

Rising Educational Divides in Attitudes: How Polarization across Cohorts Can Mask Age-Related Polarization

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Abstract: The question of whether attitudes become more polarized over time has stimulated significant scientific and political debate. This study is the first to show that polarization processes can occur both across cohorts and with rising age and that cohort-based polarization may obscure age-related polarization. I introduce the age polarization and cohort polarization hypotheses, which propose that attitudes become increasingly polarized both as individuals age and across successive cohorts. I use multi-cohort panel data from the German Socio-Economic Panel and leverage one of its longest-running attitude measures: concerns about immigration. I show that education-specific differences in immigration concerns intensify both across cohorts and with rising age and that age-related polarization only becomes apparent when cohort-based polarization is taken into account. These findings contribute to debates on polarization processes in attitudes over time and advance the literature on heterogeneity in the liberalizing effect of education.

Keywords: age; cohort; education; concerns about immigration; attitudes; polarization

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THE question of whether attitudes have become more polarized over time has puzzled researchers from diverse disciplines for many decades (e.g., Baldassarri and Bearman 2007; DiMaggio, Evans, and Bryson 1996; Finseraas 2019; Huijsmans et al. 2021). The rise of populism around the world has further increased interest in this question. This study contributes to this debate by highlighting the importance of distinguishing between different dimensions of time when addressing this question. I propose the age polarization hypothesis, which posits that attitudes become increasingly polarized as individuals age, and the cohort polarization hypothesis, which proposes that attitudes become more polarized across successive cohorts.¹ Furthermore, I argue that when both processes occur, accounting for cohort polarization is essential to uncover polarization trends with rising age.

To test these propositions, I examine age and cohort polarization processes in education-specific differences in concerns about immigration as an illustrative case. I chose this example for both substantive and data availability reasons. I chose educational divides because an important body of literature documents attitudinal divides between educational groups (for a review, see Hainmueller and Hiscox

2007), with some even referring to these divides as a “Cultural War” (Bročić and Miles 2021: 856).

I use concerns about immigration because—as I will discuss in detail in the Measures section—it is strongly related to various dimensions of attitudes toward immigration and also to right-wing voting. Furthermore, this measure is available in a long-running, multi-cohort panel data set, the German Socio-Economic Panel Study (SOEP 2022). Compared to single-cohort panel data sets or repeated cross-sectional data sets, this multi-cohort panel structure provides a substantially stronger foundation for disentangling polarization processes across cohorts and ages.

Overall, this study makes important theoretical, substantive, and methodological contributions to two broader literatures. First, a large interdisciplinary literature explores education-specific differences in attitudes toward immigration (e.g., Cavaille and Marshall 2019; Finseraas, Skorge, and Strøm 2018; Hainmueller and Hiscox 2007; Hello et al. 2004; Hello, Scheepers, and Slegers 2006; Lancee and Sarasin 2015; Margaryan, Paul, Siedler 2021; Weber 2022). This body of literature has shifted from examining the average effects of educational attainment to systematically assessing whether educational gradients vary over time and across contexts (Finseraas 2019; Kratz 2021; Velásquez and Eger 2022).

The present study makes a theoretical contribution to this literature by introducing the age polarization and cohort polarization hypotheses. These hypotheses suggest that education-specific differences in attitudes toward immigration become more pronounced with increasing age and across successive birth cohorts. In addition to its theoretical contribution, the study provides empirical evidence from Germany, demonstrating that the educational divide in concerns about immigration intensifies both as individuals age and across generational cohorts.

Second, an important sociological literature examines whether attitudes have become more polarized over time (e.g., Baldassarri and Bearman 2007; DiMaggio et al. 1996; Finseraas 2019; Huijsmans et al. 2021). In this literature, a long-standing debate centers on finding answers to why the political polarization paradox—the fact that empirical analyses rarely show attitude polarization, even though pundits often describe it as a common phenomenon—exists (Baldassarri and Bearman 2007). This study clarifies nuances in this debate. It shows that polarization processes may not be visible when assessing polarization along a single time dimension because simultaneously occurring polarization processes across different time dimensions may cancel each other out.

Literature Review

One of the most consistent and well-documented findings in the social sciences is that individuals with higher levels of education tend to express more favorable attitudes toward immigration and immigrants (Weber 2022). However, the extent to which this association reflects a causal relationship, rather than selection effects, remains a subject of ongoing debate. On the one hand, some scholars argue that education causally affects individuals’ attitudes (Bročić and Miles 2021; Cavaille and Marshall 2019; Margaryan et al. 2021). On the other hand, others

contend that the association reflects pre-existing differences in socialization and background, as individuals with more liberal predispositions are more likely to pursue higher education (Campbell and Horowitz 2016; Lancee and Sarrasin 2015; Weber 2022). The empirical evidence remains mixed even if rigorous causal designs are employed.

Some studies leveraging exogenous variation from educational reforms report causal effects of education on attitudes toward immigration (Cavaille and Marshall 2019; Margaryan et al. 2021). In contrast, longitudinal research suggests that the observed association is largely attributable to selection effects (Lancee and Sarrasin 2015; Weber 2022). Notably, the study populations in research utilizing exogenous variation are typically older than those in longitudinal studies. This age discrepancy may help reconcile the divergent findings if education-specific differences in immigration attitudes widen with age.

Supporting evidence comes from Kratz (2021), who demonstrates that critical life events in early adulthood—such as labor market entry—significantly amplify education-specific differences in immigration concerns, suggesting that these differences may become more pronounced during this life course stage. Complementing this research, recent scholarship has investigated whether the relationship between education and immigration attitudes varies across other temporal dimensions. For example, Finseraas (2019) finds no consistent historical trend in the magnitude of the education gap in immigration preferences; however, this gap fluctuates in response to macro-level conditions such as unemployment and union strength. Similarly, Velásquez and Eger (2022) show that education-specific differences in attitudes toward immigration are particularly salient during periods of large-scale refugee inflows. These studies primarily examine period effects—that is, how such differences change over historical time. In addition, some evidence points to cohort-based variation in the education–attitude relationship. Early work by Weil (1985) indicates that education-specific differences in anti-semitic attitudes increase with the duration of exposure to liberal democratic regimes.

