committed environmentalist.[9]

The social and economic issues discussed here seem fundamental ones for our planet and modern society. They require future attention from researchers.

[8] Although not solely in T+6. See Figure A1.

[9] A word of caution is necessary here. This calculation should be kept in perspective. It is based, as described in an earlier section, on an *extreme* four standard-deviation comparison between a person who is near the bottom of the environmental-concern distribution to one who is close to the top of the environmental-concern distribution.

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Table 1: Probit Equation for Having at Least One Biological Child in Wave 10 of the Survey (and Had No Children in Wave 4)

(The coefficients below are estimated marginal effects)

Independent variables – all measured in Wave 4, i.e., period *t*	Dependent variable: Have at least one biological child in Wave 10, i.e., period *t*+6			
	Coeff	*95% C.I.*	*Coeff*	*95% C.I.*
Measures of environmentalism in Wave 4 (Principal Factor Components)				
Pro-environmental behaviours/habits	-0.023***	-0.041 - -0.006	-0.024***	-0.041 - -0.006
Beliefs about own green lifestyle	-0.005	-0.023 - 0.013	-0.005	-0.023 - 0.012
Climate-change opinion and awareness	0.006	-0.012 - 0.024	0.006	-0.012 - 0.023
Socio-demographic status in Wave 4				
Female	0.022	-0.008 - 0.051	0.016	-0.013 - 0.045
Highest education: First degree	0.059	-0.084 - 0.202	0.063	-0.081 - 0.207
Highest education: A-level	0.034	-0.114 - 0.183	0.039	-0.111 - 0.188
Highest education: GCSE	0.041	-0.113 - 0.195	0.054	-0.104 - 0.211
Highest education: Other qualifications	0.017	-0.156 - 0.189	0.025	-0.152 - 0.202
Log of equivalent household income	0.013	-0.016 - 0.042	0.012	-0.016 - 0.040
Married	0.217***	0.173 - 0.261	0.204***	0.161 - 0.248
Separated	0.198*	-0.004 - 0.401	0.176*	-0.022 - 0.374
Divorced	0.112**	0.009 - 0.215	0.101**	0.001 - 0.201
Age: 20-24 years old	0.118***	0.042 - 0.195	0.118***	0.041 - 0.194
Age: 25-29 years old	0.296***	0.208 - 0.384	0.306***	0.217 - 0.395
Age: 30-34 years old	0.245***	0.158 - 0.331	0.260***	0.172 - 0.348
Age: 35-39 years old	0.071*	-0.009 - 0.150	0.083**	0.002 - 0.164
Age: 40-44 years old	-0.114***	-0.167 - -0.060	-0.104***	-0.159 - -0.049
Age: 45-49 years old	-0.105***	-0.168 - -0.042	-0.098***	-0.163 - -0.033
Age: 50-54 years old	-0.129***	-0.185 - -0.074	-0.124***	-0.179 - -0.069
Age: 55-59 years old	-0.173***	-0.238 - -0.109	-0.169***	-0.233 - -0.106
Self-reported health in Wave 4				
Very good	0.002	-0.031 - 0.035	0.011	-0.022 - 0.045
Good	-0.028	-0.068 - 0.012	-0.014	-0.056 - 0.028
Fair	-0.057**	-0.111 - -0.003	-0.042	-0.101 - 0.018
Poor	-0.096*	-0.199 - 0.007	-0.089	-0.196 - 0.018
Feeling optimistic about the future in Wave 4				
Rarely			-0.051	-0.124 - 0.022
Some of the time			-0.064	-0.140 - 0.013

Often		-0.029	-0.108 - 0.050
All the time		0.026	-0.073 - 0.124
Psychological wellbeing in Wave 4			
Overall life satisfaction (7-point scale)		0.012**	0.000 - 0.025
Mental distress (GHQ-12: Caseness)		0.005	-0.001 - 0.011
Observations	2,270	2,270	
Log likelihood	-852.279	-841.892	

Note:

The sample here consists of women aged<=45, and men aged<=60, who reported that they had no biological children in the household in Wave 4 and had zero in any previous waves, i.e., Waves 1 to 3. Wave 4 of the survey was the year 2012, and Wave 10 was the year 2018.

