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ABSTRACT

Educate Some to Represent Many? Education and Female Political Representation in Europe*

Gender disparity is present in many aspects of life, especially in politics. This paper provides new evidence on the impact of women's education on political representation focusing on several European countries. We combine multi-country data from the Gender Statistics Database of the European Institute for Gender Equality (EIGE) and from the European Social Survey (ESS). We find increased female education significantly raises the percentage of women being elected to regional parliaments. We then explore possible channels at the individual level and find education increases women's interest in politics and induces more egalitarian views about gender roles in society among women, although it fails to do so among men.

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1 Introduction

The share of women in political offices has increased considerably over the past few decades in almost every country in the world.[1] Yet, despite this notable progress and although figures are better for developed countries, significant room for improvement remains. Indeed, even though gender disparity is present in many aspects of life, according to the Global Gender Gap Index, the most striking gender disparity is still in politics.[2] The gender gap in political participation is especially worrying, considering recent evidence regarding the benefits of female participation in the collective decision-making process. For instance, Garikipati and Kambhampati (2021), using a constructed data-set for 194 countries, show COVID-19 outcomes are systematically better in countries led by women. Evidence of a link between female political participation and improved political outcomes is not only recent. Even though evidence for developed countries shows the share of female representatives has no impact on the size or composition of public expenditure (see, e.g., Ferreira and Gyourko (2014) for evidence on the US, Geys and Sørensen (2019) on Norway, or Bagues and Campa (2021) and Andina-Díaz et al. (2020) on Spain), female policy-makers have a significant effect on policy choices. In particular, they seem to expand public childcare provision by producing more amendments on women's issues or child and health issues (Baskaran and Hessami, 2019; Lippmann, 2020; Braga and Scervini, 2017). Research also shows higher female representation has improved institutional quality by reducing corruption and rent extraction by those in power (Bratton and Ray, 2002; Beaman et al., 2007; Baskaran et al., 2018; Brollo and Troiano, 2016).[3]

Thus, studying public policies that might help reduce the gender gap in political participation by increasing female political involvement is crucial and thus the aim of this paper. In particular, we provide new evidence on the impact of women's education on political representation by focusing on several European countries. Hessami and da Fonseca (2020) provide a review of several explanations for this low share of female political participation. Women may be less

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[1] As of March 2021, women hold 26.1% of parliamentary seats worldwide- an increase from 13.4% in 2000 (Global Gender Gap Report 2021). The percentage of female heads of government has increased slightly from 4.7% to 5.2% over the past 19 years; see Women in Politics: 2019' map (WIP, 2019) published by the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women) Inter-Parliamentary Union.

[2] The Global Gender Gap Index is composed of four indices: educational attainment, health and survival, economic participation and opportunity, and political empowerment. The Global Gender Gap Index is prepared by the World Economic Forum (WEF), which benchmarks 149 countries on their progress towards gender parity on a scale from 0 (disparity) to 1 (parity) for each of these four indices. The 2021 report states a worldwide average of 0.68 on this scale, leaving a global mean distance to parity of 32%. The gap in educational attainment, economic participation, and political empowerment are 4.4%, 42%, and over 78%, respectively (WEF, 2021).

[3] Quasi-experimental evidence from developing countries, in particular India, shows that larger female representation not only causes higher investments in education and health, but also improves labor market outcomes for women and better performances in terms of GDP growth (see Bhalotra and Clots-Figueras, 2014; Baskaran et al., 2018; Priyanka, 2020, among others).

disposed to run for office in a competitive setting, because they perform worse than men in this type of situation (Niederle and Vesterlund, 2007). Alternatively, voters and party leaders may be biased against female candidates (Fréchette et al., 2008; Esteve-Volart and Bagues, 2012). Another possible rationale is related to institutional features; for instance, research finds the percentage of women elected in proportional and mixed systems is noticeably higher than in majoritarian ones (Profeta and Woodhouse, 2019). Similarly, closed-list systems increase the share of women elected in opposition to open-list ones (Gonzalez-Eiras and Sanz, 2021).

We focus here on education policy and question whether providing education to women might be effective in increasing their political participation by becoming representatives.[4] To do so, we concentrate on several European countries in the period between 2003 and 2018. To measure female political representation, we use regional data from the Gender Statistics Database of the European Institute for Gender Equality (EIGE).[5] We also explore possible mechanisms driving our results and focus on both supply (females participating more in politics in general) and demand (society being more prone to vote for females) factors. To do so, we use individual data on political participation and gender attitudes from all nine waves of the European Social Survey (ESS), a transnational database of survey results carried out on a biannual basis since 2002.[6]

In analyzing to what extent improving women's education might yield a larger share of women in political offices, we face two concerns. The first relates to the sign of the correlation between education and political representation. The second is whether that correlation could be interpreted as causal. Many studies have documented that people with a high educational level participate more extensively in politics than those with a low educational level. This positive relationship has several explanations. Perhaps one of the simplest arguments is that one of the essential components of education is indoctrination in political participation. In fact, the curriculum of most international education systems emphasizes in some way that political participation is positive, that the school has to convey the importance of certain civic obligations, such as voting, being informed of political issues. (Glaeser et al., 2007, show the existence of such approaches in several countries). Education might also reduce the cost of performing

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[4]Indeed, one of the arguments most frequently used to justify public intervention in education is the widespread belief that education is an essential component in a stable democratic society insofar as it promotes democratic values, tolerance, public life, greater citizen participation in democratic processes, prepares individuals to do so in an informed and intelligent way, and, ultimately, improves the quality of democracy (see Hyman and Wright, 1979).

[5]The reason to focus on regional parliaments is related to data convenience: an analysis on national parliaments will leave us with too little observations, and so far, no data are available on female representation at the local level for a sufficient number of European countries.

[6]Note that although we use the terms women and female interchangeably throughout the paper, the data are based on biological sex and not on gender identity (the same applies for men and male).

certain effective practices of political participation (Dee, 2004; Glaeser et al., 2007). A greater education level makes processing complex political information or overcoming technological and bureaucratic barriers to political participation easier.[7] In addition, education increases the perceived benefits of participating in public life (Hanushek, 2002; Glaeser et al., 2004). In short, education facilitates improved exchanges of information between individuals, which makes expressing interests more accurately, persuading, and reaching agreements easier for them. This ultimately enhances any type of social participation, including political participation, for instance, by running for office. However, opposite arguments also exist. For example, one might think individuals with higher levels of education have a greater opportunity cost in terms of time devoted to political participation: Campante and Chor (2012) find political participation is less responsive to schooling in countries that have a higher skill premium and for countries with more individuals in skilled occupations. This effect would be clearer in activities involving greater dedication, such as becoming an elected legislator. Indeed, according to Verba et al. (1995) the main reason individuals give not participating in politics is the lack of time.

The second concern arises in identifying if the correlation between education and female political representation can be interpreted as a causal effect due to the potential endogeneity of education. To counteract this problem in this paper, we use an instrumental variable (IV) approach. Specifically, we use exogenous changes in educational legislation that extended the number of years of compulsory schooling, which took place in different regions and countries and at different points of time, as instruments for the actual education level. Educational reforms are extensively used as an instrument for education levels (Lochner, 2011). Some recent work has also used IVs to identify the possible causal effect of education on some measures of political participation, mostly voting. In general, the results are inconclusive.[8]

Our paper contributes to the literature in two ways. First, we focus on female political participation through the percentage of females elected for a set of European countries. Surprisingly, the literature provides no evidence of this link considering the existing gender gap in political participation and the possible benefits of women becoming political representatives. Second, we study several mechanisms to better understand the link between female education and political participation, such as females' political involvement and society-wide gender-role attitudes.

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[7]This difficulty is more pressing in countries such as the US, where individuals have to register in a census before elections (see Milligan et al., 2004).

[8]Dee (2004) uses data from the US and finds greater educational achievements lead to greater political participation through voting. Milligan et al. (2004) use data from the US and the UK and show the existence of a causal relationship in the case of the US but not in the UK. Siedler (2010) performs a similar study with data from the former Federal Republic of Germany and does not find a significant effect of the number of years of study on political participation. Another closely related study is Borgonovi et al. (2010), who using a sample of several European countries, does not find evidence of a causal relationship between education and turnout.

We find that improving women's education increases the share of women in political offices. An expansion of compulsory schooling is indeed associated with a larger share of women attaining at least a secondary education degree. Under the assumption that the exclusion restriction is satisfied, our results indicate a significant positive effect of the share of educated females on the proportion of female representatives. Two-stage least-squares estimates suggest a one-percentage point-increase in the share of women with at least secondary degrees in the region increases the share of elected women by 21 percentage points. By analyzing individual data, we find an increase in education significantly increases women's interest in politics. In addition, it reduces traditional gender-role attitudes, although only among women.

The paper is organized as follows. Section 2 presents the data-sets used in this analysis. Section 3 discusses our identification strategy. Section 4 contains the main results. Section 5 discusses possible mechanisms through which education could affect female political representation, and section 6 concludes.

2   Data

To answer our research question, we built a panel of European regions from nine countries between 2003 and 2018, matching data on the percentage of women among the elected members of regional parliament (or assembly) from the EIGE with data on education from the latest nine waves of the ESS. The Gender Statistics Database contains yearly data on the numbers of women and men in key decision-making positions across a number of different life domains. The domains covered include politics, public administration, judiciary, business and finance, social partners and NGOs, environment and climate change, media, science and research, and sports.[9] In this paper, we use the data available on women amongst elected representatives in the assembly of a region (i.e., regional authority). The ESS collects individual information every two years through face-to-face interviews in more than 30 European countries on social issues since 2002. The ESS is structured around a core module that is repeated in all rounds and two rotating modules in each round. The core module contains questions on trust in institutions, political engagement, and detailed information on the socio-economic characteristics of the respondents and their households.[10] In particular, the ESS contains detailed information on

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[9]Data on decision-making are collected for the 27 EU Member States, the UK, five EU candidates (including Montenegro, North Macedonia, Albania, Serbia, and Turkey), two potential candidates (Bosnia and Herzegovina and Kosovo), and the remaining three European Economic Area (EEA) countries (Iceland, Liechtenstein, and Norway). The starting years vary for the different domains and variables in the domain, our data start mostly in 2003. For additional details, see https://eige.europa.eu/gender-statistics/dgs.