Despite their contributions, existing studies fall short in two critical aspects. First, previous studies have primarily provided theoretical arguments explaining why the education–attitude nexus may vary across different period effects—such as unemployment rates, union strength, or refugee inflows. However, they did not offer theoretical explanations for why the education–attitude nexus might change with rising age or across cohorts. Second, previous research did not assess polarization processes across multiple time dimensions simultaneously. As a result, they overlooked the possibility that rising polarization across cohorts might mask polarization with rising age.

This study aims to close these gaps by incorporating insights from life course research and studies on generational change. It builds upon and integrates these insights into the field of attitude formation to derive the age polarization hypothesis and the cohort polarization hypothesis. Drawing on the findings of previous studies, it controls for previously suggested period effects and extends prior research by being the first to show that, when cohort and age polarization processes are assessed simultaneously using multi-cohort panel data, both types of polarization processes emerge. By clarifying these nuances in research questions and providing refined

empirical evidence, this study also contributes to resolving the broader debate surrounding the political polarization paradox.

Theory

This theory section is structured as follows. First, I provide theoretical arguments for why education-specific differences in concerns about immigration may become more polarized with increasing age. Second, I present reasoning supporting the expectation that these differences have become increasingly polarized across birth cohorts. Finally, I discuss how cohort-based polarization may obscure age-related polarization patterns.

Age-Related Polarization

Aging is commonly associated with increased conservatism (Glenn 1974) and more negative attitudes toward immigrants (Hernes and Knudsen 1992). I argue that these effects are more pronounced among individuals with lower levels of education. Aging brings about distinct life course stages. These life course stages expose individuals to different environments where they undergo various experiences. These diverse experiences contribute to the evolution of attitudes as part of the progression through life stages (Lersch 2023).

Attitudinal change may occur through cognitive dissonance mechanisms (Festinger 1957), wherein individuals adjust their beliefs to align with their experiences and behaviors. Alternatively, attitudes may evolve through heuristic-based reasoning, where individuals rely on accumulated experiences to form generalized conclusions (Gigerenzer and Goldstein 1996). The types of experiences encountered, the competition and vulnerabilities faced, and the psychological adaptation processes individuals engage in all vary by education level. As a result of these processes, I expect that educational attainment modifies the influence of aging such that education-specific differences in attitudes widen with age. I refer to this conjecture as the age polarization hypothesis.

This hypothesis aligns with an integration of cumulative inequality theory (Ferraro and Shippee 2009) into a dynamic version of group conflict theory (Kratz 2021; Lancee and Pardos-Prado 2013). Cumulative inequality theory posits that education-specific differences in life chances intensify with age, a proposition supported by substantial empirical evidence. For instance, research has documented widening education-specific disparities in income (Bönke, Corneo, and Lüthen 2015), prestige (Kratz, Pettinger, and Grätz 2022), and subjective well-being (Kratz and Patzina 2020) over the life course. In turn, feelings of economic and social deprivation foster perceptions of group threat (Aleksynska 2011; Braun 2022; Jetten, Mols, and Postmes 2015; Kratz 2023; Kudrnáè, Eger, and Hjerm 2023; Semyonov, Rajjman, and Yom-Tov 2002). Consequently, the pattern of increasing education-specific inequalities in life chances likely manifests in increasing education-specific differences in concerns about immigration.

Cohort-Based Polarization

Building on previous research, I propose the cohort polarization hypothesis, which posits that education-specific differences in concerns about immigration have widened across successive birth cohorts. I assume that this pattern has emerged because the liberalization of attitudes toward immigration in the past century has advanced more rapidly among individuals with higher levels of education and this differential shift has contributed to widening education-specific differences.

Early life is widely recognized as a sensitive period for attitude formation (Eger, Mitchell, and Hjerm 2022; Krosnick and Alwin 1989), with education playing a central role in shaping long-term values and beliefs (Bročić and Miles 2021). This cohort perspective suggests that attitude change occurs primarily through generational replacement—that is, societal attitudes shift as younger cohorts, socialized and educated in distinct historical contexts, gradually replace older generations (Ryder 1965). A defining element of a cohort is its period of birth, which shapes early socialization, educational exposure, and shared life experiences.

Over the past century, educational curricula in Western societies have increasingly emphasized values of tolerance toward minorities and immigrants (Kratz 2024). This evolving emphasis has contributed to a generational shift toward more liberal social attitudes (Gorodzeisky and Semyonov 2018; Kratz 2024; McLaren, Neundorf, and Paterson 2021; McLaren and Paterson 2020; Schmidt 2021; Schotte and Winkler 2018). Because individuals with higher levels of education are more intensively exposed to these educational curricula, I argue that the generational shift has been particularly pronounced among this group. Consequently, education-specific differences in concerns about immigration are likely to increase across generations.

How Cohort-Based Polarization May Mask Age-Related Polarization

Analyses of age-related trends that do not account for cohort effects are prone to bias. When the inter-cohort trend (indexed by cohort) is larger than the intra-cohort trend (indexed by age), and both move in the same direction, estimates of age effects will be systematically downwardly biased if cohort variation is ignored. Similarly, divergences between social groups over the life course may be underestimated when analogous cohort-based divergences are present but not adjusted for.

Therefore, accounting for polarization processes across cohorts is essential to uncover those linked to aging. In the case at hand, when education-specific differences increase across cohorts, such patterns may obscure rising differences that emerge with age. For instance, consider a scenario where both age-related and cohort-based polarization patterns exist: education-specific differences increase with age for every generation, and, at the same time, education-specific differences at the same age are more pronounced for later-born generations. Observing individuals at a single point in time may then lead to the erroneous conclusion that no polarization occurs with rising age. This misinterpretation arises because the lower education-specific differences in attitudes of earlier-born generations are reflected in the low differences observed at older ages.

