**ONLINE APPENDIX TO**

**Popular support for environmental protection: A life-cycle perspective**

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**Appendix A. Summary statistics and key regression results**

Figure A.1: Shifts in preferences for environmental protection within individuals across surveys



Note: The figure displays respondents’ shifts in preferences for environmental protection across surveys, defined as their response to the environment question (described in the main text) during their second inclusion in the survey minus their response recorded four years before during their first inclusion in the survey. Given the response scale, this variable can range from -10 (a move from very positive to very negative about environmental protection) to 10 (a move from very negative to very positive about environmental protection). The sample covers a fully balanced rotating panel including surveys from 1989-1993 and 2001-2013 (N=2311). Including individuals with missing control variables (N=2476) provides similar results.

Figure A.2: Environmental protection preferences 1989-2013

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Note: The figure presents the mean value of respondents’ preferences for protecting the environment during each survey of the Norwegian Election Studies (1989-2013). The data cover the fully balanced rotating panel including surveys from 1989-1993 and 2001-2013 used in the main analysis.

Table A.1: Main estimation results (cf. figure 2 in main text)

|  |  |  |
| --- | --- | --- |
| Variable | *Panel I: Surveys 2001-2013* | *Panel II: Surveys 1989-1993 & 2001-2013* |
|  | Full sample | Excluding extremes (± 9) | Including controls | Full sample | Excluding extremes (± 9) | Including controls |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Age | -0.010 \*\*(-2.40) | -0.009 \*\*(-2.33) | -0.009 \*\*(-2.30) | -0.008 \*\*(-2.20) | -0.007 \*\*(-2.04) | -0.007 \*\*(-2.01) |
| Gender | - | - | 0.177(1.60) | - | - | 0.100(1.02) |
| Income | - | - | -0.016(-1.15) | - | - | -0.008(-0.62) |
| Education | - | - | 0.033(0.36) | - | - | 0.050(0.63) |
| Intercept | 0.472 \*\*(2.35) | 0.456 \*\*(2.28) | 0.401(1.23) | 0.371 \*\*(2.15) | 0.340 \*\*(2.00) | 0.228(0.84) |
| N | 1625 | 1623 | 1625 | 2311 | 2306 | 2311 |

Note: The dependent variable is the de-trended within-person change in respondents’ preferences for protecting the environment (with these preferences measured on an 11-point scale). All models in Panel I employ a fully balanced rotating panel including the surveys from 2001-2013. In Panel II, we additionally include the rotating panel covering the surveys from 1989-1993 (as reported in the main text). Columns (1), (3), (4) and (6) employ the full estimation sample, while columns (2) and (5) exclude individuals with extreme changes in their expressed preferences over time (i.e. shifts of nine or more steps on the 11-point scale). t-values based on robust standard errors between brackets. \*\*\* p<0.01; \*\* p<0.05; \* p<0.1.

Table A.2: Predicted four-year changes in environmental preferences across age groups.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Age | 22 | 26 | 30 | 34 | 38 | 42 | 46 | 50 | 54 | 58 | 62 | 66 | 70 | 74 | 78 | 82 |
| Percent change  | 8,7 | 7,3 | 5,9 | 4,4 | 3 | 1,6 | 0,1 | -1,3 | -2,7 | -4,2 | -5,6 | -7 | -8,5 | -9,9 | -11,3 | -12,7 |

 Note: The table provides predicted four-year changes in environmental preferences across ages groups, expressed as a percentage of the standard deviation of observed preference changes. Predictions are based on Column (4) in Table A.1. The data derives from a fully balanced rotating panel including surveys from 1989-1993 and 2001-2013.

**Appendix B. Alternative empirical specifications**

In the main text, our identification strategy relies on a first-difference estimation on de-trended data to uncover an inverted U-shape for environmental preferences over the life-cycle. Here, we assess the robustness of our main findings via two alternative identification strategies.

*The time-period random effects model*

If we assume that time-period effects ($γ\_{t}$) are independent of any respondent’s age, we can model the period-effects as a random variable. The model can then be estimated by a mixed model approach using the first-difference environmental preferences as response variable, and including respondent age, time-varying controls and time-period random-effects in the regression model.

$∆Pref\_{it}=γ\_{0}+γ\_{a}Age\_{it} (+γ\_{1}Controls\_{it})+[γ\_{t}+ω\_{it}]$ (B.1)

Given the assumption of uncorrelated period-shocks, our estimates using (B.1) should then correspond to the results presented in the main text. Results using this approach are presented in Table B.1. Across all specifications, the coefficient estimates of respondents’ age are strikingly similar to those presented in Table A.1. This suggests that the period shocks to environmental attitudes are very likely to be uncorrelated with respondents’ age, lending additional support to our key findings in the main text.

*The respondent fixed effects model*

In this specification, we regress environmental preferences against respondent age while controlling for generational effects by including respondent fixed effects. This approach is related to work by, for instance, Sørensen (2012) and can be expressed as follows (with subscripts *i*, *c* and *t* referring to individuals, cohorts and time, respectively):[[1]](#footnote-1)

$Pref\_{it}=β\_{i}+β\_{t}+β\_{a}Age\_{it} (+β\_{1}Controls\_{it})+ε\_{it}$ (B.2)

Where $Age\_{it}$ and $Pref\_{it}$ equal, respectively, the age and preference for environmental protection of individual *i* (who is by birth in cohort *c*) surveyed at time *t*. The inclusion of individual fixed effects ($β\_{i}$) in the model has two main implications. First, they entail that we – as in the main text – effectively focus on variation in individuals’ preferences over time. Second, as individuals’ birth cohort does not change across surveys, any cohort-specific effects are picked up by the fixed effects. As in the main text, we estimate the model with and without additional controls for respondents’ real income (in 100.000 NOK; base year 2013) and education level (in three stages as ‘lower than secondary’, ‘secondary’ or ‘higher’ education).