[10]See https://www.europeansocialsurvey.org/ for further information.

various aspects of civic and political participation as well as gender-role attitudes. We use data from waves 1 to 9 (which correspond to the years 2002 to 2018, respectively).[11] We exclude those who were not born in the country where they were interviewed, because we cannot know where they were educated, as well as those individuals who are still in education.

We build a database comprising all the available regions from nine European countries: Austria, Czech Republic, France, Germany, Greece, Hungary, Netherlands, Poland, and Slovakia. For these countries, we have information about reforms in compulsory schooling, available information at the regional level in Gender Statistics, and regional inference is possible in the ESS. We exclude countries that lack information on female representatives in regional parliaments (Ireland and Portugal), due to the absence of elected members at this government level; we also exclude countries for which we lack information on compulsory schooling laws (Albania, Bulgaria, Croatia, Cyprus, Estonia, Iceland, Israel, Latvia, Lithuania, Luxembourg, Romania, the Russian Federation, Slovenia, Turkey, Ukraine) or where they were implemented gradually over several years or at the local level (Finland, Norway, Sweden, and Switzerland). Lastly, we exclude countries where - although we have the information mentioned above- inference in the ESS is only possible at the national level (Denmark, Italy, Spain, and UK).[12] Our main sample comprises 118 regions, for which we have 617 region-period observations.[13]

Figure 1 shows the evolution of female political representation in regional parliaments in Europe in the period under study in this paper (2003-2018).[14] Two facts are clear from this graph. First, considerable heterogeneity exists within Europe in the percentage of women among the legislators, with the Scandinavian countries, France, and most of Spain (at least in the latest years) having close to equal representation, and countries such as Italy, Poland, Hungary, and Greece having very low female representation. Second, although we can see a clear increasing trend (almost) everywhere, even in 2018, very few regions have equal representation across genders, and in many regions female representation is not even reaching one-third. Figure 2 indicates the average percentage of women in regional parliaments in the period between 2004 and 2018 for the set of regions considered in this study. On average, in our sample, the percentage of women in regional parliaments is 27.5%, but variation is substantial- not only across regions but also across time - with a standard deviation between regions of 14% and within

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[11]Given that for some countries the data collection for the first wave was mainly completed in 2003, we can match these data with the first electoral data available from the Gender Statistics Database.

[12]See https://www.europeansocialsurvey.org/data/round-index.html for details on possible statistical inference at regional level for each round and participating country. We nevertheless consider these countries while analyzing possible mechanisms behind our results at the individual level in section 5.

[13]Notice that, in principle, we could have data corresponding to 9*118 = 1,062 distinct region-period cells. However, we lack data corresponding to 445 of these cells as EIGE did not collect data every year in every country.

[14]Note we plot political representation for 2004 even though our first data points (but still very few ones) go back to 2003.

regions of 3.4%.

Figure 1: Percentage of elected females at regional level
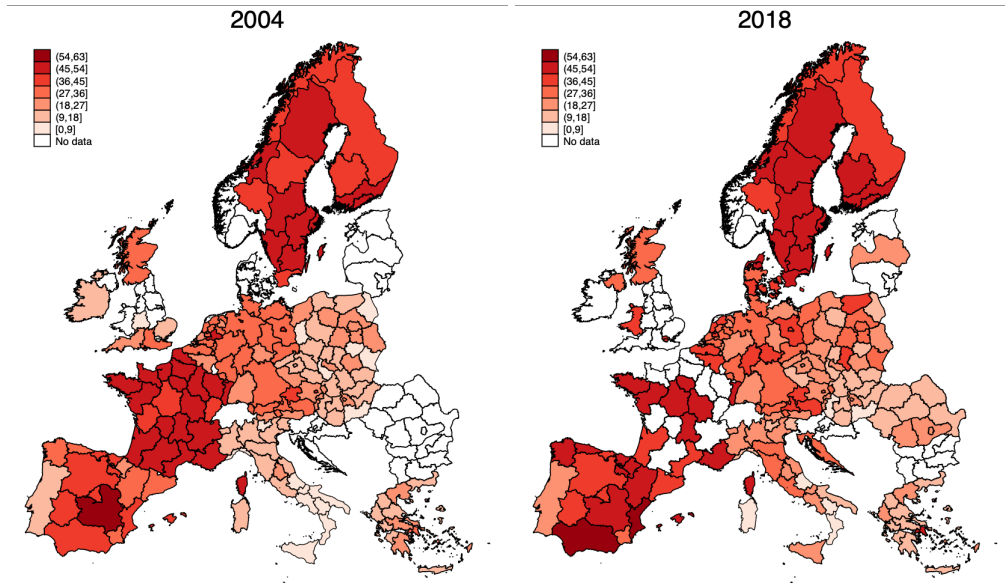
Note: All countries for which data available are included here. Source: our calculation from EIGE dataset: 2004, 2018.

See Appendix A for a detailed description of the variables used in our analysis and Appendix B for an overview of the descriptive statistics of our final estimation sample.

3   Identification strategy

To investigate the causal effects of education on female political representation, we adopt a two-stage model. The relation of interest between women's education and their political representation is given by the following (second-stage) equation:

$$FP_{rt} = \beta_0 + \beta_1 E_{rt} + X'_{rt}\beta_2 + \epsilon_r + u_{rt}, \tag{1}$$

where FP_{rt} is the percentage of women elected in the Parliament of the region r at time t, E_{rt} refers to the share of women in the voting population with at least a secondary education degree in the region r at time t, and X_{rt} denotes a vector of time-varying regional demographics, such as the percentage of women, the percentage of individuals growing up in disadvantaged families (parents with low educational background, or with single parents), and the proportion of working-age individuals (defined as 18 to 64 years old), which serves to control for the time-varying age structure of the regional population.[15]   We add regional fixed effects and

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[15]Note that by *time*, we refer to survey wave; thus, nine time periods.

Figure 2: Percentage of elected females at the regional level
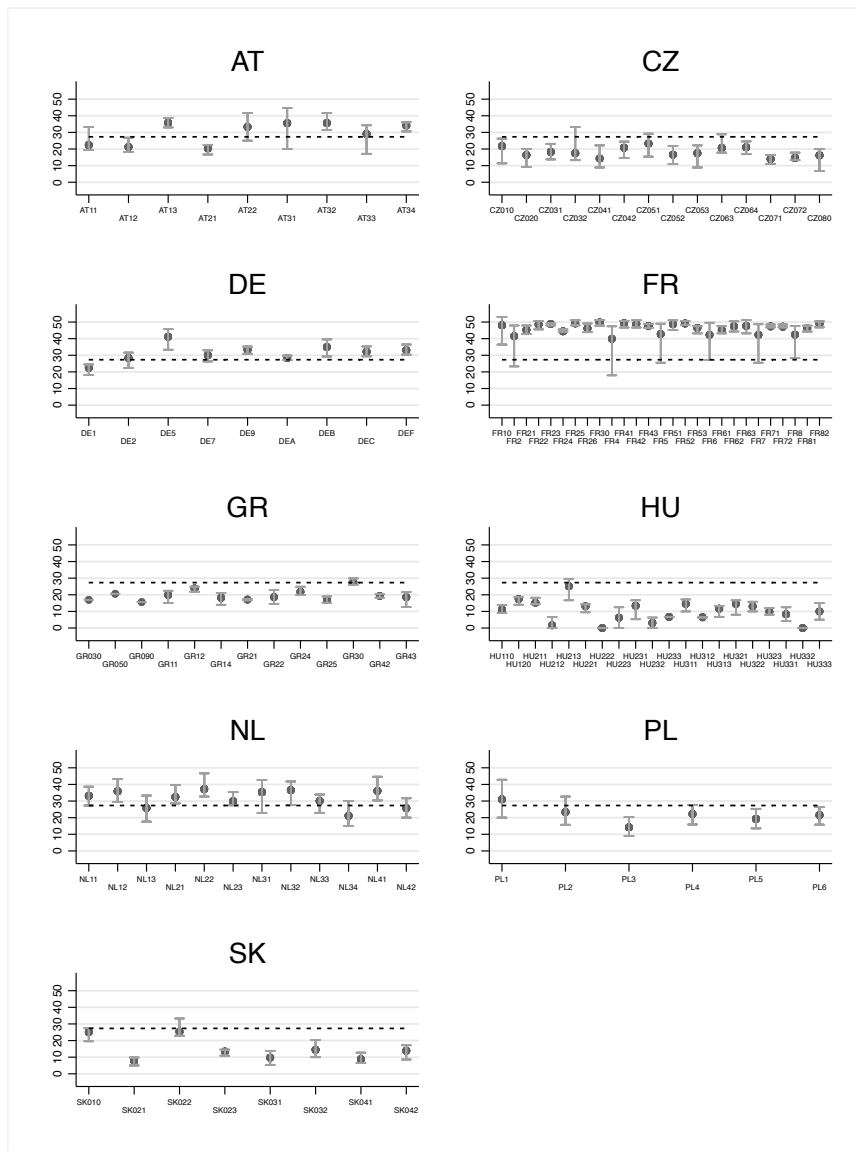
Note: In addition to average percentage, the figure shows the minimum and maximum share of elected females for the period under analysis. Source: Our calculation from EIGE dataset.

regional-specific time trends. Regional fixed effects (ϵ_r) control for unobserved factors that are region-specific and time invariant, for instance, richer regions or those with more individuals sharing traditional values. Time trends account for the fact that the younger cohorts are more likely to be exposed to compulsory schooling reforms and that Europe experienced an increase in female political representation. Without controlling for them, we would potentially mix two effects: the positive time trend and the effect of the reforms. These region-specific time trends also account for possible observable heterogeneous regional developments. Finally, standard errors are clustered at the country level to allow for correlation in the errors across regions of the same country.