The potential for such bias is highlighted by research on health disparities, which shows that generational effects can make education-specific disparities in older age groups appear more similar than in younger age groups, even if education-specific differences increase with rising age (Mirowsky and Ross 2008). The age polarization and cohort polarization hypotheses suggest that a similar pattern likely occurs in the temporal processes of attitude formation. In such situations, multi-cohort panel data offer the best opportunity to uncover the potential pattern that, for every generation, education-specific differences in attitudes increase with age, while simultaneously, education-specific differences grow across successive generations.

Current Study

This study was designed to address three main objectives: (1) to assess polarization processes in attitudes with rising age, (2) to assess polarization processes across cohorts, and (3) to evaluate whether cohort-related polarization processes obscure age-related polarization processes. I posit the age polarization and cohort polarization hypotheses, which suggest that polarization processes are highly plausible both with rising age and across cohorts. Furthermore, I expect that polarization processes across cohorts mask age-related polarization processes if they are not accounted for in the empirical analysis.

To test these conjectures, it is essential to draw on long-running multi-cohort panel data. Accordingly, I leverage one of the longest-running attitude measures available in such data: concerns about immigration, as recorded in the German Socio-Economic Panel Study. The empirical analysis proceeds as follows: I begin by demonstrating that age-related polarization processes are partly obscured when education-specific differences in concerns about immigration are examined across different ages without accounting for cohort effects. I then conduct cohort-specific analyses of age-attitude patterns, which reveal that education-specific differences in concerns about immigration at the same age are more pronounced in later-born cohorts. Finally, I show that accounting for the pattern of increasing education-specific differences across cohorts reveals a corresponding pattern of increasing differences with rising age.

Analytical Strategy

Data

This study draws upon 22 waves of data spanning from 1999 to 2020 from the German Socio-Economic Panel (SOEP V37) (Liebig et al. 2019).² Due to its long-running nature and multi-cohort panel structure, the SOEP is particularly well suited to test the formulated hypotheses for the following reasons. First, the availability of many person-years per individual from different generations enables us to rely on relatively weak assumptions to identify the effects of chronological aging, while also assessing how cohort effects influence conclusions about the impact of aging. Second, the data set contains extensive information allowing control for a wide array of confounding variables, including social desirability effects.

Furthermore, the extended duration of the study enables conditioning on a broad range of theory-guided variables to account for period effects.

The age range is restricted from 17 to 80. Because immigrants and ethnic minorities can exhibit elevated illiberal and even anti-immigration attitudes (Bobo and Hutchings 1996; Just and Anderson 2015), individuals with a migration background are included in the sample for the main analysis, and robustness checks are conducted excluding them (see the sensitivity analysis section). The sample is comprised of 444,918 person-years from 60,400 respondents (for descriptive statistics, see Table 1).

As selective attrition can lead to endogenous selection bias (Elwert and Winship 2014), a machine-learning approach is employed to account for it. Specifically, inverse probability weights are constructed to address the decreasing representativity of the sample with increasing age. The weight of individuals missing from the panel in the next observation period, for reasons other than death, is increased. The SOEP includes official death registry data indicating whether and when individuals died. A machine-learning approach is used to enhance the explanatory power of the weighting model.

Distinguishing panel attrition from dropout due to mortality is crucial: in the case of mortality, the outcome is not missing but undefined (Rubin 2006). The inverse probability weights are designed to correct for decreasing representativity with age, not to construct a “pseudo-population that has no real existence” (Chaix et al. 2012:130) by increasing the weight of deceased individuals (Noymer 2001). Therefore, dropout is defined as resulting from selective attrition, not mortality, when individuals stopped participating in the survey but did not die in the year of their last participation or the following year.

Inverse probability weighting is commonly used to correct for bias due to selective attrition (Seaman and White, 2013; Weuve et al., 2012). Recent research suggests that the weighting model should only include outcome-relevant confounders (Metten et al., 2022). Thus, confounding variables were preselected based on theoretical considerations, and a machine-learning approach determined the combination of variables that best predict attrition. A logit version of an elastic net regression (Zou and Hastie 2005) was used to assess whether Ridge (Segerstedt 1992) or Lasso (Hastie, Tibshirani, and Wainwright 2015) regression was more appropriate. Ridge regression is preferable when predictors are highly correlated, whereas Lasso performs better with lower correlation. The elastic net procedure indicated that the Lasso regression was more suitable in this case.

K-fold cross-validation was used to assess which subset regression best predicts attrition. The Lasso regression identified the following covariates: gender, German nationality, residence in eastern Germany at initial observation, social origin, age, first three years of study participation, presence of an interviewer, and years since interviewer change.

Measures

The analyses rely on the outcome variable “concerns about immigration.” Respondents were asked: “How concerned are you about the following issues?” One item listed was “Immigration to Germany,” with responses on a three-point scale:

Table 1: Summary statistics (SOEP)

	N	%	Mean	SD	Min.	Max.
Concerns about immigration						
No concerns/some concerns	317,941	71.46				
Strong concerns	126,977	28.54				
Education						
Low (ISCED 1/2)	47,142	10.60				
Medium (ISCED 3/4/5)	287,717	64.67				
High (ISCED 6)	110,059	24.74				
Gender						
Male	210,383	47.29				
Female	234,535	52.71				
Residence at first interview						
West Germany	337,866	75.94				
East Germany	107,052	24.06				
Parental school education						
Low	239,800	53.90				
High	157,730	35.45				
Missing	47,388	10.65				
Cohort						
1	116,646	26.22				
2	100,210	22.52				
3	121,133	27.23				
4	106,929	24.03				
Age (in years)			48.05	16.34	17	80
GDP growth rate			1.20	2.29	−5.69	4.18
Change in disposable income			2.51	2.66	−5.12	6.32
Unemployment rate			8.92	2.21	5.50	13.00
Total number of non-German immigrants/100,000			9.41	4.17	5.58	20.16
Total number of non-European immigrants/100,000			3.47	1.96	1.79	9.16
Total number of non-Western immigrants/100,000			2.32	1.61	0.76	8.04
Number of asylum applications/100,000			1.25	1.57	0.19	7.22
Panel conditioning						
4+ years in panel	312,476	70.23				
First year in panel	45,280	10.18				
Second year in panel	46,843	10.53				
Third year in panel	40,319	9.06				
Interviewer						
Not present	169,917	38.19				
Present	275,001	61.81				
Time since interviewer change						
4+ years	309,315	69.52				
First year	59,341	13.34				
Second year	42,751	9.61				
Third year	33,511	7.53				

Notes: The analysis sample comprises a total of 444,918 person-years (60,400 individuals).

“very concerned,” “somewhat concerned,” and “not concerned at all.”³ Poutvaara and Steinhardt (2018:4) argue that this wording captures negative attitudes toward immigration that are salient to respondents. Lancee and Pardos-Prado (2013) emphasize that the term “concern,” as opposed to “opinion” or “sentiment,” has a clearly negative connotation, aligning it with negative evaluations of immigration.

At the same time, Lancee and Pardos-Prado (2013) reference Wlezien’s (2005) conceptual discussion and acknowledge that the item captures two intertwined dimensions: perceived problematic nature and perceived importance of the issue. Therefore, individuals’ concerns about immigration may intensify either due to increasingly negative attitudes toward immigration or because they perceive current policy as problematic.

Individuals could, in principle, also express concerns about immigration not because they are against immigration but because of their apprehension about humanitarian issues stemming from the current migration policy. Previous research points to a positive correlation between concerns about immigration and the inclination to vote for a right-wing party (Kratz 2023). This research suggests that high levels of concern about migration are more likely to be associated with anti-immigration sentiments than with other immigration-related concerns, such as humanitarian issues.

Even a more conservative interpretation of concerns about immigration can yield valuable insights. Erhard, Heiberger, and Windzio (2022) suggest that high concern reflects issue salience in individuals’ mental frameworks. This interpretation links the measure to issue salience rather than negative stereotyping. Empirical studies suggest that rising salience of immigration correlates with support for anti-immigration parties (Dennison and Geddes 2018), supporting models in which salience affects public opinion (Ciuk and Yost 2016) and voting behavior (Bélanger and Meguid 2008). Thus, even if the concern measure reflects only salience, it remains a meaningful attitudinal outcome.

Explanatory variables. Educational attainment is categorized as low, medium, or high based on the International Standard Classification of Education-97 (ISCED-97) classification scale (UNESCO [1997] 2006). “Low” educational attainment refers to individuals with no vocational or university-level degree (i.e., ISCED-97 values 0, 1, 2A, and 2B). The “middle” category refers to individuals who have obtained ISCED-97 values 3A, 3B, 3C, 4A, 4B, 5A, and 5B), and the “high” category includes those who have obtained at least one degree from a university (i.e., ISCED-97 value 6).

Age is a survey variable measured in years. Finding an age parameterization that is as flexible as possible is essential to avoid biases that could be caused by imposing a too simplistic functional form (Lundberg, Johnson, and Stewart 2021). The challenge for researchers is to find a reasonable balance between the flexibility of the age parameterization and the increased variance in age cells with small case numbers. Semi-parametric approaches, such as spline regressions, allow for flexibility in functional form and can smooth regions with low case numbers. Given the data at hand, such a semi-parametric approach proved to be pragmatic. Therefore, I use 12 spline effects in the age range (17–80) (reference: age 17). Furthermore, I control for the following time-constant confounders: nationality, gender

(binary with reference “male”), and living in eastern Germany, as recorded in the first interview.

The cohorts are grouped by historical periods. The following periods have been chosen based on theoretical arguments and data peculiarities: 1919–1949 (Weimar Republic, Third Reich, and post-war period until the division of Germany), 1950–1961 (early division until the building of the Berlin Wall), 1962–1974 (Iron Curtain), and 1975–2002 (later period of German division and early period of reunification). Recognizing that grouping birth cohorts by historical epochs involves some arbitrariness, I also tested the sensitivity of the results using a more finely graded cohort classification (see the sensitivity analysis section).

Effectively addressing period effects presents both conceptual and empirical challenges. In the terminology of Fosse (2023), the present analysis is not a classical age–period–cohort (APC) analysis but rather a cohort analysis. Whereas APC analyses aim to disentangle the distinct contributions of age, period, and cohort, cohort analyses focus on describing patterns both within and across cohorts. In such analyses, including the year of measurement to control for period effects renders the analysis static and incapable of capturing dynamic trends (Fosse 2023). Accordingly, I do not include the year of measurement as a control for period effects.

At the same time, I aim to assess whether specific contextual conditions in Germany during the observation period affect the study’s main conclusions. To this end, I draw on the established literature on period effects, include controls for seven theoretically grounded macro-level variables, and conduct a series of sensitivity analyses to evaluate the robustness of the findings (see the sensitivity analysis section).

As previous research has shown that anti-foreigner sentiments rise in economically difficult periods (Semyonov, Raijman, and Gorodzeisky 2006), three variables are used here to capture economic circumstances: unemployment rate, gross domestic product (GDP) growth rate, and wage growth. Furthermore, certain kinds of immigration streams may induce perceptions of cultural threat (e.g., Meuleman, Davidov, and Billiet 2009). In line with the proposition that “opposition to further immigration increases with ethnic and cultural distance” (Dustmann and Preston 2007:15), previous research has found that immigration from non-European (Dustmann and Preston 2007; Schmidt 2021) and non-Western (Turper et al. 2015) countries in particular provokes feelings of cultural threat. Furthermore, perceptions of cultural threat combined with concerns about welfare benefits for the local population (Dustmann and Preston 2007) may result in heightened concerns about immigration when the number of asylum seekers is high (Czymara and Schmidt-Catran 2017; Gorodzeisky 2022). I merged data capturing immigration streams from various data sources (see reproducibility package) with the SOEP data to control for period effects resulting from the absolute number of asylum seekers per year, the number of non-German immigrants, the number of non-European immigrants, and the number of non-Western immigrants.

Method effects. Responses about attitudes in general and anti-immigration attitudes in particular may be affected by social desirability bias (Kratz 2021) and panel conditioning (Kiley and Vaisey 2020). In Western societies such as Germany, respondents are likely to assume that society (including interviewers) will prefer more positive views of immigration. The tendency to report lower levels of concern

about immigration will therefore be higher if the questions are being asked by an unfamiliar person (e.g., an interviewer). For this reason, lower levels of concern about immigration are expected in all survey modes where an interviewer is present. Many panel studies begin with an interviewer-guided wave followed by paper-and-pencil waves once respondents have become familiar with the survey. If the interviewee self-administers the questionnaire, the pressure to report lower levels of concern about immigration is lower. Furthermore, over the course of a panel survey, respondents develop a sense of trust in the interviewer (Kratz 2021), resulting in more truthful (supposedly) higher reported levels of concern about immigration. To capture such effects, which could lead to methodological artifacts, interviewer presence during questionnaire completion is controlled for and dummy variables for the first three panel waves are included in the models. If a social desirability bias is present in the data, over-reporting should occur not only in the first waves of the survey but also after each interviewer change. Therefore, the first three waves after an interviewer change are also controlled for with dummy variables.

Methods

I chose the following methods to test whether concerns about immigration become more polarized with rising age and across cohorts and whether cohort-based polarization masks age-based polarization. I begin by estimating an ordinary least squares (OLS) regression on the entire cohort range to illustrate that age-related polarization is not visible if cohort-based polarization is not taken into account. Specifically, I estimate the following POLS growth curve model:

$$\begin{aligned} Conc_{it} = & \alpha + \beta_1 MEduc_i + \beta_2 HEduc_i + Educ_i \sum_{n=1}^{12} \gamma_n Age_{n,it} + \mu' X_i \\ & + \pi' P_t + \delta' M_{it} + \varepsilon_{it}, \end{aligned} \quad (1)$$

where $Conc_{it}$ represents the concerns about immigration in what follows; $MEduc$ is the dummy for medium; $HEduc$ for high levels of education; and β_1 and β_2 estimate the difference between educational groups at age 17 in the POLS model. Age splines are represented by $\sum_{n=1}^{12} \gamma_n Age_{n,it}$. To assess how differences in concerns about immigration between individuals with different levels of education vary at different ages, each age spline is interacted with the education dummies, represented by $Educ_i \sum_{n=1}^{12} \gamma_n Age_{n,it}$. Furthermore, I control for vectors capturing controls for the individual characteristics ($\mu' X_i$), period variables ($\pi' P_t$), and social desirability effects ($\delta' M_{it}$) described in the Measures section.

To demonstrate that education-specific differences in concerns about immigration have increased across cohorts and to test the cohort polarization hypothesis, I estimate separate growth curves for the specific cohort groups detailed in the Measures section. To this end, I use linear and quadratic functional forms, as auxiliary analyses have shown that such functional forms fit the data best.

In the next step, I aim to show that accounting for the increasing importance of education-specific differences in concerns about immigration across cohorts unmasks age-related polarization in concerns about immigration. To demonstrate this pattern, I include cohort groups ($\sum_{n=1}^4 \phi_n Cohort_{n,i}$) and interaction effects

between cohort groups and educational attainment ($\text{Educ}_i \sum_{n=1}^4 \theta_n \text{Cohort}_{n,i}$) in the growth curve analysis. Specifically, I estimate the following growth curve model:

$$\begin{aligned} \text{Conc}_{it} = & \alpha + \beta_1 \text{MEduc}_i + \beta_2 \text{HEduc}_i + \text{Educ}_i \sum_{n=1}^{12} \gamma_n \text{Age}_{n,it} \\ & + \sum_{n=1}^4 \phi_n \text{Cohort}_{n,i} + \text{Educ}_i \sum_{n=1}^4 \theta_n \text{Cohort}_{n,i} + \boldsymbol{\mu}' \mathbf{X}_i + \boldsymbol{\pi}' \mathbf{P}_t + \boldsymbol{\delta}' \mathbf{M}_{it} + \varepsilon_{it}. \end{aligned} \quad (2)$$

Finally, I test whether conclusions about age polarization remain robust when accounting for selective mortality (i.e., the most disadvantaged individuals die earlier). If there is selective mortality, an approach that relies entirely on intra-individual variation identifies group differences in aging effects under the weakest assumptions (Brüderl, Kratz, and Bauer 2019). For example, a regression model with individual-specific fixed-effects (FE) estimates trajectories by comparing attitudes at different ages to individual-specific mean values. At the same time, comparisons between cohorts are necessarily comparisons between individuals. Therefore, as this model “wipes out” unobserved heterogeneity between individuals, it is not suited to test cohort polarization processes. I estimate the following FE growth curve model:

$$\text{Conc}_{it} = \alpha_i + \text{Educ}_i \sum_{n=1}^{12} \gamma_n \text{Age}_{n,it} + \boldsymbol{\pi}' \mathbf{P}_t + \boldsymbol{\delta}' \mathbf{M}_{it} + \varepsilon_{it}. \quad (3)$$

In this model, a person-specific FE (α_i) is estimated instead of α . As FE exploits only within variation, the difference between low, middle, and high levels of education is not defined in the model specification, and the time-constant individual controls are controlled by design. Then, I use linear splines to model the age effect. To assess education-specific differences, each age spline is interacted with the education dummies. As this FE approach removes both observed and unobserved heterogeneity due to time-constant characteristics, I only control for vectors capturing time-varying factors (i.e., period variables ($\boldsymbol{\pi}' \mathbf{P}_t$) and social desirability effects ($\boldsymbol{\delta}' \mathbf{M}_{it}$)).

Results

This section is structured as follows. First, I present the results of OLS growth curve models estimated across the entire cohort range to demonstrate that age-related polarization is not apparent when cohort-based polarization is not taken into account. Second, to illustrate that education-specific differences in concerns about immigration have widened across cohorts, I provide the results of separate growth curve models for distinct cohort groups. Third, I incorporate cohort group indicators and interaction effects between cohort groups and educational attainment into the growth curve analysis across the full cohort range to demonstrate that age-related polarization in concerns about immigration becomes evident when cohort-based polarization is taken into account. Fourth, I present results from FE growth curve models to evaluate whether conclusions about age polarization

remain robust when accounting for selective mortality. Finally, I perform sensitivity analyses to assess the robustness of the results.

Growth Curve Analysis

The following analysis aims to test the age and cohort polarization hypotheses and to assess whether age polarization is masked if cohort polarization is not taken into account (Fig. 1).⁴ Figure 1A, as an initial step, shows age-specific variations in predicted values of concerns about immigration among different educational groups when confounding factors are controlled for, as described in Equation 1. This conditional profile plot reveals an increase in education-specific differences (indicating a pattern of divergence) during young adulthood and a decrease in differences (indicating a pattern of convergence) in older age.

The spline slope coefficient for the low-education group is significant in the age range of 17–25 (0.013, $p < 0.001$), indicating a significant increase in concerns about immigration (Table S1 in the online supplement). In addition, the results show that this increase is significantly less pronounced for individuals who have obtained or will obtain higher levels of education (-0.020 , $p < 0.001$). These slope differences lead to a pattern of divergence that can be interpreted as a pattern of age-related polarization.

In contrast, the spline slope coefficients for the medium-education group (0.011, $p < 0.05$) and the high-education group (0.013, $p < 0.05$) in the age range of 75–80 point to a significantly stronger rise in concerns about immigration for these groups, compared to individuals with lower levels of education. These slope differences lead to a pattern of convergence that contradicts a pattern of age-related polarization.

To test the cohort polarization hypothesis, Figure 1B shows cohort-group-specific marginal effects of higher education at various ages when confounding factors are controlled for. This conditional effect plot indicates rising education-specific differences across generations. For instance, the marginal effect of higher education on the probability of being very concerned about immigration at age 35 amounts to roughly 15 percentage points for the cohort born between 1962 and 1974. This association is almost twice as large—around 30 percentage points—for the later cohort born between 1975 and 2004. Similarly, at age 50, the marginal effect of higher education on the probability of being very concerned is not significantly different from zero for the oldest cohort, born between 1930 and 1949. In contrast, it amounts to roughly 18 percentage points for the cohort born between 1950 and 1961 and approximately 28 percentage points for the cohort born between 1962 and 1974.

To contextualize the effect size for benchmarking purposes, the rise in education-specific differences across cohorts is substantial. For example, the 10-percentage-point increase in the marginal effect of higher education—comparing cohorts born between 1950 and 1961 and those born between 1962 and 1974 at age 50—approximately equals twice the magnitude of the East–West Germany gap reported by Lange (2021). It is also comparable to twice the marginal effect of media salience on the immigration issue among individuals with elementary education, as reported by Czymara and Dochow (2018), and to the absolute value of the effect of a

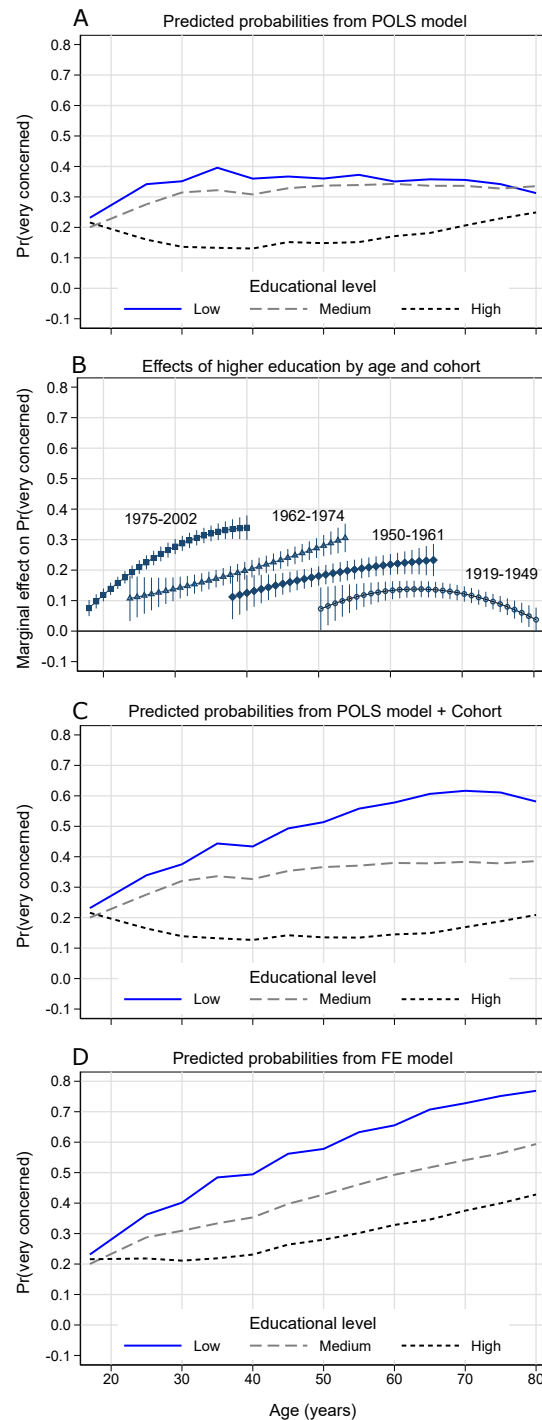


Figure 1: Age-related and cohort-based polarization. *Note:* (A) Pooled OLS trajectories and control variables include time-constant confounding factors and time-varying selection variables. (B) Pooled OLS effects and control variables are the same as in (A). (C) Pooled OLS trajectories and control variables include all variables from (A) and cohort groups + their interactions with educational attainment. (D) FE model and control variables include all time-varying variables.

0 percent to 4 percent increase in refugee shares at the district level, as documented by Giesselmann, Brady, and Naujoks (2024). Overall, the results reveal a remarkably clear pattern of increasing education-specific differences at the same age across cohort groups, which supports the cohort polarization hypothesis.

To assess how conclusions about aging change when the analytical approach accounts for this polarization across cohorts, Figure 1C shows education-specific differences at various ages when the estimation approach conditions on cohort groups as well as interactions between cohort groups and education, as described in Equation 2. The results show that while the pattern of divergence during young adulthood remains, the pattern of convergence at old age disappears. These analyses reveal that failing to account for the rising importance of education in shaping concerns about immigration across cohorts is the key factor that obscures polarization in immigration concerns with increasing age in the previous analysis.

Although the analysis in Figure 1C is conducted to demonstrate that cohort polarization is the key factor masking age polarization, Figure 1D shows the results from FEs growth curve models (Eq. 3), which identify age polarization processes under the weakest assumptions. The results show that concerns about immigration begin to rise from age 17 for individuals with low or medium levels of education, whereas this increase begins much later—around age 40—for individuals with higher levels of education. As a consequence, age polarization primarily occurs between the ages of 17 and 40. After age 40, concerns about immigration develop in a more parallel manner across the different educational groups.

Qualitatively consistent with the OLS results shown in Figure 1A, the spline slope coefficient for the low-education group is significant in the age ranges of 17–25 (0.016, $p < 0.001$), 25–30 (0.009, $p < 0.05$), and 30–35 (0.013, $p < 0.001$), indicating a significant increase in concerns about immigration (see Table S1 in the online supplement). Moreover, the results show that this increase during early adulthood is less pronounced among individuals who have obtained or will obtain higher levels of education: -0.017 ($p < 0.001$) for ages 17–25, -0.009 ($p > 0.05$) for ages 25–30, and -0.012 ($p < 0.01$) for ages 30–35. As shown in Figure 1D, these differences in slope coefficients result in a pattern of divergence that may be interpreted as age-related polarization.

In contrast to the OLS results shown in Figure 1A, the FE results do not indicate any convergence in older age. The spline slope coefficients for the medium-education group (0.005, $p > 0.05$) and the high-education group (0.007, $p > 0.05$) in the age range of 75–80 are not statistically significant; consequently, no pattern of convergence emerges (Fig. 1D).

In summary, the results suggest that while the pattern of divergence during young adulthood remains unaffected by cohort effects, convergence at old age is driven by differences across generations. The results corroborate the age and cohort polarization hypotheses: Differences in concerns about immigration between educational groups have increased across generations and continue to increase with age. As the generational trend is echoed in low attitude differences among older age groups, cohort effects lead to an underestimation of age polarization processes in later life if the analytical approach does not account for cohort effects.

Sensitivity Analysis

In this section, I assess the robustness of the results. Specifically, I provide analyses to determine if the primary findings remain robust under the following conditions: 1) accounting for selective attrition, 2) including or excluding controls for panel conditioning, social desirability, and period effects in the analysis, 3) excluding periods of high issue saliency (all observation years following the onset of the refugee movements in 2015) from the analysis, 4) coding cohort groups differently, and 5) excluding individuals with migration background.

To assess the potential impact of decreasing sample representativeness with increasing age, I incorporated inverse probability weights, which were constructed using a machine-learning approach (see the data section). The results reveal slightly steeper trajectories when accounting for selective attrition, suggesting that individuals with high levels of concern about immigration are more likely to exit the panel (Figure S1 in the online supplement). However, these analyses show that endogenous selection bias arising from selective attrition does not drive the results.

As prior research highlights, panel conditioning, social desirability bias, and period effects may influence reported attitudes. To account for these potential biases, I included relevant controls in the empirical analysis. However, incorporating too many time-varying control variables in FE models can introduce multicollinearity. To address this concern, I conducted robustness checks by excluding these controls (Figure S2 in the online supplement). The results confirmed that the main conclusions remained consistent regardless of whether these variables were included.

Furthermore, the topic of migration gained significant prominence in public discourse following the increased numbers of asylum seekers in 2015 and subsequent years. Although the main analyses controlled for various forms of immigration streams, I also explored a more radical approach by excluding all years after 2014 (Figure S3 in the online supplement). This was done to assess the robustness of the results when excluding the period characterized by heightened issue saliency. Once again, the findings remained qualitatively unchanged.

Recognizing that grouping birth cohorts by historical epochs involves some degree of arbitrariness, I conducted tests to ascertain the robustness of the results when utilizing a more finely graded birth cohort grouping. Specifically, I created a separate birth cohort group for respondents born after German reunification. Figure S4 in the online supplement presents the results, which reaffirm that the qualitative conclusions remained unaffected. Finally, the main conclusions remained unaffected regardless of whether individuals with migration background are excluded from the analysis (see Figure S5 in the online supplement).

Discussion and Conclusions

The purpose of this study was to demonstrate that polarization in attitudes can occur both with increasing age and across birth cohorts and that cohort-based polarization may obscure age-related polarization. Education-specific differences were selected as the dimension of polarization, given extensive interdisciplinary literature showing that the most significant attitudinal cleavages often emerge

between groups with differing levels of educational attainment. Concerns about immigration were chosen as the illustrative attitudinal measure due to ongoing debates surrounding the underlying mechanisms of immigration attitudes, as well as the availability of this measure in long-running multi-cohort panel data. I proposed the age polarization and cohort polarization hypotheses, which suggest that attitudes become increasingly polarized both as individuals age and across successive cohorts. Building on this framework, I further argued that cohort-based polarization may mask polarization processes associated with aging.

Summary of Results

The results indicate that education-specific differences in concerns about immigration have intensified both across cohorts and with increasing age. Notably, polarization associated with aging becomes fully apparent only when cohort-based polarization is taken into account. These original findings contribute to the literature on the liberalizing effect of education as well as to the broader discourse on the dynamics of attitudinal polarization over time.

Implications for the Liberalizing Effect of Education

This study offers key insights that help resolve the ongoing debate about the mechanisms underlying the association between education and attitudes. Previous research has been divided: studies using rigorous longitudinal designs with younger respondents often attribute the association to selection effects (Lancee and Sarrasin 2015; Weber 2022), whereas studies leveraging exogenous variation from educational reforms and older respondents tend to find causal effects (Cavaille and Marshall 2019; Margaryan et al. 2021). This study helps reconcile these findings by showing that education-specific differences in attitudes increase with age.

Furthermore, the results contribute to emerging research on how the education-attitude relationship varies across temporal dimensions. Although earlier studies identified certain period variables influencing this relationship (Finseraas 2019; Velásquez and Eger 2022), this study extends those findings by controlling for such period effects and demonstrating that the association between education and attitudes strengthens with both age and across cohorts. These findings underscore the need for further research to better understand the mechanisms driving temporal variation in the liberalizing impact of education on attitudes.

Implications for Attitude Polarization over Time

This study also contributes to the ongoing debate on whether attitudes become more polarized over time (Baldassarri and Bearman 2007; DiMaggio et al. 1996; Finseraas 2019; Huijsmans et al. 2021) and helps address the so-called “political polarization paradox”—the observation that, while public discourse often suggests growing polarization, empirical analyses rarely detect clear evidence of it. The findings of this study underscore the importance of clarifying the underlying arguments within the debate to facilitate its resolution.

It is important to distinguish among the various temporal dimensions along which polarization may occur. One such dimension concerns whether attitudes become more polarized over historical time. However, polarization can also develop along other temporal axes, such as age and cohort. This study expands existing conceptual models by introducing hypotheses that clarify how polarization processes may intensify with increasing age and across generations over the past century.

The findings underscore the importance of jointly considering polarization across multiple temporal dimensions, as age-related and cohort-based polarization can obscure one another, complicating their identification. Furthermore, the results imply that clarifying theoretical expectations regarding which temporal dimension is most likely to exhibit polarization—and employing multi-cohort panel data to disentangle age effects from cohort effects—can offer valuable insights and may contribute to resolving the political polarization paradox.

Limitations and Future Research Directions

The analyses in this study are based on the outcome, “concerns about immigration,” which encompass two inseparable aspects: whether respondents perceive immigration as problematic and how they assess its importance. To address this limitation, I took two steps. First, I drew upon previous research to emphasize the importance of examining this item, even if concerns about immigration were solely linked to the importance of the immigration issue in respondents’ mental frameworks. I stressed that such assessments are crucial because issue saliency has significant policy implications and is therefore emerging as an important research area. Second, I drew on prior research demonstrating that concerns about immigration are strongly associated with other indicators of anti-immigration attitudes and support for right-wing voting.

Educational attainment is also associated with differences across a wide range of attitudinal measures. For instance, education-specific differences have also been documented in attitudes toward race (Wodtke 2018), gender roles (Du, Xiao, and Zhao 2021), and moral attitudes (Bročić and Miles 2021). The theoretical framework of this study suggests that age polarization and cohort polarization processes may have played a role in shaping attitudes toward various historically discriminated groups. Consequently, there remains a need to systematically investigate age- and cohort-related polarization across diverse forms of attitudes.

Furthermore, while the present study assessed polarization dynamics employing a cohort analysis aimed at describing education-specific differences in intra- and inter-cohort trends, future research may build on these findings by using recent advancements in APC analysis. For instance, transferring approaches that disentangle linear trends, fluctuations, and heterogeneity arising from interactions among age, period, and cohort (Fosse and Winship 2023; Fosse, Winship, and Daoud 2020) to the study of polarization processes appears promising.

In addition, the results of the present study could inform the construction of bounds for age or cohort effects using a bounding approach (Fosse and Winship 2019). This approach has recently been adapted to assess group-specific differences

in age, period, and cohort effects (Gowen, Fosse, and Winship 2023). Applying such an adaptation of the bounding approach to polarization research could offer a promising strategy to gain further insight into group-specific polarization processes.

Finally, this analysis relies on German data, and thus the German context may influence the results. Although social and economic contexts may shape age and cohort patterns in attitudes, the broader trend of attitudes becoming more liberal over the past century has been observed across various Western societies and, albeit starting later, in post-Soviet societies (Gorodzeisky and Semyonov 2018; Kratz 2024; McLaren et al. 2021; McLaren and Paterson 2020; Schmidt 2021; Schotte and Winkler 2018). Considering these similar temporal patterns, cohort polarization and age polarization may not be unique to the German context. Polarization across cohorts and with rising age may similarly occur in other societies. Empirical tests of such polarization processes in diverse contexts could offer valuable avenues for further research. This study represents only a modest initial step toward advancing our understanding of polarization processes in attitudes across cohorts and with rising age.

Notes

- 1 I define cohort groups by individuals' birth periods, which influence their early socialization, educational exposure, and shared life experiences. In this sense, cohorts function as proxies for broader structural and cultural influences rather than as collective identity groups in the sense described by Mannheim ([1928] 1952).
- 2 Owing to some data peculiarities, not all available SOEP subsamples are used, including the following: SOEP Innovation Samples, "Families in Germany" (different questionnaire), and the migration sample from 2013 (different procedures and questionnaire).
- 3 In German, the question reads as follows: "Wie ist es mit den folgenden Gebieten—machen Sie sich da Sorgen?" with one issue being "Über die Zuwanderung nach Deutschland." Respondents could answer this question on a three-point scale ("große Sorgen," "einige Sorgen," and "keine Sorgen").
- 4 To ease comparison, the trajectories of Figure 1C and 1D are normalized to equal the probability of being very concerned about immigration in Figure 1A at age 17. As the FE model does not estimate between effects, such normalizations are pragmatic to compare results of trajectories between estimation models (Brüderl, Kratz, and Bauer 2019).

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