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HUMAN CAPITAL AND CLIMATE CHANGE

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ABSTRACT

Addressing climate change requires individual behavior change and voter support for pro-climate policies, yet surprisingly little is known about how to achieve these outcomes. In this paper, we estimate causal effects of additional education on pro-climate outcomes using new compulsory schooling law data across 16 European countries. We analyze effects on pro-climate beliefs, behaviors, policy preferences, and novel data on voting for green parties – a particularly consequential outcome to combat climate change. Results show a year of education increases pro-climate beliefs, behaviors, most policy preferences, and green voting, with voting gains equivalent to a substantial 35% increase.

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I Introduction

The costs and consequences of climate change are enormous and multifaceted (Carleton and Hsiang, 2016; Graff Zivin and Neidell, 2013; Intergovernmental Panel on Climate Change, 2022; Isen, Rossin-Slater and Walker, 2017; Park, Behrer and Goodman, 2021), with monetized impacts estimated to be as large as 20% of annual global GDP within a generation (Nordhaus, 2007). On current trajectories, the world is on track to experience 2.7°C warming above pre-industrial levels within the next century, far above the global goal of 1.5°C (Climate Action Tracker, 2022). Individual behavior change and government policy are needed to dramatically alter the trajectory of emissions. Despite the urgency and scale of the challenge, current efforts are underwhelming, in part because sizable populations around the globe remain skeptical about climate change and policies to tackle it (Bechtel, Scheve and van Lieshout, 2020; Dechezleprêtre et al., 2022; Sunstein et al., 2017). Surprisingly little is known about how to overcome such resistance.

One promising approach is the accumulation of human capital through increased educational attainment.[1] More educated individuals may be better equipped to understand the complexities of climate science and have more awareness of the risks of climate change. Descriptive correlations suggests this might be true: a global survey found people with more education were more likely to see climate change as a major threat (Pew Research Center, 2019). More education might also yield transferable skills across occupations, encouraging voting for policies which promote less-polluting industries, such as renewable energy subsidies. Yet determining the causal effect of human capital accumulation on pro-climate beliefs and behaviors is challenging. People who choose to pursue more education are, by revealed preference, forward looking and thus more concerned with the future consequences of climate change. It might not be education that is causing pro-climate beliefs and actions, but rather time preferences. Reverse causality is another challenge: individuals who believe in climate change might choose to pursue more education to better adapt to a changing world.

In this paper, we overcome causal inference challenges by assembling a new database on compulsory schooling laws (CSLs) to estimate the causal effect of human capital accumulation on a series of climate outcomes in Europe. The use of CSLs as a plausibly exogenous shift in educational attainment has a rich tradition in labor and health economics (Angrist and Krueger, 1991; Black, Devereux and Salvanes, 2008; Brunello, Fort and Weber, 2009; Gathmann, Jürges and Reinhold, 2015; Goldin and Katz, 1997; Lleras-Muney, 2005; Oreopoulos, 2006), but is much more limited on climate.[2] Moreover, due to data limitations, studies have been largely limited to single countries. We build on this nascent climate literature leveraging 39 CSL reforms in 16 countries, identified via a new reforms database and data-driven definition of CSLs that lead to meaningful educational improvements. In addition, studies to date analyze limited outcomes. We study new climate outcomes which extend well beyond standard measures of beliefs and behaviors, also examining the highly consequential domains of policy preferences and voting.

[1] Human capital captures an individual's knowledge and skills (Becker, 1962) and is typically measured by education metrics including years of schooling (Barro, 2001) and learning (Angrist et al., 2021).

[2] A small set of studies explore environmental outcomes (Meyer, 2015; Powdthavee, 2021).

Europe is an ideal setting for this study. Countries in Europe enacted dozens of education reforms in the twentieth century, expanding the number of years of education legally mandated through compulsory schooling laws. At the same time, Europe has large, harmonized multi-country surveys, enabling credible within- and cross- country analyses, with recent climate modules added to the European Social Survey (ESS), which we analyze in this study. Moreover, Europe has a robust green party movement, which has an explicit environmental agenda.[3] We codify a novel dataset of green party voting outcomes, enabling identification of pro-climate voting behavior.

Our analysis focuses on outcome indices as well as on specific indicators within each index, including comparisons between correlations and causal estimates. We find significant impacts on nearly all pro-climate measures. Our headline results show that an additional year of education leads to an increase of 4.0 percentage points (PP) in pro-climate beliefs, 5.8 PP in behaviors, 1.0 PP in policy preferences, and 3.6 PP in green voting. Relative to status quo rates, these impacts are non-trivial, translating into 6.3% increase for beliefs, 8.5% for behaviors, 1.7% for policy preferences, and a striking 35.0% increase for green party voting.

These results are notable since education has been conspicuously absent from most major climate change discussions.[4] Our findings suggest expanding general education should be added to the menu of approaches considered in tackling one of the greatest modern threats to human well-being. Indeed, human capital accumulation may be vital in shaping beliefs about the costs and benefits of policies to reduce emissions (Dechezleprêtre et al., 2022) and extend directly to consequential outcomes such as policy preferences and voting.

The rest of the paper is organized as follows. The next section describes our data. Section III details our empirical strategy and Section IV presents our results. Some brief concluding remarks are offered in Section V.