The coefficients, here and in other Probit equations in the paper, can be interpreted directly as marginal effects at the means. The three principal factor components are constructed so that higher numbers imply positive environmentalism or awareness, and standardised to have a mean of 0 and a standard deviation of 1. Other controls include a set of UK regional dummies.

The constituent components that make up each of the three principal factors are listed in Table 2.

The mean of the dependent variable is approximately 0.2.

GHQ is a mental-illhealth score, used by UK doctors, and aggregates answers to 12 questions about how well someone has been sleeping, whether they have been feeling depressed, feelings of worthlessness, etc. Caseness is a cut-off level that refers to those cases who are judged likely to benefit from specialist psychiatric help.

In this table, and throughout, stars indicate statistical-significance levels (* 10%; ** 5%; *** 1%). Ninety-five percent confidence intervals are given.

Table 2: Disaggregating the Component Questions that Lie Behind the Make-Up of the Three Principal Factors

	Dependent variable: Have at least one biological child in Wave 10, i.e., period *t*+6	
Independent variables – measured in Wave 4, i.e., period *t*	*Coeff*	*95% C.I.*
Pro-environmental behaviours/habits		
Do not leave TV on standby at night	-0.022***	-0.036 - -0.008
Switch off lights in rooms that aren't being used	-0.001	-0.016 - 0.014
Keep the tap running while you brush your teeth	0.007	-0.008 - 0.021
Put more clothes on when rather than turning on heater	-0.017**	-0.033 - -0.002
Not buy something because of too much packaging	-0.003	-0.021 - 0.015
Buy recycled paper products such as toilet paper or tissues	-0.025***	-0.042 - -0.007
Take your own shopping bag when shopping	0.004	-0.011 - 0.019
Use public transport rather than travel by car	-0.038***	-0.056 - -0.019
Walk or cycle for short journeys less than 2-3 miles	0.023***	0.006 - 0.040
Car share with others who need to make a similar journey	0.002	-0.012 - 0.015
Take fewer flights when possible	0.011	-0.006 - 0.028
Beliefs about own green lifestyle		
How one feels about current lifestyle and the environment	-0.005	-0.020 - 0.011
Changes to help environment need to fit with lifestyle	0.010	-0.004 - 0.025
Current lifestyle is environmentally friendly	-0.005	-0.023 - 0.013
Pay more for environmentally friendly products	-0.006	-0.021 - 0.010
Climate change-change opinions		
Being green is an alternative lifestyle	0.004	-0.012 - 0.019
Behaviour contributes to climate change	-0.000	-0.016 - 0.016
Soon experience major environmental disaster	0.003	-0.013 - 0.019
Environmental crisis has been exaggerated	-0.005	-0.022 - 0.012
Climate change too far in future to worry	0.009	-0.009 - 0.028
Not worth UK making changes	-0.005	-0.023 - 0.012
Climate change is beyond control	0.001	-0.014 - 0.016
UK will be affected by climate change next 30 years	0.001	-0.014 - 0.017
F-test on pro-environmental behaviours/habits	44.59 (p=.000)	
F-test on beliefs about own green lifestyle	2.73 (p=.604)	
F-test on climate-change opinions	1.87 (p=.985)	
Observations	2,270	
Log likelihood	-821.452	

Note:

The sample consists of women, aged<=45, and men, aged<=60, who reported to have no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. The coefficients can be interpreted directly as marginal effects at the means. Each pro-environmental variable is adjusted to have higher values represent being more pro-environment and/or more aware about the climate change. They are standardised to have a mean of 0 and a

APPENDIX (AS SUPPLEMENTARY MATERIAL ONLINE)