Note that estimating Equation 1 by ordinary least squares (OLS) produces a biased estimate of

the parameter of interest β_1 because female education is potentially endogenous. This scenario could be the case if time-varying unobservables are present at the regional level that affect both education and female political representation. For instance, shocks in labor markets might induce more residents to acquire additional education and alter female representation. Similarly, the arrival of some political parties to power in the regional parliament might increase education expenditure by providing more grants to students and introducing affirmative action policies to promote women in politics. Thus, we need a source of exogenous variation in education to be able to identify its effect on female political representation. To address this concern, we use a quasi-experimental identification strategy relying on schooling reforms. That is, we use the exogenous variation in the average years of education brought by the average increase in compulsory schooling in each region.

Table 1 shows the list of reforms we take into account (either for the main analysis or for the study on possible channels at the individual level in section 5), in which compulsory schooling increased by one year or more. As can be seen, all the reforms were implemented at the country level except in the case of Germany, where they implemented the reform at the regional level. The first cohort potentially affected is from 1944 to 1964. However, in line with the literature, we eliminate from the analysis the first cohort affected, because the extent of this cohort's exposure to educational reform is unclear. [16]

We thus instrument the share of women in the voting population with at least a secondary education degree by the average number of compulsory schooling years of the voting population in region r at time t, CS_{rt}. Therefore, CS_{rt} is the average of the number of compulsory years of education for individuals of a given age, weighted by the proportion of the population of that age at time t in region r. Formally, our first-stage equation is as follows:

$$E_{rt} = \gamma_0 + \gamma_1 CS_{rt} + X'_{rt}\gamma_2 + \epsilon_r + u_{rt}, \tag{2}$$

Observe that the number of compulsory years of education for individuals of a given age and at time t varies over time because a given age in 2002 and 2018 corresponds to two cohorts 16 years apart. For instance, individuals aged 54 in 2002 belong to cohort 1948 and, if born in Austria, were expected to stay at school for at least eight years, while individuals aged 54 in 2018 belong to cohort 1964 and, if born in Austria, had acquired education for at least nine

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[16]With the only exception of France as according to Grenet (2013), the 1959 reform affected everyone who was born on or after January 1. Thus, the reform arguably impacts the entire 1953 cohort in France. Nevertheless, we re-estimated the models by dropping this pivotal cohort of France from the sample. In addition, we also check the robustness of the result by including the first cohort affected for all countries. The results, available upon request, are not altered by these changes.

Table 1: Compulsory education reforms

Country	Reform year	FCA	Years Comp Educ	Entry age
Austria	1966	1953	8 to 9	6
Czech Republic/Slovakia	1960	1946	8 to 9	6
Denmark	1971	1960	7 to 9	7
Germany:			8 to 9	6
Schleswig-Holstein	1956	1942		
Bremen	1958	1944		
Niedersachsen	1962	1948		
Saarland	1964	1950		
Nordrhein-Westfalia	1967	1954		
Hessen	1967	1954		
Rheinland-Pfalz	1967	1954		
Baden-Wurtenberg	1967	1954		
Bayern	1969	1964		
France	1967	1953	8 to 10	6
Greece	1976	1964	6 to 9	6
Hungary	1961	1947	8 to 10	6
Italy	1963	1951	5 to 8	6
Netherlands	1975	1959	9 to 10	7
Poland	1966	1952	7 to 8	7
Portugal	1964	1956	4 to 6	6
UK	1972	1957	10 to 11	5

Note: We use data from Austria, Czech Republic, France, Germany, Greece, Hungary, Poland, and Slovakia in our main analysis. The remaining countries are used in the discussion analysis. FCA refers to the first cohort affected by the given reform.

years. Similarly, the compulsory education of individuals aged 60 in 2002 (cohort 1942) and born in the Czech Republic was eight years, while that of their peers in 2018 (cohort 1958) was nine (see Table 1). Given the inclusion of region and time fixed effects, the region-by-time component of the instrument identifies our IV approach. Assuming the increase in education is larger after the reforms, such a design allows us to estimate a local average treatment effect (LATE) for a sub-population of our sample, namely, the women who attained at least secondary education due to the compulsory schooling reform. The key assumption for identification is that - within each region - additional schooling was assigned to individuals only on the basis of their date of birth and independently of their future political behavior. Another crucial assumption for identification is that no other reform was implemented at the same time, affecting the individuals of the same cohort, that would have also affected female political representation (see, e.g., Murtin and Viarengo, 2011; Fort, 2006; Fort et al., 2016). We address these concerns in section 4.1 after presenting our main results.

For comparison purposes, we also analyze the possible effect of education reforms on the share of men with at least a secondary education.

4 Results

Table 2 presents our first-stage results (i.e., corresponding to Equation 2) of the estimated effect of the compulsory schooling law (CSL) on the proportion of females (top panel) and males (bottom panel) having at least secondary education. In column (1), we estimate the model without including time fixed effects, region fixed effects, region-specific time trends, or controls. In column (2), we add region fixed effects; in column (3), we add time fixed effects; in column (4), we add region-specific time trends; and in column (5), we add controls.

First, observe that a unitary increase in average years of compulsory education does not correspond to a uniform increase in education across genders. Reforms had a stronger impact on female secondary education, with about a 20-percentage-point increase in the share of females with a secondary education for a one-year increase in the average of compulsory schooling,[17] whereas the effect for males is mostly insignificant or of a lower magnitude when significant. Moreover, once we look at the F-statistics, we can see that, contrary to the case for women, the average of compulsory schooling is likely a very weak instrument for men's secondary education.

Table 2: Effect of increasing compulsory schooling on education

	(1)	(2)	(3)	(4)	(5)
			Female		
Years of Compulsory Schooling	0.013	0.190**	0.203**	0.183*	0.207***
	(0.862)	(0.034)	(0.013)	(0.051)	(0.010)
Observations	617	617	617	617	617
R-squared(adj)	0.003	0.845	0.847	0.863	0.864
F-stat	0.032	6.532	10.141	5.278	11.394
			Male		
Years of Compulsory Schooling	0.008	0.063*	0.051**	-0.007	-0.121**
	(0.902)	(0.066)	(0.020)	(0.773)	(0.020)
Observations	617	617	617	617	617
R-squared(adj)	0.000	0.732	0.731	0.753	0.765
F-stat	0.016	4.508	8.430	0.089	8.384
Survey wave FE	No	No	Yes	Yes	Yes
Regions FE	No	Yes	Yes	Yes	Yes
Regional Time Trends	No	No	No	Yes	Yes
Controls	No	No	No	No	Yes

Note: The dependent variable is the proportion of individuals with a secondary education: females in the upper panel and males in the bottom one. The main explanatory variable is the mean compulsory years of education in the voting population. Other controls include: share of females, share of the population of working-age, share of individuals with non-educated parents, and share of those who lived with single parent. Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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[17]Note the average increase in compulsory schooling within regions is only around 1% of the mean year of schooling, corresponding to a bit more than a month of schooling. Thus, the average increase in female secondary education is on average in our sample around 1.6 percentage points (the descriptive statistics are reported in Table B.2 in the Appendix).

Table 3 reports our main results corresponding to Equation 1. The OLS estimates suggest women's education positively but moderately affects their political representation. In particular, estimates in column (1) suggest one additional percentage point in the proportion of women with a secondary education increases the proportion of women elected by 5.8 percentage points (sample mean is 27.5%). The corresponding IV estimate reported in column (2) reinforces this finding. An increase of one percentage point in the share of women with a secondary education increases women's political representation by 21 percentage points (about 77% at the mean). Results for the reduced-form equation are presented in column (4). We can see that an increase of one year of compulsory schooling increases the percentage of women elected by almost 5 percentage points, which corresponds to a bit less than half a standard deviation, reflecting an increase of 18% at the mean. When discussing these results, we note our reduced-form estimations provide us with the Average Treatment Effect, that is, the effect of being exposed to the reform, whereas the IV should be interpreted as a LATE effect, and thus captures the effect of increasing education levels of the individuals that would not have stayed in school otherwise ("compliers"). In our sample, the median years of schooling of the individuals born before the first cohort affected by the reform in their respective country is 11, which means that before the reform, more than 50% of the individuals were reaching (at least) the new mandatory level of schooling. Nonetheless, a non-negligible 25% of the females in those cohorts did not attend more than the pre-reform compulsory-level requirement (versus only 10% of males). This group of potential "compliers" comprises significantly more individuals from families in which the father was unemployed and from single-parent families, and consists almost entirely of individuals from non-educated families (around 92% on average). Therefore, one way to interpret our results is that increasing years of schooling for the children of more disadvantaged families had a significant long-term impact on female political representation (see Table B.3 in the Appendix).

4.1 Robustness Checks

Weak instrument. As we know, weak instruments can bias point estimates and cause substantial distortions (Staiger and Stock, 1997). The first-stage F-statistic for testing the hypothesis that the instruments are unrelated to the endogenous variable is a standard measure of the strength of the instrument and as shown in Table 2, and once we account for region-specific time trends, our measurement is above the standard rule-of-thumb threshold of 10.

