Online Appendix

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This appendix provides supporting information for the article "European Institutional Integration and the Educational Divide in Support for the European Union." The appendix has two sections. The first section contains descriptive information for each variable in the empirical analysis, as well as an overview of our country-year sample. The second section reports sensitivity tests that we discuss in the paper without presenting the specific results.

1 Data details

Table A1 lists the minimum (min), median, mean, maximum (max), and the standard deviation (SD) of each variable in our Bayesian logistic mixed-effects models. We standardized the continuous variables by centering and scaling them by two times their SD. Table A2 reports the countries in our sample (so-called EU-15) and the years in which these countries were included in the Eurobarometer survey between 1976 and 2014.

Table A1: Standardized data used in Bayesian logistic mixed-effects models.

Variable	Min	Median	Mean	Max	SD
Education	0.00	1.00	0.94	2.00	0.77
European institutional integration	−1.58	0.08	0.00	0.96	0.50
Age	−0.96	−0.03	0.00	1.54	0.50
Female	0.00	0.00	0.50	1.00	0.50
Married	0.00	0.00	0.61	1.00	0.49
Left-Right self-placement	−1.05	−0.08	0.00	1.14	0.50
Unemployed	0.00	0.00	0.06	2.00	0.24
Retired	0.00	0.00	0.23	2.00	0.42
Unemployment rate	−1.10	−0.06	0.00	2.67	0.50
Social transfers	−1.45	0.07	0.00	1.59	0.50
Globalization	−1.63	0.07	0.00	0.78	0.50

Table A2: Countries and years included in the sample.

Country	Years
Austria	1995—2014
Belgium	1976—2014
Denmark	1976—2014
Finland	1995—2014
France	1976—2014
Germany	1976—2014
Greece	1980—2014
Ireland	1976—2014
Italy	1976—2014
Luxembourg	1976—2014
Netherlands	1976—2014
Portugal	1985—2014
Spain	1985—2014
Sweden	1995—2014
United Kingdom	1976—2014

2 Additional empirical results

Results in Figure 4 of the article are not sensitive to weights and a random slope for education. The regression results in our article do not rely on survey weights. The reason is that the required weighting of the likelihood contribution of each observation would make the corresponding computation overly expensive. To test the sensitivity of our results to a weighted approach, Figure A1 compares the initial results of the simpler base model to the same model with survey weights (the structure of the survey weights are explained in Section 4.1 in the article). The estimated posterior means and 95% credible intervals of both models are virtually identical.

Moreover, there is increasing evidence that ignoring group-level variation in the effects of lower-level variables can lead to biased estimates of hierarchical models, in particular in the context of cross-level interactions (Bell et al., 2019; Hazlett and Wainstein, 2022; Heisig et al., 2017; Heisig and Schaeffer, 2019). Hence, the next two models in Figure A1 contrast the results from our previous interaction model with an interaction model that includes a random slope for education. The random slope allows the effect of education to vary freely across years. Consequently, if the fact that the proportion of higher educated increased over time had an impact on our results, including the random slope for education would significantly alter our estimates. However, apart from slightly widening credible intervals, our findings remain again substantially unchanged.

Figure A1: Sensitivity to weights and random slope for education.

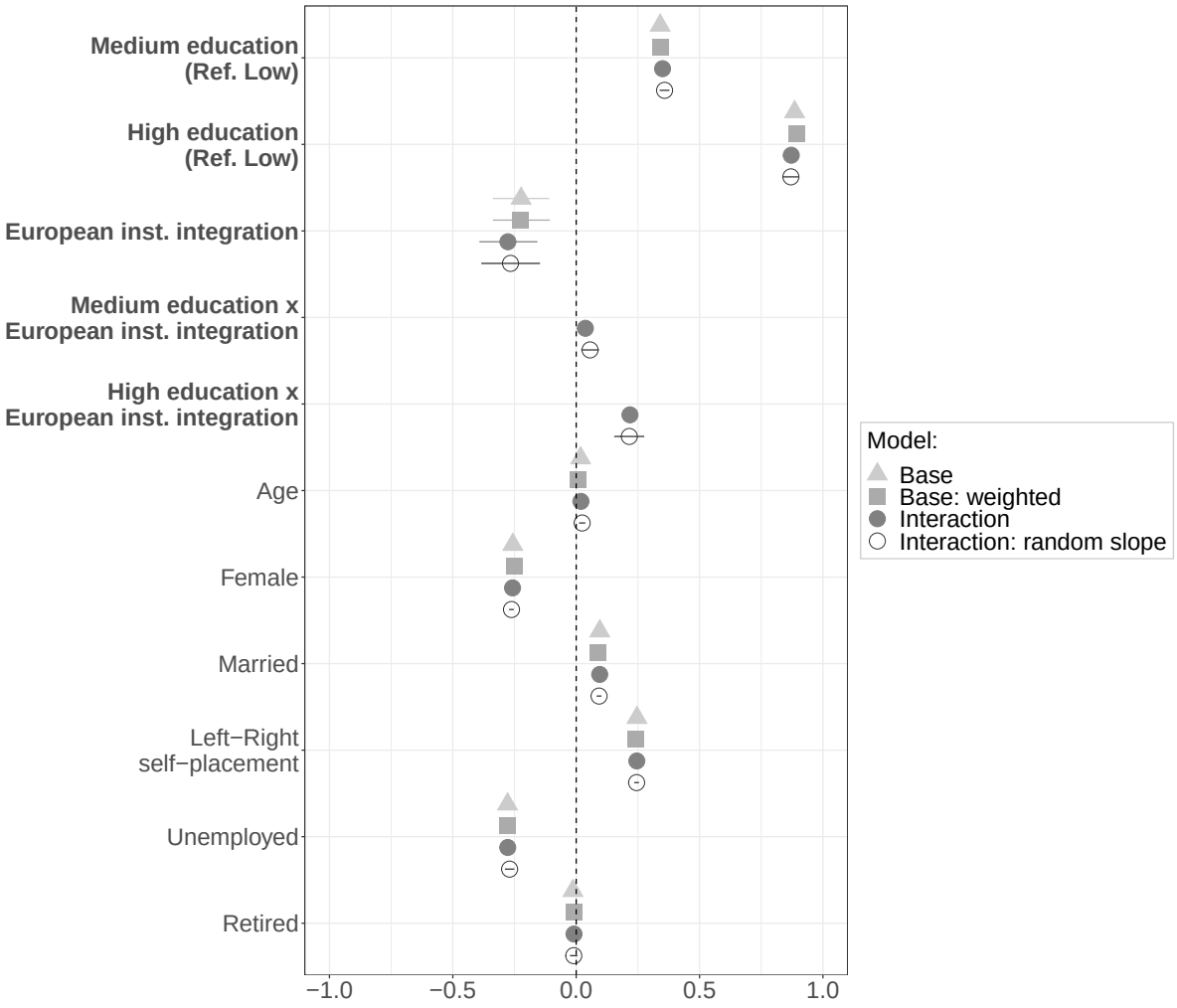
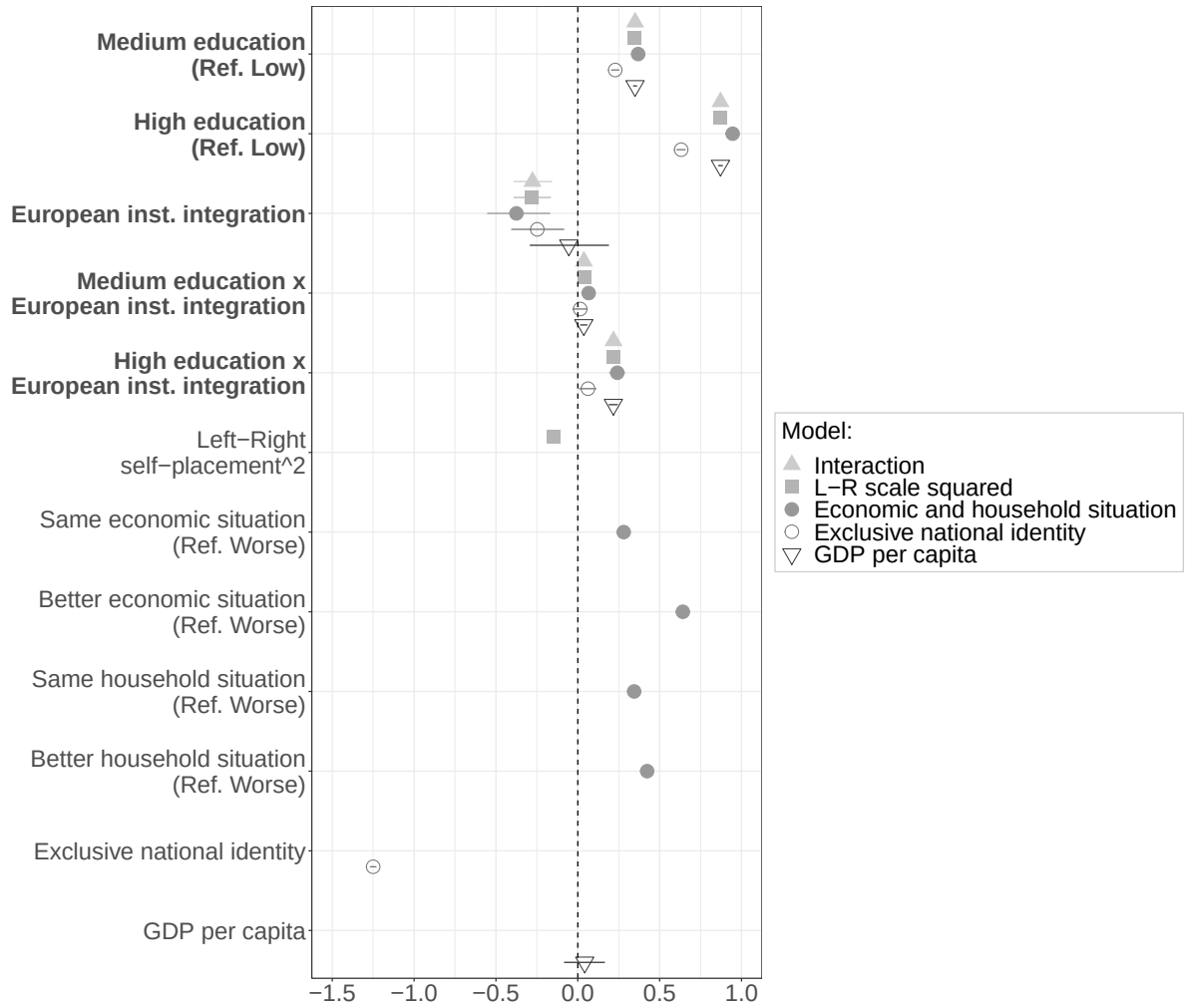