II Data

Data on pro-climate outcomes – including beliefs, behaviors, policy preferences, and voting outcomes – come from the European Social Survey (ESS).[5] The ESS is conducted biannually across dozens of European countries using stratified random sampling with a total sample size ranging from 20,000 to 40,000 individuals per round. The ESS is a large microdata set capturing information on a host of social issues and is harmonized over time and across countries. In 2016, the ESS introduced novel questions on climate outcomes, such as "how often do you do things to reduce energy use?" and "how likely are you to buy energy efficient appliances?" Moreover, the ESS collected data on policy preferences such as "to what extent are you in favour or against using public money to subsidise renewable energy such as wind and solar power?" Finally, we include

[3] Green political parties' environmental focus includes climate change, pollution, and industrial agriculture.

[4] A recent analysis showed that only 24% of countries mention youth education in the context of the Paris Agreement (Kwauk, 2021) – a historic international treaty on climate change.

[5] European Social Survey European Research Infrastructure (ESS ERIC). (2020). ESS8 - integrated file, edition 2.2 [Data set]. Sikt - Norwegian Agency for Shared Services in Education and Research. https://doi.org/10.21338/ESS8E02_2

rich data on voting for green parties since 2002. Europe has a thriving green party movement in 32 countries. We codify a novel dataset of "green voting" across Europe based on party platforms. Many political parties around the world have broad mandates, and are thus too general to explore specific climate voting patterns. In contrast, green parties have an explicit environmental agenda, enabling identification of pro-climate voting.

Table 1 shows the climate outcomes we consider in our analysis and Table A2 in the Online Appendix includes the parties we classify as "green" in each country. Each climate outcome is transformed into a binary 'pro-climate' indicator if the response is equal to or above the median. For example, a response is 'pro-climate' if the respondent answered "strongly in favor" or "somewhat in favor" when asked about policies to subsidize renewable energy, since the median response is "somewhat in favor". Alternatively, we also consider a continuous outcome, where 1 is the most pro-climate response and 0 is the least.

In addition to analyzing individual outcomes, we aggregate climate outcomes into three indices: beliefs, behaviors, and policy preferences. Table 1 lists each question and denotes the index to which it belongs; indices are simple within-individual averages. Our main results also include an indicator for whether respondents voted for a member of a green party in the last election for countries where such a party exists.

Table 1: **Climate Outcomes – Beliefs, Behaviors, Policy Preferences, and Voting**

Question	Beliefs	Behaviors	Policy	Voting
Do you think the world's climate is changing	✓			
Climate change good or bad impact across world	✓			
How worried about climate change	✓			
How much electricity should be generated from coal/hydro/solar	✓			
How worried too dependent on fossil fuels	✓			
How much thought about climate change before today		✓		
How likely to buy most energy efficient home appliance		✓		
How often do things to reduce energy use		✓		
Favor increase taxes on fossil fuels to reduce climate change			✓	
Favor subsidize renewable energy to reduce climate change			✓	
Favor ban of inefficient household appliances to reduce CC			✓	
Voted for green party in last national election				✓

Notes. Each outcome is grouped by index category. Each index is computed as an average for each individual across the indicated questions. The final outcome, green voting, is a stand-alone binary outcome not aggregated with others into an index. For beliefs about the source of electricity, we create a sub-index: the ESS has questions about individuals' opinions on electricity generation from coal, gas, hydroelectric, nuclear, solar, wind, and biofuel. Given these outcomes are highly inter-related, we average pro-hydroelectric, pro-solar, and anti-coal beliefs. We exclude indicators which might be collinear with renewables captured by solar and hydro-electric, such as wind, as well as indicators with more ambiguous climate interpretations, such as nuclear.

We restrict our analysis to respondents at least 25 years old at the time they were surveyed to capture effects for those who have completed their schooling. In particular, we analyze outcomes for cohorts who received schooling and were affected by education reforms in the 1960s through the

1980s and were adults being surveyed in the ESS from 2002 to 2018. In addition to climate and voting outcomes, the ESS data contains birth year and years of education for every individual, which are critical to mapping climate outcomes to cohorts of students affected by compulsory schooling laws, and who in turn experienced exogenous shocks to their educational attainment.

To examine the causal effect of education on climate outcomes, we leverage a new World Bank dataset on compulsory schooling laws (CSLs) in Europe. Europe has had dozens of education reforms throughout the twentieth century expanding the number of years of education legally mandated through compulsory schooling laws. Figure A1 in the Appendix includes a map of the number of compulsory schooling law reforms which can be mapped to the ESS data over this time period. For each CSL, we have information on the year it was passed, the year it came into effect, and the new minimum schooling requirement under the law. For most CSLs, we also have the school starting age, and assume this to be 6 years – the most common school starting age – for CSLs for which it is missing; this lets us calculate the birth year of the first affected cohort. We identify the CSL which applies to each respondent by finding the CSL that is applicable to their birth year cohort.

Together, these two unique datasets yield exogenous shocks to education which can be mapped directly onto climate outcomes including beliefs, behaviors, policy preferences, and voting.

III Empirical Strategy

III.A Compulsory Schooling Laws as an Instrument

Compulsory schooling laws are commonly used in the economics literature as an instrument for educational attainment. We briefly review the necessary conditions for their use in our context. First, compulsory schooling must affect educational attainment. While this may seem obvious, we show in Section III.B that this relationship holds for many reforms, but does not necessarily hold for all. Thus, following (Oreopoulos, 2006), we carefully identify reforms which bind – that is, reforms which affect a large enough share of students to have a detectable increase in educational attainment. We restrict our sample to reforms with positive and significant first stages. Second, compulsory schooling must affect climate outcomes through the educational attainment channel, and not be confounded by other factors. Given the passing of compulsory schooling laws is a national, exogenous shock, resulting gains in education are largely orthogonal to other factors that would otherwise make the individual schooling decision endogenous. For example, a potential confounding variable in the education-climate relationship is individuals' valuation of the future (e.g. their discount rates or degree of present bias), which can simultaneously motivate them to pursue education as an investment in their future, as well as be concerned about the future costs of climate change. Compulsory schooling laws that have a strong first stage overcome this confounder by mandating individuals to obtain greater educational attainment, regardless of these factors.