We further perform the cluster–robust weak-instrument test developed by Montiel Olea and Pflueger (2013), which calculates effective F-statistics and critical values for the null hypothesis

Table 3: Effect of female education on female representation

	(1) OLS	(2) IV	(3) First Stage	(4) Reduced Form
Female Education	0.058***	0.211**		
	(0.002)	(0.012)		
Compulsory Schooling (y.)			0.207***	0.044*
			(0.010)	(0.069)
Observations	617	617	617	617
F-Test of IVs			11.394	

Note: The dependent variable is the proportion of females among elected representative in regional assembly. The main explanatory variable is the share of females with at least a secondary education in the voting population. Other controls include share of females, share of the population in working age, share of individuals with non-educated parents, and share of those who lived with single parent. Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

that the bias is due to potentially weak instruments.[18] In our case, the effective F-statistic is equal to 12.6, and we can only reject the null hypothesis that the bias exceeds 30% of the benchmark bias,[19] but, reassuringly, if we focus on a sub-sample of our regions for which our instrument is stronger and where we can thus reject the null hypothesis of a bias exceeding 10%, our IV estimates are still very significant and only slightly reduced in magnitude to a 15- (instead of 21-) percentage-point increase in female representation.[20]

Sample selection. As a further robustness check, to ensure our estimates are not driven by any region in particular, we estimate the baseline model by excluding one region at a time. The results are robust and statistically significant at the conventional levels, and the effects range in magnitude from 18 to 23 percentage points.[21] Moreover, whenever our instrument remains strong, our results are consistent and robust to the exclusion of a single country at the time with point estimates ranging between [0.18, 0.25], see Table 4 below. The only case in which our results are no longer significant (and the instrument is very weak) is when we exclude France, which makes up 22% of our initial sample, and the exclusion of which drives our sample size below 500.

Alternative education measure. Finally, we check that our results are not driven by the choice of the education variable. Namely, we consider women's average years of education instead of the share of women with at least a secondary education. Results are shown in Table 5. First,

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[18]More specifically, the null hypothesis is that the estimator's approximate asymptotic bias exceeds a fraction τ of a "worst-case" benchmark. This benchmark is equal to the OLS bias when errors are conditionally homoskedastic and serially uncorrelated. The test rejects the null hypothesis when the effective F-statistic exceeds a critical value. The critical value depends on the significance level,e.g. 5%, and the desired threshold, e.g. τ=10%.

[19]The threshold for the effective F-statistics is 23.11 for 10% bias and 15.06 for 20% bias.

[20]This sample, excluding the Netherlands, has an effective F-statistic equal to 28, so well above the 10% bias threshold.

[21]We do not show results for space reasons, but they are available from the authors upon request.

Table 4: Robustness: Exclusion of one country at the time

	(1) AT	(2) CZ	(3) DE	(4) FR	(5) GR	(6) HU	(7) NL	(8) PL	(9) SK
Female Education	0.179**	0.213**	0.226**	0.120	0.256***	0.252***	0.147**	0.227***	0.217**
	(0.0811)	(0.0886)	(0.104)	(0.123)	(0.0867)	(0.0962)	(0.0619)	(0.0839)	(0.0856)
Observations	563	519	569	481	587	557	521	569	570
F-Test of ivs	12.70	12.08	14.89	2.643	8.184	10.50	24.89	11.10	12.09

Note: The dependent variable is the proportion of female among elected representative in regional assembly. The main explanatory variable is the share of female with at least a secondary education in the voting population. Other controls include: share of females, share of the population in working age, share of individuals with non-educated parents and share of those who lived with single parent. Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Robustness: Average years of schooling

	(1) IV	(2) First Stage
Female Education (y.o.s)	0.033**	
	(0.021)	
Compulsory Schooling (y.)		1.313***
		(0.006)
Observations	617	617
F-Test of ivs		13.451

Note: The dependent variable is the proportion of females among elected representatives in the regional assembly. The main explanatory variable is the female average years of education in the voting population. Other controls include: share of females, share of the population in working age, share of individuals with non-educated parents, and share of those who lived with single parent. Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the reported F-statistic suggests the instrument is not weak. And second, we also find a positive and significant effect of women's education on representation. In particular, we find a one-year increase in women's education increases the share of female representatives by 3.3 percentage points, 12% at the mean.[22]

5   Possible mechanisms

Several explanations for the continued low share of female representatives have been proposed in the related literature (see Hessami and da Fonseca (2020) and references therein). In particular, supply- and demand-side explanations such as the fact that women may be less disposed to stand for office in a competitive setting and/or voters and party leaders may be biased against female candidates. We next analyze how education might mediate these forces and discuss possible channels through which an increase in female education can affect female political representation. The first possible explanation could be that an increase in women's education translates into an increased interest in politics, which could also, in time, translate into a higher willingness to run for office. Another possible channel through which schooling might increase the share of females being elected can be related to changes in gender-role attitudes, both among females and males, resulting on the one side in individuals being more favorable toward voting for female representatives and on the other side in institutions being more proactive in fostering women's representation in national and regional parliaments.[23]

To analyze possible drivers of our main result above, we use individual-level information contained in the ESS regarding several measures of political involvement and gender-role attitudes. Descriptive statistics of our final sample for individual-level analysis are available in Tables B.4 and B.5 for females and males, respectively, in Appendix B.

Female political interest and involvement.   As mentioned above, several papers have studied the possible causal link between education and political participation, primarily turnout (see Dee (2004) for US, Milligan et al. (2004) for both US and UK, Siedler (2010) for Germany, and Borgonovi et al. (2010) for several European countries). In addition to Voting, we consider several measures of political participation here. First, we study Interest in politics. Second, we look into individual political involvement, which, in addition to voting, also includes being

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[22]A one-year increase in women's education, given the sample average of 12 years of schooling, is equivalent to an 8% increase in the average female education. See Harka and Rocco (2021) for similar first-stage results.

[23]Several European countries (e.g., Belgium, Germany, France, Spain, Italy, or the Netherlands) introduced laws with this aim. See Dahlerup et al. (2013) for a review of electoral gender quotas in Europe.

a Politician, Work in a political party, and being Member of a political party. [24] A first look into the relationship between female representation and participation at the aggregate level indeed suggests a positive correlation between the percentage of women being elected in regional parliaments and different measures of female political involvement, as shown in Figure 3.

Figure 3: Female elected and political involvement
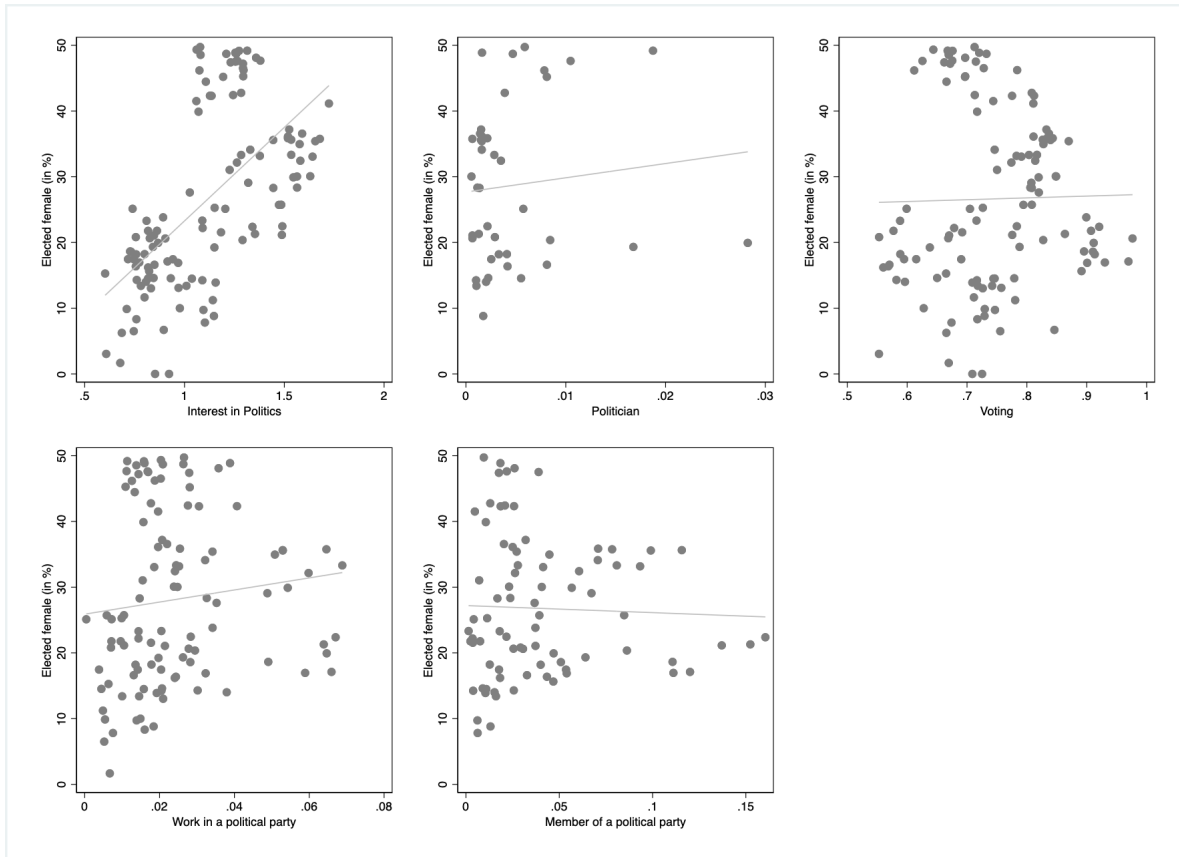
Note: Each point represents average values of the corresponding variables for a region in the period under analysis. Source: EIGE and ESS.

Gender-role attitudes. An increasing number of recent contributions document the role of norms and beliefs in explaining economic outcomes. [25] Education has been a significant factor in shaping individuals' attitudes, values, and beliefs. Recent studies suggest a causal link

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[24] We use the occupation variable available in the ESS to define a politician as those who declare being a legislator or senior official. Even though a few people reporte being a politician (447 of the 220,412 observations in our complete data set), this number translates into 20.3 politicians per 10,000 citizens, which is quite similar to the 20.6 in the US (PoliEngine, 2019). The low number of politicians in society prevents an appropriate study of the impact of education on being a politician at the individual level. Nevertheless, we show results here. See Appendix A for a detailed definition of the variables.

