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Parental Transmission and the Importance of the (Noncausal) Effects of Education on Political Engagement: Missing the Forest for the Trees

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Abstract

By most accounts, an important prerequisite for a well-functioning democracy is engaged citizens. A very prominent explanation of variation in political engagement suggests that parental transmission through socialization accounts for individual-level differences in political engagement. In this paper, we show, using a large Danish twin survey (N = 2,071), that classic formulations of parental transmission theory can be supplemented by findings from the biopolitics literature, allowing us to disentangle when heritable factors are important and when socialization factors are important predictors of political engagement. We show that as the level of family politicization and consistency increases, the influence of genes decreases. We take this to imply that family socialization can compensate for (genetic) individual differences and foster increased political engagement. By only focusing on the "causal" effect of education, we are missing the forest for the trees.

Keywords

applied social psychology, behavior genetics, development

Introduction

For a democratic society to thrive, it is essential that the citizenry is politically interested, knowledgeable, and involved in the democratic process. Consequently, substantial effort has been devoted to understanding how we cultivate engaged citizens. A prominent explanation is that parents socialize their offspring to be politically engaged (Andolina et al., 2003; Hyman, 1959; Jennings & Niemi, 1981; McIntosh et al., 2007; Jennings et al., 2009). A second important explanation emphasizes that (civic) education enhances the propensity of citizens to be interested and involved in politics (Persson, 2015; Willeck & Mendelberg, 2022). This idea is most clearly articulated in Philip Converse's famous statement that education is the "universal solvent" (Converse, 1972).

However, a series of studies have argued that the causal effect of education on political engagement is either exaggerated or, in some cases, perhaps nonexistent. According to these studies, education is a proxy for the influence of family upbringing and/or genetic dispositions in the form of personality traits and cognitive abilities (e.g., Berinsky & Lenz, 2011; Highton, 2009; Kam & Palmer, 2008). So far, most of the literature has been somewhat one-sided, arguing either that there *is or isn't* a causal effect of education. Very few studies have explicitly tested which of the proposed confounders suggested in the literature impact the association between education and engagement, although two notable exceptions are studies by Rasmussen (2016) and Oskarsson et al. (2017). Rasmussen (2016) shows that the effect of education on political knowledge is (partially) confounded by personality traits and cognitive ability, and Oskarsson et al. (2017) demonstrate that the effect of education on social trust is completely genetically confounded.

It is surprising that the literature on the relationship between education and political engagement has not cross-fertilized with the literature on the familial underpinnings (e.g., parental influences and genes) of political engagement

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since both stand to gain by learning from the theoretical and empirical insights of the other. What if we are missing the forest for the trees? What if there is an important influence of education on political engagement, but one that is not well captured by focusing only on estimating *the* causal effect of education, or by focusing exclusively on confounding? This article remedies some of these shortcomings by combining insights from both lines of research to study the (noncausal) effects of education on political engagement and the important conditioning effects of the family environment.

From the classic literature on parental socialization and transmission of (political) values, attitudes, and behaviors (Hyman, 1959; Jennings & Niemi, 1968), it is no surprise that part of the variation in the effect of education on political engagement is explained by parental influences. Indeed, we would expect that to be the case, especially when families are engaged in politics (Jennings et al., 2009). Specifically, the literature suggests that an engaged family environment could potentially *enhance* the effect of education on political engagement—a *Matthew effect* where the educated participate more and the noneducated participate less. Alternatively, the family environment could *compensate* for the lack of formal education by transmitting political engagement through socialization (Damian et al., 2015; Neundorf et al., 2016). The idea here is that those with low levels of education would gain the most from socialization and their levels of engagement could potentially "catch up" to those with high levels of education. In this article, we make three contributions to the literature, which are outlined below.

First, the classic literature on familial transmission has paid little attention to the fact that part of familial transmission may take place through genetic transmission. The literature is aware of this potential mechanism, but because there has been a lack of suitable data sources to tackle the problem, there has not been much empirical research addressing this point. As Jennings et al. (2009) note, ". . . it is possible that genetic mechanisms are doing at least some of the work. It remains for additional research to reconcile and perhaps integrate these two approaches to understanding parent-child concordance" (p. 796). By drawing on insights from the biopolitics literature, which has stressed the importance of genetic inheritance (Alford et al., 2005; Dinesen et al., 2016; Fowler et al., 2008; Oskarsson et al., 2017), we can develop a better understanding of when and why familial transmission, as opposed to genetic transmission, matters for the effect of education on political engagement.

Second, the literature on the causal effect of education on political engagement has paid little attention to the fact that it is not only genetic dispositions that might confound the effect of education. Family upbringing likely plays an important role as well. Although Kam and Palmer (2008) highlighted the importance of family upbringing as a potential confounder of the effect of education on political engagement; few studies, to our knowledge, have actually been able to demonstrate empirically the importance of this potential confounder for political engagement.

Third, and related to the above point, many studies on education and political engagement have focused on assessing whether the relationship between education political engagement is causal (Persson, 2015). Although this is an important endeavor, it is somewhat surprising that more studies have not explored the role of contextual factors in shaping the relationship between education and engagement. Numerous studies have demonstrated that environmental factors matter when it comes to the link between education and engagement in politics. Campbell (2009), for instance, shows that the effect of education on participation depends on the educational environment a person is situated in. If one's peers are also highly educated, education has a smaller effect on political participation and engagement, compared with contexts where the same individual is surrounded by peers who hold less formal education. Recently, three studies have focused on the effect of a different contextual factor, parental socialization, on the relationship between education and engagement in politics. Robinson (2020) finds that while the effect of education on political knowledge is completely confounded by pre-adult factors, there is indeed an effect of education on political knowledge in families who discuss politics frequently. Similarly, Lindgren et al. (2019) find no effect of education on political participation but show that in families with low socioeconomic status (SES), raising levels of education can *compensate* for pre-adult proclivities to participate. Finally, Oskarsson et al. (2020) find, using a novel adoptee design, that exposure to consistent parental behavior weakens the influence of genetic predispositions on turnout.

Building on these insights, we argue that by focusing only on the question of whether education has a causal effect on participation, we might be missing the forest for the trees. Education could have varying effects on political engagement given different contextual factors. In this paper, we have two main aims, both of which draw on insights and approaches from behavior genetics:

- To investigate whether the effect of education on political engagement is confounded by family upbringing and/or by genetic differences.
- To disentangle the moderating influence of the rearing environment (here, we focus on family politicization) on the relationship between education and political engagement.

We note that these topics have important potential policy implications. For example, if the effect of education on engagement is confounded by family upbringing, one implication is that changing family SES could make an important difference in shaping political engagement and political equality (Lindgren et al., 2019). Below, we provide an overview of our expectations.

Hypothesis

Social learning theory (Bandura, 1969, 1986) has been used to explain the correspondence between parent–child political attitudes such as party identification and interest in politics (Jennings et al., 2009). The more frequent and salient the cues are from parents, the more likely the transmission through social learning to offspring, implying that the more politicized the family is, the stronger the transmission (Jennings et al., 2009). This expectation forms the basis of our main hypothesis, and its two competing subhypotheses based on the socialization literature discussed above:

Hypothesis 1 (H1): The more politicized the family rearing environment, the stronger the moderation of the effect of education on political participation.
Hypothesis 1A (H1A): An engaged family environment *enhances* the effect of education on political engagement, that is, a "Matthew effect."
Hypothesis 1B (H1B): An engaged family environment *compensates* for the effect of education on political engagement and thus compensates for pre-adult proclivities to participate and become educated.

Methods and Data

Data and Case

Participants were drawn from the Danish Twin Registry's younger cohort of twins born between 1970 and 1989. The twins were surveyed 3 times. We use data from the first wave, which were collected in 2009. The only exception is for our measure of politicization, which is only available in the second wave. All analyses using the measure of politicization thus have a smaller sample size compared with the rest of the analyses. The Danish Twin Registry is very similar to the general population in terms of educational attainment and political attitudes (Christensen et al., 2006; Klemmensen et al., 2012). A full "Transparency and Openness" statement regarding the data can be found in Supplemental Appendix 4.

In this paper, we examine a range of political outcomes that capture psychological and behavioral engagement in politics. More specifically, we focus on political participation, political interest, consumption of political news, and external political efficacy. Investigating multiple aspects of political engagement allows us to conduct a fairly thorough investigation of the effect of education on political engagement, an important democratic construct.

Measures

Descriptive statistics for all measures can be found in Supplemental Appendix 1.

Political Participation. Participation is measured by four items asking about a series of political and social activities such as "Signed a petition" and "Participated in a demonstration." The full set of activities can be found in Supplemental Appendix 2. The answer categories are as follows: "Have done within the last year," "Have done it at an earlier time," "Have not done it but might do it," and "Have not done it and will never do it" (as well as a "Don't know" option). The measure of political participation is a summative index of the individual items. Alpha reliability is .64 for this index.

Political Interest. Political interest is measured by asking respondents "How interested are you in politics?" on a four-point scale ("Very," "Somewhat," "Not very," or "Not at all" interested).

External Efficacy. External efficacy is measured using two questions on the responsiveness of government. The questions are translated from the well-known ANES "NOSAY" and "NOCARE" items (Niemi et al., 1991). The first asks whether respondents agree with the statements "People like me have don't have any say about what government does" and "I don't think the government cares much what people like me think." The answer categories were "Completely agree," "Agree," "Partially disagree," and "Completely disagree" (as well as a "Don't know" option). Our measure of external efficacy is a simple summative score of these two items; alpha reliability is .80 for this score.

Consumption of Political News. Consumption of political news is measured using the question "How often do you follow politics either via TV, radio, or by reading newspapers?" Respondents could answer with "Every day," "Multiple times a week," "One or two times a week," "Rarely," or "Never."

Family Politicization. Family politicization is measured using the question "Growing up, how often did you discuss politics with your family (except your twin)?" The answer categories were "Never," "Rarely," "Now and then," and "Often."

Demographics. Age and gender are ascertained from Danish registries.

Method

Twins have recently been used as a "natural experiment," and many studies have focused on MZ (i.e., "identical") twins to examine the relationship between education and political attitudes and behaviors (Dinesen et al., 2016;

Oskarsson et al., 2017; Robinson, 2020; Weinschenk & Dawes, 2019). The idea is quite simple: Since MZ twins reared together share both their upbringing and segregating genes, they are matched on likely confounders. Thus, if we want to investigate the causal effect of education on political engagement, we can investigate twin pairs where one twin has a higher level of education than the other twin. More specifically, we can examine whether the twin with the higher level of education compared to the twin with a lower level of education exhibits a higher level of engagement. This model is typically referred to as a "twin-pair fixed-effects" model. Unobserved confounders that are associated with the individual twin's own experience (unique environment), such as unique influences by peers, teachers, or others, are not taken into account. Turkheimer and Harden (2014) thus term the effect using this design *quasi*-causal since unobserved nonshared confounding cannot be ruled out (see also Rasmussen et al., 2019). A fully noncausal effect estimate would be a naive marginal correlation between education and political engagement since this would not take genetic confounding or confounding by upbringing into account.

A detailed description of our approach to estimating the twin models can be found in Supplemental Appendix 3. What we are interested in this article is the quasi-causal effect of education on political engagement. To estimate this, we estimate two models decompasing the variance into additive genetic (A), common environmental (C) and non shared environmental influences (E) using a so-called Cholesky decomposition (Neale & Cardon, 2013), as illustrated in Figure 1.

To get at the underlying logic of the model, we draw an analogy to ordinary least squares (OLS) regression. Each of the variance components for the first variable X (A_{x1}, C_{x1}, and E_{x1}) can be thought of as separate quantities, which are regressed on the second variable Y. The variance components for the second variable (A_{y1}, C_{y1}, and E_{y1}) are simply an ACE model estimated on the residual variance (i.e., after the shared variance is taken into account). The shared paths (paths a_{11}, c_{11}, and e_{11}) are thus nothing more than regression coefficients, each representing different quantities. If we know the variance of A and the covariance between this parameter and Y, we can calculate the effect as we would in ordinary OLS (i.e., $Cov(X, Y)/Var_Y$), which translates into $a_{11} = Cov(A_X)/Var_A$ for the effect of additive genetics from X on Y).

It turns out that the parameter e_{11} corresponds to what we would obtain if we had simply used a fixed-effects model. We outline this in more formal detail in Supplemental Appendix 3, but hopefully, the intuition is clear. Again, using an OLS analogy can help with the understanding. Since we are "controlling for" both the additive genetic effects (a_{11}) and the effects of the rearing environment (c_{11}), what is left is exactly the within-twin pair differences in a twin pair (i.e., whether the twin who has a higher level of education is also more engaged in politics). The quasi-causal effect estimate thus concerns whether we obtain a significant, and sizable, effect of the e_{11} parameter.

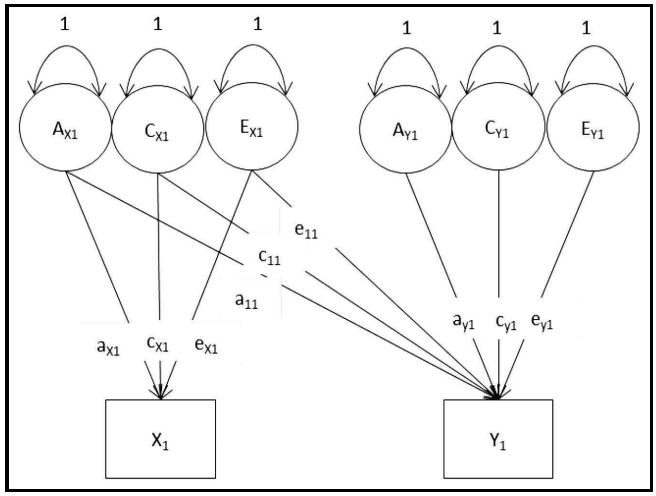

Figure 1. Cholesky Decomposition.

If we only used a fixed-effects model, we would be unable to investigate whether genetic confounding or confounding by the rearing environment is responsible for the effect of education on political participation, and hence, we would be unable to separate the effects of genetic confounding from the family environment. Importantly, we would be missing the opportunity to investigate whether and how confounding changes as a function of family politicization. As we demonstrate below, there is no quasi-causal effect of education on political engagement, but the effect of genetic confounding decreases as family politicization increases. By not allowing our model to investigate the (noncausal) effect of education on engagement, we would be missing the forest for the trees. To allow these parameters to vary as a function of family politicization, we need to elaborate slightly on Figure 1 and estimate a so-called gene–environment interaction model.

The Moderating Effect of Family Politicization

The Cholesky decomposition allows us to investigate whether the parameters a11, c11, or e11 are moderated by family politicization. Before discussing the model more formally, is it worth reiterating the substantive interpretation of the moderation parameters? Robinson (2020) demonstrates that the quasi-causal effect of education (i.e., path e11) on political knowledge decreases as the level of discussion in the home increases. But what would be the implication of the moderation of the paths a11 and c11? If we find that the effect of a11 decreases (and c11 or e11 are not moderated) as a function of family politicization, this

would imply that genetic differences are relatively unimportant for the effect of education on engagement, if one grows up in a family environment characterized by politicization. This would suggest that we can increase the effect of education on political engagement by changing the level of family SES. In short, high SES within families may be able to compensate for the genetic effect of education on political participation. Conversely, if genetic confounding increases as the level of family politicization increases, this would indicate the existence of a Matthew effect, such that there would be a double boost in engagement for those who are genetically predisposed toward engagement and raised in a politicized family environment.

With this short substantive digression, we will briefly outline the moderation model in more formal detail. The moderation in our model is very similar to a classical OLS moderation effect (Brambor et al., 2006; Rasmussen et al., 2021) and can be interpreted as such. If we have an independent variable (e.g., education) and a dependent variable (e.g., political participation) and family politicization is the moderator (M), we would estimate it as follows using OLS:

$$Y = \beta_0 + \beta_1 X + \beta_2 M + \beta_3 XM + \varepsilon. \quad (1)$$

Here, we can assess whether the interaction effect is significant by a significance test for the parameter β_3, and we can plot the effect at interesting levels of the moderator by calculating the marginal effect—taking the partial derivative of Y with respect to X:

$$\frac{\partial Y}{\partial X} = \beta_1 + \beta_3 M. \quad (2)$$

This is analogous to the gene–environment interaction model, shown in Figure 2, which we use here (Purcell, 2002). We implement this model by letting the covariance vary as a function of our moderator. Thus, we can calculate the moderation effect for path a11 as

$$\frac{\partial A}{\partial Y} = a_{11} + \beta_{MA} M. \quad (3)$$

Some care is needed in terms of drawing causal inferences for the moderating effect of family politicization. Obviously, family politicization is not randomly assigned. In addition, it is likely correlated with offspring education. For example, we know from previous studies that genes associated with educational attainment are also associated with social mobility and inequality (Barth et al., 2020; Belsky et al., 2018; McGue et al., 2020). In short, we encourage future studies to investigate the robustness of the results presented here.

Model Estimation

All models were estimated in Mplus version 8 (Muthén & Muthén, 2017) using the MplusAutomation (Hallquist & Wiley, 2018) package in R, and all plots were created using ggplot2 (Wickham, 2016). We present bootstrapped standard errors using 1,000 repetitions since standard errors for parameters close to their boundary are not normally distributed.[1] All models include age and gender as controls, as is standard for biometrical modeling (McGue & Bouchard, 1984). Missing data are handled using full information maximum likelihood (Enders, 2010), which is the Mplus default. All variables have been rescaled to have a variance of one and a mean of zero.

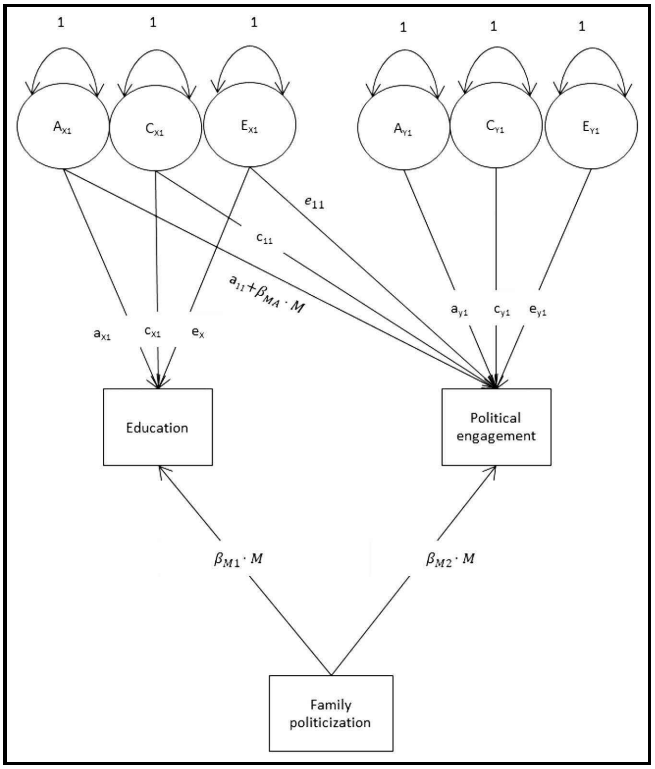

Figure 2. Gene–Environment Interaction Model.

For the bivariate Cholesky models, we ran a series of models to investigate whether we could reduce the models without significantly reducing the fit of the model. We, therefore, first estimated a full Cholesky model (including all parameters in Figure 1). We then ran models where we constrained one or more parameters to zero. We then chose the model with the lowest Akaike information criterion (AIC) that did not lead to a statistically significant reduction in model fit (Neale & Cardon, 2013). If an A, C, or E model parameter is not significant, we do not investigate its cross path (i.e., paths a_{11}, c_{11}, and e_{11}, since it does not make much sense to investigate the covariance of a construct without any significant variance). These results are presented in Tables 3 to 6 and in Supplemental Appendix 1.

For the moderation models, we only estimated interaction effects for the cross paths that were significant in the final model-fitting process. This is also the typical practice

Table 1. Cholesky Decomposition for the Effect of Education on Measures of Political Engagement.

Construct	Parameter	Political interest	Consumption of news	Participation	External efficacy
Education	a_x	0.702 [0.548, 0.857]*	0.729 [0.582, 0.876]*	0.695 [0.544, 0.846]*	0.719 [0.561, 0.877]*
	c_x	0.425 [0.151, 0.698]*	0.378 [0.036, 0.720]*	0.437 [0.205, 0.668]*	0.398 [0.102, 0.694]*
	e_x	0.571 [0.518, 0.625]*	0.571 [0.518, 0.624]*	0.572 [0.517, 0.626]*	0.570 [0.516, 0.624]*
Measure of engagement	a_y	0.521 [0.270, 0.772]*	0.610 [0.437, 0.783]*	0.348 [0.007, 0.689]*	0.542 [0.299, 0.785]*
	c_y	0.362 [0.073, 0.651]*	0.000 [−0.388, 0.389]	0.461 [0.270, 0.652]*	0.003 [−0.373, 0.380]
	e_y	0.676 [0.628, 0.724]*	0.707 [0.657, 0.758]*	0.726 [0.675, 0.776]*	0.780 [0.724, 0.837]*
Cross paths between education and engagement	a_{11}	0.375 [0.267, 0.483]*	0.357 [0.262, 0.452]*	0.374 [0.275, 0.473]*	0.311 [0.214, 0.409]*
	c_{11}	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]
	e_{11}	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]
	MZ/DZ pairs	827/917	827/917	827/913	825/913

Note. The results in the table are standardized results using the Cholesky decomposition from Figure 1 on each of the four measures of political engagement and education.
Coefficients significant at a .05 level are indicated with *.

in OLS unless we are dealing with a cross-over interaction, which we are not theorizing here (Loftus, 1978).

The Trees: The Noncausal Effect of Education on Political Engagement

The results for the effect of education on our measures of political engagement are shown in Table 1. In none of the models is the quasi-causal effect of education, the e_{11} parameter, on any of the measures of political engagement significant. If we were *only* interested in the (quasi-causal) effect of education on political engagement, the story would end here. Importantly, though, the estimated Cholesky models also allow us to see that this finding is due to genetic confounding. The reason we see an association between education and political engagement is because of genetic differences which give rise to political engagement and to differences in education (i.e., common cause confounding).

It is also interesting to note what the results do *not* show: We find no evidence of confounding by the shared environment (C). Although we find a significant C component for both education on one hand and political participation and political interest on the other, none of the estimated models is the effect of education on political engagement confounded by the common environment. This finding is particularly interesting from the perspective of the classical socialization literature on the parental transmission of political attitudes and behaviors (Jennings & Niemi, 1968). Although this literature has highlighted the potential for genetic influences on the transmission of attitudes and behaviors (Hyman, 1959), our finding is the first to demonstrate that the effect of education on political engagement is highly genetically confounded for a wide range of measures.

From the perspective of political equality, it is quite interesting to know whether a person's social background can amplify or compensate for genetic (dis-)advantages regardless of whether the effect of education on political engagement is causal or not. To investigate this possibility, we, therefore, turn to an investigation of exactly how the effect of education on engagement is moderated by family politicization.

The Forest: The Moderating Influence of Family Politicization

Family Politicization

For all measures of political engagement, the (genetically confounded) effect of education is significantly moderated by family politicization and the effect is negative, as is shown in Table 2. This implies that as family politicization increases, the amount of genetic confounding decreases. Thus, it is not the case that genetic dispositions to engage in politics and pursue an education and growing up in a family with high levels of political engagement work together to create political (in)equality: They complement

Table 2. Moderation of the Effect of Education on Political Engagement.

Construct	Parameter	Political interest	Consumption of news	Participation	External efficacy
Education	a_x	0.836 [0.767, 0.905]*	0.437 [0.260, 0.613]*	0.838 [0.769, 0.906]*	0.809 [0.742, 0.877]*
	c_x	.003 [−0.698, 0.691]	.640 [0.536, 0.744]*	−.001 [−0.489, 0.487]	.007 [−0.539, 0.553]
	e_x	0.534 [0.474, 0.594]*	0.624 [0.555, 0.694]*	0.531 [0.472, 0.590]*	0.530 [0.471, 0.588]*
Measure of engagement	a_y	0.565 [0.434, 0.696]*	0.003 [−0.432, 0.439]	0.577 [0.299, 0.854]*	0.454 [−0.036, 0.945]
	c_y	0.028 [−1.129, 1.186]	0.189 [−0.267, 0.645]	0.113 [−1.076, 1.303]	0.341 [−0.229, 0.910]
	e_y	0.789 [0.713, 0.866]*	0.746 [0.679, 0.814]*	0.764 [0.686, 0.843]*	0.768 [0.682, 0.853]*
Cross paths between education and engagement	a_{11}	0.238 [0.155, 0.321]*	0.583 [0.395, 0.771]*	0.136 [0.055, 0.216]*	0.176 [0.093, 0.258]*
	c_{11}	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]
	e_{11}	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]	0.000 [0.000, 0.000]
	β_{MA} *M*	−0.093 [−0.179, −0.008]*	−0.248 [−0.328, −0.168]*	−0.091 [−0.176, −0.007]*	−0.107 [−0.190, −0.023]*
	MZ/ DZ pairs	325/327	325/327	325/327	325/327

Note. The results in the table are standardized results using the gene–environment interaction model from Figure 2 on each of the four measures of political engagement. Sample sizes are lower for these results compared to 1, since we lose a twin pair if a twin is missing information on this construct because it is treated as an independent variable, whereas we use FIML to estimate the dependent parameters. In addition, we only have information on politicization for a subset of the twins from a later survey, as discussed in the "Measures" section.
Coefficients significant at a .05 level are indicated with a *.

each other. In short, family politicization can *compensate* for lack of dispositions to become educated and engaged. We can thus confirm hypothesis H2B above.

To illustrate the magnitude of the relationship, we calculated the marginal effect using Equation 3 where family politicization varies from $+/-$ two standard deviations from a mean of zero on family politicization. As an example, for political interest, we have a marginal effect of education that can be written as $a_{11} + \beta_{MA}M = 0.238 - 0.093$M. Since all variables have been rescaled to have a mean of zero and a variance of one, we can calculate the (additive genetic) effect of education on interest at two standard deviations above the mean in the following way: $a_{11} + \beta_{MA}M = 0.238 - 0.093 \cdot 2 = 0.052$. Figure 3 illustrates that for our four measures of political engagement, there is no genetic effect of education on political engagement when family politicization is two standard deviations above the mean.

Compensation but No Matthew Effect

It can sometimes be difficult to fully comprehend exactly what is at stake when only looking at the marginal effects. To further elaborate on the effects of family politicization, we have calculated predicted values at $+/-$ two standard deviations above and below the mean for the moderator for the effect of education on political interest. This is illustrated in Figure 4. Since we are interested in illustrating how politicization compensates, we show the *difference* across these levels. For instance, the effect of education when education is high ($+2SD$) and family politicization is low ($-2SD$) can be calculated in the following manner. *Predicted value* $= a_{11} \cdot 2 + \beta_{MA} \cdot 2 = 0.238 \cdot 2 + (-0.093 \cdot (-2) \cdot 2) = 0.848$, and when education is low ($-2SD$) and family politicization is also low ($-2SD$), we obtain *Predicted value* $= a_{11} \cdot 2 + \beta_{MA} \cdot 2 = 0.238 \cdot (-2) + (-0.093 \cdot (-2) \cdot (-2)) = -0.848$. The *difference* here is then $.848 - (-.848) = 1.696$. This corresponds to the blue point on the left side of the graph in Figure 4. From Figure 4, we can clearly see that when family politicization is low (i.e., at -2 standard deviations below the mean), there is a sizable *difference* in the effect of education on political interest, whereas there is *no* significant difference when family politicization is high. If we had observed a Matthew effect, there would be positive externalities to having both a high level of education and a highly politicized family environment.

Discussion and Conclusion

In this paper, we have demonstrated that there is no causal effect of education on political engagement. Although this finding might have been extremely provocative had we

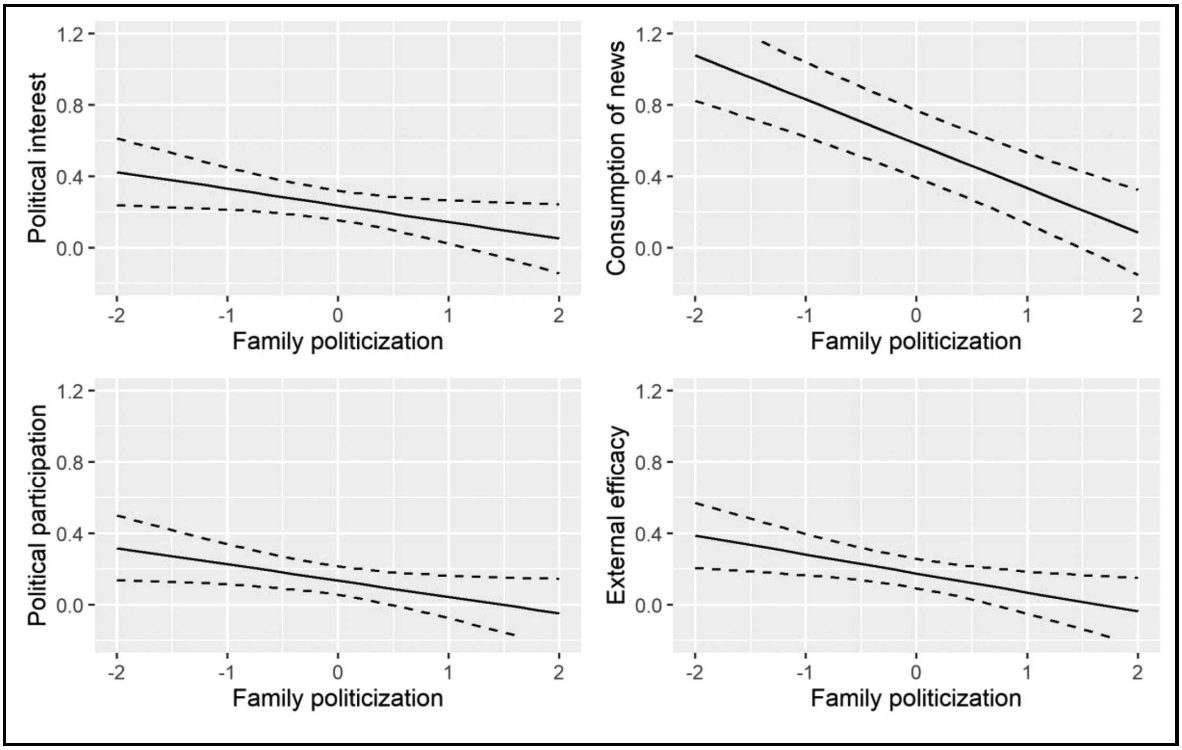

Figure 3. Genetically Confounded Effect of Education on Political Engagement by Levels of Family Politicization.
Note. Marginal effects of the effect of education on political engagement as a function of family politicization.

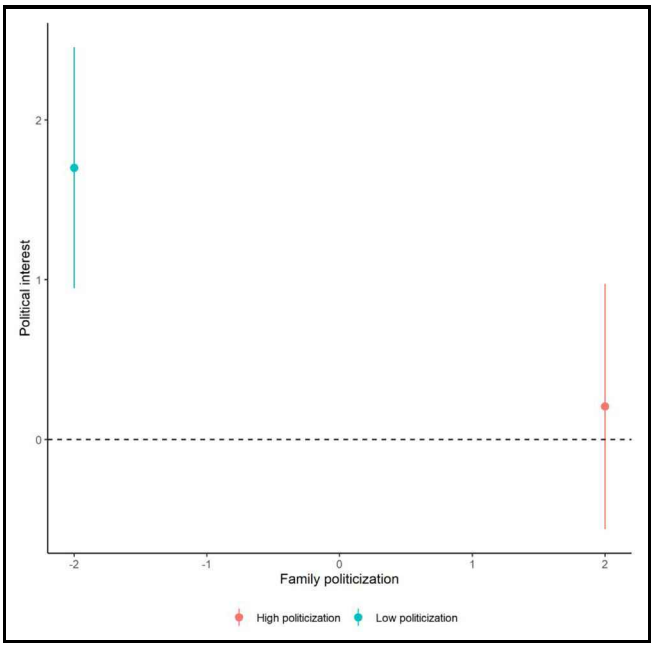

Figure 4. Effect of Education on Political Interest at Varying Levels of Politicization.
Note. The figure illustrates the *difference* in the effect of education on political engagement when education is two standard deviations above/below the mean as a function of politicization. High and low politicization also correspond to two standard deviations above/below the mean.

presented it in 2007, the past decade has yielded a good deal of empirical evidence that questions the causal role of education on a range of political behaviors and attitudes, which makes our finding much less contentious (Kam & Palmer, 2008; Persson, 2015).

The reason why scholars continually revisit the relationship between education and political engagement is of course because of the important role education has traditionally played in ensuring political equality and the important role education is perceived to play in a democratic society (Converse, 1972). But by only focusing on whether the effect of education on political engagement is (completely or partially) confounded, we risk missing the forest for the trees.

Here, we have demonstrated that the effect of education on a range of psychological and behavioral measures of political engagement is *genetically* confounded and not confounded by the shared environment, such as parental education and SES. This is surprising since many scholars interested in the parental transmission of values (Jennings & Niemi, 1968) have focused on the social aspects that give rise to the transmission of values and behaviors and how the lack of transmission could lead to inequalities in political engagement. One way to interpret these results is by drawing on the work of the French sociologist Pierre Bourdieu, who has argued that the educational system serves to reproduce existing social inequalities through

social capital (Bourdieu, 1984). What we are able to demonstrate is that this does *not* appear to be happening. Indeed, for none of our measures of political engagement does the shared environment confound the effect of education on political engagement. Instead, we found that genetic differences seem to be the driving force. An interpretation consistent with this finding is that our sample is drawn from Denmark, which is a country with low social barriers to entry in the educational system. Since there are few social barriers to entry in the educational system, what matters are genetic differences in the motivation and/or capacity to pursue a long-term higher education.

We would thus not expect the same relationship to be at play in other contexts. In the United States, there are higher social barriers to entry in the educational system. Studying the relationship between intelligence and educational attainment in the United States and Sweden, Johnson et al. (2010) find that shared environmental influences common to intelligence and education are especially important for those with low levels of intelligence in Minnesota, whereas this relationship was reversed in Sweden, where shared environmental influences were especially important at high levels of intelligence. The authors speculate that different educational systems may explain these differences. Thus, we note that the same dynamic could be at play when it comes to the relationship between education and political engagement. In the context of our findings, we might expect that the amount of shared environmental confounding between education and political engagement would not be zero in other contexts but exert a nontrivial influence and that this might be moderated family politicization. Future studies should investigate the important interplay between genetic and environmental factors in shaping political engagement in less equal societies with more severe barriers to entry in the educational system. We encourage future researchers to replicate and extend this study across a wide range of contexts.

We have also demonstrated that the (noncausal) effect is moderated by family politicization: When family politicization is high, the genetic confounding disappears. This finding is consistent with family background *compensating* for genetic differences leading to differences in educational outcomes and in turn differences in political engagement. When family politicization is high, genetic confounding disappears. Family background can thus completely compensate for the effect of genetic disadvantages. Using an adoptee design, Willoughby et al. (2021) (see also Oskarsson et al., 2018) are able to demonstrate that the transmission of political attitudes from parent-to-child is influenced by genetic as well as by environmental factors. The influence of the moderator presented here is thus likely not only environmental in origin. Our results are consistent with the results reported by Lindgren et al. (2019), who show that while there is no overall average effect of education on voter turnout, education has an effect on turnout among those from low SES households. In this paper, we were able to demonstrate why this might be case: Family background can compensate for genetic disadvantages. On a more theoretical level, these results are also an important reminder that genetic determinism is always too simple to be useful. What is needed is a birds-eye view of the complex interplay between genetic and environmental factors that allows us to not miss the forest for the trees.

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Authors' Note

All scripts for the analyses will be made available on OSF upon publication. This study's design and its analysis were not pre-registered. We are not allowed to share or post the Danish Twin Registry data used in this paper. However, information on the conditions for getting access to data and how to apply for data can be located here: https://www.sdu.dk/en/om_sdu/institutter_centre/ist_ sundhedstjenesteforsk/centre/dtr/researcher/guidelines. We note that data used for this research was provided by the Danish Twin Registry, University of Southern Denmark. The findings, opinions, and recommendations expressed therein are those of the author(s) and are not necessarily those of the Danish Twin Research Center. The Danish Twin Registry has been approved by SDU RIO (SDU Legal Services) and the Committee on Health Research Ethics. The participants were enrolled by informed consent. The Danish Twin Registry, *SD*U RIO notification no. 10.585.

Declaration of Conflicting Interests

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Supplemental Material

The supplemental material is available in the online version of the article.

Note

1. https://www.statmodel.com/examples/genetics.shtml

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