The plausibility of the assumption that CSLs affect climate outcomes only through the education channel is further bolstered by the fact that most of the possible effects of CSLs on other mediating factors, such as income, likely increase as a direct result of the education channel. This means our estimate is the bundled effect of education, including changes in income and other mediators, that come with an exogenous increase in schooling. In line with both of these points, Table A4 in the Online Appendix shows a strong first stage on education, while no statistically significant effect on other variables which should not be affected by CSL changes and would not operate through the education channel, such as gender or country of birth.

Our estimation strategy instruments for years of education using a series of indicators for whether each compulsory schooling law binds for a given cohort of individuals. We construct these indicators cumulatively, that is, the estimated effect of the current law is the marginal effect of the law relative to the prior law. We run a two-stage least squares regression where the second stage regresses our climate outcomes on predicted education based on the applicable compulsory schooling laws, controlling for time trends and country fixed effects.[6] For a given individual i we estimate:

$$E_{icy} = \alpha_c + \beta_r \mathbf{CSL}_{icyr} + T_y \times \delta_c + \varepsilon_{icy} \tag{1}$$

$$Y_{icy} = \alpha_c + \beta_r \widehat{\mathbf{E}}_{icyr} + T_y \times \delta_c + \varepsilon_{icy} \tag{2}$$

where CSL_{icyr} is a binary indicator of whether an individual i in country c is a member of a cohort y affected by the reform r, and is therefore in the treatment group.[7] We estimate effects across multiple countries and reforms, with CSL_{icyr} representing a vector of binary indicators across all included reforms r. In Equation (1) we estimate the first stage of the effect of CSLs on educational attainment E_{icy}. Since educational attainment has trended upward over time, we condition on a linear country-specific time trend T_y.[8] We include country fixed effects δ_c given we analyze results in a unified cross-country framework.[9] We interact time trends and country fixed effects to produce country-specific time trends. Standard errors are clustered at the country-law (e.g., the CSL) level, which is the level of treatment assignment. We estimate Equation (2), the

[6]We further Winsorize educational attainment at the 1 percent level, to minimize outlier bias and address spurious coding in the ESS data of extreme values. With Winsorization, we have a minimum of two years of schooling and a maximum of 22 years. Without Winsorization, 414 respondents or 0.11% of our sample report at least 30 years of education, which clearly does not map to our standard notion of years of full-time education, even for individuals with a PhD, motivating Winsorization. Otherwise, the maximum reported education is 60 years of schooling which exerts undue leverage on the rest of the data. Nevertheless, our results also hold when using raw years of education or topcoding at 20 years of education instead.

[7]This is defined based on each respondents' birth year and starting school age to derive when the reform would first take effect for a given individual.

[8]Higher order time trends consume too much of the variation caused by the instrument, leaving insufficient identifying variation. We believe that the model with a quadratic time trend is misspecified, as evidenced by the fact that such a model yields *negative* and highly statistically significant effects of education on household earnings, contradicting the economic consensus that education causally increases earnings (Angrist and Krueger, 1991; Ashenfelter and Rouse, 1998; Card, 2001). In contrast, our model with linear country-specific time trends produces estimates more consistent with the literature.

[9]Omitted indicators are the earliest laws in each country, such that the earliest laws take the value of the country fixed effect, and each subsequent law has a positive β estimate as long as the reform i increased education relative to the country's time trend.

causal effect of additional education on a given climate outcome Y_{icy}, with two-stage least squares, where the first stage is estimated from Equation (1) with educational attainment instrumented by CSL reforms.

This specification mirrors those most common in the economics literature (Acemoglu and Angrist, 2000; Lleras-Muney, 2005; Oreopoulos, 2006). It is important to note that these strategies all identify local treatment effects of education that are applicable to individuals on the margin of dropping out in the absence of the CSL. This is the policy-relevant estimate if the policy in question is to increase minimum schooling requirements.

III.B First Stages: the Effect of CSLs on Education

Compulsory Schooling Laws (CSLs) legally mandate an increase in educational attainment, often by raising the minimum school leaving age. For example, in 1963, Italy increased minimum schooling from 5 years of education to 8 (equivalent to increasing the minimum school leaving age from 11 to 14 years old). We carefully identify reforms for which there is a strong first stage – that is, where an increase in required years of schooling by CSLs substantially increases average educational attainment, net of the time trend, rather than assume all CSLs increase education, or that all individuals are affected by CSLs. While legally enforceable, changes to CSLs will only have a strong first stage if they are enforced, rolled out rapidly, and bind for those who would otherwise not proceed to attain more schooling without the law (e.g., some individuals may attain 8 years of education in Italy even before it was legally required).

We estimate Equation 1 on all rounds of the ESS with standard errors clustered by country$\times$law.[10] We define and analyze binding first stages as those that are positive and statistically significant with a t-statistic greater than 1.96, indicating a robust relationship. Figure 1 shows the 16 countries with relevant reforms (and up to 39 country-reforms, with multiple binding reforms in some countries). Table A3 in the Online Appendix shows all first stages with positive effects, including those that are not statistically significant. Countries in the main analysis include Albania, Austria, Belgium, Bulgaria, Czechia, Germany, Denmark, Hungary, Iceland, Italy, Lithuania, Luxembourg, Latvia, Russia, Slovakia, and Ukraine. We exclude countries, such as the United Kingdom, where reforms occurred at the sub-national level and do not map cleanly to the ESS data.