Table A1: Principal Factor Analysis on Pro-Environmental Variables

a) Pro-environmental behaviours/habits

Variables	Principal Factor	Uniqueness
Do not leave TV on standby at night	0.1459	0.9361
Switch off lights in rooms that aren't being used	0.1833	0.8825
Keep the tap running while you brush your teeth	0.2593	0.8799
Put more clothes on when rather than turning on heater	0.3006	0.8622
Not buy something because of too much packaging	0.4668	0.7254
Buy recycled paper products such as toilet paper or tissues	0.4542	0.7477
Take your own shopping bag when shopping	0.2866	0.8332
Use public transport rather than travel by car	0.3804	0.7456
Walk or cycle for short journeys less than 2-3 miles	0.4360	0.7150
Car share with others who need to make a similar journey	0.2805	0.8476
Take fewer flights when possible	0.3983	0.8074

Note: Factor 1's eigenvalue = 1.29.

b) Beliefs about own green lifestyle

Variables	Principal Factor	Uniqueness
How one feels about current lifestyle and the environment	0.3125	0.9018
Changes to help environment need to fit with lifestyle	0.3453	0.8624
Current lifestyle is environmentally friendly	0.2888	0.8937
Pay more for environmentally friendly products	0.4481	0.7991

Note: Factor 1's eigenvalue = 0.50.

c) Climate-change opinion and awareness

Variables	Principal Factor	Uniqueness
Being green is an alternative lifestyle	0.4464	0.7674
Behaviour contributes to climate change	0.3520	0.7874
Soon experience major environmental disaster	0.5166	0.5606
Environmental crisis has been exaggerated	0.6775	0.5390
Climate change too far in future to worry	0.7000	0.4785
Not worth UK making changes	0.6382	0.5692
Climate change is beyond control	0.4771	0.6645
UK will be affected by climate change next 30 years	0.4240	0.7520

Note: Factor 1's eigenvalue = 2.35.

Table A2: Descriptive Statistics

	No child in t+6 (*N*=1,885)		Have at least one child in t+6 (*N*=481)	
Variables	**Mean**	**S.E.**	**Mean**	**S.E.**
Measures of environmentalism				
Pro-environmental behaviours/habits	-.121	.021	-.148	.042
Beliefs about own green lifestyle	-.115	.023	-.166	.045
Climate-change opinion and awareness	-.114	.023	.01	.044
Socio-demographic status				
Female	1.328	.011	1.536	.023
Highest education: First degree	.436	.011	.638	.022
Highest education: A-level	.284	.01	.225	.019
Highest education: GCSE	.192	.009	.116	.015
Highest education: Other qualifications	.055	.005	.015	.005
Log of equivalent household income	10.19	.018	10.365	.033
Married	.288	.01	.428	.023
Separated	.016	.003	.008	.004
Divorced	.097	.007	.019	.006
Age	39.015	.308	30.403	.299
Self-reported health	2.269	.023	1.967	.038
Overall life satisfaction (7-point scale)	5.092	.033	5.389	.06
Mental distress (GHQ-12: Caseness)	1.599	.065	1.69	.129

Note:
It might be wondered why the means for the Principal Factors are not zero. The reason is that the pro-environmental variables were normalized before running the regression, that is, on the larger, unconditional sample. These are the descriptive statistics for the conditional sample used here.

Table A3: Correcting for Panel Attrition by Including Heckman's Inverse Mills Ratio

