



Are environmental concerns deterring people from having children? Longitudinal evidence on births in the UK

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ABSTRACT

Do ‘green’ environmental concerns – such as about biodiversity, climate change, pollution – deter citizens from having children? This paper reports the first longitudinal evidence consistent with that increasingly discussed hypothesis. It follows through time a random sample of thousands of initially childless men and women in the UK. The paper shows that those individuals who are committed to a green lifestyle are found to be substantially less likely to go on later to have offspring. Probit and Weibull survival models are estimated. The results are robust to controlling for people’s age, education, income, marital status, mental health, life satisfaction, optimism, and physical health. The paper’s key estimated effect-size is substantial. A person entirely unconcerned about environmental behaviour is estimated to be just over 50% more likely to go on to have a child than a deeply committed environmentalist.

“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 \(2019\)](#)

“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.cnb.com/2021/08/12/climate-change-is-making-people-think-twice-about-having-children.html>

1. Introduction

There is growing concern that fears for the environment and climate change may deter people from having children (for example, [Schneider-Mayerson and Leong, 2020](#)). However, despite increasing media discussion of such ideas (as in the quotes above) and theoretical ideas provided by previous scholars (e.g., [Salonen and Åhlberg, 2013](#); [Rieder, 2016](#); [Schneider-Mayerson, 2021](#)), much of the existing formal evidence is qualitative and based on answers to questions about what people might do. Given the lack of evidence on actual births data, the extent to which people’s reproductive choices are influenced by their ecological stances continues to be imperfectly understood.

This paper contributes to the literature by – to our knowledge – being the first of its kind to document longitudinal evidence, using data on the numbers of babies born, consistent with the hypothesis that committed environmentalists in today’s industrialized nations are reluctant to bring children into the world. Probit and Weibull survival models are fitted to United Kingdom data.

How, conceptually, might environmentalism affect fertility decisions? One hypothesis is that increasing awareness of the large carbon

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footprint associated with having a child, together with concern about overpopulation, may increase the moral burden from procreation among people who are already pro-environmental (Rieder, 2016; Schneider-Mayerson, 2021). Murtaugh and Schlax (2009) calculated, for example, that each child would add around 9400 metric tons of carbon dioxide to the carbon legacy of an average female in the U.S., which is approximately 5.7 times her lifetime emissions. Wynne and Nicholas (2017) estimated that having one fewer child lowers annual personal carbon dioxide emission by approximately 58.6 tons compared to 2.4 tons from living car-free and 1.6 tons from avoiding airplane travel. Another hypothesis, based on the theory in economics that parents' utility and fertility decision are affected by their future offspring's 'quality' or well-being (Becker, 1960, 1974), suggests that individuals with climate-change concerns may not want children because they do not want them to grow up in a world full of climate uncertainties and risks (Schneider-Mayerson and Leong, 2020).

Postmaterialism theory (Inglehart, 1971, 1977) suggests that, under conditions of continuously expanding economic and personal security, younger generations in Western societies have been moving from holding materialistic values to a new set of values that emphasises autonomy and self-expression. One of the theory's predictions is that as more young people switch toward new non-materialistic values, they are also more likely to pursue postmaterial social goals such as increased free self-expression and a healthy natural environment (Salonen and Åhlberg, 2013; Booth, 2017, 2021). At the same time, their preferences for autonomy and work-life balance may also lead them to want fewer children (e.g., Vitali et al., 2009), which suggests that non-materialistic values might themselves be driving both environmentalism and fertility decisions simultaneously. In that theory, environmentalism may not have an independent relationship with reproduction decisions beyond its relationship with non-materialistic values that could fluctuate over the life-course.

With respect to the existing qualitative evidence, Schneider-Mayerson and Leong (2020), for example, designed a survey of 607 US-Americans between the ages of 27 and 45. Approximately 60% of respondents reported being "very" or "extremely concerned" about the carbon footprint of procreation, and 96% of respondents were "very" or "extremely concerned" about the well-being of their existing, expected, or hypothetical children in a climate-changed world. This was due to an overwhelmingly negative expectation among participants of a future with climate change. Using the same data, Schneider-Mayerson (2021) concluded 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." Smith et al. (2023) in interviews with young people found climate anxiety played an important dampening role in their fertility intentions. Gordon (2021) investigated 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 were asked to indicate their ideal number of children, ideal age to start having children, and whether their desire for a child had recently changed. There was no clear empirical support for a relationship between climate-change beliefs and reproductive decision-making. More recently, a study of American adolescents by Rackin et al. (2022) did uncover relevant evidence. Those young people who endorsed that government should deal with environmental problems reported lower average fertility desires than those who did not. The statistical association was driven by a decreased desire for large families. See also Relman and Hickey (2019).