[25] For instance, norms or beliefs about the role of women in society affect women's participation in paid and unpaid work. Fortin (2005, 2015), Fernández (2007), Chen and Ge (2018), and Ye and Zhao (2018) find a positive association between egalitarian views toward gender roles and female labor force participation rates. Alesina and Giuliano (2011) show traditional gender-role attitudes imply more home production of goods and services and less participation in market activities for women.

between schooling and more egalitarian gender-role attitudes (see Dinçer et al., 2014; Erten and Keskin, 2018; Du et al., 2020; Rivera-Garrido, 2022).[26] The most closely related, Rivera-Garrido (2022) performs a similar analysis to ours using individual data from the European Social Survey (rounds 2, 4, and 5) and 14 European countries.[27] Her results indicate education has a strong causal effect on gender-role attitudes for women from low-educated families.

To measure gender-role attitudes, similar to recent related literature, we use two questions asked in some ESS rounds. The first question is whether a woman should be prepared to cut down on her paid work for the sake of her family (Women Family). The second question is whether men should have more rights to a job than women when jobs are scarce (*Men more rights*). Focusing on our regional sample, Figure 4 indeed shows a negative correlation between the percentage of women being elected in regional parliaments and the proportion of individuals holding traditional gender-role attitudes among females and males (on the left and right side, respectively).

Empirical strategy and results   To study whether an increase in female education *causes* an increase in female political interest, involvement, and more egalitarian gender-role attitudes (which, in turn, might lead to higher female political representation), we modify the IV model described in section 3 to adapt it to individual data. Thus, the relationship of interest between education and the different measures of political involvement and gender-role attitude is the second-stage equation as follows:

$$y_{ictw} = \alpha_0 + \alpha_1 E_{ictw} + X'_{ictw}\alpha_2 + \eta_w + \mu_c + \lambda_{ct} + u_{ictw}, \tag{3}$$

where y_{ictw} is the particular measure of political involvement or gender-role attitude for individual i, born in country c, in year t, and interviewed in wave w, while E_{ictw} is the individual's education (i.e., a dummy that takes a value of 1 if she has completed a secondary education) and X_{ictw} denotes a vector of individual characteristics.[28] The first-stage equation we estimate is:

$$E_{ictw} = \delta_0 + \delta_1 CS_{ictw} + X'_{ictw}\delta_2 + \eta_w + \mu_c + \lambda_{ct} + v_{ictw}, \tag{4}$$

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[26]Previous studies have also found individuals with higher educational attainment tend to hold more egalitarian attitudes toward gender roles than those with less educational attainment, suggesting that receiving more education may change individuals' attitudes (Thornton et al., 1983; Kane, 1995; Brewster and Padavic, 2000).

[27]Note we use a larger set of ESS rounds (which include round 8) and a different set of countries than Rivera-Garrido (2022).

[28]This education measure can give a closer idea of educational output than just the number of years of education she has attained. For instance, a repeater who does not finish high school may have more years of schooling than one who has completed that level. Nevertheless, we check the robustness of our results to the number of years of education as an alternative measure of females' education.

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Figure 4: Female elected and gender-role attitudes
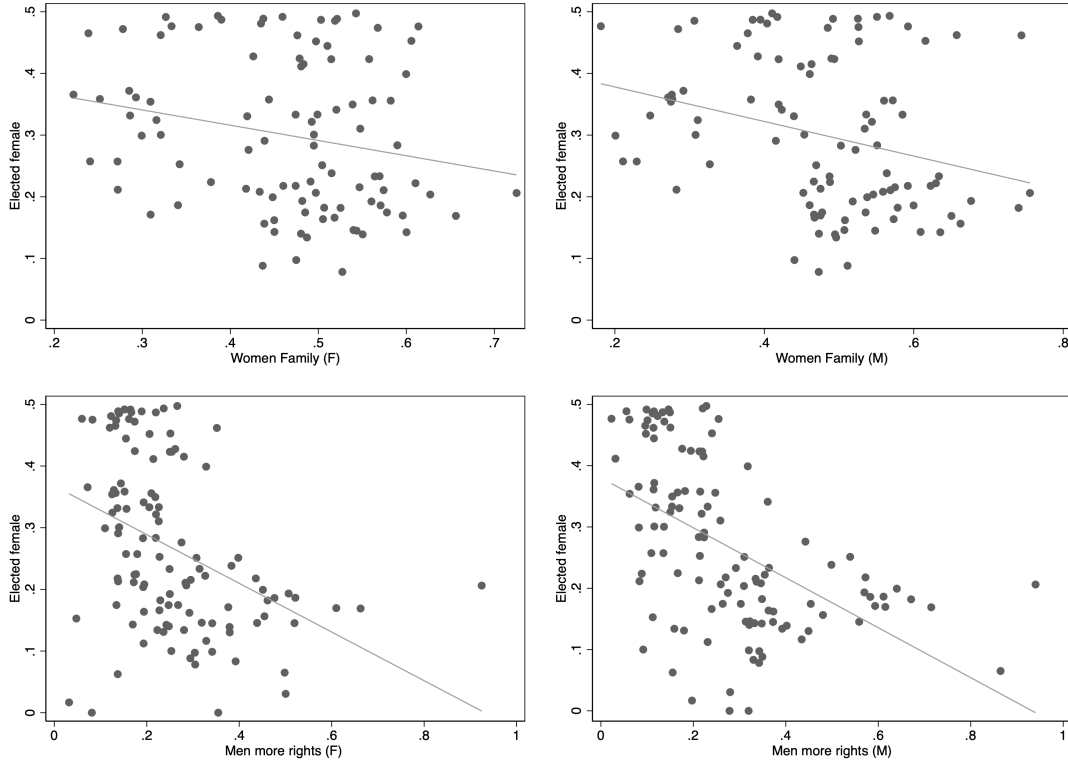
Note: Each point represents average values of the corresponding variables for a region in the period under analysis. Source: EIGE and ESS.

where CS_{ictw} describes the number of years of compulsory education, and η_w is a survey-wave fixed-effect, μ_c is a country fixed-effect, and λ_{ct} is a country-specific linear time trend. Country fixed effects control for invariant factors within countries, such as national differences in institutions affecting participation or reporting styles. Because treated individuals are, by construction, younger than controls, we include time trends to account for secular tendencies. By doing so, we identify the effect of the reform on those people who, even with the positive trend, would not have acquired more education without the reform. If we do not include these trends, secular increases in some measure of political participation may be incorrectly attributed to school reforms, thus biasing the results (Lochner, 2011). For a similar specification, see Albarrán et al. (2020) or Brunello et al. (2016). In addition, from Stephens and Yang (2014), we know these temporal trends must be country-specific. Finally, all our regressions cluster errors at the country cohort-of-birth level. Similar to the regional analysis above, to identify the causal impact of education, we exploit the exogenous variation of schooling induced by CSLs that raised the school leaving age (SLA). Individuals in year-of-birth cohorts affected by CSLs must attend more years of schooling. Under the selection-on-observables assumption that a (country-specific) trend controls for factors that make cohorts different in terms of polit-

ical participation and education, the remaining variation in education can be attributed to the CSLs and is truly exogenous (i.e, no direct effect of being affected by the reform and therefore a younger cohort in education and political participation because time effects have been controlled for). This assumption is sensible when the cohorts are not very distant. The crucial assumption for identification is that within each country, additional schooling was assigned to individuals only on the basis of their date of birth and independently of their future political participation (i.e., cohorts of the treatment and control groups are comparable except for exposure to treatment). We restricted our sample to individuals born at a maximum of seven years before and after the first affected cohort.[29] We exclude from our sample individuals still in school.

We perform several checks to show our results are robust to different changes in our measure of education, window size, and selection of countries (see Appendix C).

Table 6 shows the IV estimates of Equation (3) above, where the dependent variables are the different measures of political interest and involvement, including being a politician.[30] Notice our instrument is a good predictor of female education. The large F-statistic rules out a weak-instrument problem, as already shown in previous contributions using a multi-country approach (see, e.g., Albarrán et al., 2020; Brunello et al., 2016).

We first focus on whether and to what extent more educated women are interested in politics, as shown in column (19. The OLS estimates suggest a positive correlation between education and interest in politics. Women with at least a secondary education are 55.1 percentage points more likely to declare, based on a 5 point scale (0-4), that they are interested in politics, which corresponds to about 41% of the average. Once we look into the effect of an exogenous increase in education, we find that acquiring at least a secondary education results in an 71-percentage points increase in the probability of reporting being interested in politics (about 53% at the mean).

Education is also positively associated with several forms of active political participation. However, even though the probability of reporting having voted in the last elections or being a politician is higher among higher educated women (about 10 percentage points-sample mean is about 77%-for voting, and 0.1 percentage points - sample mean is about 0.06%- for being a politician), this finding seems primarily due to some individual traits, such as cognitive ability, conscientiousness, or some environmental traits, like parental and peers inputs, that increase

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[29]When deciding on a specific window size, we face a trade-off. The more cohorts we include, the larger the sample size, which allows us to estimate our model precisely. However, including many cohorts makes it more difficult to assume both groups are comparable, while allowing us to exclude other education reforms that might have affected the population.

[30]See Table B.6 in the Appendix B for similar results for males.

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Table 6: Effect of increasing education on political interest and participation

	(1) Interest in politics	(2) Politician	(3) Vote	(4) Work Political Party	(5) Member Political Party
OLS coeff.	0.551***	0.001**	0.098***	0.020***	0.016***
	(0.024)	(0.001)	(0.011)	(0.003)	(0.004)
IV coeff.	0.709*	0.021	-0.289	-0.089	0.059
	(0.367)	(0.027)	(0.179)	(0.064)	(0.207)
First-stage coeff.	0.022***	0.016***	0.022***	0.023***	0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
F-Test of ivs	27.835	14.357	24.947	26.947	17.994
p-value	0.000	0.000	0.000	0.000	0.000
Observations	21869	20502	21448	21831	13132
Country FE	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, and non-educated family as controls. Robust standard errors in parentheses, $^*\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

both individuals' willingness to acquire a higher education level and their sense of civic duty.[31] Our results are in line with recent contributions on European countries that do not find any statistically significant effect of education on turnout (Pelkonen, 2012; Siedler, 2010; Milligan et al., 2004; Borgonovi et al., 2010), or even - as Harka and Rocco (2021) find using Italian data - a negative impact of schooling on voting.[32]

Table 7 shows the IV estimates of Equation (3) above, where one of the measures of gender-role attitudes is the dependent variable. It presents results for both females (columns (1) and (2)) and males (columns (3) and (4)).