	Dependent variable: Dropped out by Wave 10		Dependent variable: Have at least one biological child in Wave 10, i.e., period *t*+6	
Independent variables – measured in Wave 4, i.e., period *t*	*Coeff*	*95% C.I.*	*Coeff*	*95% C.I.*
Measures of environmentalism				
Pro-environmental behaviours/habits	-0.074***	-0.096 - -0.053	-0.028**	-0.054 - -0.002
Beliefs about own green lifestyle	0.028**	0.006 - 0.051	-0.004	-0.022 - 0.015
Climate-change opinion and awareness	-0.039***	-0.062 - -0.017	0.003	-0.016 - 0.023
Socio-demographic status				
Female	-0.053***	-0.090 - -0.017	0.014	-0.019 - 0.046
Highest education: First degree	-0.230***	-0.302 - -0.157	0.050	-0.102 - 0.203
Highest education: A-level	-0.140***	-0.216 - -0.065	0.031	-0.120 - 0.182
Highest education: GCSE	-0.149***	-0.223 - -0.074	0.045	-0.113 - 0.203
Highest education: Other qualifications	-0.073*	-0.159 - 0.014	0.021	-0.154 - 0.197
Log of equivalent household income	-0.061***	-0.089 - -0.033	0.009	-0.023 - 0.041
Married	-0.074***	-0.127 - -0.021	0.199***	0.149 - 0.248
Separated	0.217***	0.087 - 0.348	0.196*	-0.021 - 0.413
Divorced	-0.012	-0.089 - 0.066	0.100**	0.000 - 0.201
Widowed	-0.053	-0.158 - 0.053		
Age: 20-24 years old	0.504***	0.414 - 0.594	0.120***	0.043 - 0.197
Age: 25-29 years old	0.225***	0.142 - 0.308	0.283***	0.149 - 0.416
Age: 30-34 years old	0.148***	0.074 - 0.223	0.225***	0.059 - 0.392
Age: 35-39 years old	0.117***	0.045 - 0.189	0.053	-0.105 - 0.211
Age: 40-44 years old	0.073**	0.005 - 0.141	-0.116**	-0.224 - -0.007
Age: 45-49 years old	-0.012	-0.081 - 0.057	-0.111*	-0.235 - 0.014
Age: 50-54 years old	-0.164***	-0.235 - -0.094	-0.135**	-0.268 - -0.003
Age: 55-59 years old	-0.250***	-0.325 - -0.176	-0.177***	-0.289 - -0.064
Age: 60-64 years old	-0.318***	-0.394 - -0.242		
Self-reported health				
Very good	-0.124**	-0.235 - -0.014	0.045	-0.027 - 0.117
Good	-0.177***	-0.282 - -0.071	0.053	-0.017 - 0.123
Fair	-0.108**	-0.214 - -0.002	0.031	-0.039 - 0.100
Poor	-0.063	-0.174 - 0.047	-0.065	-0.195 - 0.065
Feeling optimistic about the future				
Rarely	-0.101**	-0.194 - -0.008	-0.054	-0.129 - 0.021
Some of the time	-0.149***	-0.235 - -0.062	-0.071*	-0.154 - 0.013
Often	-0.140***	-0.230 - -0.049	-0.036	-0.122 - 0.050

All the time	0.009	-0.101 - 0.119	0.025	-0.073 - 0.123
Overall life satisfaction (7-point scale)	-0.008	-0.022 - 0.005	0.012*	-0.001 - 0.024
Mental distress (GHQ-12: Caseness)	0.006	-0.001 - 0.013	0.005	-0.001 - 0.011
Respondent's cooperation level				
Good	0.178***	0.127 - 0.229		
Fair	0.453***	0.261 - 0.645		
Poor	0.653*	-0.118 - 1.423		
Inverse Mills ratio			-0.020	-0.428 - 0.387
Observations	20,272		2,270	
Log likelihood	-13318.408		-841.887	

Note: The sample consists of women, aged<=45, and men, aged<=60, who reported to have no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. The coefficients can be interpreted directly as marginal effects at the means. All three principal factor components are standardised to have a mean of 0 and a standard deviation of 1. Other controls include the UK regional dummies.

Table A4: Estimation with Alternative Measures of Environmentalism: Cardinal Index of Pro-Environmental Variables

	Dependent variable: Have at least one biological child in Wave 10, i.e., period *t*+6	
Independent variables – measured in Wave 4, i.e., period *t*	*Coeff*	*95% C.I.*
Cardinal index, i.e., sum of variables		
Pro-environmental behaviours/habits	-0.025***	-0.041 - -0.008
Beliefs about own green lifestyle	-0.002	-0.020 - 0.015
Climate-change opinion and awareness	0.004	-0.013 - 0.021
Observations	2,270	
Log likelihood	-841.276	

Note: The sample consists of women, aged<=45, and men, aged<=60, who reported to have no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. The coefficients can be interpreted directly as marginal effects at the means. The cardinal indices of pro-environmental variables are derived by adding together the relevant pro-environmental variables and then standardised to have a mean of 0 and a standard deviation of 1. Other controls are as in Table 1.