Work by Arnocky et al. (2012) was some of the first to examine the relationship between individual environmental concern, fertility intentions, and attitudes toward reproduction; they did so using a sample of 139 Canadian university students. General environmental concern and pollution-related health worries predicted a less positive attitude

toward having children. Supportive results of a similar kind on Canadian data were found by Davis et al. (2019): self-reported pro-environmental behaviour was found to negatively predict pro-reproductive attitudes. Helm et al. (2021) and Nakkerud (2021) discussed the possible ethical and philosophical issues that a potential parent might internally debate. In early and more general work, Ghimire and Mohai (2005) used multiple data sets from Nepal to try to assess the impact of environmental views on contraceptive use in a rural agricultural setting. They showed that perceptions about certain aspects of the environment were related to individuals' subsequent use of contraceptives. Individuals who thought that their environment-agricultural productivity had deteriorated were more likely to use contraceptives than those who believed that their environment had improved or had remained about the same.

There is some evidence to suggest that environmentalism may not affect fertility decisions across all cultural contexts. For example, Rose and Testa (2015) find evidence using Eurobarometer survey that climate-change concerns in some countries are not strongly correlated with people's intended number of children. Fu et al. (2023) demonstrate that while young, educated, and climate-concerned Chinese expressed significant worries about their potential children in a climate-changed future, they ranked climate change much lower than other factors as influences upon their reproductive choices (those others being factors such as family income and the opportunity cost of raising children). The authors attributed their findings to "China's history of family planning, state-constructed climate change discourse, stage of development, and hierarchical cultural worldview." Another example where cultural contexts matter to the relationship between environmentalism and fertility decisions comes from a study by Szczuka (2022), which finds contradicting results on the association between climate-change concerns and the ideal number of children in the Visegrád countries (V4), i. e., Hungary, Czech Republic, Poland, and Slovakia.

This previous research is important. Nevertheless, the literature is, first, essentially 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.

At a wider level, it should be mentioned that our work fits, when viewed in perspective, within a longstanding literature on the factors that influence humans' 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, demonstrated how a rise in the unemployment rate can act to dissuade people from having children. The authors pointed 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 (2015) analysis of fertility across different areas of the USA after the Great Recession, Seltzer (2019) work on the consequences of the loss of manufacturing and other goods-producing businesses, and from Hoffmann 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.

Taken together, environmentalism can be predicted to lower

people's demand for children. This is in part because people who are more environmentally conscious are also more likely to worry about the future of their children and the implications of having children on the environment. A negative relationship between environmentalism and fertility may also reflect people's postmaterialism values, i.e., those who are relatively non-materialistic are likely to be more pro-environmental in their behaviours and prefer a more autonomous lifestyle.

2. Empirical methods

2.1. Data

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.

In Wave 4, which was conducted between 2012 and 2014, the survey participants completed self-report questionnaires on their climate-change literacy and pro-environmental behaviours for the first time before reporting for the second time in Wave 10. The full sample size when added across the years is approximately 40,000 randomly selected person-observations. The main sample used in this study, however, was initially deliberately restricted for the particular purpose of the investigation. It consists of individuals who were (i) childless in Wave 4; (ii) had no history of having a child prior to Wave 4; (iii) aged between 16 and 40 in the Wave 4 if female; (iv) aged between 16 and 55 in Wave 4 if male; and (v) participated in all waves up to Wave 10's survey, i.e., $t + 6$. This produced a balanced panel sample of 1972 individuals in total. Of those, 748 were females. The average ages, given the subsample we chose to try to pick up likely child-bearing individuals, were 38.1 for males and 27.4 years for females.

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

Pro-environmental behaviours/habits. The participants were asked to self-complete information on how often they engage in each of the ten pro-environmental behaviours (*envhabit1*, ..., *envhabit9*). They are (1) "Leave your TV on standby at night", (2) "Switch off lights in rooms that aren't being used", (3) "Keep the tap running while you brush your teeth", (4) "Put more clothes on when rather than turning on the heater", (5) "Not buying something because of too much packaging", (6) "Buy recycled paper products such as toilet paper or tissues", (7) "Take your own shopping bag when shopping", (8) "Use public transport rather than travel by car", (9) "Walk or cycle for short journeys less than 2-3 miles", (10) "Car share with others who need to make a similar journey", and (11) "Take fewer flights". Possible responses to these statements range from "1. Never" to "5. Always".

Beliefs about own green lifestyle. The participants were asked to rate whether they agree or disagree with four attitudes toward pro-environmental lifestyle statements. They are (1) "Being green is an alternative lifestyle" (*scenv_grn*), (2) "Pay more for environmentally friendly products" (*scenv_pmep*), (3) "Current lifestyle is environment friendly" (*scenv_crlf*), (4) "How I feel about current lifestyle and the environment" (*scenv_fstt*), and (5) "Changes to help environment need to fit with lifestyle" (*scenv_fitl*). Possible responses for statements (1) to (3) range from "1. Strongly disagree" to "5. Strongly agree", while for statement (4) range from "1. Likes to do a lot more" to "3. Happy with what I do".

Climate-change opinion and awareness. The participants were asked to self-rate whether they agree or disagree with eight climate change statements that include (1) "Behaviour contributes to climate change" (*scenv_bccc*), (2) "Climate change is beyond control" (*scenv_tlat*), (3) "Climate change is too far in the future to worry" (*scenv_nowo*), (4) "Not worth making changes if others don't" (*scenv_noot*), (5) "Not worth

UK making changes" (*scenv_canc*), (6) "Environmental crisis has been exaggerated" (*scenv_crex*), and (7) "Soon experience major environmental disaster" (*scenv_meds*). Possible responses for statements (1) to (7) range from "1. Strongly disagree" to "5. Strongly agree". The participants were also asked (8) whether they think the UK will be affected by climate change in 30 years, with possible responses being Yes or No.

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, although, in response to a referee and being mindful of the close links between the two in, for example, Kaiser and Oswald (2022), we admittedly would expect actions and attitudes to be attuned.

Covariates. We included covariates that are likely to be correlated with both fertility and pro-environmental attitudes and behaviours. This includes dummy variables representing gender; completed at least a first (ie. bachelor's) degree; married; age; age-squared; self-reported health (1 = Very poor, ..., 5 = Excellent); and self-reported optimism about the future (1 = Not at all, ..., 5 = All the time). We also controlled for log of equivalent household income, i.e., log of annual household income divided by an OECD equivalence scale, overall life satisfaction (1 = Completely dissatisfied, ..., 7 = Completely satisfied), a measure of Caseness GHQ-12 mental strain (0 = Best psychological health, ..., 12 = Worst psychological health), and regional dummies.

2.2. Empirical strategy

We conduct two main regression analyses. The first 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 So the inherent nature of such a statistical inquiry is a particularly simple one.

More formally, we estimate the following Probit regression that potentially links attitudes in time period t to later births in time period $t + n$:

$$C_{it+n} = \beta E_{it} + X'_{it}\gamma + \varepsilon_{it}, \quad (1)$$

where C_{it+n} is a dummy variable representing whether individual i has a biological child in period $t + n$, where $n \leq 6$.² E_{it} is a set of views and behaviour on environmental issues measured in $t = T$ or wave 4; X'_{it} is a vector of personal control variables measured in wave 4, including gender, age, age-squared/100, completing first degree, log of equivalent household income, married, self-rated health, feeling optimistic about the future, life satisfaction, and usual psychological distress; and ε_{it} is an error term. The coefficient β denotes the partial correlation between E_{it} and C_{it+n} . For simplicity, we present the estimated partial correlations as marginal effects at means in our study. A balanced panel across all waves from Wave 4 to 10 is used to estimate Eq. (1).

The second approach is regression analysis that investigates whether people's environmental views and behaviour predict the time-to-event of having a biological child by a later period. This methodology involves fitting a parametric survival model with panel data where we observe the same individuals over a period of time. For estimating the hazard ratio of having a biological child, we choose the random-effects parametric Weibull survival model instead of Cox regression model,

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

² This variable is derived from the reported number of respondent's biological children living in the household (labelled *nnatch* in the Survey documentation that is publicly available online).

which we describe in more detail below.

$$h(t_{ij}) = h_0(t_{ij}) \exp(\beta E_{ij} + X'_{ij} \gamma + v_i), \quad (2)$$

where $i = 1, \dots, N$; $j = 1, \dots, T$; and $h(t_{ij})$ is the hazard function for some baseline hazard function, $h(t_0)$. The survivor function for the Weibull family is the complement of the cumulative distribution function:

$$S(t) = 1 - F(t). \quad (3)$$

The conditional density of having a biological child ('failure') at time t is given by:

$$g(t|t \geq t_0, C = 1) = g(t)/S(t_0), \quad (4)$$

where t_0 is the starting time under observation $t_0 \geq 0$; t is the ending time under observation $t \geq t_0$; and C is a binary variable representing whether having a biological child ('failure').

We are aware that to parents the use of the word 'failure' here would be viewed as inexplicable, because they would view birth as a success. But here we follow the jargon of survival models.

In this model, we treat X , except for gender, as a set of time-varying variables taken from across all available waves in the estimation of the hazard function. However, given that we only have information on views and behaviour on environmental issues in Waves 4 and 10, a time-invariant environmental variable, which we generate from averaging the variable within-person across two waves, is used to estimate Eq. (2). Hence, we can rewrite Eq. (2) as

$$h(t_{ij}) = h_0(t_{ij}) \exp(\beta \bar{E}_i + X'_{ij} \gamma + v_i), \quad (2')$$

where \bar{E}_i is a set of time-invariant environmental variables, averaged across two waves, i.e., Waves 4 and 10. In this study, the Weibull models are estimated using the STATA code 'xtstreg' with robust standard errors clustered at the individual level.

For the econometric estimation, we perform a principal factor analysis (PFA) on the environmental variables described earlier in the Data section. The standard form of PFA is not appropriate here, because it assumes that variables are continuous, whereas the analysis in this case is necessarily with Likert-style ordinal data.

For this reason, the analysis draws – in part – upon so-called polychoric-correlation methods. Specifically, we conduct a polychoric correlation of environmental variables in the first-stage before running PFA to reduce the dimensionality of these variables in the second-stage (Lee et al., 1995). Hence the PFA in the paper 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.

Hence the first principal factors are calculated and used analytically. The central variable in the later regression tables is termed '*Pro-environmental behaviours/habits*' (eigenvalue = 1.73). Two other environmental 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*' (eigenvalue = 0.62) and '*Climate-change opinion and awareness*' (eigenvalue = 2.86). The '*Beliefs about own green lifestyle*', in particular, has an eigenvalue <1 and thus should be viewed with some caution in the regression. See Tables A1 and A2 in the Appendix for the exploratory factor analysis based on polychoric correlation and the polychoric correlation matrix, respectively. Each principal factor was standardized to have a mean of zero and a standard deviation of unity across the sample.

3. Results and discussion

The paper's central finding is visible in Table 1. Pro-environmentalism enters negatively and with a small standard error.

The table reports six Probit regression equations – to be read vertically – in which the dependent variable is the probability of having had a child by Wave 10 (which is six years after the person's green characteristics here were measured). This probability is regressed on a large number of independent variables that are other potential predictors of future fertility. The sample here is those men and women who had no child in Wave 4 of the survey. A collection of robustness tests, under different assumptions, was done and is available in Lockwood et al. (2022). A later table in this paper (Table 2) also provides results for an alternative estimation technique.

Table 1 contains six columns of results, accompanied by standard errors. The estimated coefficients here are marginal effects at the mean obtained from the Probits. In Columns 1–3 of Table 1, the probability function is allowed to depend each time on one of the three Principal Factors that measure environmentalism in different ways, and on an individual's gender, education, income, marital status, age, self-reported health, self-rated optimism level, a measure of cognitive well-being in overall life satisfaction, and a measure of recent experiences of psychological distress in the General Health Questionnaire (GHE-12).

Are committed environmentalists less likely to produce offspring? The answer from the empirical analysis is yes. The key variable, for pro-environmental behaviours, enters Column 1's regression with a coefficient of -0.028 and a small standard error. Strong environmentalists are thus more likely, in these data, to remain people – over the period – who do not have children. Nevertheless, it should be emphasized that while 'Beliefs about own green lifestyle' and 'Climate-opinion and awareness' enter Columns 2 and 3 with an expected negative sign, the estimated coefficients are not statistically well-determined at the 5% level. In Column 4 of Table 1, in which all three Principal Factors are included in the same regression, only the pro-environmental behaviours coefficient is negative and statistically significant at -0.025 . This is not what we would have expected, but we report the findings as appropriate.

How influential – in the sense of the implied effect-size – is environmentalism? The estimated effect in Table 1's fourth 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. Here this would be associated, six years later, with a 2.5 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 is approximately 0.24, which corresponds to a 24% probability of having a child over the period. Therefore, after subtracting the 2.5 percentage points, that estimate would imply a reduction to a 21.5% probability of having a first child during those six years.

This type of calculation is for a one-SD alteration around the mean (in people's measured 'greenness'). It is also possible to think, of course, about the implications of starker comparisons.

To illustrate that, consider an extremely committed environmentalist, who is, for example, two-SDs above the mean in their environmentalism.³ At exactly the other end of this hypothetical spectrum, consider someone who is unconcerned with behaving in an environmentally conscious way, and is two-SDs below the mean.⁴ In this case, the comparison is more striking: it is between a probability of having a birth of 0.19 for the former (the highly environmental person) and 0.29 for the former (the highly non-environmental person). That difference,

³ Here, for illustrative purposes, we will ignore the fact that a Probit equation is a non-linear estimator.

⁴ These are extremes, of course. Out of 1972 individuals, 23 people are two-SDs below the mean and 35 people are two-SDs above the mean.

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)

VARIABLES	Dependent variable: Have at least one biological child in Wave 10, i.e., period $t + 6$					
	All	All	All	All	Males	Females
Measures of environmentalism in Wave 4 (Exploratory factor analysis based on polychoric correlation)						
Pro-environmental behaviours/habits	-0.028*** (0.010)			-0.025** (0.011)	-0.009 (0.010)	-0.041* (0.022)
Beliefs about own green lifestyle		-0.017* (0.009)		-0.010 (0.010)	-0.002 (0.010)	-0.031 (0.022)
Climate-change opinion and awareness			-0.009 (0.009)	0.003 (0.011)	0.002 (0.010)	0.008 (0.025)
Socio-demographic status in Wave 4						
Female (=1)	0.038** (0.019)	0.039** (0.019)	0.039** (0.019)	0.038** (0.019)		
Age	0.063*** (0.009)	0.063*** (0.009)	0.063*** (0.009)	0.063*** (0.009)	0.048*** (0.008)	0.244*** (0.033)
Age-squared/100	-0.107*** (0.014)	-0.106*** (0.014)	-0.107*** (0.014)	-0.107*** (0.014)	-0.080*** (0.011)	-0.437*** (0.057)
Highest education: First degree (=1)	0.051** (0.020)	0.048** (0.020)	0.046** (0.020)	0.052** (0.020)	0.041** (0.020)	0.006 (0.043)
Log of equivalent household income	0.017 (0.017)	0.020 (0.018)	0.020 (0.018)	0.017 (0.017)	0.035** (0.017)	-0.015 (0.029)
Married (=1)	0.227*** (0.026)	0.222*** (0.026)	0.222*** (0.026)	0.226*** (0.026)	0.155*** (0.025)	0.329*** (0.054)
Self-reported health in Wave 4 (reference group = Excellent)						
Very good	0.017 (0.021)	0.017 (0.021)	0.019 (0.021)	0.016 (0.021)	0.027 (0.021)	-0.025 (0.043)
Good	-0.020 (0.026)	-0.018 (0.026)	-0.016 (0.026)	-0.021 (0.026)	-0.001 (0.027)	-0.090* (0.053)
Fair	-0.030 (0.040)	-0.028 (0.040)	-0.025 (0.040)	-0.031 (0.040)	0.025 (0.049)	-0.113 (0.075)
Poor	-0.107 (0.071)	-0.104 (0.072)	-0.103 (0.072)	-0.107 (0.071)	-0.044 (0.081)	-0.246* (0.143)
Feeling optimistic about the future in Wave 4 (reference group = None of the time)						
Rarely	-0.073 (0.048)	-0.075 (0.049)	-0.075 (0.049)	-0.074 (0.049)	-0.078* (0.047)	-0.056 (0.091)
Some of the time	-0.090* (0.051)	-0.090* (0.052)	-0.089* (0.052)	-0.090* (0.051)	-0.104* (0.056)	-0.086 (0.084)
Often	-0.046 (0.053)	-0.047 (0.054)	-0.045 (0.054)	-0.046 (0.053)	-0.080 (0.056)	-0.004 (0.088)
All of the time	0.035 (0.065)	0.035 (0.066)	0.036 (0.066)	0.035 (0.065)	-0.048 (0.057)	0.207* (0.113)
Psychological wellbeing in Wave 4						
Overall life satisfaction (7-point scale)	0.011 (0.008)	0.011 (0.008)	0.011 (0.008)	0.011 (0.008)	0.011 (0.008)	0.016 (0.015)
Mental distress (GHQ-12: Caseness)	0.004 (0.004)	0.004 (0.004)	0.004 (0.004)	0.004 (0.004)	-0.001 (0.004)	0.012* (0.007)
Observations	1972	1972	1972	1972	1224	748

Note: *** < 1%; ** < 5%; * < 10%.

Reference groups: Male; less than first degree as highest completed education; non-married (e.g., single/divorced/separated/widowed); excellent health; and feeling optimistic about the future: none of the time. Other controls include dummies representing UK geographical regions.

based on an admittedly deliberately wide contrast, seems a large one. It implies that ceteris paribus the highly non-environmental person's probability of producing offspring is approximately 50% greater than the committed environmentalist.⁵ If we put this in an alternative way, highly environmental people are in an aggregate sense estimated here to have 190 first-borns compared to every 290 first-borns from extreme non-environmentalists.

In Table 1 the other two environmental principal factors (on beliefs and climate-change opinions) have small coefficients with large standard errors. It is not possible to know why. Perhaps a potential explanation 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. There is also evidence in the literature suggesting that factors that influence climate-change opinions do not

necessarily have the same consequences for climate change-related behaviours. For example, Powdthavee (2021) finds that the raising of the minimum school leaving age law in England and Wales significantly improved people's climate change opinions but had minimal effect on their pro-environmental behaviours. Given that the correlations between pro-environmental behaviours and the other two Principal Factors are only moderate at around 0.32–0.39, there will be people who hold clear climate-change opinions but who apparently do not behave according to their beliefs.

Another issue is: are men and women different in the way their environmentalism predicts having children? It might at first be argued that this question is an ill-determined one, because it requires, of course, both male and female to combine to produce children. Nevertheless, as a statistical matter it can be checked. The last two columns of Table 1 split the sample and re-estimate equations separately for the male subsample and female subsample. The coefficient on environmental behaviours is noticeably smaller in the male subsample (at -0.09), and is not statistically significant at conventional levels. By contrast, the coefficient on

⁵ Derived from 0.29/0.19.

Table 2
Random-Effects Parametric Proportional Hazard Model.

VARIABLES	Estimated hazard ratios on ‘failure’, i.e., having at least one biological child		
	All	Males	Females
Measures of environmentalism averaged across Waves 4 and 10 (Exploratory factor analysis based on polychoric correlation)			
Pro-environmental behaviours/habits	0.898*** (0.027)	0.897*** (0.036)	0.904** (0.039)
Beliefs about own green lifestyle	1.001 (0.034)	1.011 (0.046)	0.978 (0.051)
Climate-change opinion and awareness	0.986 (0.032)	1.013 (0.043)	0.942 (0.051)
Socio-demographic status			
Female (=1)	1.056 (0.056)		
Age	1.238*** (0.035)	1.395*** (0.050)	1.293*** (0.107)
Age-squared/100	0.712*** (0.025)	0.622*** (0.027)	0.636*** (0.076)
Highest education: First degree (=1)	0.785*** (0.045)	0.916 (0.072)	0.671*** (0.057)
Log of equivalent household income	0.854*** (0.023)	0.846*** (0.030)	0.873*** (0.036)
Married (=1)	4.301*** (0.293)	4.586*** (0.416)	4.105*** (0.466)
Self-reported health (reference group = Excellent)			
Very good	0.841** (0.062)	0.794** (0.082)	0.868 (0.095)
Good	0.839** (0.071)	0.757** (0.090)	0.874 (0.110)
Fair	0.602*** (0.070)	0.498*** (0.085)	0.705** (0.119)
Poor	0.595** (0.134)	0.560* (0.169)	0.604 (0.199)
Feeling optimistic about the future (reference group = none of the time)			
Rarely	0.924 (0.131)	0.933 (0.171)	0.918 (0.211)
Some of the time	1.012 (0.139)	1.057 (0.188)	0.969 (0.215)
Often	1.148 (0.161)	1.033 (0.186)	1.319 (0.302)
All of the time	1.353* (0.216)	1.258 (0.263)	1.493 (0.385)
Psychological wellbeing in Wave 4			
Overall life satisfaction (7-point scale)	1.084*** (0.026)	1.063* (0.033)	1.098** (0.043)
Mental distress (GHQ-12: Caseness)	1.020** (0.010)	1.016 (0.015)	1.033** (0.014)
Observations	15,240	9310	5930
Number of unique individuals	6747	4128	2622

Note: *** < 1%; ** < 5%; * < 10%.

Reference groups: Male; less than first degree as highest completed education; non-married (e.g., single/divorced/separated/widowed); excellent health; and feeling optimistic about the future: none of the time. Other controls include dummies representing UK geographical regions.

such behaviours in the female subsample is substantial (−0.041), although it is only marginally statistically significant. However, we would be cautious about likely Type II errors. Given the much smaller sample sizes, we would be reluctant to over-interpret this difference in the estimated coefficients by gender. A later table finds sharper results for males and females.

Table 1 has the particular feature that it focuses on individuals’ lives after six ensuing years (period t + 6). Might it be that there is something unusual, or potentially mistaken, about relying on a comparison over six years, namely between Wave 4 and Wave 10?

To check for that, Fig. 1 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 different way to test the paper’s hypothesis is to use time-to-event methods. As a robustness check on the previous conclusion, Table 2 applies a random-effects parametric proportional hazard model (Eq. 2’) to the timing of having a first-born. However, instead of using only Wave 4’s measures of environmentalism, we focus on time-invariant environmentalism variables that we derived from averaging the variable within-person across Waves 4 and 10. Other than gender, other variables enter our random-effects parametric proportional hazard model as time-varying variables. The exponentiated coefficients (or hazard ratios), instead of marginal effects, are now reported in Table 2.

Consistent with Table 1’s results, out of the three Principal Factors, only one (pro-environmental behaviours) has an estimated hazard ratio that is both <1 and is statistically significantly different from zero at conventional cut-off levels. Although the exponentiated coefficients of time-invariant variables do not have a natural interpretation as conditional hazard ratios, their magnitudes provide some idea of the effects of the time-invariant covariates. From the first column of Table 2’s results, the estimated coefficient of pro-environmental behaviours is 0.898, which indicates that the hazard functions for people who are 1SD more pro-environmental tend to be around 1% smaller than for an average person. We illustrate this relationship in Fig. 2 by plotting the marginal ‘failure’ (which here means simply having a child) for people of different pro-environmental behaviours using the estimates obtained in the first column of Table 2.

Other results are consistent with our expectations. For example, an increase in age increases the hazard ratio of having a first-born, but it does so at a nonlinear rate. On average, the hazard ratio would decrease around 1% with an annual increase in equivalent household income of 1%. Getting married substantially increases the hazard ratio, whilst relatively poorer health reduces it. The results on pro-environmental behaviours are statistically robust for both males and females subsample regressions.⁶

Table 2’s estimates thus align with the paper’s earlier conclusion from Table 1.

4. Conclusions

Are environmental concerns deterring citizens⁷ in rich nations from having children? We provide some of the first econometric evidence – of a very simple longitudinal kind – consistent with that idea. Using data on randomly selected individuals from the United Kingdom, the paper documents evidence of a link between a person’s environmentalism and their later (reduced) fertility.

The current study is, as far as we know, the only one of this type. However, there has been important previous conceptual and empirical discussion (described in this paper’s introduction) on the possibility that there might be such a connection between environmental worry and the desire not to procreate. It includes recent research by, for example, Matthew Schneider-Mayerson (2021) and Sabrina Helm et al. (2021). Nevertheless, the main published studies in the field appear to be cross-sectional, and often record people’s statements about attitudes to having children, rather than being able to measure whether children are actually eventually born. No earlier work has apparently drawn upon actual data on later births.

The paper’s central contribution is illustrated in Table 1 for a sample of 1972 randomly selected childless adults from the United Kingdom. Further checks and robustness tests using panel survival-time regressions, rather than Probit regressions, are provided in Table 2. The broad conclusion in each case is that people who are strong environmentalists in year T are less likely to have children by year T + 6.⁸ That

⁶ More robustness checks are in our previous version (Lockwood et al., 2022).

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

⁸ Although not solely in T + 6. See Figure 1.

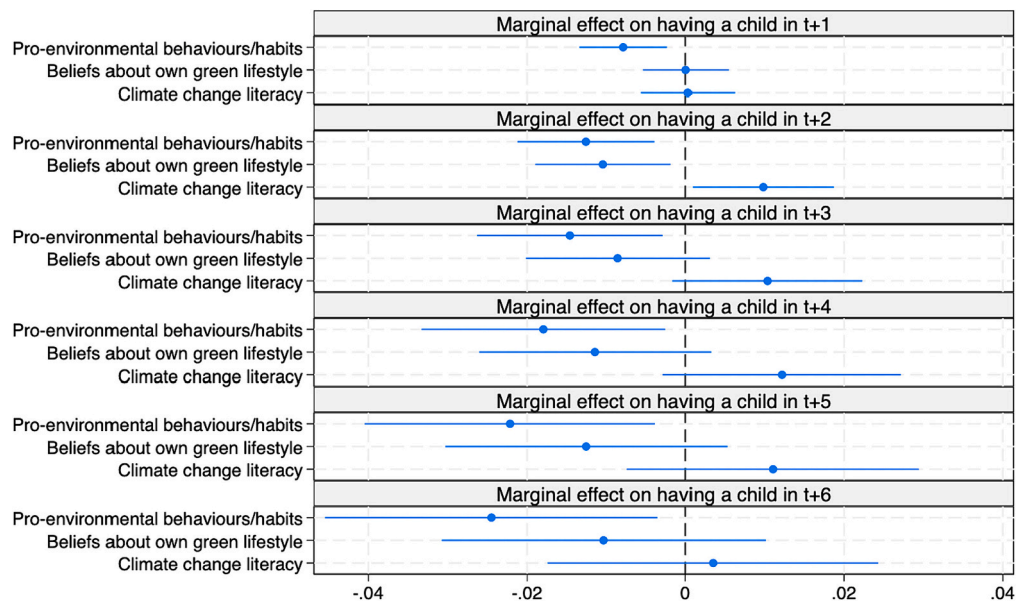


Fig. 1. Marginal Effects of Pro-Environmental Principal Factor Components on the Probability of Having at Least One Biological Child in Future Waves, i.e., $t + n$. **Note:** 95% C.I. are reported. The sample consists of women, aged ≤ 40 in wave 4, and men, aged ≤ 55 in wave 4, who reported to have no 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 standardized to have a mean of 0 and a standard deviation of 1. All control variables are the same as in Table 1.

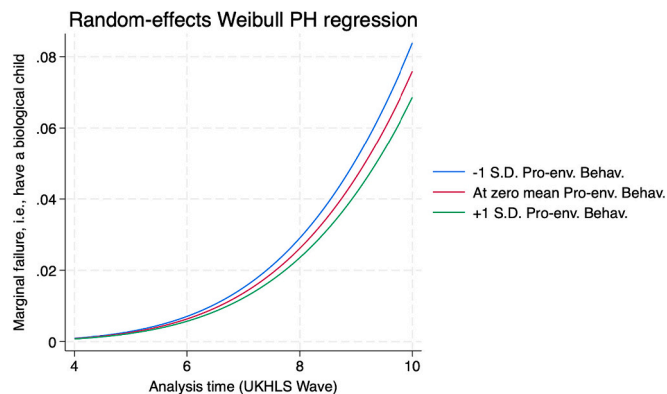


Fig. 2. A Plot of the Marginal ‘Failure’ (ie. Having a Child) for People with Different Pro-environmental Behaviours/Habits in a Random-Effects Proportional Hazard Regression.

Note: PH = proportional hazard. The marginal ‘failure’ rate across waves as moderated by sample-wide, time-invariant pro-environmental behaviours/habits, averaged within-person across two waves, i.e., Waves 4 and 10.

may be because they fear those children will have a bleak future or because the act is consistent with a pro-environmental lifestyle or for some other reason. The paper’s calculated effect-size is substantial. After holding constant a range of other influences, a person entirely unconcerned about environmental behaviour is estimated to be approximately 50% more likely to have a child when compared to a truly committed environmentalist.⁹

We wish to stress that this study has important limitations. Our design adopts the simplest longitudinal style and might be termed ‘prospective’ empirical analysis in some research disciplines. In

⁹ A word of caution is necessary here. This calculation should be kept very firmly 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.

particular, it should be emphasized that it is not possible to think of the current study as equivalent to a giant randomized control trial where some individuals are assigned to a treatment group and others to a control placebo group. Nor is it feasible to be certain of the precise causal channels between environmentalism and later fertility. Nor are we able to uncover all potential reasons for the declining fertility time-trend in industrialized nations like the UK. Moreover, for data reasons, the study cannot separate out those men and women who have infertility forced upon them by biology or illness or accidents. Nor can we be sure what happens, say, twenty years after people hold certain environmental beliefs. Finally, we have been unable to assess the effects of within-person changes in environmentalism. Hence this paper’s evidence, while suggestive, remains a substantial way from definitive.

The social and economic issues discussed here are, and seem certain to remain, fundamental ones for the planet and human society. We believe they demand further attention from economists and other social scientists.

AI

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CRedit authorship contribution statement

Nattavudh Powdthavee: Writing – review & editing, Formal analysis, Data curation, Conceptualization. **Andrew J. Oswald:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Ben Lockwood:** Writing – review & editing, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare none.

Data availability

The data set is publicly available.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ecolecon.2024.108184>.

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