



## The relationship between political attitudes and political participation: Evidence from monozygotic twins in the United States, Sweden, Germany, and Denmark

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### ABSTRACT

Many studies have shown that political efficacy, interest in politics, and political knowledge are strongly related to political participation. In most analyses, these variables are described as having a causal effect on participation. In this paper, we examine the extent to which the relationship between political attitudes and participation is confounded by familial factors. By using the discordant twin design, which relates within-pair differences in political attitudes to within-pair differences in political participation, we are able to examine the relationship net of confounding factors rooted in genes and the early rearing environment. Using four samples of monozygotic twins from the United States, Sweden, Germany, and Denmark, we find that the relationship between political attitudes and political participation is confounded to a large extent. This study makes an important contribution to the literature on political attitudes and political participation given the longstanding idea that attitudes cause political participation. Our findings also have practical implications for those interested in elevating levels of political participation. In addition, they have important implications for how scholars theorize about, model, and examine political participation in the future.

Why are some people heavily involved in politics while others rarely or never participate? This is one of the most important and longstanding questions in political science, and scholars have provided a wide variety of answers. One line of research on the determinants of political participation has focused on the impact of political attitudes. In terms of attitudes, many scholars have focused on political efficacy, interest in politics, and political knowledge, and studies have repeatedly found that each of these attitudes is positively related to political participation (Delli Carpini and Keeter, 1996; Brady et al., 1995; Verba et al., 1995; Blais & Labbé-St-Vincent, 2011; Karp and Banducci, 2008; Tolbert and

McNeal, 2003; Abramson and Aldrich, 1982).<sup>1</sup> In most analyses, attitudes are described as having a causal effect on participation, but in this paper we are interested in taking a closer look at the nature of the relationship.<sup>2</sup> More specifically, we are interested in whether the relationship between attitudes and political participation is jointly determined by some additional variable or set of variables.

Existing research provides some interesting ideas about variables that might confound the relationship between attitudes and participation in politics. Psychological attributes are one possible source of confounding. Numerous studies have shown that personality traits are

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<sup>1</sup> Efficacy is usually seen as having two components—internal efficacy, which refers to the beliefs about one's own ability to influence politics, and external efficacy, which focuses on beliefs about the responsiveness of government to citizens. We will examine the effects of both measures later in the paper.

<sup>2</sup> For example, Delli Carpini and Keeter (1996) say that "Political knowledge boosts participation because it promotes an understanding of why politics is relevant" (224). In addition, Blais and Labbé-St-Vincent (2011) note that "We thus wish to establish in the first part of this article that the general propensity to vote in elections is driven primarily by political interest" (396).

correlated with efficacy, interest, and knowledge (Mondak, 2010; Mondak and Halperin, 2008; Dawes et al., 2014; Gerber et al., 2011a) and with political participation (Gerber et al., 2011b; Mondak et al., 2010; Cooper et al., 2013). Moreover, previous research has also reported a strong link between cognitive ability, attitudes, and political participation (Denny and Doyle, 2008; Dawes et al., 2014). It is also worth noting that genetic factors might play a role in the relationship between attitudes and participation. Numerous studies in political psychology have shown that efficacy, interest, and knowledge are all partially heritable (Klemmensen et al., 2012a, 2012b; Bell et al., 2009; Weinschenk and Dawes, 2017; Arceneaux et al., 2012) and that political participation also has a heritable component (Fowler et al., 2008; Klemmensen et al., 2012a; Dawes et al. 2014, 2015; Weinschenk et al., 2019). In fact, Klemmensen et al. (2012a) find that “most of the covariation between efficacy and political participation is accounted for by a common underlying genetic component” (409). It is possible, then, that political attitudes are capturing genetic factors and/or psychological attributes that are correlated with both political attitudes and participation in politics. Political socialization is another potential confounder. Family experiences and attributes have been shown to influence one’s attitudes towards politics (Jennings and Niemi, 1981; Jennings et al., 2009) and political participation (Plutzer, 2002; Kudrnáč and Lyons, 2017). Thus, political attitudes could be proxying for pre-adult experiences or traits. Fortunately, methods exist that allow us to get a sense of whether the relationship between attitudes and participation is confounded and, if so, to estimate the extent of confounding. By looking at the relationship between political attitudes and participation *within* monozygotic (MZ) twin pairs reared together, we are able to avoid potential confounders rooted in genetic factors and common environmental influences because such twins share both.

It is important to note that the question of whether the relationship between attitudes and participation is confounded has been examined before. Indeed, in their analysis of voter turnout in Britain, Denny and Doyle (2008) find that the relationship between one attitude—political interest—and turnout is confounded to some extent. Using a bivariate probit model, they show that those with high levels of cognitive ability and an aggressive personality are more likely to be interested in politics and to vote in elections. Thus, they note that “political interest and turnout are driven by common characteristics, both observable and unobservable, which generate a correlation between the two and this vitiates the common practice of modeling the latter as depending on the former” (309). Rodenburger (2020) also examines the relationship between political interest and turnout. Using bivariate probit regressions and data from a German sample, he finds that the effect of political interest on turnout is not causal but results from unobserved factors that drive both. It is worth pointing out that the results from Denny and Doyle (2008) and Rodenburger (2020) imply some confounding but their models do not provide a test of the key claim that there is no causal relationship between interest and turnout. Thus, we take their results as preliminary evidence that the relationship between interest and turnout is confounded by certain traits. It is important to note that our study differs from and extends previous work in a number of important ways. Above all, we use a more comprehensive approach (the discordant twin design) that can provide evidence of the amount of confounding, and we include a broader set of attitudes, outcomes and countries. This study makes an important contribution to the literature on political attitudes and political participation. A longstanding idea in the literature is that attitudes cause political participation, but most studies have not examined or accounted for the possibility of confounding. If the relationship between attitudes and participation is confounded, then many studies have misinterpreted the connection between attitudes and participation.

The rest of this paper unfolds in a straightforward manner. In the next section, we provide an overview of our approach. In brief, we use the discordant twin design, a technique that has been used heavily in the field of labor economics (see, e.g. Ashenfelter and Krueger 1994; Ashenfelter and Zimmerman 1997; Isacsson 1999) but has only recently started to get

attention in political science as a way of assessing confounding. We are not aware of any previous studies that have used this design to study the relationship between political attitudes and participation. Next, we provide an overview of the datasets and measures we use to examine the relationship between political attitudes and participation. After a discussion of the results, we provide ideas for future research.

## 1. Our approach: the discordant twin design

Within political science, there are now numerous examples of the use of twin data to study the genetic and environmental sources of variance in political traits (Alford et al., 2005; Dawes et al., 2014; Fowler et al., 2008; Settle et al., 2009). In this study, we use twin data for a different purpose—to estimate the relationship between attitudes and participation using the discordant twin design. This approach is also sometimes called the co-twin control design (McGue et al., 2010). We are only aware of a few studies in political science that have used this approach, none of which have focused on attitudes and participation. In the first political science study to use this design, Dinesen et al. (2016) examined the effect of education on political participation. Gidengil et al. (2017) also used a discordant design to study education and participation, but they focused on siblings rather than just twin siblings. Oskarsson et al. (2017) also used this technique to examine the effect of education on social trust in Sweden, and Weinschenk and Dawes (2019) and Robinson (2019) used it to study the relationship between education and political knowledge in the United States. The value of this design, which only uses data on monozygotic (MZ) twin pairs, stems from the fact that MZ twins share 100% of their DNA and, assuming they have been raised together, have been exposed to the same family environment. This approach allows us to estimate the relationship between the two measures net of confounding factors rooted in genetic factors and early rearing environment.

Building on previous studies (Ashenfelter and Zimmerman, 1997; Isacsson, 1999; Oskarsson et al., 2017), we assume that the true relationships between a given political attitude and political participation are:

$$Y_{1j} = \beta X_{1j} + F_j + \varepsilon_{1j} \quad (1a)$$

$$Y_{2j} = \beta X_{2j} + F_j + \varepsilon_{2j} \quad (1b)$$

where  $Y$  denotes political participation and  $X$  represents a given political attitude for twin  $i$  (1, 2) in pair  $j$  (1, 2, ...,  $N$ ). The error term in each equation is made up of an individual-specific component ( $\varepsilon_{ij}$ ) and a family-specific component ( $F_j$ ). The family-specific effects vary across but not within twin-pairs and capture unobserved familial factors (e.g., socialization) and unobserved genetic factors that potentially influence both attitudes and participation.

Differencing (1a) and (1b) controls for family effects:

$$Y_{1j} - Y_{2j} = \beta_{FE} (X_{1j} - X_{2j}) + (\varepsilon_{1j} - \varepsilon_{2j}) \quad (2)$$

where  $B_{FE}$  represents the within-twin-pair estimate of the relationship between a given attitude and participation.<sup>3</sup> Since MZ twins share 100% of their DNA and are assumed to have the same rearing environment, the estimate of  $B_{FE}$  is not biased by unmeasured familial factors. A useful way to think about this approach is that it corresponds to a situation where we would include a dummy variable (fixed effect) for each of the families in the regression model. In addition to the assumption about the same rearing environment, we should note that one important assumption of the discordant twin design is that differences in attitudes are exogenous conditional on the fixed effects. We note that the strength

<sup>3</sup> The FE in the equation stands for fixed-effect. Differencing Equations (1a) and (1b) removes the shared family factors; this is equivalent to adding dummy variables (fixed effects) for each family in the dataset to a regression model where a given political attitude is used to predict political participation.

**Table 1**  
Overview of independent variables (*Top Panel*) and dependent variables (*Bottom Panel*).

Dataset	Independent Variables
	<i>Political Knowledge</i>
United States	Who is responsible for deciding if a law is constitutional, Who nominates judges to fed. courts, Which major pol. party is more conservative at the national level, Main duty of Congress, Required majority for Congress to override a presidential veto, $\alpha = .70$
Sweden	Not measured in this study
Germany	Not measured in this study
Denmark	Not measured in this study
	<i>Internal Efficacy</i>
United States	Not measured in this study
Sweden	Is your ability to understand what goes on in politics better or worse than that of other people?
Germany	Not measured in this study
Denmark	People like me have no influence on what the government does, People like me have no influence on local government decisions, $r = .64$
	<i>External Efficacy</i>
United States	Public officials don't care much about what people like me think, People like me don't have any say in what the government does, $r = .70$
Sweden	Are people like you more or less able than others to make politicians take your demands into consideration?
Germany	Not measured in this study
Denmark	The government does not care about what people like me think, Local government does not care about what people like me think, $r = .69$
	<i>Political Interest</i>
United States	How interested are you in politics and public affairs?
Sweden	Generally speaking, how interested are you in politics?
Germany	Generally speaking, how interested are you in politics?
Denmark	How much interest do you generally have in what is going on in politics?
Dataset	Dependent Variables
	<i>Voter Turnout</i>
United States	Turnout in 2004 presidential election
Sweden	Each subject's average turnout across three (1970, 1994, 2010) general elections, $\alpha = .45$ , Voter turnout in the 2009 European parliament election. All measures are validated turnout
Germany	Turnout in the most recent parliamentary election if eligible
Denmark	Turnout in the last parliamentary election, Turnout in last local government board election, Turnout in last European Parliament election, $\alpha = .50$
	<i>Political Participation Indices</i>
United States	Attended a political meeting or rally, Worked in a political campaign, Contributed money to a political party or candidate or to any other political cause, Held any governmental office no matter how minor, Communicated thoughts or requests to a government official, $\alpha = .70$
Sweden	Contacted a politician, Contacted a public sector official, Participated in a protest or demonstration, Boycotted a certain good, Made a financial contribution, Signed a petition, $\alpha = .60$
Germany	Taken part in a political meeting, discussion event, or demonstration, Taken part in an online-petition or signature collection
Denmark	Boycotted a company or products for political or ethical reasons or on environmental grounds, $\alpha = .60$
	Signed a petition, Boycotted or deliberately bought certain products for political, ethical or environmental reasons
	Taken part in a demonstration, Attended a political meeting or rally, Contacted or attempted to contact a politician or a civil servant to express your views, Donated money for a social or a political activity, Contacted or appeared in the media to express your views
	Joined a political Internet forum or a discussion group, Participated in neighborhood activities, $\alpha = .61$

of the discordant twin design is that it eliminates bias in the estimated relationship between political attitudes and participation stemming from the unmeasured effects of genetic factors and family environment that both twin siblings experience. However, there may be additional sources of confounding that are not accounted for by the discordant twin design. The estimated relationship will still be biased if factors responsible for different sibling attitudes (e.g., personality traits, education, differences in parental treatment) also influence differences in their participation. (We note that parents differentially influencing kids implies that what our analysis uncovers is a lower bound of the amount of familial confounding). In addition, bias may result from siblings influencing each other: one sibling's political attitudes may affect the political participation of the other sibling (constituting a violation of the Stable Unit Treatment Value Assumption). While these additional sources of bias are important to consider when evaluating the causal impact of political attitudes on participation, it is important to point out that the focus of this study is to understand *whether (and how much)* familial confounding exists between political attitudes and participation.

With this overview in mind, it is important to be clear about the limits and the strengths of the discordant twin design. On one hand, since the discordant twin design is based on observational data, it does not provide us with definitive causal estimates—as we noted above, the estimated relationship between political attitudes and participation could still be confounded by experiences *unique* to each twin in a pair. On the other hand, the discordant twin design provides a very strong control for unobservable factors or traits that are difficult to measure (i.e., individual differences in genetic factors and early-life environment). This is important since it is likely that such factors account for part of the strong relationship that previous research has found between political attitudes and participation. In short, we are using the discordant twin design because it has the power to rule out the impact of confounds in a correlational relationship and to show how far correlational studies “miss the mark” by assuming causality.

In order to assess confounding, our analyses are based on a comparison between naïve OLS (Ordinary Least Squares) models in which twins are treated as individuals without regard to their membership in a twin pair (unobserved family factors are not taken into account) and twin-pair fixed-effects models that account for all factors that are common to twins in a pair (family factors are differenced out). Since the correlations between unobserved family factors, attitudes, and political participation, respectively, are likely to be in the same direction, the assumption is that the naïve OLS estimate of the effect of an attitude on political participation will be upward biased. A comparison between the naïve estimates and the fixed-effects estimates provides an indication of how the relationship changes after accounting for confounders rooted in the family. For example, if an estimate is the same when comparing the OLS and fixed-effects results, this would indicate that the relationship is not confounded by family factors. However, if an estimate is smaller in the fixed-effects model than it is in the naïve OLS model, this would suggest that the relationship is confounded by familial factors (i.e., genetic factors, socialization, etc.). A comparison of the magnitude of the coefficients provides a sense of the extent of confounding. We now turn to an overview of our data and measures.

## 2. Data & measures

In this paper, we examine the relationship between efficacy, interest, and knowledge and political participation in four advanced democracies—the United States, Sweden, Germany, and Denmark. Given that we need datasets with large samples of MZ twins, measures of attitudes, and measures of political participation, the choice of countries primarily reflects data availability. In all of these countries, we were able to identify datasets that contain relevant samples and measures. Nevertheless, we note that the comparative element of our study does raise the question of whether the relationship between political attitudes and

participation plays out similarly in the four countries we study. We use the following datasets to examine the relationship between attitudes and participation: Minnesota Twins Political Survey ( $N = 328$  MZ twin pairs), Swedish Twin Registry ( $N = 1000$  MZ twin pairs), German TwinLife Study ( $N = 491$  MZ twin pairs), and Danish Twin Registry ( $N = 253$  MZ twin pairs). Details about each dataset are provided in the *Online Appendix* for interested readers.

In *Table 1*, we provide an overview of the measures used in our analyses.<sup>4</sup> All measures are coded to range from 0 to 1 in order to help make the results comparable across datasets. Before proceeding, it is worth pointing out that we do not have measures of efficacy, interest, and knowledge in all four datasets—in the United States sample we have measures of all three attitudes, but the Swedish and Danish samples only have measures of efficacy and interest, and the German sample only has a measure of interest.<sup>5</sup> Even so, it is worthwhile to include the Swedish, Danish, and German samples, since they allow us to examine the link between efficacy, interest, and participation in a range of contexts and samples.

### 3. Results & analysis

Given the number of datasets and measures we are using in this paper, our goal is to present our results as compactly as possible. Thus, we summarize all of our model results in two figures below. All of the models are presented in table form in the *Online Appendix* for interested readers.<sup>6</sup> Before we turn to our substantive findings, there are a couple of things to note about our figures. In each figure below, we report two sets of estimates for each of the attitudes. First, we present the naïve OLS estimates.<sup>7</sup> As we noted above, in these models unobserved family factors are not taken into account.<sup>8</sup> Second, we present the twin-pair fixed-

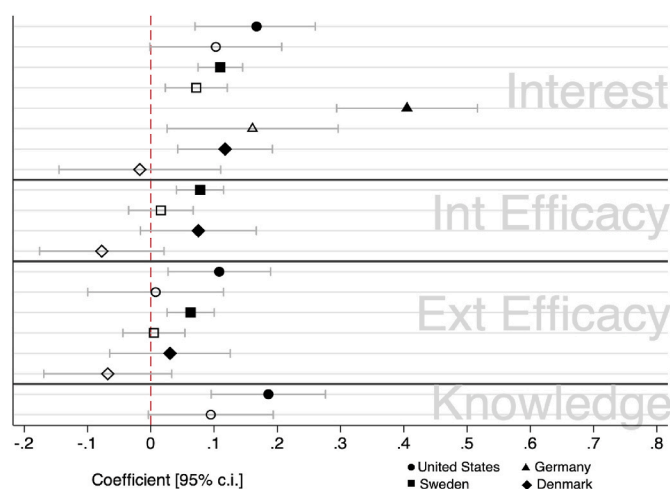
<sup>4</sup> We note that the alpha scores for some of the participation indices are in the 0.60 range, which indicates an acceptable (but not excellent) level of reliability. In order to examine the behavior of the indices, we developed regression models using age (birth year), sex, educational attainment, income (if available in the survey), and religiosity as predictors of the participation indices. These variables are commonly included in models of political participation. Overall, we found that the demographic predictors behaved as expected (i.e., education had a positive relationship with participation, people who were more religious were more participatory than their counterparts). This is comforting as it provides some indication that the participation indices behave as expected—they are correlated with demographic variables in anticipated ways. Model results are presented in the *Online Appendix*.

<sup>5</sup> The studies vary in how efficacy is measured. In some studies, we only have external efficacy measures and in others we have both.

<sup>6</sup> We note that in each table in the *Online Appendix*, we present results from power analyses corresponding to each of the within-family coefficients we present. Details about how we conducted the power analyses are also provided. The power estimates can be interpreted as the probability that a significance test will correctly reject the null hypothesis if an effect of the given magnitude based on the given sample size is present. In addition, we note that in order to examine the external validity of our results, we ran OLS models (using similar measures) in nationally representative samples for each country (ANES for U.S., ESS for Sweden, Germany, and Denmark). A comparison of these results to the OLS results from our twin samples provides a sense of whether the estimates are externally valid. The results are included in the *Online Appendix*. In general, we find that the OLS results from the twin samples and the OLS results from the general population samples are generally quite similar.

<sup>7</sup> There was some positive skew in the U.S., Swedish, and German participation indices (the distribution in Denmark was fairly normal). As a robustness check, we examined whether the U.S., Swedish, and German results changed when using Poisson regression models. Comfortingly, we found that the reduction in the size of the coefficients when comparing the naïve and fixed-effects models was very similar to what we report in the paper.

<sup>8</sup> In each OLS model included in this paper, we control for birth year fixed effects, sex, and the interaction between the birth year fixed effects and sex. This is necessary so that OLS results can be compared to the within-family results. Results for these variables are omitted from each table in the *Online Appendix* for the sake of tidiness but full results are available on request.



**Fig. 1.** Comparison of OLS and Fixed-Effects Estimates, Attitudes and Turnout. Notes: Solid symbol indicates OLS estimate and hollow symbol indicates FE estimate.

effects estimates.<sup>9</sup> These estimates account for all factors that are common to twins in a pair. By comparing the size of the coefficients from the different models, we can see how the relationship between a given political attitude and measure of political participation changes after accounting for confounders rooted in the family. We should also note that we have opted to group the results by the different attitudes. Thus, within each panel, we denote the different contexts by using distinct symbols for each sample. Within each graph, solid symbols indicate the naïve OLS estimates and hollow symbols represent the fixed-effects estimates. Each estimate is enveloped by the 95% confidence interval.

In *Fig. 1*, we present the results for voter turnout.<sup>10</sup> Overall, the results here provide evidence that the relationship between each attitude and voter turnout is confounded. Turning first to political interest, we see that each fixed-effects estimate is smaller than the corresponding OLS estimate. In some cases, the reduction in the size of the coefficient is quite large. For example, the coefficient for political interest in the fixed-effects model in the German sample is about 60% smaller than it is in the OLS context. In the U.S. sample, the coefficient decreases by 38% and in Swedish sample the coefficient decreases by 35%. It is also worth noting that in some cases, the coefficient is statistically significant in the OLS model but is no longer statistically significant once we move to the twin-pair fixed-effects specification. For example, in the Danish sample the coefficient for political interest is statistically significant at the  $p < .01$  level, but it is no longer statistically significant in the fixed-effects model. When it comes to internal efficacy (which was only available in the Swedish and Danish samples), there is also evidence of confounding. In the Swedish sample, the size of the coefficient decreases by 79% when moving from the OLS context to the fixed-effects context. Here, the coefficient is statistically significant at the  $p < .001$  level in the OLS model but is no longer statistically significant in the fixed-effects

<sup>9</sup> It is important to note that there are within-twin pair differences for our key measures. In the *Online Appendix*, we present the mean differences for each measure. Overall, there are differences within twin pairs in all of the samples. This is important since the discordant twin design relates within-pair differences in attitudes to within-pair differences in participation.

<sup>10</sup> For Sweden, the results in the figure are from the models using the turnout index (general elections) as the dependent variable. In the *Online Appendix*, we have provided tables showing the results for each individual turnout item that makes up the index. In addition, the results for the 2009 European parliament turnout model are included in the appendix. The only other sample with multiple turnout items is Denmark. Again, the results in the figure use the turnout index as the dependent variable, but the results for each individual turnout item that makes up the index are provided in the *Online Appendix*.

context. In the Danish sample, internal efficacy is not statistically significant in the OLS model, thus, an analysis of the fixed-effects model is not particularly interesting. The results for external efficacy also provide evidence of confounding. We see that in the United States and Sweden, the coefficient decreases when moving from the OLS model to the fixed-effects model. Indeed, in the United States, the size of the coefficient decreases by 93% and in Sweden the magnitude of the coefficient decreases by about 92%. In both cases, the coefficient in the OLS model is statistically significant, but it is no longer significant in the fixed-effects context. In the Danish sample, the effect of external efficacy is not statistically significant in the OLS context. Again, it is not all that interesting to compare the OLS and fixed-effects models in this case. The final attitude in Fig. 1 is political knowledge, which we were only able to measure in the U.S. sample. Here, we see that the size of the coefficient decreases when we move from the OLS model to the fixed-effects model. The magnitude of the coefficient decreases by about 49% when we compare the OLS estimate to the fixed-effects estimate. In addition, the coefficient is not statistically significant in the fixed-effects model.

In Fig. 2, we examine the relationship between each attitude and the participation index in each sample. Once again, we find consistent evidence of confounding. Starting with political interest, we see that all of the fixed-effects estimates are smaller in magnitude than the OLS estimates. In the U.S. sample, the coefficient decreases by 45%, in the Swedish sample it decreases by 43%, in the German sample it decreases by 39%, and in the Danish sample it decreases by 68%. In the Danish case, the coefficient in the fixed-effects model is not statistically significant. The panel for internal efficacy also indicates that the relationship between this attitude and participation is confounded to some extent. In the Swedish sample, the coefficient decreases by 64% when moving from the OLS model to the fixed-effects model. In Denmark, there is also a reduction in the magnitude of the coefficient, although it is not quite as pronounced as in Sweden. Here, the estimate decreases by 34% when moving from the OLS context to the fixed-effects context. The external efficacy panel also provides evidence of confounding. Again, all of the coefficients are smaller in size in the fixed-effects models than in the OLS specifications. In the U.S. sample, the coefficient decreases by 59% when comparing the fixed-effects estimate to the OLS estimate. In Sweden, the decrease in the size of the coefficient is 76%. In this case, the fixed-effects coefficient is not statistically significant. Finally, in Denmark the decrease in the size of the coefficient is about 24%. The results for political knowledge are shown in the bottom panel of Fig. 2. We again see that the magnitude of the coefficient is smaller in the fixed-effects model than in the OLS model. In fact, the coefficient decreases by 67% when we move from the OLS specification to the twin-pair fixed-

effects specification. Overall, then, we find solid evidence that the relationship between each attitude and participation is confounded to a large extent in each of our four samples.<sup>11</sup>

#### 4. Discussion & conclusion

In this paper, we examined the relationship between a number of important political attitudes and political participation. While many previous studies have suggested that knowledge, interest, and efficacy have a causal effect on political participation (Delli Carpini and Keeter, 1996; Brady et al., 1995; Verba et al., 1995; Abramson and Aldrich, 1982), we wanted to examine whether the relationship between these attitudes and various measures of participation was confounded. Indeed, previous studies have shown that psychological traits, genetic factors, and family socialization are related to both attitudes and political participation. In other words, attitudes and participation might be jointly determined by some additional variable or set of variables. Research by Denny and Doyle (2008) and Rodenburger (2020) provided some initial evidence that the relationship between attitudes and participation is confounded by certain psychological traits, but we were interested in expanding upon their work. In this paper, we applied a methodological approach—the discordant twin design—that, to our knowledge, has not been used in previous work on the confounding of the relationship between attitudes and participation. One of the key advantages of our approach compared to others is its ability to reveal confounding due to family factors (i.e., heritable psychological traits, socialization), especially if a relationship is totally confounded by family factors.

Overall, we found consistent evidence that the relationship between attitudes and political participation is confounded. In many cases, after we accounted for familial confounders, we found that the magnitude of the relationship between attitudes and political participation decreased substantially. In some cases, the relationship between attitudes and participation was no longer statistically significant after accounting for confounders rooted in the family, but we note that some relationships remained significant in the fixed-effects context. One key question is what to make of the remaining significant effects in the fixed-effects models. Of course, because the discordant twin design is still a correlational approach, it is difficult to say for sure what the remaining effects mean. Given that our model accounts for shared familial factors, our view is that the remaining relationship is likely spurious and confounded by different non-shared factors. We believe that this is an area ripe for future research. Future work should try to overcome the potential remaining within-twin pair confounding by measuring these phenomena directly (i.e., by measuring experiences *unique* to each twin).

Our results have some important implications given previous research on attitudes and participation. In the past, the assumption has been that the relationship between attitudes and participation is causal.

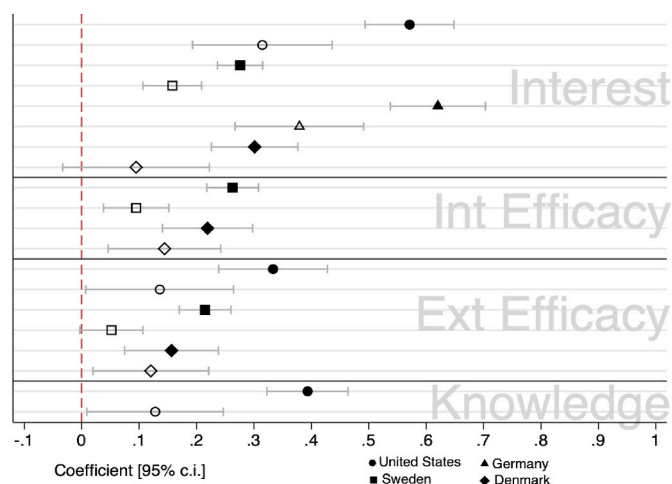


Fig. 2. Comparison of OLS and Fixed-Effects Estimates, Attitudes and Participation Indices Notes: Solid symbol indicates OLS estimate and hollow symbol indicates FE estimate.

<sup>11</sup> We note that co-twin estimates presented in Figs. 1 and 2 are equivalent to the E-term in an ACE model (which captures non-shared environmental factors and measurement error). Any difference in the naïve estimate of the effect of a given attitude and the fixed-effect estimate could reflect controlling for common family factors, but also, in principle, measurement error (or both). One thing that lessens our concern about this point is the fact that we find remarkable consistency across the 40 models presented in Figs. 1 and 2. It seems very unlikely to us that we would find this much consistency if our results were being driven by measurement error. Indeed, we have data from samples in four different countries (collected at different time periods), four different attitudinal measures (collected using different question wordings/response categories), and two sets of dependent variables (also measured using different question wordings/response categories across the surveys).

Mondak et al. (2010), for example, have argued that the effects of some personality traits on civic participation are *mediated* by political attitudes (i.e., efficacy, knowledge).<sup>12</sup> This suggests a causal chain that goes from personality to political attitudes to participation.<sup>13</sup> However, our results challenge this idea. As we noted above, attitudes and participation may be correlated not because they are causally related but instead because both are driven by common factors such as personality traits.