Table A5: Ordinary Least Squares (OLS) Equation for the Number of Biological Children in *t*+6

Independent variables – measured in Wave 4, i.e., period *t*	Dependent variable: Number of biological children in Wave 10, i.e., *t*+6			
	Coeff	*95% C.I.*	*Coeff*	*95% C.I.*
Measures of environmentalism				
Pro-environmental behaviours/habits	-0.027*	-0.055 - 0.001	-0.076***	-0.107 - -0.044
Beliefs about own green lifestyle	-0.010	-0.036 - 0.017	0.029*	-0.001 - 0.060
Climate-change opinion and awareness	0.016	-0.010 - 0.042	0.009	-0.022 - 0.040
Restricting the sample to only people without biological children in Waves 1-4	Yes		No	
Observations	2,367		5,687	
R-squared	0.254		0.341	

Note: The sample consists of women, aged<=45, and men, aged<=60. All three principal factor components are standardised to have a mean of 0 and a standard deviation of 1. Other controls are as in Table 1.

Table A6: Cox Proportional Hazard Model

Independent variables – all measured in Wave 4, i.e., period *t*	Have at least one biological child (=1) by *t* period			
	Coeff	*95% C.I.*	*Coeff*	*95% C.I.*
Measures of environmentalism in Wave 4 (Principal Factor Components)				
Pro-environmental behaviours/habits	-0.057*	-0.118 - 0.003	-0.060**	-0.108 - -0.012
Beliefs about own green lifestyle	-0.039	-0.106 - 0.028	-0.040	-0.094 - 0.013
Climate-change opinion and awareness	-0.030	-0.095 - 0.036	-0.032	-0.083 - 0.018
Socio-demographic status in Wave 4				
Female	0.133**	0.015 - 0.250	0.012**	0.002 - 0.022
Highest education: First degree	0.012*	-0.001 - 0.025	0.005	-0.044 - 0.055
Highest education: A-level	0.004	-0.056 - 0.063	0.009	-0.041 - 0.060
Highest education: GCSE	0.007	-0.054 - 0.067	0.022	-0.029 - 0.073
Highest education: Other qualifications	0.019	-0.042 - 0.079	0.007	-0.054 - 0.068
Log of equivalent household income	0.006	-0.067 - 0.078	-0.014***	-0.019 - -0.009
Married	0.161***	0.144 - 0.178	0.160***	0.144 - 0.175
Civil partnership	0.032	-0.042 - 0.106	0.032	-0.040 - 0.103
Separated	0.088***	0.029 - 0.148	0.082***	0.031 - 0.134
Divorced	0.075***	0.036 - 0.115	0.074***	0.036 - 0.112
Widowed	0.067	-0.067 - 0.202	0.069	-0.032 - 0.170
Separated from civil partner	-8.136	-1.553e+07 - 15531498.124	-10.390***	-10.620 - -10.160
A former civil partner	0.165**	0.023 - 0.308	0.161**	0.038 - 0.283
Age: 20-24 years old	0.071	-0.067 - 0.209	0.073	-0.057 - 0.204
Age: 25-29 years old	0.108	-0.027 - 0.243	0.111	-0.023 - 0.244
Age: 30-34 years old	0.149**	0.014 - 0.284	0.151**	0.018 - 0.284
Age: 35-39 years old	0.160**	0.024 - 0.295	0.163**	0.030 - 0.296
Age: 40-44 years old	0.146**	0.010 - 0.282	0.149**	0.015 - 0.282
Age: 45-49 years old	0.081	-0.056 - 0.218	0.082	-0.052 - 0.217
Age: 50-54 years old	0.034	-0.105 - 0.173	0.037	-0.098 - 0.173
Age: 55-59 years old	-0.014	-0.153 - 0.126	-0.011	-0.148 - 0.126
Age: 60	-0.097	-0.269 - 0.076	-0.095	-0.269 - 0.079
Self-reported health in Wave 4				
Very good	-0.008	-0.027 - 0.011	-0.006	-0.020 - 0.008
Good	-0.002	-0.021 - 0.018	0.002	-0.013 - 0.016
Fair	-0.023*	-0.050 - 0.004	-0.017	-0.037 - 0.004
Poor	-0.046	-0.101 - 0.009	-0.039	-0.088 - 0.010