[10] By using all rounds of the ESS to determine strong first stages, we have more power to estimate the true effect of compulsory schooling laws beyond the country's time trend.

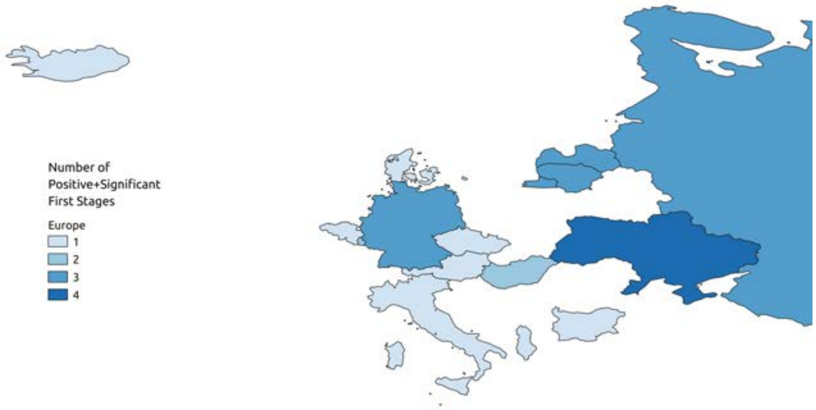

Figure 1: **Compulsory schooling law changes with positive and significant effects on education by country**. This figure shows the number of compulsory schooling law changes with strong first stage estimates by country. The map show the number of reforms that are positive and statistically significant. Countries in the main analysis include Albania, Austria, Belgium, Bulgaria, Czechia, Germany, Denmark, Hungary, Iceland, Italy, Lithuania, Luxembourg, Latvia, Russia, Slovakia, and Ukraine.

IV Results

Results on our three main pro-climate indices - beliefs, behaviors, and policy preferences - as well as green voting are shown in Table 2. An additional year of education leads to an increase of 4.0 percentage points (PP) in pro-climate beliefs, 5.8 PP in behaviors, 1.0 PP in policy preferences, and 3.6 PP in green voting. These impacts translate into a 6.3% increase for beliefs, 8.5% for behaviors, 1.7% for policy preferences, and a whopping 35.0% for green party voting. Panel B of Table 2 shows the results with continuous outcomes to ensure results are not driven by binary threshold values defined as being "pro-climate". Results remain consistent. Point estimates are positive and p-values also follow a similar pattern. For example, an additional year of education has large and statistically significant effects on pro-climate beliefs and behaviors, with p-values below $<$ 0.001 in both panels. Of note, while effect directions and statistical significance can be compared, the magnitudes in Panels A and B are not directly comparable.[11] In Online Appendix Figure A3 we include a series of robustness tests, such as various time trends and inclusion of all CSLs with positive first stages, not just those that are statistically significant, among others. Results show slightly dampened effects, but consistently large and positive effects.

In Figure 2, we compare the causal effects derived from IV estimates on the three pro-climate indices and green voting to their corresponding OLS correlation estimates, expressed in terms of standard deviations for comparability between outcomes. In Figure 2 and Table 3 we analyze

[11] In Panel A, a one unit change in the outcome is the difference between being below and above median, whereas in Panel B, a move from 0 to 1 means changing from the most anti-climate response to the most pro-climate.

outcomes using binary indicators for ease of interpretation. Results are similarly robust whether using binary or continuous outcomes. The gains shown in Table 2 translate to 0.152 standard deviation increase for pro-climate beliefs, a 0.184 increase for behaviors, a 0.033 increase for policies, and a 0.130 for green party voting. Moreover, IV causal estimates are substantially larger than OLS estimates for beliefs, behaviors, and voting. One important potential explanation for these larger causal estimates is downward bias in the OLS estimates due to income effects. More educated individuals are often richer, and richer individuals are often more conservative – a standard assumption in political economy models (Meltzer and Richard, 1981) – and thus might be less pro-climate. Indeed in Table A1 in the Online Appendix we see correlations exactly along these lines. The substantial increase in causal IV estimates relative to OLS estimates – more than a tripling in magnitude – highlights the importance of credible causal identification of the effects of education on pro-climate outcomes.

Table 2: **The effect of education on pro-climate outcomes**.

	(1) Pro-climate beliefs	(2) Pro-climate behaviors	(3) Pro-climate policy preferences	(4) Green voting
Panel A: indicators for above-median climate stance				
Years of education	0.040	0.058	0.010	0.036
	(0.007)	(0.009)	(0.009)	(0.013)
	[0.000]	[0.000]	[0.225]	[0.005]
Mean	0.640	0.682	0.627	0.103
Percent change	6.3 %	8.5 %	1.7 %	35.0 %
Panel B: continuous pro-climate variables				
Years of education	0.018	0.035	0.005	0.036
	(0.004)	(0.007)	(0.006)	(0.013)
	[0.000]	[0.000]	[0.408]	[0.005]
Mean	0.635	0.633	0.601	0.103
Percent change	2.9 %	5.6 %	0.8 %	35.0 %
Observations	17353	17349	16950	52493
Clusters	36	36	36	39

Notes: This table shows the causal effect of a year of education on each pro-climate outcome index, as in Equation (2). The outcome in Panel A denotes effects on being pro-climate defined in binary terms (relative to the median). Panel B shows averages of the continuous outcomes, where 1 is the most pro-climate response to each question and 0 is the least. Standard errors clustered by country×CSL in parentheses. Standard errors are in parentheses and p-values are in brackets.