We also believe that our results have some implications for practitioners interested in increasing rates of political participation. A commonly suggested way to increase political participation is to identify ways to make politics more interesting and accessible or to find ways to provide more free information to people. One implication of our results is that such interventions may not spur as much participation as we would hope for among citizens if interest, efficacy, and knowledge are shaped by factors that are present very early on in one's life. Of course, this does not mean that political attitudes cannot be altered or that levels of political participation can never be increased, although it seems reasonable, in light of past research, to note that we probably should not expect massive effects when trying to alter peoples' habits and/or attitudes.<sup>14</sup> Rather, it suggests that people who are interested in shaping attitudes or participation should think carefully about *when* and *where* they are implementing interventions. For example, if political attitudes or participatory habits are formed or shaped early on in life, it could be useful to try and figure out *when* attitudes/participation habits are the most malleable (i.e., in high school versus elementary school). Some recent work (see, e.g., Holbein 2017) has shown that interventions administered in early childhood (i.e., Kindergarten) can have positive effects on political behavior when people reach adulthood. It is also important to note that contextual factors may play a role (Fazekas and Littvay, 2015). It is possible that in certain contexts or environments, it may be easier to shape political participation and/or attitudes. The findings in this paper provide some evidence on how different contexts influence the relationship between attitudes and participation since we used data from different counties. Indeed, we found similar results across the four samples used here. This provides some preliminary evidence that the confounding of the relationship between political attitudes and participation plays out similarly in different places. Of course, it is important that additional research be conducted in order to examine whether our findings generalize beyond the advanced democracies studied here. We encourage follow-up studies that examine the nature of the relationship between attitudes and political participation in a wide range of different time periods, samples, and countries.

As a final note, we want to point out that our results have repercussions for how political scientists should theorize about, model, and examine political participation in the future. As we argued above, many of the concepts of interest to scholars of political participation are incredibly similar and may be jointly influenced by a common set of variables. Thus, scholars should pay greater attention to the possibility of confounding when studying the underpinnings of political participation. In recent years, there has been a number of studies on whether the relationship between education and participation is causal or confounded (Dinesen et al., 2016; Gidengil et al., 2017; Kam and

<sup>12</sup> They say, for example, that "People high in openness to experience are thoughtful, analytical, and welcoming of exposure to information. As a result, they fare well in terms of both the actual possession of political knowledge and self-confidence that they can navigate the complexities of the political arena. In turn, this knowledge and efficacy facilitates civic engagement. They go on to note that "the results...are consistent with our thesis that the effects of openness on civic engagement are mediated by efficacy and political knowledge" (p. 11–12).

<sup>13</sup> Other studies have argued this as well (see, e.g., Gallego and Oberski 2012; Blais and Labbé-St-Vincent 2011; Wang et al., 2019).

<sup>14</sup> Even the largest voter mobilization effects are fairly small (Gerber et al., 2008) and the effects appear to decrease in size over time (Davenport et al., 2010).

Palmer, 2008, 2011; Henderson and Chatfield, 2011; Mayer, 2011). The question of causality could be applied to numerous other variables that are often included as predictors of political participation. For example, religiosity consistently has a positive relationship with political engagement (Rosenstone and Hansen, 1993; Verba et al., 1995). Does involvement in religious institutions cause people to be more politically active or are religiosity and political participation driven by common factors (i.e., family upbringing, personality traits, etc.)? We have some understanding of the nature of the relationship between religiosity and attitudes (Friesen and Ksiazkiewicz, 2015; Ksiazkiewicz and Friesen, 2019), but little understanding of how religiosity and participation are related. Similarly, in most models of participation, partisan strength has a strong, positive relationship with political involvement. Is the relationship causal in nature or is it confounded by factors that influence both variables? Existing research suggests that both the strength of partisanship and the intensity of political involvement are driven by at least some similar factors, including personality traits and biological factors (Gerber et al., 2012; Settle et al., 2009; Fowler et al., 2008). We encourage future researchers to seek out and use methodological approaches that allow for an examination of whether and to what extent confounding is occurring. Although previous studies have theorized that political efficacy, interest, and knowledge are causally related to participation in politics, the use of the discordant twin design revealed that the relationship is highly confounded. This finding challenges previous theoretical and empirical claims that have been made about how attitudes and participation are related.

#### Data availability

The authors do not have permission to share the Swedish and Danish twin datasets. The Minnesota and German datasets are available and can be obtained by interested researchers. Details about each dataset are provided in the Online Appendix.

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#### Appendix A. Supplementary data

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