Figure A2: Sensitivity to additional individual-level and country-level covariates (other controls not shown).



Results in Figure 4 of the article replicate with additional individual-level and country-level covariates. Figure A2 presents the results from five different models. The interaction model refers to the interaction model in Figure 4 in the main text (controls not shown). The second model adds to this interaction model a squared term for the political Left-Right self-placement to the remaining set of controls. The squared transformation is statistically significant but the estimates for our main variables of interest remain virtually identical.

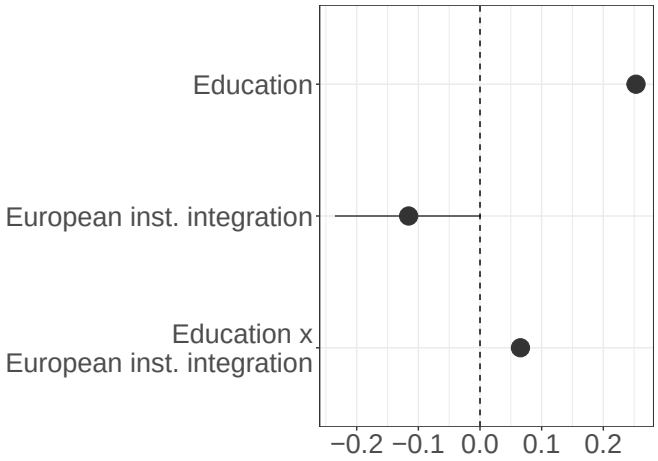
The third model adds two measures that capture how individuals assess the current and future economic situation in their country as well as the current and future financial situation of their household. Both measures have significant weaknesses. They both appear first in the Eurobarometer in wave 18 in the year 1982. In its early formulation, both survey items are backward looking, asking respondents how they think their country's

economic and their household's financial situation has changed over the last year. Respondents answer these questions on a five-item scale: (1) a lot better, (2) a little better, (3) stayed the same, (4) a little worse, (5) a lot worse. However, since Eurobarometer wave 58.1 (year 2002) in our dataset, the question phrasing is forward looking, asking individuals how they think the economic and financial situation will change in the next 12 months. In addition, the answer categories are recorded on a three-item scale: (1) better, (2) same, (3) worse. To have a longer observation period, we decided to combine both questions nonetheless, recoding the response scale of the earlier survey item (merging the first two response categories as 'better' and the last two as 'worse'). Including the resulting variables in the model significantly reduces the number of observations (from 820,688 to 284,697) due to the shorter and incomplete time series. With these caveats in mind, Figure A2 shows that our main results remain unaffected by these additional controls.

In the fourth model, we add a dummy for exclusive national identity. This variable is based on the following survey item: *In the near future, do you see yourself as (1) (NATIONALITY) only, (2) (NATIONALITY) and European, (3) European and (NATIONALITY), or (4) European only?* Our binary variable recodes this response scale such that a value of 1 indicates national identity only, and 0 otherwise. The first time the question appeared in the Eurobarometer was in wave 37 in the year 1992 and since then, the question was only infrequently included (in 14 out of 23 years). Accordingly, controlling for this variable in the analysis reduces the number of observations to 204,645. The results in Figure A2 suggest that our main effects are still statistically significant but smaller. However, the interpretation of these estimates is very difficult, if not impossible, due to post-treatment bias: an individual's identity is (at least partly) conditioned by that person's level of education, and at the same time an individual's identity and whether that person supports the EU reflects likely (unmeasured) common causes. Thus, it is impossible to know how much the inclusion of the identity variable biases our estimates of interest (Elwert and Winship, 2014; Montgomery et al., 2018).

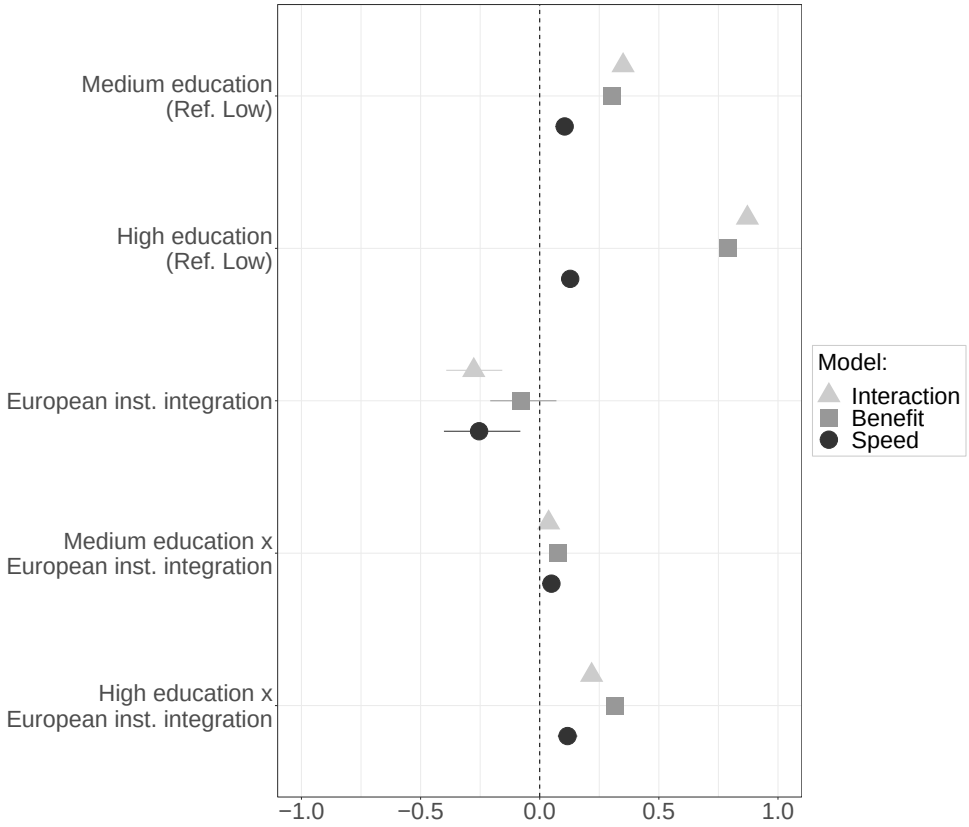
Finally, the last model controls for GDP per capita (data from the World Bank) in addition to the other country-level controls (not shown). This variable has little effect on our main estimates.

Figure A3: Continuous measure of education standardized within country-years (controls not shown).



Treating education as continuous variable standardized within country-years does not change main findings. Based on the question of how old respondents were when they completed their education, the education variable is originally measured on the following nine-point scale: (1) up to 14 years, (2) 15 years, (3) 16 years, (4) 17 years, (5) 18 years, (6) 19 years, (7) 20 years, (8) 21 years, (9) 22 years or older. In the article, we transform this scale into a three-level categorical variable: low education (15 years or younger), medium education (16 to 19 years), and high education (20 years or older). We test the sensitivity of this coding approach in Figure A3, where we treat education on its original nine-point scale as a continuous variable. We standardize this variable by grouping it in country-years, subtracting the group-specific mean, and scaling it by two times its standard deviation. This standardization helps to account for changes in the composition of the education variable over time by comparing each individual's educational level to the mean and (double) standard deviation of educational levels within their specific country and time period. The estimates presented in Figure A3 corroborate our main finding that European institutional integration increases the educational gap in EU support.

Figure A4: Alternative measures of EU support (controls not shown).



Main results hold when alternative measures of EU support are used. Figure A4 summarizes our estimates of interest from three models. Besides our standard interaction model, the second model uses the following Eurobarometer question as response variable: *Taking everything into consideration, would you say that (YOUR COUNTRY) has on balance benefited or not from being a member of the European Community/European Union?* A value of 1 indicates that a person thinks her country has benefited from membership, and 0 otherwise. The question appeared first in Eurobarometer wave 22 in the year 1984 and was frequently included since. Running the model with this response variable reduces the number of observations to 561,342. Figure A4 shows that this specification yields very similar results as the interaction model.

The third model uses a response variable that asks respondents about their preferred speed of European integration. While the exact formulation of the question changed over time, the response scale remained unchanged, ranging from (1) standing still to (7) as fast as possible. The survey item was first included in Eurobarometer wave 26 in the year 1986, but no longer after 2008. We use a cumulative logit-link function to account for the ordered categorical nature of the data. The number of observations is 224,924. The results in Figure A4 depict a similar pattern for our estimates of interest as previously

reported.

Main finding in our article can be replicated with data from the European Social Survey. We replicate our analysis with an alternative data source for the individual-level factors: the European Social Survey (ESS). In five of its waves (2004, 2006, 2008, 2012, 2014) over the relevant time period up to 2014, the ESS included the following question on EU support: *Now thinking about the European Union, some say European unification should go further. Others say it has already gone too far. Using this card, what number on the scale best describes your position?* Respondents were then asked to position themselves on a 11-point scale ranging from (0) *unification has already gone too far* to (10) *unification should go further*. Treating this item as our continuous dependent variable, we repeat the previous interaction model using the same set of controls as in the interaction model of the article.

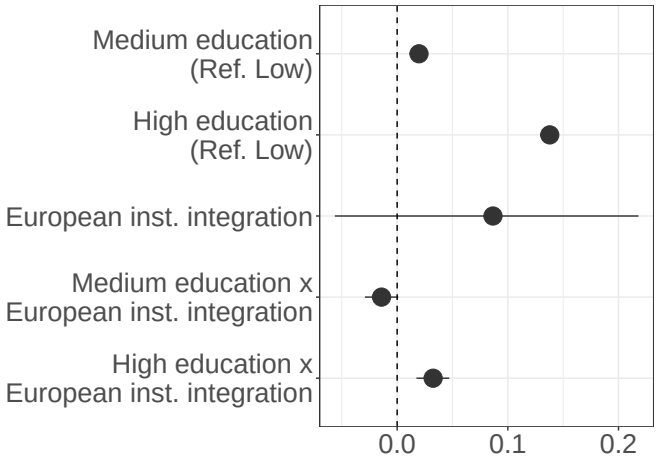
The regression equation is given by:

$$
\begin{aligned}
\text{Response}_{ict} &\sim \text{Normal}(\mu_{ict}, \sigma) \\
\mu_{ict} &= \text{Education}_{ict}\beta_1 + \text{Integration}_{ct}\beta_2 + (\text{Education}_{ict} \cdot \text{Integration}_{ct})\beta_3 \\
&\quad + x'_{ict}\lambda_1 + z'_{ct}\lambda_2 + \text{Year}'_{t-1}\lambda_3 + \eta_c + \xi_{ct} + \psi_\alpha + \epsilon_{ict} \\
\beta_1, \beta_2, \beta_3, \lambda_1, \lambda_2, \lambda_3 &\sim \text{Normal}(0, 1) \\
\eta_c, \xi_{ct} &\sim \text{Student}(4, 0, 1) \\
\psi_\alpha &\sim \text{Student}(3, 0, 2.5) \\
\sigma &\sim \text{Student}(3, 0, 2.5),
\end{aligned}
$$

where we measure Education_{ict} again as a three-level categorical variable, with the first level indicating low education (parimary education or less), the second level indicating medium education (lower, upper, and post-secondary non-tertiary education), and the third level indicating high education (tertiary education). The results are based on 5,000 Markov chain Monte Carlo iterations of which 2,000 are discarded as burn-in.

Figure A5 presents the corresponding interaction results (controls not shown), which are based 104,496 complete observations from the EU-15. Despite the very short observation period in which most of the important institutional steps have already taken place, we are still able to replicate the finding that higher levels of European institutional integration are associated with a larger divide in EU support between low and high educated citizens, as reflected by the positive and statistically significant interaction term between European institutional integration and high education (the results of the interaction with medium education is not distinguishable from zero).

Figure A5: Results based on data from the European Social Survey, interaction model (controls not shown).



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