Our OLS estimates show a negative association between education and conservative gender-role attitudes for both men and women. Nevertheless, IV estimates indicate a 63-3-percentage-point (sample mean of 25.6%) negative effect of having a secondary education on only the likelihood of agreeing with the second question and only for women, which is 1.5 times its SD, in line with the above-mentioned literature (Du et al., 2020; Rivera-Garrido, 2022).[33] Therefore, our results support the hypothesized role of changes in gender attitude as a channel through

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[31]Our OLS results also show the association between education and political participation is stronger for men than for females. For instance, the propensity to become a politician increases by 0.3 percentage points for men and 0.1 percentage points for females. Indeed, once we look into the effect of an exogenous increase in education, we find that acquiring at least a secondary education results in a 7.1-percentage-point increase in the probability of reporting being a politician (see Table B.6 in the Appendix).

[32]A plausible explanation is the one provided by Dee (2004), who argues individuals with a higher educational level may participate less because they are more aware that their individual votes have a very reduced probability of influencing final policies.

[33]Du et al. (2020) use the China General Social Survey and find the extra schooling induced by the compulsory schooling reform in 1986 leads to more egalitarian gender-role attitudes. They also find the education effect is concentrated among females and urban residents. Whereas Dinçer et al. (2014) use Turkey's 1997 Education Law and find little evidence that schooling changed women's attitudes toward gender equality, Erten and Keskin (2018), using the same educational reform, find a significant effect of education on gender-role attitudes.

Table 7: Effect of increasing education on gender-role attitudes

	Traditional Gender-Role Attitude			
	(1)	(2)	(3)	(4)
	Women Family (F)	Women Family (M)	Men more rights (F)	Men more rights (M)
OLS coeff.	-0.128***	-0.114***	-0.160***	-0.163***
	(0.022)	(0.021)	(0.015)	(0.017)
IV coeff.	-0.715	0.157	-0.748**	-0.148
	(0.636)	(0.572)	(0.296)	(0.317)
First-stage	0.019***	0.019**	0.022***	0.025***
coeff.	(0.006)	(0.009)	(0.005)	(0.007)
F-Test of ivs	11.183	4.623	16.381	14.171
p-value	0.0010	0.0328	0.0001	0.0002
Observations	8,193	6,345	10,261	8,123
Country FE	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes

Note: in addition to controls above specified, all models include noncitizen, father only, non-educated family as controls.

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

which an exogenous increase in education affects the demand for higher female political representation. This finding seems to be true only for women. Although more educated men are also expressing more egalitarian views, this observation seems again to be due to some underlying characteristics that impact both tastes for higher education and values instead of directly by an increase in the years of schooling.

To conclude, we show evidence of two possible mechanisms through which an increase in female education increases their political representation. On the one hand, it can increase the supply of females running for office, as we have shown education increases their interest in politics and their support for a less traditional gender role, although we do not see a significant increase in them becoming a politician or in their participation in the political parties. On the other hand, the changes in gender-role attitudes that we have shown could also increase the demand for female politicians or the support for existing female candidates.

6 Concluding remarks

The existing gender gap in political participation is especially worrying, considering recent evidence regarding the benefits of female participation in the collective decision-making process. Thus, studying public policies that might help reduce the gender gap in political participation by increasing female political involvement is crucial. In this paper, we use regional data from the Gender Statistics Database of the European Institute for Gender Equality and the European

Social Survey to analyze the extent to which education might help improve female political engagement. We exploit quasi-experimental evidence from schooling reforms that extend the period of compulsory schooling in several European countries. We find that increasing education significantly increases the percentage of women being elected to regional parliaments. We then explore possible mechanisms at the individual level, and we find an increase in schooling significantly increases female interest in politics and induces more egalitarian views about gender roles in society among females, although it fails to do so among males. Therefore, whereas changes in male attitude or voting behavior are very unlikely to be behind the larger share of females elected in more educated areas, changes in female attitude towards their role in society in general and in politics, in particular, might, in turn, be driving the increase in female political representation.

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A   Variable definitions

- *Female elected*: Share of females among the elected members of regional parliament (NUTS2 level). Source: Gender Statistics Database (EIGE)

- *Age*: Variable that indicates the age of the respondent. Source: European Social Survey (ESS)

- *Working-age population*: Share of individuals ages 18-64. Source: ESS

- *Non citizen*: A dummy variable equal to 1 if the individual is not a citizen of the country where he/she lives. Source: ESS

- *Parental education*: A variable that is equal to 1 minus a dummy variable (educated_family) equal to 1 if either the father or the mother (or both) attained a medium education level (upper secondary and post-secondary non-tertiary education). Source: ESS

- *Years of education*: A variable containing information about the number of years of full-time education that the respondent has completed satisfactorily. We constrain the variable to be within a particular interval, according to the highest level of education attained. The ESS (edulvla) uses five educational levels: 1 primary or lower; 2 lower secondary; 3 (upper) secondary; 4 post-secondary non-tertiary; 5 tertiary. We exclude individuals with edulvla==1 and more than 12 years of education, those with edulvla = 2 and more than 14 years of education, those with edulvla = 3 and more than 17 years of education, those with edulvla = 4 and more than 25 years of education, and those with edulvla = 5 and more than 30 years of education. We also exclude individuals with too little education, given their education level: those with edulvla = 3 and less than 10 years of education and those with edulvla = 5 and less than 14 years of education.

- *High education*: A dummy variable equal to 1 for those individuals with a secondary education or higher.

- *Years of compulsory education*: Variable that indicates the number of compulsory years of education according to Table 1.

- *Interest in politics*: A dummy variable equal to 1 if the individual is very interested or highly interested, and 0 otherwise. Source: ESS

- *Politician*: A dummy variable equal to 1 if the individual occupation is legislator, senior government official, traditional chief and head of village, or senior officials of special-interest organizations. Source: ESS

- *Vote*: A dummy variable equal to 1 if the individual voted in the last national election. Source: ESS

- *Work in a political party*: A dummy variable equal to 1 if the individual worked for a political party or action group in the last 12 months. Source: ESS

- *Member of a political party*: A dummy variable equal to 1 if the individual is a member of a political party or action group in the last 12 months. Source: ESS

- *Women Family*: A dummy variable equal to 1 if individuals 'Agree' or 'Strongly Agree' with the statement "A woman should be prepared to cut down on her paid work for the sake of her family" (possible answers to both questions are "Strongly Agree", "Agree", "Neither Agree nor Disagree", "Disagree Strongly," or "Disagree"). Source: ESS

- *Men more rights*: A dummy variable equal to 1 if individuals 'Agree' or 'Strongly Agree' with the statement "Men should have more rights to a job than women when jobs are scarce" (possible answers to both questions are "Strongly Agree," "Agree," "Neither Agree nor Disagree," "Disagree Strongly," or "Disagree"). Source: ESS

B   Other Tables and Graphs

Table B.1: Descriptive statistics: Regional data

	AT	CZ	DE	FR	GR	HU	NL	PL	SK	Total
Elected Female	0.297	0.181	0.313	0.467	0.201	0.101	0.316	0.219	0.146	0.273
	(0.0780)	(0.0506)	(0.0571)	(0.0531)	(0.0421)	(0.0691)	(0.0676)	(0.0715)	(0.0694)	(0.138)
Elected male	0.703	0.819	0.687	0.532	0.807	0.899	0.684	0.785	0.854	0.727
	(0.0780)	(0.0506)	(0.0571)	(0.0561)	(0.0818)	(0.0691)	(0.0676)	(0.0951)	(0.0694)	(0.141)
Compulsory Schooling (y.)	8.701	8.867	8.691	9.413	7.314	9.675	9.583	7.771	8.855	8.980
	(0.0955)	(0.0706)	(0.109)	(0.171)	(0.282)	(0.105)	(0.0972)	(0.0506)	(0.0522)	(0.680)
Secondary Degree or More (F)	0.974	0.992	0.968	0.747	0.596	0.958	0.929	0.975	0.985	0.898
	(0.0285)	(0.0151)	(0.0352)	(0.103)	(0.138)	(0.0493)	(0.0416)	(0.0158)	(0.0161)	(0.135)
Secondary Degree or More (M)	0.984	0.996	0.984	0.789	0.667	0.969	0.947	0.990	0.989	0.919
	(0.0202)	(0.00798)	(0.0229)	(0.111)	(0.125)	(0.0463)	(0.0367)	(0.00998)	(0.0169)	(0.119)
Female	0.527	0.511	0.518	0.536	0.504	0.525	0.514	0.524	0.521	0.521
	(0.0587)	(0.0487)	(0.0663)	(0.0723)	(0.0505)	(0.0665)	(0.0585)	(0.0261)	(0.0514)	(0.0599)
Non-educated Parents	0.364	0.133	0.158	0.556	0.829	0.373	0.634	0.579	0.324	0.436
	(0.115)	(0.0622)	(0.0589)	(0.0927)	(0.0738)	(0.136)	(0.0946)	(0.109)	(0.0950)	(0.227)
Single Parent	0.0864	0.0755	0.0830	0.0845	0.0439	0.0801	0.0495	0.0941	0.0694	0.0746
	(0.0330)	(0.0289)	(0.0478)	(0.0461)	(0.0252)	(0.0557)	(0.0286)	(0.0258)	(0.0275)	(0.0412)
% in Working Age	0.811	0.824	0.786	0.781	0.783	0.769	0.818	0.822	0.847	0.802
	(0.0652)	(0.0474)	(0.0739)	(0.0688)	(0.0615)	(0.0588)	(0.0528)	(0.0341)	(0.0444)	(0.0627)

Note: Standard deviation in parenthesis.