Following the approach in the main text, we first eliminate any time-specific effects by de-trending the data. The modified estimation approach can be written as:

$Pref\_{it}=β\_{0}+β\_{t}time dummies+ε\_{it}$ (B.3)

$\hat{ε}\_{it}=β\_{i}+β\_{a}Age\_{it} (+β\_{2}Controls\_{it})+μ\_{it}$ (B.4)

Where $time dummies$ is a full set of survey dummies and all other variables are defined as above. Before discussing the results, it is important briefly to discuss the differences and similarities between the approach in equations (B.3) and (B.4), and the approach used in the main text. The central difference lies in the starting point of both models. The model in the main text eliminates cohort effects at the onset and can only be used to identify a *non-linear* life-cycle relationship. The model given by (B.3) and (B.4) can in principle be used to estimate *linear* age effects, but cannot identify this as only an age effect due to the relationship between age and cohort (though this problem can be ‘mitigated’ by grouping people into cohorts of more than one year, as we do in some specifications below).

Figure B.1 summarizes the estimated life-cycle effects ($β\_{a}$) from equation B.4 using either ten-year (left-hand panel) or five-year (right-hand panel) age-groups and birth cohorts. The estimates using five-year groups/cohorts remain rather imprecise due to limited group/cohort sizes, but nonetheless show a substantively meaningful decline in the point estimates for the two oldest age groups. The point estimate is also statistically significantly negative for the oldest age group in the analysis. This is consistent with life-cycle effects whereby aging individuals put less emphasis on protecting the environment (Torgler and Garcia-Valiñas 2007; Franzen and Meyer 2010). The estimates using ten-year groups/cohorts are more precisely estimated and display a clear inverted U-shaped life-cycle effect (note that the point estimate for the oldest age group is statistically significantly different from all other age groups except the youngest one and the 26-35 group (p=0.106)). This is confirmed in table B.2, where we use one-year age-groups and birth cohorts. The non-linear specification of the life-cycle effect in columns (4) to (6) consistently outperforms the linear specification in columns (1) to (3), confirming the presence of an inverted U-shaped life-cycle effect. Overall, therefore, the results in figure B.1 and table B.2 are qualitatively similar to those reported in the main text, and verify the robustness of our main findings.

Figure B.1: Life-cycle effect in environmental protection preferences - fixed effects model



Note: The figure reports point estimates (with 95% confidence intervals based on standard errors clustered at respondent level) from a fixed effects panel regression using respondents’ preferences for protecting the environment measured on an 11-point scale as the dependent variable. Controls for income, education level, birth cohort and survey year included throughout. Left-hand figure employs ten-year age groups and birth cohorts, while right-hand figure employs five-year age groups and birth cohorts. All models employ a fully balanced rotating panel including surveys from 1989-1993 and 2001-2013.

Table B.1: Estimation results - random effects model

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Full sample | Excluding extremes (± 9) | Including controls |
|  | (1) | (2) | (3) |
| Age | - 0.010 \*\*\*(-3.13) | -0.0096 \*\*\*(-3.14) | -0.0095 \*\*\*(-4.63) |
| Income | - | - | -0.0002 \*(-1.68) |
| Education | - | - | 0.041(0.35) |
| Survey year RE | 0.160(0.056) | 0.157(0.056) | 0.165(0.055) |
| N | 1625 | 1624 | 1625 |

Note: The dependent variable is the first difference in respondents’ preferences for protecting the environment measured on an 11-point scale. All models employ a fully balanced rotating panel including surveys from 1989-1993 and 2001-2013. Columns (1), (3) employ the full estimation sample, while columns (2) exclude individuals with extreme changes in their expressed preferences over time (i.e. shifts of nine or more steps on the 11-point scale). The estimates for survey year random effects (RE) are standard errors. Robust z-values are presented between brackets. \*\*\* p<0.01; \*\* p<0.05; \* p<0.1.

Table B.2: Estimation results - fixed effects model

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Full sample | Excluding extremes (± 9) | Including controls | Full sample | Excluding extremes (± 9) | Including controls |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Age | - 0.010(-0.84) | -0.009(-0.78) | -0.018(-1.34) | 0.081 \*(1.95) | 0.73 \*(1.78) | 0.069(1.60) |
| Age squared | - | - | - | -0.001 \*\*(-2.24) | -0.001 \*\*(-2.06) | -0.001 \*\*(-2.04) |
| Income | - | - | -0.002(-0.15) | - | - | -0.008(-0.48) |
| Education | - | - | 0.144(1.57) | - | - | 0.106(1.21) |
| Respondent FE | YES | YES | YES | YES | YES | YES |
| N | 4622 | 4612 | 4622 | 4622 | 4612 | 4622 |

Note: The dependent variable is respondents’ (de-trended) preferences for protecting the environment measured on an 11-point scale. All models employ a fully balanced rotating panel including surveys from 1989-1993 and 2001-2013. Columns (1), (3), (4) and (6) employ the full estimation sample, while columns (2) and (5) exclude individuals with extreme changes in their expressed preferences over time (i.e. shifts of nine or more steps on the 11-point scale). t-values based on standard errors clustered on respondent between brackets. \*\*\* p<0.01; \*\* p<0.05; \* p<0.1.

1. Sørensen, R.J. (2012). Does aging affect preferences for welfare spending? A study of peoples’ spending preferences in 22 countries, 1985-2006. *European Journal of Political Economy* 29: 259-271. [↑](#footnote-ref-1)