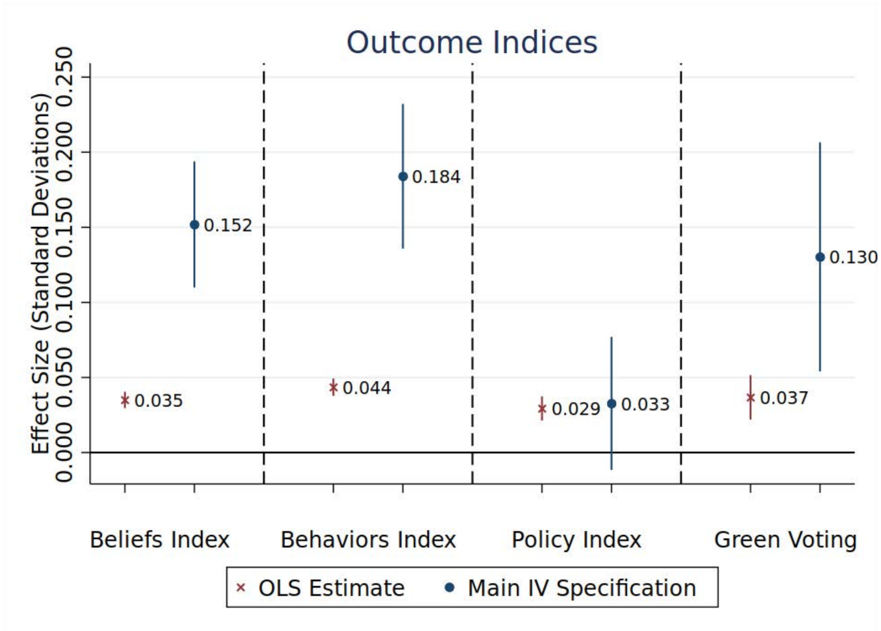

Figure 2: **Effects of Education on Pro-Climate Outcomes - Standardized causal estimates vs. correlations**. This figure plots estimates from our main IV specification which captures causal estimates compared to the OLS estimate which shows correlational estimates, both with linear country-specific time trends and country fixed effects. The OLS regression is restricted to the same sample as the IV. The indices are standardized and expressed in terms of standard deviations. 90% confidence intervals shown from standard errors clustered at the country×law.

While Table 2 shows our primary results, the panels of Table 3 break down each of the indices into their components, showing positive and significant estimates on nearly every sub-outcome. In terms of specific indicators, on beliefs, we find one year of education has a 4.5 percentage point increase in thinking the world's climate is changing, with similar effects on worrying about climate change and worrying about dependency on fossil fuels. We also find effects on beliefs in favor of pro-clean energy captured in an index composed of being pro-solar, pro-wind, and anti-coal. In terms of behaviors, we find 4.1 and 6.0 percentage point increases in reducing energy use and buying energy efficient appliances, respectively, with a 7.1 PP increase in having thought about climate change before today. For policy preferences, we find a 2.2 PP increase in favoring bans on the sale of inefficient appliances and a 2.4 PP increase on favoring subsidies for renewable energy. In contrast, we find no effect on preferences to increase taxes on fossil fuels, a result that attenuates our policy index despite two of the three components being strongly positive. This result suggests that individuals may be less supportive of pro-climate policies when the costs of those actions are salient and run counter to self-interest (Dechezleprêtre et al., 2022), such as through immediate tax increases. The impacts on green voting are larger than those for policy preferences, suggesting that rather than promote individual policies, a broad commitment to a green agenda might attract the most voter support from more educated citizens.

Table 3: **Effect of education on each element of pro-climate outcome indices**.

	Climate Outcomes				
	(1)	(2)	(3)	(4)	(5)
Panel A: pro-climate beliefs	Think the world's climate is changing	CC has bad (not good) impact across world	Worried about CC	Pro-clean energy beliefs	Too dependent on fossil fuels
Years of education	0.045	0.024	0.052	0.025	0.048
	(0.016)	(0.014)	(0.010)	(0.009)	(0.015)
	[0.005]	[0.091]	[0.000]	[0.007]	[0.001]
Observations	16926	15986	16473	16842	16517
Clusters	36	35	36	36	36
Mean	0.542	0.566	0.760	0.717	0.654
Percent change	8.2 %	4.2 %	6.8 %	3.4 %	7.4 %
Panel B: pro-climate behaviors	Thought about CC before today	Likely to buy most efficient appliance	How often do things to reduce energy use		
Years of education	0.071	0.060	0.041		
	(0.010)	(0.014)	(0.016)		
	[0.000]	[0.000]	[0.012]		
Observations	17240	16888	17059		
Clusters	36	36	36		
Mean	0.688	0.664	0.706		
Percent change	10.3 %	9.0 %	5.8 %		
Panel C: pro-climate policy preferences & voting	Favor increase taxes on fossil fuels to reduce CC	Favor subsidise renewable energy	Favour ban sale of inefficient household appliances	Green Voting	
Years of education	-0.008	0.024	0.022	0.036	
	(0.017)	(0.011)	(0.010)	(0.013)	
	[0.631]	[0.028]	[0.037]	[0.005]	
Observations	16417	16734	16611	52493	
Clusters	36	36	36	39	
Mean	0.544	0.748	0.589	0.103	
Percent change	-1.5 %	3.3 %	3.7 %	35.0 %	

Notes: This table shows point estimates for each of the elements of the indices. Panel A shows the elements of the beliefs index, Panel B the behaviors index, and finally Panel C shows both the policy preferences index and green voting. Outcomes are binary, so multiplying the point estimate by 100 yields the percentage point increase in the likelihood of having a pro-climate stance on the given outcome from an additional year of education. Standard errors clustered at the country×law level in parentheses and p-values in brackets. Estimates include country fixed effects and country-specific linear time trends. "CC" means "climate change".