Feeling optimistic about the future in Wave 4			
Rarely		-0.025	-0.059 - 0.009
Some of the time		-0.011	-0.043 - 0.021
Often		-0.013	-0.045 - 0.019
All the time		-0.005	-0.042 - 0.031
Psychological wellbeing in Wave 4			
Overall life satisfaction (7-point scale)		0.004*	-0.001 - 0.009
Mental distress (GHQ-12: Caseness)		0.000	-0.002 - 0.002
Number of subjects	9,260	9,260	
Number of childbirth events	1,333	1,333	
Time to event (in person-years)	58,862	58,862	
Number of observations	9,137	9,137	
Log likelihood	-10508.304	-10481.91	

Note:

The sample here consists of women aged<=45, and men aged<=60, who reported that they had no biological children in the household in Wave 4 and had zero in any previous waves, i.e., Waves 1 to 3. Wave 4 of the survey was the year 2012, and Wave 10 was the year 2018.

A positive coefficient in a Cox regression indicates an increase in the likelihood of having a biological child, whereas a negative coefficient indicates a decrease in the likelihood.

The constituent components that make up each of the three principal factors are listed in Table 2.

GHQ is a mental-illhealth score, used by UK doctors, and aggregates answers to 12 questions about how well someone has been sleeping, whether they have been feeling depressed, feelings of worthlessness, etc. Caseness is a cut-off level that refers to those cases who are judged likely to benefit from specialist psychiatric help.

In this table, and throughout, stars indicate statistical-significance levels (* 10%; ** 5%; *** 1%).

Table A7: Disaggregating the Component Questions that Lie Behind the Make-Up of the Three Principal Factors: Cox Proportional Hazard Model

	Have at least one biological child (=1) by *t* period	
Independent variables – measured in Wave 4, i.e., period *t*	*Coeff*	*95% C.I.*
Pro-environmental behaviours/habits		
Do not leave TV on standby at night	-0.027	-0.074 - 0.020
Switch off lights in rooms that aren't being used	0.017	-0.031 - 0.066
Keep the tap running while you brush your teeth	-0.055**	-0.107 - -0.002
Put more clothes on when rather than turning on heater	-0.037	-0.091 - 0.016
Not buy something because of too much packaging	0.042	-0.011 - 0.095
Buy recycled paper products such as toilet paper or tissues	0.069**	0.015 - 0.123
Take your own shopping bag when shopping	-0.144***	-0.206 - -0.083
Use public transport rather than travel by car	-0.157***	-0.225 - -0.089
Walk or cycle for short journeys less than 2-3 miles	0.105***	0.049 - 0.162
Car share with others who need to make a similar journey	-0.076***	-0.131 - -0.021
Take fewer flights when possible	-0.026	-0.074 - 0.022
Beliefs about own green lifestyle		
How one feels about current lifestyle and the environment	-0.023	-0.070 - 0.025
Changes to help environment need to fit with lifestyle	-0.028	-0.074 - 0.018
Current lifestyle is environmentally friendly	-0.039	-0.093 - 0.016
Pay more for environmentally friendly products	-0.031	-0.085 - 0.022
Climate change-change opinions		
Being green is an alternative lifestyle	-0.044*	-0.096 - 0.007
Behaviour contributes to climate change	0.044	-0.009 - 0.097
Soon experience major environmental disaster	-0.012	-0.073 - 0.050
Environmental crisis has been exaggerated	-0.028	-0.087 - 0.031
Climate change too far in future to worry	-0.007	-0.067 - 0.053
Not worth UK making changes	0.038	-0.022 - 0.099
Climate change is beyond control	-0.003	-0.055 - 0.049
UK will be affected by climate change next 30 years	0.006	-0.051 - 0.064
F-test on pro-environmental behaviours/habits	74.11 (p=.000)	
F-test on beliefs about own green lifestyle	6.03 (p=.197)	
F-test on climate-change opinions	8.42 (p=.393)	
Number of subjects	9,260	
Number of childbirth events	1,333	
Time to event (in person-years)	58,862	
Number of observations	9,137	
Log likelihood	-10481.91	

Note:

The sample consists of women, aged<=45, and men, aged<=60, who reported to have no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. Each pro-environmental variable is adjusted to have higher values represent being more pro-environment and/or more aware about the climate change. They are standardised to have a mean of 0 and a standard deviation of 1. Other controls are the independent variables in Table 1.

In this table, and throughout, stars indicate statistical-significance levels (* 10%; ** 5%; *** 1%).

Table A8: Checking for Selection on Unobservables

	Dependent variable: Have at least one biological child in Wave 10, i.e., period *t*+6	
Independent variables – all measured in Wave 4, i.e., period *t*	*Coeff*	*95% C.I.*
Measures of environmentalism in Wave 4 (Principal Factor Components)		
Pro-environmental behaviours/habits	-0.018*	-0.035 - -0.001
Beliefs about own green lifestyle	-0.008	-0.025 - 0.010
Climate-change opinion and awareness	0.007	-0.011 - 0.024
The ratio of the impact of unobservables to the impact of observable controls that would drive each coefficient variable to zero, δ		
δ for pro-environmental behaviours/habits		-0.561
δ for beliefs about own green lifestyle		0.472
δ for climate-change opinion and awareness		0.091
R-squared		0.264
Observations		2,366

Note:

OLS regression equation.

Oster (2019) recommends effects be considered robust where $\delta > 1$. On the other hand, the negative sign on δ indicates the unobservables would have to be correlated with the pro-environmental variable in the opposite direction as its relationship with the observable characteristics to overturn the results.

The corresponding δ for pro-environmental behaviour suggests that selection on unobservables would have to be correlated with the pro-environmental behaviour in the opposite direction as the observable characteristics and have to be half the size as large to drive the coefficient to zero.

In this table, and throughout, stars indicate statistical-significance levels (* 10%; ** 5%; *** 1%).

Other included controls (not reported in detail here) are the independent variables in Table 1.

SUPPLEMENTARY MATERIAL FOR ONLINE

Three different estimators.

Marginal effects from Table 1.

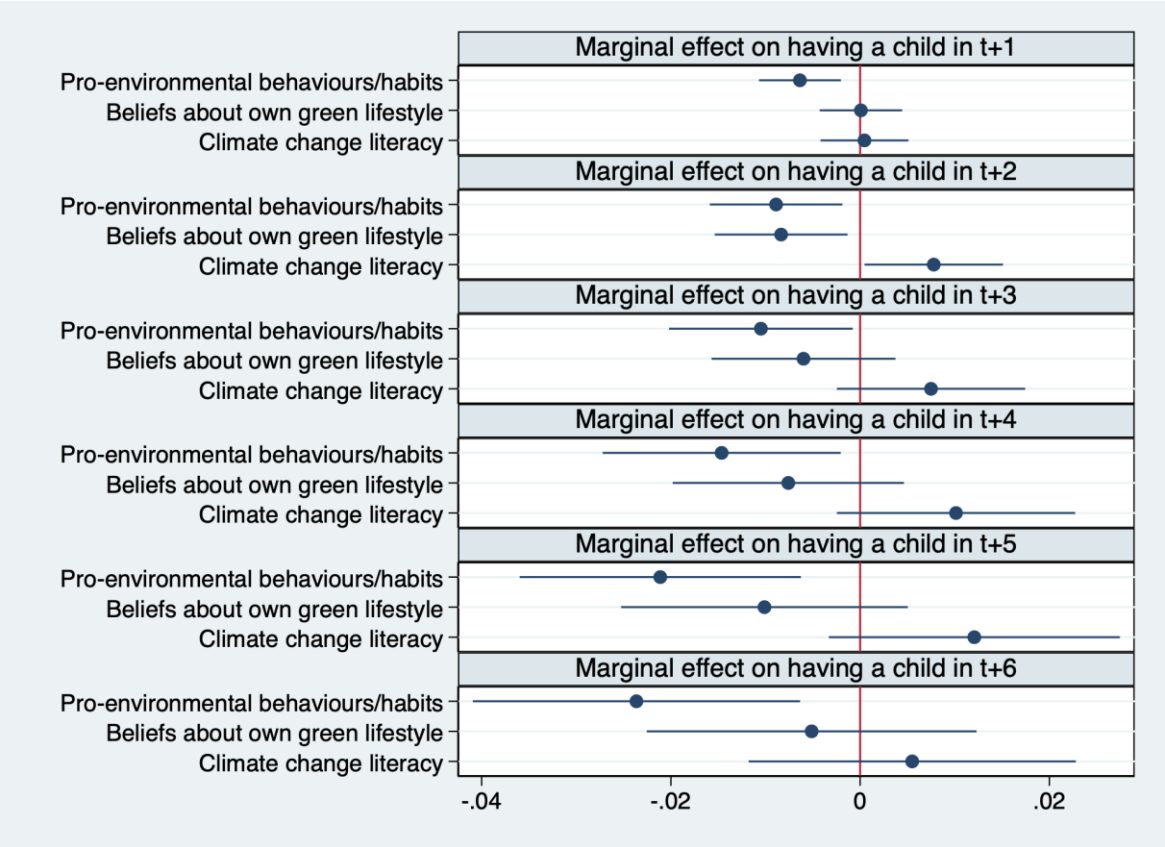
Table A9: Comparing Marginal Effects from Probit, Logit, and OLS models

	Dependent variable: Have at least one biological child in Wave 10, i.e., period *t*+6					
	MFX Probit		**MFX Logit**		**OLS**	
Independent variables – measured in Wave 4, i.e., period *t*	***Coeff***	***95% C.I.***	***Coeff***	***95% C.I.***	***Coeff***	***95% C.I.***
Principal Factor Components						
Pro-environmental behaviours/habits	-0.023***	-0.041 - -0.006	-0.019**	-0.034 - -0.004	-0.018**	-0.035 - -0.001
Beliefs about own green lifestyle	-0.005	-0.023 - 0.013	-0.005	-0.020 - 0.009	-0.008	-0.025 - 0.010
Climate-change opinion and awareness	0.006	-0.012 - 0.024	0.005	-0.009 - 0.019	0.007	-0.011 - 0.024
Table 1's control variables	Yes		Yes		Yes	
Observations	2,271		2,270		2,366	

Note: The sample consists of women, aged<=45, and men, aged<=60, who reported to have no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. The coefficients can be interpreted directly as marginal effects at the means. All three principal factor components are standardised to have a mean of 0 and a standard deviation of 1. Other controls include UK regional dummies.

Confidence intervals (95% C.I.) in parentheses.

Figure A1: Marginal Effects of Pro-Environmental Principal Factor Components on the Probability of Having at Least One Biological Child in Future Waves, i.e., *t+n*



Note: 95% C.I. are reported. The sample consists of women, aged<=45, and men, aged<=60, who reported to have no biological children in the household in Wave 4 and in any previous waves, i.e., Waves 1 to 3. Each panel represents separate regression equations. All three principal factor components are standardised to have a mean of 0 and a standard deviation of 1. All control variables are the same as in Table 1.