Table B.2: Descriptive statistics: Variation between and within regions

	Mean	Between std. dev.	Within std. dev.
Elected female	.27	.14	.041
Secondary Degree or more (F)	.9	.14	.049
Secondary Degree or more (M)	.92	.12	.055
Compulsory Schooling (y.)	9	.75	.095

Table B.3: Characteristics of the "compliers"

	Non-Complier	Possible Complier	Diff.	Obs.
Female	0.52	0.67	-0.16***	34238
Family not educated	0.57	0.92	-0.35***	32643
Father tertiary education	0.10	0.01	0.09***	31014
Mother tertiary education	0.03	0.00	0.03***	32036
Family tertiary education	0.10	0.01	0.10***	32393
Father unemployed when 14	0.02	0.04	-0.01***	33330
Lived with mother only, father dead or absent when 14	0.08	0.10	-0.02***	33330
Lived with father only, mother dead or absent when 14	0.03	0.04	-0.01***	33715
Non citizen	0.01	0.01	-0.00	34238

Note: The table shows the mean values and the difference between the group of non-complier, i.e., individuals who already had a higher level of education than the compulsory one before the reform, and possible complier, i.e., individuals who had a lower level of education than the compulsory one pre-reform. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.4: Descriptive statistics: Individual data- females

	AT	CZ	DE	DK	FR	GB	GR	HU	IE	IT	NL	PL	PT	SK	Total
Years of Compulsory Schooling	8.552	8.584	8.558	7.598	8.975	10.38	7.651	9.025	8.508	6.680	9.431	7.640	5.156	8.587	8.324
	(0.497)	(0.493)	(0.497)	(0.615)	(1.000)	(0.608)	(1.493)	(0.964)	(0.500)	(1.574)	(0.495)	(0.614)	(1.405)	(0.493)	(1.536)
Secondary Education	0.985	0.988	0.987	0.983	0.741	0.794	0.823	0.964	0.887	0.717	0.951	0.993	0.367	0.992	0.862
	(0.121)	(0.110)	(0.114)	(0.128)	(0.438)	(0.404)	(0.382)	(0.186)	(0.317)	(0.451)	(0.217)	(0.0815)	(0.482)	(0.0896)	(0.345)
Non-educated parents	0.447	0.251	0.151	0.369	0.704	0.688	0.820	0.597	0.718	0.880	0.710	0.762	0.946	0.619	0.629
	(0.497)	(0.434)	(0.358)	(0.483)	(0.457)	(0.463)	(0.385)	(0.491)	(0.450)	(0.325)	(0.454)	(0.426)	(0.226)	(0.486)	(0.483)
Lived with single parent when 14	0.0927	0.0914	0.0878	0.0448	0.0818	0.0804	0.0266	0.112	0.0837	0.0476	0.0597	0.0889	0.0807	0.0836	0.0783
	(0.290)	(0.288)	(0.283)	(0.207)	(0.274)	(0.272)	(0.161)	(0.315)	(0.277)	(0.213)	(0.237)	(0.285)	(0.273)	(0.277)	(0.269)
Age	57.43	64.27	55.97	51.39	58.59	53.77	43.20	63.86	53.57	63.57	50.89	57.75	54.78	63.93	56.44
	(7.242)	(6.223)	(6.492)	(5.844)	(6.388)	(6.650)	(5.015)	(6.616)	(6.717)	(7.240)	(6.695)	(6.594)	(6.343)	(5.661)	(8.492)
Interest in Politics	1.579	1.027	1.707	1.785	1.393	1.434	1.012	1.220	1.342	1.017	1.613	1.289	0.993	1.322	1.333
	(0.859)	(0.748)	(0.783)	(0.750)	(0.928)	(0.930)	(0.906)	(0.909)	(0.940)	(0.863)	(0.757)	(0.812)	(0.912)	(0.807)	(0.892)
Politician	0.00137	0.00269	0.00162	0.000898	0.00265	0.000510	0.00446	0.00236	0.000938	0.00175	0.00147	0	0	0.00168	0.00150
	(0.0370)	(0.0518)	(0.0402)	(0.0300)	(0.0514)	(0.0226)	(0.0667)	(0.0486)	(0.0306)	(0.0418)	(0.0383)	(0)	(0)	(0.0409)	(0.0387)
Vote	0.899	0.672	0.869	0.957	0.809	0.795	0.881	0.805	0.869	0.838	0.848	0.777	0.767	0.814	0.821
	(0.301)	(0.470)	(0.338)	(0.203)	(0.393)	(0.403)	(0.324)	(0.396)	(0.337)	(0.369)	(0.359)	(0.416)	(0.423)	(0.390)	(0.384)
Work in Political Party	0.0618	0.0231	0.0280	0.0431	0.0347	0.0342	0.0417	0.0141	0.0381	0.0142	0.0312	0.0191	0.0125	0.0195	0.0296
	(0.241)	(0.150)	(0.165)	(0.203)	(0.183)	(0.182)	(0.200)	(0.118)	(0.191)	(0.118)	(0.174)	(0.137)	(0.111)	(0.138)	(0.170)
Member of Political Party	0.138	0.0411	0.0256	0.0488	0.0258	0.0149	0.0424	0.00956	0.0326	0.0187	0.0380	0.0100	0.0228	0.0192	0.0343
	(0.345)	(0.199)	(0.158)	(0.216)	(0.159)	(0.121)	(0.202)	(0.0974)	(0.178)	(0.136)	(0.191)	(0.0997)	(0.149)	(0.137)	(0.182)
Gender Attitude(1)	0.509	0.563	0.432	0.126	0.456	0.411	0.417	0.522	0.363	.	0.220	0.598	0.559	0.528	0.442
	(0.501)	(0.496)	(0.496)	(0.332)	(0.498)	(0.492)	(0.493)	(0.500)	(0.481)	(.)	(0.415)	(0.491)	(0.497)	(0.500)	(0.497)
Gender Attitude(2)	0.165	0.289	0.165	0.0256	0.172	0.128	0.328	0.439	0.118	0.221	0.0944	0.303	0.242	0.350	0.223
	(0.371)	(0.454)	(0.371)	(0.158)	(0.378)	(0.334)	(0.470)	(0.497)	(0.322)	(0.416)	(0.293)	(0.460)	(0.428)	(0.477)	(0.416)

Table B.5: Descriptive statistics: Individual data- males

	AT	CZ	DE	DK	FR	GB	GR	HU	IE	IT	NL	PL	PT	SK	Total
Years of Compulsory Schooling	8.530	8.624	8.565	7.592	9.024	10.39	7.701	9.094	8.493	6.662	9.427	7.649	5.130	8.628	8.405
	(0.499)	(0.484)	(0.496)	(0.637)	(1.000)	(0.611)	(1.487)	(0.959)	(0.500)	(1.601)	(0.495)	(0.609)	(1.367)	(0.484)	(1.466)
Secondary Education	0.987	0.991	0.998	0.979	0.802	0.780	0.865	0.970	0.862	0.812	0.952	0.992	0.420	0.989	0.886
	(0.115)	(0.0961)	(0.0492)	(0.145)	(0.399)	(0.414)	(0.342)	(0.172)	(0.345)	(0.391)	(0.215)	(0.0873)	(0.494)	(0.103)	(0.317)
Non-educated parents	0.426	0.242	0.144	0.364	0.675	0.657	0.834	0.571	0.731	0.874	0.694	0.741	0.931	0.579	0.598
	(0.495)	(0.428)	(0.352)	(0.481)	(0.469)	(0.475)	(0.373)	(0.495)	(0.444)	(0.332)	(0.461)	(0.438)	(0.254)	(0.494)	(0.490)
Lived with single parent when 14	0.0849	0.0810	0.0635	0.0517	0.0916	0.0718	0.0394	0.0835	0.0704	0.0717	0.0572	0.0833	0.0693	0.0967	0.0731
	(0.279)	(0.273)	(0.244)	(0.221)	(0.289)	(0.258)	(0.195)	(0.277)	(0.256)	(0.258)	(0.232)	(0.276)	(0.254)	(0.296)	(0.260)
Age	57.74	63.78	56.35	51.54	58.24	53.63	42.89	63.04	54.15	63.49	51.38	57.29	54.88	63.41	56.41
	(7.352)	(6.034)	(6.302)	(5.579)	(6.287)	(6.789)	(5.240)	(6.630)	(6.517)	(7.273)	(6.770)	(6.641)	(5.965)	(6.588)	(8.273)
Interest in Politics	1.943	1.307	2.099	2.011	1.707	1.707	1.278	1.449	1.612	1.333	1.863	1.637	1.291	1.587	1.644
	(0.843)	(0.747)	(0.785)	(0.752)	(0.945)	(0.929)	(0.958)	(0.916)	(0.957)	(0.957)	(0.773)	(0.802)	(0.972)	(0.810)	(0.905)
Politician	0.000769	0.00368	0.00746	0.00273	0.00495	0.00177	0.00624	0.000796	0.00224	0.00626	0.00907	0.00239	0.00158	0.00379	0.00375
	(0.0277)	(0.0606)	(0.0861)	(0.0522)	(0.0702)	(0.0421)	(0.0788)	(0.0282)	(0.0473)	(0.0789)	(0.0948)	(0.0489)	(0.0398)	(0.0615)	(0.0611)
Vote	0.910	0.700	0.890	0.955	0.848	0.782	0.875	0.821	0.852	0.867	0.853	0.775	0.812	0.806	0.832
	(0.287)	(0.458)	(0.313)	(0.208)	(0.360)	(0.413)	(0.331)	(0.384)	(0.355)	(0.339)	(0.354)	(0.418)	(0.391)	(0.396)	(0.374)
Worked in a Political Party	0.130	0.0524	0.0874	0.0528	0.0550	0.0387	0.0590	0.0261	0.0646	0.0480	0.0501	0.0445	0.0575	0.0431	0.0577
	(0.336)	(0.223)	(0.283)	(0.224)	(0.228)	(0.193)	(0.236)	(0.159)	(0.246)	(0.214)	(0.218)	(0.206)	(0.233)	(0.203)	(0.233)
Member of Political Party	0.238	0.0729	0.0690	0.0802	0.0350	0.0245	0.0766	0.0162	0.0589	0.0735	0.0538	0.0341	0.0535	0.0406	0.0635
	(0.426)	(0.260)	(0.254)	(0.272)	(0.184)	(0.155)	(0.266)	(0.126)	(0.236)	(0.262)	(0.226)	(0.181)	(0.225)	(0.198)	(0.244)
Gender Attitude(1)	0.492	0.608	0.499	0.0900	0.457	0.344	0.515	0.569	0.322	.	0.228	0.644	0.641	0.520	0.458
	(0.501)	(0.488)	(0.500)	(0.286)	(0.499)	(0.475)	(0.500)	(0.496)	(0.468)	(.)	(0.420)	(0.479)	(0.480)	(0.500)	(0.498)
Gender Attitude(2)	0.190	0.413	0.158	0.0334	0.158	0.114	0.504	0.488	0.132	0.281	0.103	0.380	0.280	0.379	0.260
	(0.393)	(0.493)	(0.365)	(0.180)	(0.365)	(0.318)	(0.500)	(0.500)	(0.338)	(0.451)	(0.304)	(0.486)	(0.449)	(0.486)	(0.439)