V Conclusion

Climate change poses existential risks to the planet and generates trillions of dollars in annual costs to society. While changing pro-climate beliefs, behaviors, policy preferences, and voting is difficult, a promising approach is through more education. This paper provides strong causal evidence that education can impact a range of pro-climate outcomes. We find that an additional year of education is linked with increases in pro-climate beliefs, behaviors, most policy preferences, and green voting, with voting gains equivalent to a large 35% increase – effects which are particularly consequential to promote pro-climate policies.

While education is often a footnote in climate change agendas, this paper reveals the promise of education as an additional tool to combat climate change. Europe in particular is a context where climate change is receiving substantial attention, including efforts such as the European Green New Deal, yet education remains an underutilized lever. Moreover, while educational attainment has expanded dramatically in recent decades, the median school reform law in 2020 in Europe guaranteed only 10 years of schooling, a full two years below a complete primary and secondary education of 12 years. These gaps are even more dramatic in the developing world; in sub-Saharan Africa educational reform laws only guarantee 8 years of schooling on average. Expanding access to education has traditionally been believed to play a transformative role in the economic and social well-being of societies – it now also appears to play a vital role in the battle against climate change.

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A Appendix

A.A Correlations between Education, Income, and Conservatism

Table A1: **Correlations between education, income, and conservatism**.

	Raw		Residualized	
	Schooling	Conservatism	Schooling	Conservatism
Income	0.383	0.068	0.295	0.061

Notes: This table shows correlation coefficients between income and both schooling and conservatism. Conservatism reflects where respondents self-report falling on a 0-1 scale where 1 is most right-leaning and 0 is most left-leaning on the political spectrum. Years of schooling is the Winsorized years of education attained, as in the main text. Lastly, income is the self-reported household income decile, normalized to fall on the 0-1 range. Raw correlations are simply the correlation coefficients in our main analysis sample. Residualized coefficients are the result of first residualizing income, schooling, and conservatism on country fixed effects and country-specific linear time trends as in the main analysis.

A.B Green Party Coding

Table A2: **Green party coding**.

Country	Abbr.	Green Parties
Austria	AT	Grüne
Belgium	BE	Groen!, Ecolo
Switzerland	CH	Green Party
Cyprus	CY	The Cyprus Green Party
Czechia	CZ	Česká pirátská strana
Germany	DE	Alliance 90/The Greens
Denmark	DK	SF Socialistisk Folkeparti, Alternativet
Estonia	EE	Erakond Eestimaa Rohelised
Spain	ES	En Comú Podem, Iniciativa per Catalunya-Verds
Finland	FI	Green League
France	FR	EELV (Europe Ecologie Les Verts)
Hungary	HU	LMP (Lehet Más A Politika)
Ireland	IE	Green Party
Iceland	IS	Vinstri hreyfinguna - grænt framboõ
Lithuania	LT	Lithuanian Green Party (LZP)
Latvia	LV	Zaļo un Zemnieku savienība
Netherlands	NL	Green Left
Norway	NO	Miljøpartiet De Grønne
Portugal	PT	PAN - Pessoas-Animais-Natureza
Sweden	SE	Miljöpartiet de gröna

Notes: An individual is coded as voting green if they reported voting for one of the listed parties in the last election. Missing responses and those from countries with no green parties in the relevant election are coded as missing. Those who voted for a different party in countries with green parties at the time are coded as not voting green.

A.C First Stage Estimates

In this paper, we leverage a new dataset on compulsory schooling laws in Europe from the World Bank, which is one of the largest datatabases on CSLs to date. Figure A1 shows the number of compulsory schooling law reforms by country.

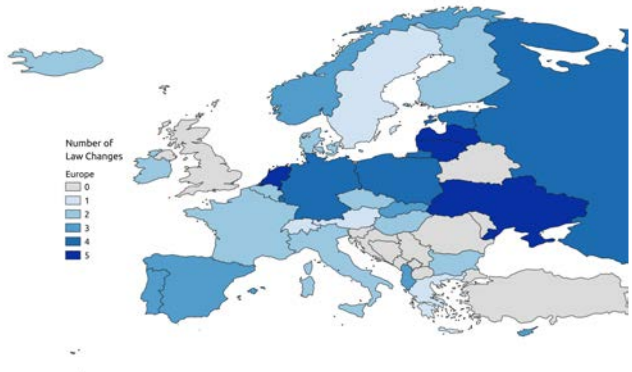

Figure A1: **Number of compulsory schooling Law (CSL) reforms by country**. The map shows all CSL changes that can be mapped to the ESS data. Note that a British reform commonly used in literature is excluded from our analysis, because this reform is region-specific and the ESS data does not have enough geographic granularity to accurately assign regional laws to respondent's individual level climate outcomes.

Figure A2 shows all first stages with positive effects, in addition to the first stages with both positive and highly statistically significant effects included in the main analysis in the paper. Exact first stage estimates are included in the table below. We provide these estimates to give a comprehensive picture of where CSLs bind and have large effects versus where effects are smaller.

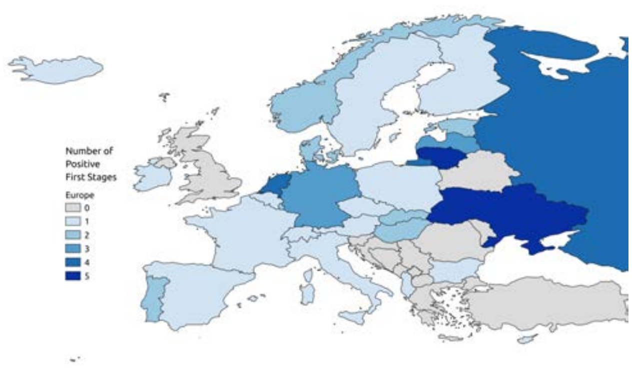

Figure A2: **Positive CSL changes by country**. This figure shows the number of compulsory schooling law changes with positive (but not necessarily significant) first stage estimates by country.

Table A3: **CSL changes with any education effect**

Reform & Year	Estimate	Positive	Positive+Significant
AL8	2.079	✓	✓
1963	(0.271) [0.000]		
AT9	0.595	✓	✓
1966	(0.201) [0.004]		
BE8	1.217	✓	✓
1919	(0.122) [0.000]		
BG8	0.718	✓	✓
1960	(0.349) [0.042]		
CH9	0.069	✓	
1970	(0.209) [0.741]		
CY6	0.194	✓	
1962	(0.480) [0.687]		
CZ9	0.363	✓	✓
1948	(0.013) [0.000]		
DE13	0.502	✓	✓
1992	(0.044) [0.000]		
DE4	0.315	✓	✓
1920	(0.015) [0.000]		
DE8	0.981	✓	✓
1946	(0.026) [0.000]		
DK7	0.893	✓	✓
1958	(0.247) [0.000]		
DK9	0.109	✓	
1972	(0.310) [0.726]		
EE6	0.850	✓	
1920	(0.776) [0.276]		
EE8	0.729	✓	
1958	(0.666) [0.276]		
ES8	0.331	✓	
1970	(0.355) [0.353]		
FI6	1.136	✓	
1921	(1.399) [0.419]		
FR10	0.116	✓	
1967	(0.061) [0.059]		
HU10	0.568	✓	✓
1961	(0.173) [0.001]		

HU8	1.077	✓	✓
1945	(0.095) [0.000]		
IE9	0.182	✓	
1972	(0.203) [0.371]		
IS7	1.361	✓	✓
1936	(0.555) [0.016]		
IT8	1.040	✓	✓
1963	(0.516) [0.046]		
LT11	0.023	✓	
1980	(0.045) [0.607]		
LT5	1.894	✓	✓
1937	(0.051) [0.000]		
LT7	0.766	✓	✓
1953	(0.030) [0.000]		
LT8	1.477	✓	✓
1958	(0.082) [0.000]		
LT9	0.135	✓	
1980	(0.124) [0.276]		
LU10	0.717	✓	✓
1977	(0.098) [0.000]		
LU11	0.785	✓	✓
1993	(0.019) [0.000]		
LV5	1.176	✓	✓
1937	(0.055) [0.000]		
LV7	0.188	✓	✓
1953	(0.032) [0.000]		
LV8	0.736	✓	✓
1958	(0.088) [0.000]		
NL10	0.142	✓	
1973	(0.162) [0.382]		
NL7	0.169	✓	
1928	(0.292) [0.565]		
NL8	0.570	✓	
1950	(0.289) [0.051]		
NL9	0.220	✓	
1969	(0.173) [0.207]		
NO7	0.761	✓	
1936	(0.772) [0.327]		

NO9	0.105	✓	
1969	(0.809) [0.897]		
PL8	0.309	✓	
1966	(0.463) [0.506]		
PT6	1.170	✓	
1964	(0.804) [0.148]		
PT9	0.756	✓	
1986	(0.750) [0.316]		
RU5	1.482	✓	✓
1937	(0.039) [0.000]		
RU7	0.855	✓	✓
1953	(0.024) [0.000]		
RU8	0.651	✓	✓
1958	(0.086) [0.000]		
RU9	0.069	✓	
2004	(0.096) [0.472]		
SE9	0.357	✓	
1963	(0.864) [0.680]		
SK8	1.338	✓	✓
1948	(0.153) [0.000]		
SK9	0.709	✓	✓
1948	(0.145) [0.000]		
UA12	0.714	✓	✓
2002	(0.024) [0.000]		
UA5	1.575	✓	✓
1937	(0.077) [0.000]		
UA7	1.144	✓	✓
1953	(0.043) [0.000]		
UA8	0.474	✓	✓
1958	(0.141) [0.001]		
UA9	0.102	✓	
1996	(0.156) [0.517]		
Observations	315927		

[1]Notes: This table shows first stage estimates for Equation (1) for each CSL that positively affects educational attainment. The point estimate is the effect on educational attainment following each CSL's implementation, controlling for country-specific linear time trends and country fixed effects. The numbers following each country code indicate the years of schooling required by each law (AL8 requires 8 years of schooling in Albania). The listed year is

A.D CSL Validity Test

Table A4: **Validity test**

	(1) Male b/se/p	(2) Born in Country b/se/p	(3) Years of Education b/se/p
After first CSL	0.009	0.008	1.016
	(0.011)	(0.005)	(0.144)
	[0.430]	[0.107]	[0.000]
Observations	159091	159057	159169

Standard errors in parentheses. P-values in brackets.

Notes: This table shows the coefficient on the indicator for being after the first CSL change in a country while additionally controlling for country fixed effects and linear country-specific time trends. The outcomes are (1) an indicator for the respondent being male, (2) an indicator for being born in the country they are surveyed in, and (3) Winsorized years of education. The small and nonsignificant estimates in Columns (1) and (2) along with the large and highly significant estimate on years of education support the validity of the instrument, as CSL changes affect schooling without a discernible effect on predetermined outcomes like gender and birth country, suggesting that there are not other important confounders at play. Note that while the ESS has plenty of other outcomes that could be tested in this manner, gender and birth location are the primary ones that we do not expect to be influenced by education, as these are determined before the amount of schooling is realized.

A.E Robustness and Alternate Specifications

In this section, we consider the robustness of our estimates to several modeling decisions. We analyze results with all positive first stages (not just those that are statistically significant as in the main analysis), as well as using all reforms. In addition, we analyze results with alternative time trends such as squared time trends. Finally, rather than using indicators for compulsory schooling laws as the instrument for educational attainment, we use the current level of the minimum schooling requirement rather than a binary indicator, controlling for the upward time trends and country fixed effects.

Figure A3 shows a plot of estimates across these robustness tests, showing broadly similar patterns and robustness. We see slightly dampened effects across various robustness tests, which is to be expected, however positive and large effects of education on pro-climate outcomes persist.

the first birthyear affected by the law. CSL changes not included in this table have nonpositive first stage estimates. Standard errors are in parentheses.

[2]Notes: Regressions of indicators for male and being born in the same country as being surveyed in on the indicators for each CSL in the presence of country fixed effects and country-specific linear time trends.

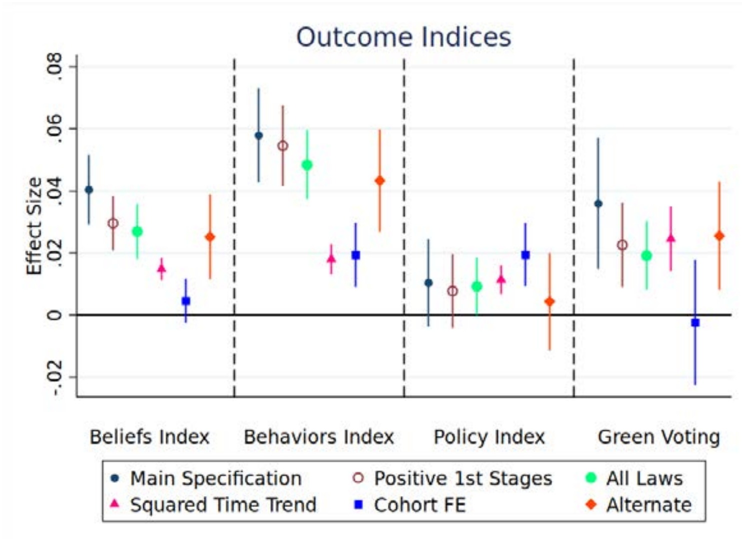

Figure A3: **Robustness checks**. Figure shows IV estimates for the four outcome indices under alternative time trend specifications and inclusion criteria for the first stage. The main specification is as in Section III (linear country-specific time trend and country fixed effects for CSL changes with positive statistically significant effects). *Squared Time Trend* is the same as *Main* but replaces the country-specific linear birth year term with a country-specific squared birth year term (centered on 1950). *Cohort Fixed Effect* is the main specification replacing the country-specific linear time trend with birth cohort indicators (allowing for a completely flexible European time trend, but without variation by country beyond a country-specific intercept). *All Laws* is the main specification including all reforms as instruments. *Alternate* is the secondary IV specification where the instrument is the number of years of schooling interacted with country. 90% confidence intervals shown from standard errors clustered at the country×law.

A.F ESS Question Text and Pro Environmental Beliefs Definitions

We include exact question working and coding for our main pro-climate outcomes.

- **Importance to care for nature and environment**: (ESS 2016 and 2018) Now I will briefly describe some people. Please listen to each description and tell me how much each person is or is not like you. Use this card for your answer. She/he strongly believes that people should care for nature. Looking after the environment is important to her/him.

- **How likely to buy most energy efficient home appliance**: If you were to buy a large electrical appliance for your home, how likely is it that you would buy one of the most energy efficient ones?
  0 Not at all likely - 10 Extremely likely

- **How often do things to reduce energy use**: There are some things that can be done to reduce energy use, such as switching off appliances that are not being used, walking for short journeys, or only using the heating or air conditioning when really needed. In your daily life, how often do you do things to reduce your energy use?

- **How much electricity should be generated from coal**: The highlighted box at the top of this card shows a number of energy sources that can be used to generate electricity. Please take a moment to look over them. How much of the electricity used in [country] should be generated from each energy source? First, how much of the electricity used in [country] should be generated from coal?

- **How worried too dependent on fossil fuels**: How worried are you about [country] being too dependent on using energy generated by fossil fuels such as oil, gas and coal?

- **Do you think the world's climate is changing**: You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing?

- **How much thought about climate change before today**: How much have you thought about climate change before today?

- **How worried about climate change**: How worried are you about climate change?

- **Climate change good or bad impact across world**: How good or bad do you think the impact of climate change will be on people across the world? Please choose a number from 0 to 10, where 0 is extremely bad and 10 is extremely good.
  0 Extremely bad - 10 Extremely good

- **Favour increase taxes on fossil fuels to reduce climate change**: To what extent are you in favour or against the following policies in [country] to reduce climate change? Increasing taxes on fossil fuels, such as oil, gas and coal.

- **Favour subsidise renewable energy to reduce climate change**: To what extent are you in favour or against the following policies in [country] to reduce climate change? Using public money to subsidise renewable energy such as wind and solar power.

- **Favour ban of least energy efficient household appliances to reduce climate change**: To what extent are you in favour or against the following policies in [country] to reduce climate change? A law banning the sale of the least energy efficient household appliances.