Table B.6: Effect of increasing education on political participation: Males

	(1) Interest in politics	(2) Politician	(3) Vote	(4) Work Political Party	(5) Member Political Party
OLS coeff.	0.534***	0.003**	0.105***	0.033***	0.009
	(0.025)	(0.001)	(0.012)	(0.005)	(0.009)
IV coeff.	0.937	0.071*	-0.182	0.121	0.343
	(0.609)	(0.043)	(0.298)	(0.178)	(0.505)
First-stage coeff.	0.017***	0.018***	0.016**	0.016***	0.010
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
F-Test of ivs	7.872	10.428	6.300	7.678	2.573
p-value	0.0055	0.0128	0.0061	0.0014	0.1102
Observations	17,875	17,410	17,528	17,862	10,627
Country FE	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, non-educated family as controls. Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C   Robustness check

C.1   Measures of schooling

We next study whether our results hold after using other measures of schooling, in particular, average years of schooling. Tables C.1 and C.2 below replicate Tables 6 and 7 in the main text.

Table C.1: Effect of increasing education on political participation: Years of schooling

	(1) Interest in Politics	(2) Politician	(3) Vote	(4) Work Political Party	(5) Member Political Party
OLS coeff. (years sch.)	0.077***	0.0002***	0.014***	0.004***	0.002***
	(0.002)	(0.000)	(0.001)	(0.000)	(0.000)
IV coeff.	0.148**	0.005	-0.058	-0.018	0.006
	(0.074)	(0.006)	(0.040)	(0.014)	(0.022)
First-stage coeff.	0.108***	0.075**	0.111***	0.112***	0.157***
	(0.033)	(0.038)	(0.035)	(0.033)	(0.034)
F-Test of ivs	10.592	3.966	10.246	11.111	20.925
Observations	21,869	20,502	21,448	21,831	13,132
Country FE	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, non-educated
family as controls. Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2: Effect of increasing education on gender-role attitudes: Years of schooling

	Traditional Gender-Role Attitude			
	(1) Women Family (F)	(2) Women Family (M)	(3) Men More Rights (F)	(4) Men More Rights (M)
OLS coeff.	-0.020***	-0.015***	-0.021***	-0.020***
	(0.002)	(0.002)	(0.001)	(0.001)
IV coeff.	-0.087	0.061	-0.154*	-0.029
	(0.087)	(0.236)	(0.084)	(0.060)
First-stage	0.153***	0.048	0.107**	0.127**
	(0.057)	(0.067)	(0.047)	(0.063)
F-Test of ivs	7.306	0.519	5.076	4.032
p-value	0.0075	0.4723	0.0253	0.0459
Observations	8,193	6,345	10,261	8,123
Country FE	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, and non-educated family as controls.

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.2 Window size

We perform an additional robustness check: estimating our model again using a window of five and nine cohorts instead of seven. See Tables C.3 and C.4 below for political participation and Tables C.5 Tables C.6 for gender-role attitudes.

Table C.3: Effect of increasing education on political participation: Window size=5

	(1) Interest in Politics	(2) Politician	(3) Vote	(4) Work Political Party	(5) Member Political Party
OLS coeff.	0.565***	0.001	0.100***	0.022***	0.014***
	(0.030)	(0.001)	(0.013)	(0.004)	(0.005)
IV coeff.	0.920**	0.003	-0.144	-0.006	0.157
	(0.404)	(0.030)	(0.186)	(0.074)	(0.198)
First-stage coeff.	0.022***	0.015***	0.022***	0.022***	0.017***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
F-Test of ivs	23.772	10.651	21.169	22.425	18.568
Observations	15,646	14,690	15,330	15,619	9,400
Country FE	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, and non-educated family as controls. Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.4: Effect of increasing education on political participation: Window size=9

	(1) Interest in politics	(2) Politician	(3) Vote	(4) Work Political Party	(5) Member Political Party
OLS coeff.	0.551***	0.001***	0.098***	0.020***	0.018***
	(0.021)	(0.000)	(0.009)	(0.003)	(0.003)
IV coeff.	0.419	0.030	-0.328**	-0.097*	0.048
	(0.341)	(0.026)	(0.153)	(0.056)	(0.166)
First-stage coeff.	0.024***	0.018***	0.025***	0.024***	0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
F-Test of ivs	34.106	18.261	32.721	33.393	16.560
Observations	27,980	26,205	27,423	27,932	16,900
Country FE	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, and non-educated family as controls. Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.5: Effect of increasing education on gender-role attitudes: Window size=5

	Traditional Gender-Role Attitude			
	(1)	(2)	(3)	(4)
	Women Family (F)	Women Family (M)	Men More Rights (F)	Men More rights (M)
OLS coeff.	-0.110***	-0.117***	-0.164***	-0.159***
	(0.026)	(0.024)	(0.019)	(0.020)
IV coeff.	-1.078*	-0.198	-0.539**	-0.367
	(0.558)	(0.324)	(0.274)	(0.268)
First-stage	0.024***	0.035***	0.022***	0.034***
	(0.007)	(0.008)	(0.006)	(0.007)
F-Test of IVs	11.074	18.860	14.986	26.691
Observations	5855	4527	7335	5782
Country FE	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes

Note: In addition to controls above specified, all models include noncitizen, father only, and non-educated family as controls.

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.6: Effect of increasing education on gender-role attitudes: Window size=9

	Traditional Gender-Role Attitude			
	(1)	(2)	(3)	(4)
	Women Family (F)	Women Family (M)	Men More Rights (F)	Men More Rights (M)
OLS coeff.	-0.130***	-0.121***	-0.154***	-0.168***
	(0.019)	(0.017)	(0.013)	(0.015)
IV coeff.	0.346	0.456	-0.369	-0.031
	(0.717)	(0.711)	(0.247)	(0.368)
First-stage	0.020***	0.015*	0.022***	0.020***
	(0.006)	(0.008)	(0.005)	(0.007)
F-Test of ivs	11.992	3.221	17.107	9.213
Observations	10532	8188	13168	10450
Country FE	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes

Note: in addition to controls above specified, all models include noncitizen, father only, amd non-educated family as controls.

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.3   Country selection

Our results could be driven by one specific country. We check that possibility by showing results next by eliminating one country at a time on politicization (Interest in politics) and gender-role attitudes above on which education has an impact. As shown, results are close to those in Tables 6 and 7 in the main text.

Table C.7: Effect of education on political participation and gender-role attitudes

	(1) AT	(2) CZ	(3) DE	(4) DK	(5) FR	(6) GB	(7) GR	(8) HU	(9) IE	(10) IT	(11) NL	(12) PL	(13) PT	(14) SK
	Interest in politics													
Sec educ	0.736**	0.640**	0.829**	0.867***	0.798**	0.528	0.867***	0.733**	0.611*	0.843*	0.949***	0.715**	0.761*	0.695**
	(0.032)	(0.048)	(0.009)	(0.008)	(0.012)	(0.107)	(0.005)	(0.024)	(0.054)	(0.058)	(0.003)	(0.025)	(0.057)	(0.035)
Observations	20,169	19,846	20,447	20,611	19,908	19,898	20,321	20,252	19,600	20,975	19,798	19,844	19,841	20,525
F-Test of ivs	42.891	45.194	45.555	45.503	37.582	42.274	59.436	45.682	58.376	35.102	47.665	44.804	29.916	45.393
	Men more rights (F)													
Sec educ	-0.692**	-0.693***	-0.551**	-0.622**	-0.702**	-0.666**	-0.494**	-0.588**	-0.530**	-0.714**	-0.632**	-0.624**	-0.763*	-0.654**
	(0.015)	(0.010)	(0.020)	(0.017)	(0.018)	(0.019)	(0.018)	(0.019)	(0.023)	(0.013)	(0.012)	(0.017)	(0.073)	(0.013)
Observations	9,679	9,157	9,706	9,735	9,417	9,457	9,181	9,527	9,257	9,998	9,400	9,431	9,357	9,558
F-Test of ivs	13.393	14.620	15.648	14.723	11.256	11.749	23.302	14.105	17.463	15.096	16.031	14.243	7.155	14.867
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Trends in Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes